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BY

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OF

ARTS and SCIENCES.

PUNISHMENT.

PUNISHMENT, a penalty impofed upon the commiffion of fome crime or offence againft the laws.

It is effential to the nature of a law, that it import or decree a punifhment to the tranfgreffors of it.

Solon very juftly afferted, that the two great ftimulants of human action being hope and fear, a good government could not poffibly exift without an equitable fyftem of rewards and punifhments.

The forms and manners of punifhment are various in various countries and ages, and for various crimes; as treafon, felony, adultery, parricide, &c.

There was a time, fays Beccaria, when all punifhments were pecuniary. The crimes of the fubjects were the inheritance of the prince, fo that an injury done to fociety was a favour to the crown, and the fovereign and magiftrates, thofe guardians of the public fecurity, were interefted in the violation of the laws. Crimes were tried at that time in a court of exchequer, and the caufe became a civil fuit between the perfon accufed and the crown. The magiftrate then poffeffed powers that were not neceffary for the public welfare, and the criminal fuffered punifhments different from thofe which the neceffity of example required. The judge was rather a collector for the crown, an agent for the treafury, than a protector and minifter of the laws.

Among the Romans, the *pecuniary* punifhments were the *muleta* and *confifcatio*. The *corporal* punifhments were *capitis diminutio*, *aquæ et ignis interdictio*, *profcriptio*, *deportatio*, *relegatio*, *furca*, *crux*, *carcer*, *culeus*, *equuleus*, *fcalæ gemoniæ*, *damnatio ad gladium*, *ad metallum*, *flagellatio*, *talio*, &c. which fee defcribed under their refpective articles.

Among us the principal *civil* punifhments are, *fines*, *imprifonments*, *the ftocks*, *pillory*, *burning in the hand*, *whipping*, *ducking-ftool*, *hanging*, *beheading*, *quartering*, *burning*, *tranfportation*, &c.

The *ecclefiaftical* punifhments are, *cenfures*, *fufpenfions*, *deprivations*, *degradations*, *excommunications*, *anathemas*, *penances*, &c. The *military* punifhments are, *being fhot*, *running the gantelope*, *riding the wooden horfe*, *the bilboes*, &c.

Among the Turks, &c. *impaling*, *baftinadoes* on the foles of the feet, &c. obtain. See EMPALEMENT, &c.

The right of punifhing crimes againft the law of nature, as murder and the like, is in a ftate of mere nature vefted in every individual. Accordingly the firft murderer, Cain, was fo fenfible of this, that we perceive him (Gen. iv. 14.) expreffing his apprehenfions, that *whoever* would find him would flay him. In a ftate of fociety, this right is transferred from individuals to the fovereign power; and thus men are prevented from being judges in their own caufes, which is one of the evils that civil government was intended to remedy. The fword of juftice is now vefted by the confent of the whole community in the magiftrate alone. Every punifhment which does not arife from abfolute neceffity, fays the great Montefquieu, is tyrannical; and this propofition is rendered more general by Beccaria, who obferves, that every act of authority of one man over another, for which there is not an abfolute neceffity, is tyrannical. Upon this principle, the fovereign's right to punifh crimes is founded; that is, upon the neceffity of defending the public liberty, entrufted to his care, from the ufurpation of individuals; and punifhments are juft in proportion, as the liberty, preferved by the fovereign, is facred and valuable. It was neceffity that forced men to give up a part of their liberty, and it is certain, that every individual would chufe to put into the public ftock the fmalleft portion poffible; as much only as was fufficient to engage others to defend it. The aggregate of thefe, the fmalleft portions poffible, forms the right of punifhing: all that extends beyond this is abufe, and not juftice. The laws only can determine the

the punishment of crimes; and the authority of making penal laws can only reside with the legislator, who represents the whole society, united by the social compact. No magistrate, therefore, as he is one of the society, can, with justice, inflict on any other member of the same society, punishment that is not ordained by the laws, nor increase the punishment already determined by the laws. To the sovereign representing the society itself, who makes general laws to bind the members, it does not belong to judge, whether any individual has violated the social compact, or incurred the consequent punishment. In this case, there are two parties, one represented by the sovereign, who insists upon the violation of the contract, and the other is the person accused, who denies it. It is necessary then, that there should be a third person to decide this contest; that is to say, a judge or magistrate, from whose determination there should be no appeal. Judges, in criminal cases, says Beccaria, have no right to interpret the penal laws, because they are not legislators. The lawful interpreter is the sovereign, that is, the representative of society, and not the judge, whose office is only to examine, if a man have, or have not committed an action contrary to the laws. Many evils arise from the erring instability of arbitrary interpretation.

The lawfulness of punishing criminals, who are chargeable with offences against the laws of society, that are only "mala prohibita" and not "mala in se," is founded upon this principle, that the law by which they suffer was made by their own consent; it is a part of the original contract into which they entered, when first they engaged in society; it was calculated for, and has long contributed to, their own security. This right, conferred by universal consent, gives to the state exactly the same power, and no more, over all its members, as each individual member had naturally over himself or others. Hence some have doubted how far a human legislature ought to inflict capital punishments for *positive* offences;—offences against the municipal law only, not against the law of nature; since no individual has, naturally, a power of inflicting death upon himself or others for actions in themselves indifferent.

With regard to offences "mala in se," capital punishments are in some instances inflicted by the immediate command of God himself to all mankind, as in the case of murder, by the precept delivered to Noah, their common ancestor and representative (Gen. ix. 6.), "whoso sheddeth man's blood, by man shall his blood be shed." In other instances they are inflicted after the *example* of the Creator, in his positive code of laws for the regulation of the Jewish republic; as in the case of the crime against nature. But they are sometimes inflicted without such express warrant or example, at the will and discretion of the human legislature, as for forgery, for theft, and sometimes for offences of a lighter kind. None of these crimes are offences against natural, but only against social, rights. The practice of inflicting capital punishments, for offences of human institution, is thus justified by that great and good man, sir Matthew Hale (1 Hal., P. C. 13.) "When offences grow enormous, frequent, and dangerous to a kingdom or state, destructive or highly pernicious to civil societies, and to the great insecurity and danger of the kingdom or its inhabitants, severe punishment and even death itself is necessary to be annexed to laws in many cases by the prudence of lawgivers." It is, therefore, as judge Blackstone observes, the enormity, or dangerous tendency of the crime, that alone can warrant any earthly legislature in putting him to death that commits it. It is not its frequency only, or the difficulty of otherwise preventing it, that will excuse our attempting to prevent it by a wanton effusion of human blood. For, though the end of punishment is to deter men from offending, it can never follow from this circumstance, that it is lawful to deter them at any rate and by any means; since there may be unlawful methods of enforcing obedience even to the justest laws. Every humane legislator, as the learned judge remarks, will be therefore extremely cautious of establishing laws that inflict the penalty of death, especially for slight offences, or such as are merely positive. Nor will it avail to allege that no lighter penalty will be effectual, because experience has not taught us that capital punishments are more effectual. Was the vast territory of all the Russias, it may be asked, worse regulated under the empress Elizabeth, than under her more sanguinary predecessors? Or has it been since, under Catharine II., less civilized, less social, and less secure? And yet we are assured, that neither of these illustrious princesses have, throughout their whole administration, inflicted the penalty of death; and the latter, upon full persuasion of its being useless, and even pernicious, issued orders for abolishing it entirely throughout her extensive dominions. But if capital punishments, says Blackstone, were proved by experience to be a sure and effectual remedy, that would not prove the necessity (upon which the justice and propriety depend) of inflicting them upon all occasions, when other expedients fail. This reasoning would, as we may justly apprehend, extend much too far. Where the evil to be prevented is not adequate to the violence of the preventive, a sovereign that thinks seriously can never reconcile laws that inflict death to the dictates of conscience and humanity. To shed the blood of our fellow-creature, says the learned and humane judge, is a matter that requires the greatest deliberation, and the fullest conviction of our own authority; for life is the immediate gift of God to man; which neither he can resign, nor can it be taken from him, unless by the command or permission of him who gave it; either expressly revealed or collected from the laws of nature or society by clear and indisputable demonstration. Blackstone, however, would not be understood to *deny* the right of the legislature in any country to enforce its own laws by the death of the transgressor, though some persons of abilities have *doubted* it. To this class of persons we may refer the ingenious writer already cited. The useless profusion of punishments, which has never made man better, has induced Beccaria to enquire, whether the punishment of *death* be really just or useful in a well-governed state? What right, he asks, have men to cut the throats of their fellow-creatures? Certainly not that on which the sovereignty and laws are founded. The laws are only the sum of the smallest portions of the private liberty of each individual, and represent the general will, which is the aggregate of that of each individual. Did any one ever give to others the right of taking away his life? Is it possible, that in the smallest portions of the liberty of each, sacrificed to the good of the public, can be contained the greatest of all good, life? If it were so, how shall it be reconciled to the maxim which tells us, that a man has no right to kill himself? Which he certainly must have, if he could give it away to another. The punishment of death is not authorized by any right; for no such right exists. The death of a citizen cannot be necessary, but in one case; when, though deprived of his liberty, he has such power and connections as may endanger the security of the nation; when his existence may produce a dangerous revolution in the established form of government. But even in this case, it can only be necessary when a nation is on the verge of recovering or losing its liberty; or in times of absolute anarchy, when the disorders themselves hold the place of laws.

If the experience of all ages be not sufficient to prove, that the punishment of death has never prevented determined men

men from injuring ſociety; if the example of the Romans; if twenty years reign of Elizabeth, empreſs of Ruſſia, in which ſhe gave the fathers of their country an example more illuſtrious than many conqueſts bought with blood; if, ſays Beccaria, all this be not ſufficient to perſuade mankind, who always ſuſpect the voice of reaſon, and who chuſe rather to be led by authority, let us conſult human nature in proof of this aſſertion.

It is not the intenſeneſs of the pain that has the greateſt effect on the mind, but its continuance; for our ſenſibility is more eaſily and more powerfully affected by weak but repeated impreſſions, than by a violent, but momentary, impulſe. The power of habit is univerſal over every ſenſible being. As it is by that we learn to ſpeak, to walk, and to ſatisfy our neceſſities, ſo the ideas of morality are ſtamped on our minds by repeated impreſſions. The death of a criminal is a terrible but momentary ſpectacle, and therefore a leſs efficacious method of deterring others, than the continued example of a man deprived of his liberty, condemned, as a beaſt of burthen, to repair, by his labour, the injury he has done to ſociety. "If I commit ſuch a crime," ſays the Spectator to himſelf, "I ſhall be reduced to that miſerable condition for the reſt of my life." A much more powerful preventive than the fear of death, which men always behold in diſtant obſcurity.

The terrors of death make ſo ſlight an impreſſion, that it has not force enough to withſtand the forgetfulneſs natural to mankind, even in the moſt eſſential things; eſpecially when aſſiſted by the paſſions. Violent impreſſions ſurpriſe us, but their effect is momentary; they are fit to produce thoſe revolutions which inſtantly transform a common man into a Lacedæmonian or a Perſian; but in a free and quiet government they ought to be rather frequent than ſtrong.

The execution of a criminal is, to the multitude, a ſpectacle, which in ſome excites compaſſion mixed with indignation. Theſe ſentiments occupy the mind much more than that ſalutary terror which the laws endeavour to inſpire; but in the contemplation of continued ſuffering, terror is the only, or at leaſt predominant ſenſation. The ſeverity of a puniſhment ſhould be juſt ſufficient to excite compaſſion in the ſpectators, as it is intended more for them than for the criminal.

A puniſhment, to be juſt, ſhould have only that degree of ſeverity which is ſufficient to deter others. Now there is no man, who, upon the leaſt reflection, would put in competition the total and perpetual loſs of his liberty, with the greateſt advantages he could poſſibly obtain in conſequence of a crime. Perpetual ſlavery, then, has in it all that is neceſſary to deter the moſt hardened and determined, as much as the puniſhment of death: —it has even more. There are many who can look upon death with intrepidity and firmneſs; ſome through fanaticiſm, and others through vanity, which attends us even to the grave; others from a deſperate reſolution, either to get rid of their miſery, or ceaſe to live: but fanaticiſm and vanity forſake the criminal in ſlavery, in chains and fetters, in an iron cage; and deſpair ſeems rather the beginning than the end of their miſery. The mind, by collecting itſelf and uniting all its force, can, for a moment, repel aſſailing grief; but its moſt vigorous efforts are inſufficient to reſiſt perpetual wretchedneſs.

In all nations, where death is uſed as a puniſhment, every example ſuppoſes a new crime committed. Whereas in perpetual ſlavery, every criminal affords a frequent and laſting example; and if it be neceſſary that men ſhould often be witneſſes of the power of the laws, criminals ſhould often be put to death; but this ſuppoſes a frequency of crimes; and from hence this puniſhment will ceaſe to have its effect, ſo that it muſt be uſeful and uſeleſs at the ſame time.

We ſhall be told, that perpetual ſlavery is as painful a puniſhment as death, and therefore as cruel. To which we anſwer, that if all the miſerable moments in the life of a ſlave were collected into one point, it would be a more cruel puniſhment than any other; but theſe are ſcattered through his whole life, whilſt the pain of death exerts all its force in a moment. There is alſo another advantage in the puniſhment of ſlavery, which is, that it is more terrible to the ſpectator than to the ſufferer himſelf; for the ſpectator conſiders the ſum of all his wretched moments, whilſt the ſufferer, by the miſery of the preſent, is prevented from thinking of the future. All evils are increaſed by the imagination, and the ſufferer finds reſources and conſolations, of which the ſpectators are ignorant; who judge by their own ſenſibility of what paſſes in a mind, by habit grown callous to misfortune.

He who foreſees that he muſt paſs a great number of years, even his whole life, in pain and ſlavery; a ſlave to thoſe laws by which he was protected; in ſight of his fellow citizens, with whom he lives in freedom and ſociety; makes an uſeful compariſon between thoſe evils, the uncertainty of his ſucceſs, and the ſhortneſs of the time in which he ſhall enjoy the fruits of his tranſgreſſion. The example of thoſe wretches continually before his eyes, makes a much greater impreſſion on him than a puniſhment, which, inſtead of correcting, makes him more obdurate.

The puniſhment of death is pernicious to ſociety, from the example of barbarity it affords. If the paſſions, or the neceſſity of war, have taught men to ſhed the blood of their fellow creatures, the laws, which are intended to moderate the ferocity of mankind, ſhould not increaſe it by examples of barbarity, the more horrible, as this puniſhment is uſually attended with formal pageantry. Is it not abſurd, that the laws, which deteſt and puniſh homicide, ſhould, in order to prevent murder, publicly commit murder themſelves? What are the true and moſt uſeful laws? Thoſe compacts and conditions which all would propoſe and obſerve, in thoſe moments when private intereſt is ſilent, or combined with that of the public. What are the natural ſentiments of every perſon concerning the puniſhment of death? We may read them in the contempt and indignation with which every one looks on the executioner, who is nevertheleſs an innocent executor of the public will; a good citizen, who contributes to the advantage of ſociety; the inſtrument of the general ſecurity within, as good ſoldiers are without. What then is the origin of this contradiction? Why is this ſentiment of mankind indelible, to the ſcandal of reaſon? It is, that in a ſecret corner of the mind, in which the original impreſſions of nature are ſtill preſerved, men diſcover a ſentiment which tells them, that their lives are not lawfully in the power of any one, but of that neceſſity only, which with its iron ſceptre rules the univerſe.

What muſt men think, when they ſee wiſe magiſtrates and grave miniſters of juſtice, with indifference and tranquillity, dragging a criminal to death, and whilſt a wretch trembles with agony, expecting the fatal ſtroke, the judge, who has condemned him, with the coldeſt inſenſibility, and perhaps with no ſmall gratification from the exertion of his authority, quits his tribunal to enjoy the comforts and pleaſures of life? They will ſay, 'Ah! thoſe cruel formalities of juſtice are a cloak to tyranny, they are a ſecret language, a ſolemn veil, intended to conceal the ſword by which we are ſacrificed to the inſatiable idol of deſpotiſm. Murder, which they would repreſent to us as an horrible crime, we ſee practiſed by them without repugnance, or remorſe. Let us follow their example. A violent death appeared terrible in their descriptions, but we see that it is the affair of a moment. It will be still less terrible to him, who, not expecting it, escapes almost all the pain.' Such is the fatal, though absurd reasoning of men who are disposed to commit crimes; on whom, the abuse of religion has more influence than religion itself.

How happy were mankind, says this author, if laws were now to be formed; now that we see on the thrones of Europe, benevolent monarchs, friends to the virtues of peace, to the arts and sciences, fathers of their people, though crowned yet citizens; the increase of whose authority augments the happiness of their subjects, by destroying that intermediate despotism, which intercepts the prayers of the people, to the throne. If these humane princes have suffered the old laws to subsist, it is doubtless because they are deterred by the numberless obstacles, which oppose the subversion of errors established by the sanction of many ages; and therefore every wise citizen will wish for the increase of their authority.

It has long since been observed, says Voltaire, to whom the commentary on Beccaria's essay is attributed, that a man after he is hanged is good for nothing, and that punishments invented for the good of society, ought to be useful to society. It is evident, that a score of stout robbers, condemned for life to some public work, would serve the state in their punishment, and that hanging them is a benefit to nobody but the executioner.

There have been some judges, says this writer, who were passionately fond of spilling human blood; such was Jefferies in England, and such in France was the man whom they called *Coupe-tête*. Nature never intended such men for magistrates, but for executioners.

As to the *end*, or final cause of human punishments, this is not to be considered as an atonement or expiation for the crime committed, but as a precaution against future offences of the same kind. This purpose is accomplished in three ways; either by the amendment of the offender himself, with a view to which all corporal punishments, fines, and temporary exile or imprisonment are inflicted; or by deterring others by the dread of his example from committing similar offences, "ut pœna (as Cicero expresses it, pro Cluentio, 46) ad paucos, metus ad omnes perveniat;" or, lastly, by depriving the party who offends and injures, of the power to do future mischief, which is effected by either putting him to death, or condemning him to perpetual confinement, slavery, or exile. The method of inflicting punishment, however, ought always to be proportioned to the particular purpose it is meant to serve, and by no means to exceed it; and therefore the pains of death, and perpetual disability by exile, slavery, or imprisonment, ought never to be inflicted, but when the offender appears incorrigible.

The *measure* of human punishments must be left to the arbitration of the legislature, which should inflict such penalties as are warranted by the laws of nature and society, and such as appear to be the best calculated to answer the end of precaution against future offences. Some have recommended, and highly extolled for its equity, the "lex talionis," or law of retaliation; but judge Blackstone observes, that this can never be in all cases an adequate or permanent rule of judgment. Although there cannot be any regular or determinate method of rating the quantity of punishments for crimes, by any one uniform rule, applicable to all cases, and without ultimately referring to the will and discretion of the legislative power; yet there are some general principles, deduced from the nature and circumstances of the crime, that may afford some assistance in allotting to it an adequate punishment. One circumstance that serves in some measure to determine the nature and degree of punishment regards the object of it; for the more dignified in respect of rank, character, and influence, the object of an injury is, so much greater care should be taken to prevent that injury, and of course under this aggravation the punishment should be more severe. Accordingly treason in conspiring the king's death, is by the English law punished with greater rigour than even actually killing any private subject. Moreover, the violence of passion, or temptation may, in some cases, alleviate a crime; such is theft in case of hunger, contradistinguished from the same crime committed through avarice, and to serve the purposes of luxury. Homicide, in consequence of sudden and violent resentment, is less penal than upon cool deliberate malice. The age, education, and character of the offender; the repetition (or otherwise) of the offence; the time, the place, the company in which it was committed: all these, and a thousand other incidents, may aggravate or extenuate the crime. Thus Demosthenes (in his oration against Midias) finely works up the aggravations of the insults he had received: "I was abused," says he, "by my enemy, in cold blood, out of malice, not by heat of wine, in the morning, publicly, before strangers as well as citizens; and that in the temple, whither the duty of my office called me."

Farther, as punishments are chiefly intended for the prevention of future crimes, those should be most severely punished, which are the most destructive of the public safety and happiness; and, among crimes of an equal malignity, those which a man has the most frequent and easy opportunity of committing, which cannot be so easily guarded against as others, and which, therefore, the offender has the strongest inducement to commit; according to Cicero's observation (Pro Sexto Roscio, 40); "ea sunt animadvertenda peccata maximé, quæ difficillimé præcaventur."

We may also observe, that punishments of unreasonable severity, especially when indiscriminately inflicted, have less effect in preventing crimes, and amending the manners of a people, than such as are more mild or merciful in general, and yet properly intermixed with due distinctions of severity. Crimes, says Beccaria, are more effectually prevented by the *certainty* than the *severity* of punishment. The certainty of a small punishment will make a stronger impression, than the fear of one more severe, if attended with the hopes of escaping; for it is the nature of mankind to be terrified at the approach of the smallest inevitable evil, whilst hope, the best gift of heaven, hath the power of dispelling the apprehension of a greater; especially if supported by examples of impunity, which weakness or avarice too frequently afford.

If punishments be very severe, men are naturally led to the perpetration of other crimes, to avoid the punishment due to the first. The countries and times most notorious for severity of punishments, were always those in which the most bloody and inhuman actions and the most atrocious crimes were committed; for the hand of the legislator and the assassin were directed by the same spirit of ferocity; which, on the throne, dictated laws of iron to slaves and savages, and, in private, instigated the subject to sacrifice one tyrant to make room for another.

In proportion as punishments become more cruel, the minds of men, as a fluid rises to the same height with that which surrounds it, grow hardened and insensible; and the force of the passions still continuing, in the space of an hundred years, the *wheel* terrifies no more than formerly the *prison*. That a punishment may produce the effect required, it it is fufficient that the *evil* it occafions fhould exceed the *good* expected from the crime; including in the calculation the certainty of the punifhment, and the privation of the expected advantage. All feverity beyond this is fuperfluous, and therefore tyrannical.

There are yet two other confequences of cruel punifhments, which counteract the purpofe of their inftitution, which was, to prevent crimes. The *firft* arifes from the impoffibility of eftablifhing an exact proportion between the crime and punifhment, for though ingenious cruelty hath greatly multiplied the variety of torments, yet the human frame can fuffer only to a certain degree, beyond which it is impoffible to proceed, be the enormity of the crime ever fo great. The *fecond* confequence is impunity. Human nature is limited no lefs in evil than in good. Exceffive barbarity can never be more than temporary; it being impoffible that it fhould be fupported by a permanent fyftem of legiflation; for if the laws be too cruel they muft be altered, or anarchy and impunity will fucceed. The exceffive feverity of laws (fays Montefquieu, Sp. of Laws, b. 6. c. 13.) hinders their execution; when the punifhment furpaffes all meafure, the public will frequently, out of humanity, prefer impunity to it.

Thus alfo the ftatute 1 Mar. ft. 1. c. 1. recites in its preamble, "that the ftate of every king confifts more affuredly in the love of the fubject towards their prince, than in the dread of laws made with rigorous pains; and that laws made for the prefervation of the commonwealth without great penalties, are more often obeyed and kept, than laws made with extreme punifhments." Happy had it been for the nation, fays judge Blackftone, if the fubfequent practice of that deluded princefs, in matters of religion, had been correfpondent to thefe fentiments of herfelf and parliament, in matters of ftate and government. It may be farther obferved, that fanguinary laws are a bad fymptom of the diftemper of any ftate, or at leaft of its weak conftitution. The laws of the Roman kings, and the twelve tables of the *decemvirs*, were full of cruel punifhments: the Porcian law, which exempted all citizens from fentence of death, filently abrogated them all. At this period the republic flourifhed: under the emperors fevere punifhments were revived; and then the empire fell.

We may further add, that it is abfurd and impolitic to apply the fame punifhment to crimes of different malignity. Befides, a multitude of fanguinary laws (befides the doubt that may be entertained concerning the right of making them) proves likewife a manifeft defect either in the wifdom of the legiflative, or the ftrength of the executive power. Although it be much eafier to extirpate than to amend mankind; yet that magiftrate muft be efteemed both a weak and a cruel furgeon, who cuts off every limb, which through ignorance or indolence he will not attempt to cure. Beccaria therefore propofes to form in every ftate a fcale of crimes, with a correfponding fcale of punifhments, defcending from the greateft to the leaft; but if this idea be deemed romantic, a wife legiflator will at leaft mark the principal divifions, and not affign penalties of the firft degree to offences of an inferior rank. When men fee no diftinction made in the nature and gradations of punifhment, the generality will be led to conclude, there is no diftinction in the guilt. Much as we may be difpofed to admire and extol the excellence of the Englifh law in a variety of refpects, yet none can otherwife than regret the frequency of its capital punifhments; inflicted by a multitude of fucceffive and independent ftatutes, upon crimes very different in their natures; and we cannot forbear paying our tribute of refpect to fir Samuel Romilly, whofe talents and character far exceed our praife, and other legiflators, who are laudably exerting themfelves in fimplifying and mitigating our penal code.

It is a melancholy truth, fays judge Blackftone, that among the variety of actions, which men are daily liable to commit, no lefs than 160 have been declared by act of parliament to be felonies without benefit of clergy; or in other words, to be worthy of inftant death. So dreadful a lift, inftead of diminifhing, increafes the number of offenders. The injured, through compaffion, will often forbear to profecute: juries, through compaffion, will fometimes forget their oaths, and either acquit the guilty or mitigate the nature of the offence; and judges, through compaffion, will refpite one half of the convicts, and recommend them to the royal mercy. Among fo many chances of efcaping, the ready and hardened offender overlooks the multitude that fuffer; he boldly engages in fome defperate attempt, to relieve his wants or fupply his vices; and if, unexpectedly, the hand of juftice overtakes him, he deems himfelf peculiarly unfortunate, in falling at laft a facrifice to thofe laws, which long impunity has taught him to contemn.

Beccaria, whofe excellent effay we have often cited in this article, obferves, that the more immediately after the commiffion of a crime, a punifhment is inflicted, the more juft and ufeful it will be. It will be more juft, becaufe it fpares the criminal the cruel and fuperfluous torment of uncertainty, which increafes in proportion to the ftrength of his imagination, and the fenfe of his weaknefs; and becaufe the privation of liberty, being a punifhment, ought to be inflicted before condemnation, but for as fhort a time as poffible. Imprifonment, he fays, being only the means of fecuring the perfon of the accufed, until he be tried, condemned, or acquitted, ought not only to be of as fhort duration, but attended with as little feverity as poffible. The time fhould be determined by the neceffary preparation for the trial, and the right of priority in the oldeft prifoners. The confinement ought not to be clofer than is requifite to prevent his flight, or his concealing the proofs of the crime; and the trial fhould be conducted with all poffible expedition. Can there be a more cruel contraft than that between the indolence of a judge, and the painful anxiety of the accufed; the comforts and pleafures of an infenfible magiftrate, and the filth and mifery of the prifoner? In general, "The degree of the punifhment, and the confequences of a crime, ought to be fo contrived, as to have the greateft poffible effect on others, with the leaft poffible pain to the delinquent." If there be any fociety in which this is not a fundamental principle, it is an unlawful fociety; for mankind, by their union, originally intended to fubject themfelves to the leaft evils poffible.

An immediate punifhment is more ufeful; becaufe the fmaller interval of time between the punifhment and the crime, the ftronger and more lafting will be the affociation of the two ideas of *crime* and *punifhment;* fo that they may be confidered, one as the caufe, and the other as the unavoidable and neceffary effect.

It is, then, of the greateft importance, that the punifhment fhould fucceed the crime as immediately as poffible, if we intend, that in the rude minds of the multitude, the feducing picture of the advantage arifing from the crime, fhould inftantly awake the attendant idea of punifhment. Delaying the punifhment ferves only to feparate thefe two ideas; and thus affects the minds of the fpectators rather as being a terrible fight, than the neceffary confequence of a crime; the horror of which fhould contribute to heighten the idea of the punifhment.

There

There is another excellent method of strengthening this important connection between the ideas of crime and punishment; that is, to make the punishment as analogous as possible to the nature of the crime; in order that the punishment may lead the mind to consider the crime in a different point of view, from that in which it was placed by the flattering idea of promised advantages. This ingenious writer closes his essay with the following general theorem, as the result of his previous reasoning. "That a punishment may not be an act of violence, of one or of many against a private member of society, it should be public, immediate, and necessary; the least possible in the case given; proportioned to the crime, and determined by the laws." Montesq. Sp. of Laws. Beccaria's Essay on Crimes and Punishments. Blackst. Com. vol. iv.

A valuable work, comprising the subject of this article, was presented to the public in the year 1811 by M. Dumont of Geneva. It was formed of detached materials, furnished by the papers of Mr. Jeremiah Bentham, and the whole is executed with such judgment in the arrangement of the matter, and so much liveliness and elegance as to the style of the composition, that M. Dumont appears more like an original author than an editor. This work would have afforded us many instructive and interesting extracts, if our limits had allowed our making that use of it, which it deserves. This, however, is the less necessary, as the reader may have access to the original treatise, *viz.* "Theorie des Péines et des Recompenses; par M. Jeremie Bentham, Jurisconsulte Anglois; redigée in François d'apres les Manuscrits, par M. Et. Dumont de Génevè," 2 vol. 8vo. à Londres, 1811: or to the ample analysis of it in the Edinburgh Review, N° 43. A brief account of its contents may, however, be gratifying to our readers. This work consists of two great parts or branches; the theory of penal legislation, and the theory of remunerative legislation. The first contains in a systematical form all the principles that serve to regulate the choice of different modes of punishment and the apportionment of punishments to crimes. In the second are exhibited the principles upon which the lawgiver ought to proceed, when he holds out inducements either alone or attended with corresponding penalties, to influence the conduct of his subjects. The first book explains the general principles of the system, and opens with definitions and classifications.

Punishment, in its most general sense, is the infliction of some evil upon an individual, with an intention that he should suffer this evil, and with a reference to some act done or omitted. Punishment, in its legal sense, is the infliction of some evil, according to judicial forms, upon an individual convicted of some act forbidden by law, and with the intention of preventing the recurrence of such acts. Punishments, as well as crimes, are divisible into four classes, as they affect the *person*, the *property*, the *reputation*, or the *condition* of those upon whom they are inflicted. Those which affect the person, or corporal punishments, are subdivided into various species; they may be simply or complexly afflictive, or restrictive, or active (*e. g.* compulsory labour) or capital. The other three classes are all privative, affecting the delinquent with loss or degradation. Hence arises another general classification of punishments, by dividing them into corporal and privative.

From this definition it appears, that the object of all punishment is the prevention of the offence in future, either by the same delinquent or by other persons in similar circumstances. The first end is accomplished in three ways; by taking from the offender the physical power of committing the offence; by taking away the desire; or by deterring him. The other, and principal object of the infliction, that of restraining others, can only be effected as far as the punishment is concerned, by the threat which it holds out of similar infliction. These objects, as they form the only just motives, constitute also the only justification of punishments. Although the direct and primary object of punishment is prevention, the civil magistrate, having provided for that object, has another duty to perform, which is to provide as far as possible for the reparation of the injury sustained through the crime committed.

The *expence* or *cost* of any punishment is, in the language of this system, the whole evil of every kind occasioned by it, including the suffering of the delinquent, the loss of his labour or life to the state, the pecuniary cost of his punishment; and, in short, every thing endured, paid, or foregone, in order to obtain the double preventive which the punishment is intended to administer. The *gain* or *profit* of the punishment consists in this preventive, or in the tendency of the punishment to secure it. A punishment may be termed frugal or economical which produces the desired effect with as little suffering as possible; and it may be termed costly or prodigal, when the same effect might have been produced by a smaller degree of suffering. The *real value* is distinguished from the *apparent value*, of the suffering; the former being the actual amount of that which is inflicted; the latter, the portion of it which is exhibited, or otherwise made known to, and understood by the public. The expence of a punishment is equivalent to the real amount; the profit is in proportion to the apparent amount only; and hence are deduced these important maxims: 1. That, *cæteris paribus*, a punishment easily comprehended, is preferable to one of difficult apprehension: 2. That one which takes hold of the memory, is preferable to one easily forgotten: 3. That one which is as great or greater in apparent than in real amount, is preferable to one which is really greater than it appears to be:—the excess of real amount being in truth so much thrown away, so far as regards the principal object, of general example.

The next subject of discussion comprehends the principles that ought to regulate the extent of punishment, for the prevention of crimes. These are contained in the following propositions. 1. The evil of the punishment must exceed the advantage arising from the crime; so that, generally speaking, the stronger the temptation to commit any crime, the more severe ought to be the punishment, subject to exceptions in extreme cases. 2. When the criminal act evidently indicates a habit or practice, the punishment should be proportioned, not to the gain derived from a single offence, but to the probable amount of profit flowing from a course of such conduct. 3. An addition must be made to the punishment, in order to compensate its want of certainty and proximity. 4. In cases where a temptation offers for the commission of different crimes, a more severe punishment should be denounced against the greater crime. 5. The more pernicious any crime is, the more safely may a severe punishment be ventured upon, for the chance of preventing it. 6. The nominal amount of punishment for the same crime, must often be varied at the discretion of the judge, according to the circumstances of the delinquent, in order to preserve the real amount of suffering.

The qualities of punishment, the consideration of which naturally succeeds that of the measure or quantity, are such as follow: it should be *divisible; invariable*, or *certain* or *equal; commensurable* with others; *analogous* to the crime; *exemplary; economical; remissible;* that it should restrain the offender from doing harm; conduce to his *reformation;* yield a *profit*, in the ordinary sense of the word; be *simple* in its description;

defcription; and fo far *popular* as to fhock none of the eftablifhed feelings or prejudices of the community. Thefe qualities are, for the moft part, underftood as foon as they are mentioned. Some of them, however, undergo a more ample difcuffion than others. This is the cafe with refpect to the qualities of *analogy* and *popularity*. One of the fources of analogy fpecified by Mr. Bentham is that of employing the fame inftrument or operation in the punifhment, as the delinquent did in the crime, as, *e. gr.* burning an incendiary who had committed any aggravated act of *arfon*, by which lives were facrificed as well as property. Another method is that of inflicting on the delinquent the fame injury which he offered to the innocent perfon. A third confifts in fubjecting to punifhment the part of the body with which the offender committed the crime. A fourth, in affecting the face with fome disfigurement fimilar to difguifing, where part of the offence was the ufe of a difguife. Other analogies alfo are enumerated. In difcuffing the *popularity* of punifhment, the author adverts to the prevalence of falfe feelings and prejudices, and he reduces the errors proceeding from thefe caufes to four heads; as they confift in miftaken notions of *liberty*, *decency*, *religion*, and *humanity*. The author allows, however, that a lawgiver fhould, for a time at leaft, frame his inftitutions fo as to humour even the caprices and errors of his people, when he finds them too deeply rooted and widely fpread, to be overcome or difregarded. To any fpeculative arguments, founded upon falfe views of thofe different fubjects, of courfe no regard fhould be paid;—as to thofe fanatics in politics, religion, or fentiment, who would have no imprifonment becaufe it violates liberty, or abolifh capital punifhments becaufe they encroach upon the province of the Deity, or becaufe they are painful to the feelings.

The author mentions four cafes, in which punifhment is wholly inept, and ought not to be inflicted; *viz.* where the crime being either imaginary, or unfit for legiflative interference, may be faid not to exift, and the punifhment would be *unfounded*: where the punifhment would be wholly *inefficacious* on the delinquent, or others in the fame circumftances, as in the cafe of idiots: where the means being fufficient to accomplifh the end in view, punifhment would be *fuperfluous*: where more evil being likely to refult from punifhing the particular offenders than from letting them efcape, the infliction would be too *coftly*, as in the cafe of an extenfive mutiny or rebellion.

We have already ftated, that the author divides punifhments into two great claffes, *corporal* and *privative*; that he again fubdivides corporal punifhments into five kinds, and privative into three. 1. The *firft* clafs of corporal punifhments confifts of punifhments *fimply afflictive*, denoting thofe which caufe bodily fuffering, with little attendant injury; and even thofe moft fimple, as the lafh, are accompanied with a certain difgrace by their public exhibition, which is an effential part of the procefs. Of the various kinds of fimple infliction, our author gives the preference to the lafh, under certain modifications. 2. The *fecond* clafs confifts of punifhments *complexly afflictive*, or thofe in which the mere bodily fuffering is attended with, or followed by, fome other lofs, either of perfonal comfort or reputation. Thefe are fubdivided into three kinds, comprehending thofe that are inflicted by *deforming* the perfon, which is done either by *difcolouring*, *e. gr.* burning in the hand; or *disfiguring*, *e. gr.* flitting the nofe, or cutting the ear; by *difabling* a limb or organ, without deftroying it; by *mutilating* or deftroying the part. The *third* clafs comprehends *reftrictive* punifhments, which prevent the offender from doing or enjoying fomething agreeable or ufeful to him. The *reftrictions* thus impofed are of two kinds; *fimple* prohibitions, and reftraints upon *loco-motion*. The former are fo limited in their application, that we need not particularly fpecify them; but the latter are divided into five kinds; *viz. imprifonment*, in the ordinary fenfe of the word; *quafi-imprifonment*, or confinement within the diftrict to which the offender belongs: *relegation*, or confinement to fome other diftrict within the dominions of the ftate: *local interdiction*, or banifhment from a particular diftrict: *banifhment* from the territories of the ftate, either indefinitely, or to fome fpecific foreign part. *Imprifonment*, according to our author's ftatement, in order to be effectual, ought to place the offender, for a limited time, under the moft complete reftraint, inftead of being long and flight. Mr. Bentham enlarges in the enumeration of the evils comprehended under this mode of fuffering, of which fome belong *infeparably* and neceffarily to it; others fuch as are *acceffary*, but moft frequently accompany it; and others again fuch as arife from *abufes* of it. With imprifonment, he fays, in certain cafes, and always for a very limited time, may moft advantageoufly be joined *folitude*, *darknefs*, and *regimen*. Our author, having expofed the abfurd fyftem of "prifon-fees," infers from his general principles that there ought to be three kinds of prifon, adapted to the feveral purpofes of *fimple* detention, *penitentiary* confinement, and *perpetual* imprifonment. The firft being only applicable to the cafe of infolvent debtors guilty of imprudence or extravagance, and of accufed perfons kept for trial, fhould have no accompaniment whatever of rigour. The leading principle in diftinguifhing the two others is, that the fubjects of the former are to enter again into fociety; while thofe of the latter, being for ever excluded from it, the exemplary nature of their fufferings fhould be the principal object of attention. The names of the three prifons, for thefe feparate purpofes, fhould be different, as well as their external appearance; and every thing which can feize hold of the imagination, without awakening fympathy, fhould be prefented, both in the conftruction of the perpetual prifon, and in the fituation of its inhabitants. 4. The *fourth* clafs of punifhments comprehends thofe that are termed *active* or *laborious*. Punifhments of this clafs, when examined by the rules already premifed, are found to unite the greateft number of advantages with the feweft defects. In the difcuffion of this fubject, the author directs our attention to what may be called the extreme cafe of mifmanagement in this kind of punifhments. Here he alludes to Botany Bay. The tranfportation of convicts to America, which preceded the prefent plan, with feveral difadvantages of great moment, was, upon the whole, infinitely preferable. It was grofsly unequal, inafmuch as it became fervitude with exile to the poor, while it was only fimple relegation to thofe who could pay for their paffage. It was defective too in preventive power, the opportunities of efcape being neceffarily great. In both thefe particulars, the deportation now practifed has the manifeft advantage. All the convicts are equally under reftraint, and their efcape is much more difficult; but in every other point of view, it is either as bad, or a great deal worfe. It is as little as poffible exemplary: the difproportion between the real and apparent fuffering,—the excefs of the former,—is in truth a maximum. The community in this country fee a convict fent on a long voyage, to a fertile country, lying in a fine climate. This is the example. The reality is, that the miferable wretch, after rotting in the hulks for a year or two, is crammed with fome hundreds of his fellows into a floating prifon, or, it may be, a peft-houfe, in which, if he furvives the rifks of famine, peftilence, mutiny, fire, fhipwreck, and explofion, he is conveyed, through the in-

 fliction

fliction of a ten months' voyage, to a life of alternate flavery and rebellion, where guilty or cruel excefs fucceeds exquifite fuffering, without varying the uniform mifery, or changing the prevalent character of the body; and all this paffes at the oppofite extremity of the earth's diameter, from whence it operates no more in any manner of way upon the inhabitants of England, than if it were paffing in the moon. The tendency of difcipline in the colony to reform the convicts, fuppofing them to have arrived there, may eafily be eftimated. They are not feparated from their companions in guilt; they have no better examples before them, no eyes to watch them. The partial hiftorian of the rifing fettlement, himfelf the chief magiftrate, (Mr. Collins,) has fupplied us with the details; and, in fpite of his inclination to fee every thing in the faireft light, he has painted, if the pages of a journal for fixteen years may be faid to paint, by far the blackeft picture ever yet exhibited of human fociety. His book is a catalogue of crimes; it would be a record of convictions, but that perjury fo univerfally prevails as to enfure the efcape of all who are not taken in the fact. The vice at the root of all the reft, a rage for fpirits approaching to frenzy, can neither be cured, nor deprived of gratification. Far from improving by their refidence there, it was only at the firft eftablifhment that any remiffion of unfavourable fymptoms appeared. As foon as the firft convicts had finifhed their period of fervitude, their liberty brought along with it an influx of diforder and contamination, which each fucceeding year feems to increafe. If this fyftem, then, prevents the delinquent from repeating his crimes, it is only by transferring the fcene of them to a diftant fettlement, where it fofters and augments them; and although, with reference to one part of the empire, this may be termed prevention, the legiflator, whofe care fhould embrace the whole, has no right to give it fuch a name. As to the pecuniary expence, by which fo much evil is purchafed, we find it in the parliamentary reports eftimated at above a million in about ten years, or about thirty-eight pounds for each convict, befides the value of his labour. Laft of all, the punifhment inflicted is perfectly different from the one to which the fentence of the law has condemned the convict. Not to mention the detention before tranfportation, and the arrival fometimes when the term of punifhment has nearly expired, the power of returning at its expiration is poffeffed by few men, and no women; while of the voyage fome idea may be formed, from the average mortality between 1787 and 1795, being above one in ten; and from a jail fever, always a probable occurrence, on one occafion, in 1799, having carried off one hundred in three. If, in fuch a cafe, we could look to the fettlement as a colonial fpeculation, we fhould find its gains in a fimilar proportion; but this eftimate would be as fuperfluous after what has been faid, as it would be foreign to the defign of this inquiry.

In the work before us we have a general fketch of the author's plan of improvement upon this fyftem, together with a view of its connection with the principles which he has unfolded, and of the prodigious advantages accruing from it. The "Panopticon" is diftinguifhed by three leading properties. From the form of the building, and the difpofition of the cells, the infpector can fee each prifoner at all times, without being feen by them, and can direct them without leaving his poft: the management of the eftablifhment is carried on by contract, the government paying a fixed price for the whole expences of each convict, and the contractor having the whole profit, as he has the entire charge and regulation, of the work to be performed, but allowing a certain proportion of the gain to the convict: the contractor infures the lives and fafe cuftody of the convicts; he is allowed yearly a certain fum for the deaths, as calculated from the common tables, and he pays the fame fum for each death which actually does happen, and for every efcape which takes place. If we miftake not, Mr. Bentham, by his contract with government, further engaged to pay fo much for each prifoner who, after his difcharge, fhould afterwards be convicted of any offence. The entire publicity of his accounts was another condition, and one upon which he himfelf infifted. The Panopticon was to be open at all times to every magiftrate, and at certain hours to the public generally.

The moft ftriking points of the comparifon between both fyftems, as they are prefented to us by the anonymous author of the article on the fubject in the Edinburgh Review, are fuch as follow. The punifhment is in the higheft degree exemplary; it is all feen and underftood; it appears much greater than it really is; the comforts of the convicts, in their intercourfe with each other according to their improvement, and in the ftate of induftry, and cleanlinefs, and wholefome regimen, for which they have exchanged their ordinary habits, being, however real, by no means fuch as ftrike the multitude of fpectators, who only fee confinement, compulfory labour, and ignominy. The reforming effects of the plan are equally manifeft: the labour, to which they are in part allured by a fixed allowance of profit; the perfect temperance in which they live; the facility afforded of feparating them into claffes, according to their habits and behaviour; the means of eafy inftruction, both religious and other, which they give; all furnifh as good a chance of reclaiming thofe unhappy perfons who are not hardened in guilt, as from any fuch difcipline can reafonably be expected. The preventive powers of the Panopticon are complete, while the convict remains in it; and although a relapfe after liberation can only be guarded againft by reformation, a contrivance is added to this eftablifhment, admirably calculated to provide againft the firft dangers of the difcharge: the convict is transferred to another place of mitigated confinement, where he is rather under infpection than in cuftody, and from whence he is gradually allowed wholly to withdraw. With refpect to the coft of the plan, we may form fome eftimate of it from the terms of Mr. Bentham's contract. Each convict was to coft government 13*l.* 10*s.*, including 1*l.* 10*s.* for the proportion of the expences of building and ground. He was to provide a fund for indemnifying the parties injured; to allow the convicts one quarter of the profits of their labour; and, after the firft trial, to make a reduction in the charge. Practical men, well verfed in fuch matters, had no doubt that a very confiderable reduction might have been fpeedily afforded; and that, in a few years, the profits would entirely defray the expences of the eftablifhment to the ftate. While all manner of delays and difficulties were thrown in the way of this experiment; while wits and jobbers, or, as they termed themfelves, matter-of-fact men, averfe to theories, and deprecating novelties, were employed in running it down; trials were made in America of penitentiary houfes upon fimilar principles, though in a much lefs perfect fhape, and without fome of Mr. Bentham's chief improvements. We have the moft irrefragable teftimony borne to their fuccefs, by the interefting narratives of the duc de Rochefoucault Liancourt and captain Turnbull: the one a perfon eminently fkilled in the fubject of prifons; the other a mere practical obferver, imbued with no knowledge beyond that of the naval profeffion. Both thefe very different witneffes concur in their ftatement of the falutary confequences of the plan; and if we wifhed to find a perfect contraft to the melancholy

melancholy narratives of Mr. Collins, we could certainly nowhere ſo well be ſuited as in the deſcriptions which the French and Engliſh travellers have given us of the convicts in New York and Philadelphia.

5. Capital puniſhments compoſe the *fifth* claſs. This claſs conſiſts either of *ſimply* inflicting death with the leaſt poſſible degree of ſuffering, or in accompanying the deſtruction of life with *torments*. The latter method, at one period univerſally prevalent, and ſtill known in moſt countries, is happily almoſt aboliſhed in the two moſt civilized nations. In France, the Code Napoleon allowed it only in the caſes of parricide, and attempts againſt the ſovereign's life, where the addition made to the puniſhment of death is cutting off the right hand. In England, it is only in the caſe of high treaſon that ſuch augmentations are allowed: the puniſhment of the law is no doubt barbarous in the extreme, but in practice it is always remitted. All ſuch cruelties have the effect of inſpiring pity in the ſpectators towards the criminal, and of rendering criminals more hardened and ſavage.

The ingenious author of the critique on Mr. Bentham's theory, to whoſe analyſis of the work we are ſo much indebted in the compilation of this article, agrees with him in his objections to Beccaria, who maintains that a puniſhment of longer duration is more terrible to the ſpectator. Clearly there is none ſo dreadful as death. M. Dumont adds, that its apparent ſuffering is greater than its real, which applies only to the pains of it. On the other hand, it exceeds all others in ſome material defects; not only is it expenſive, and beginning to become unpopular; it is quite irremiſſible, and it is in the higheſt degree unequal, and incapable of diviſion or apportionment. A very ſatisfactory ſtatement is given under this head, of the evil tendency of frequent executions, of the kind of reaſoning by which offenders at the moment of temptation get rid of the fear of death, and eſpecially of the wide difference between encountering certain deſtruction, and yielding to impulſes which may lead to it. The evils ariſing from its being irremiſſible are alſo ably expounded; yet we think the author has neglected to conſider how much of its horror conſiſts in this quality. It is manifeſt that no other puniſhment can utterly exclude hope. In comparing capital with other puniſhments, our author is diſpoſed to give the latter the preference, almoſt to the excluſion of the former; chiefly becauſe, however exemplary to men in general the infliction of death may be, and how deep ſoever the impreſſion it makes on their minds, it has not the ſame terrors for the claſs of men moſt likely to commit the worſt offences, violent ſpirits and hardened delinquents. That its range ſhould be extremely limited, we are willing to admit; but we differ from him in the poſition, that for this claſs of men, perpetual confinement to hard labour would have more terrors than death. The total extinction of life, without chance of eſcape, pardon, or mitigation, ought ſtill to be denounced againſt the worſt offences; and, by being confined to theſe, will unqueſtionably become doubly terrible. The evils ariſing collaterally from the abuſe of this puniſhment, are ſo ably pointed out by ſir Samuel Romilly, that our author abridges a part of the treatiſe before us, by referring to his tract.

The other great diviſion of puniſhments in Mr. Bentham's theory, conſiſts more peculiarly in *privation*. Theſe may be arranged in three claſſes, as they impoſe a forfeiture of *reputation*, of *property*, or of *condition*. 1. Puniſhments which affect a man's reputation conſiſt of appeals to public opinion, and are thoſe meaſures which the lawgiver takes with reſpect to him, for directing that opinion againſt him. The lawgiver may inflict puniſhments of this kind, or rather may expoſe the offender to have them inflicted, either by ſimply *denouncing*, with the authority belonging to his functions, that certain acts ſhall be deemed infamous, or by treating the particular offender *judicially* in a certain way. The latter is the mode uſed in modern times; and it is practiſed in different ways; by *publication* of the offence;—by judicial *admonition*;—by inflicting *puniſhments* of the other claſſes, corporal as well as privative, the immediate object of which is not the deſtruction of reputation;—by inflicting what may be termed *quaſi-corporal* puniſhments, the ſole object of which is infamy;—by *degradation*, or depriving the offender of his rank, natural or conventional;—by *diſcrediting* him, or preventing his teſtimony from being received. 2. The deſcription of puniſhments affecting property conſiſts of thoſe which are *pecuniary*, and which are *quaſi-pecuniary*, as confiſcation of lands, &c. 3. The forfeiture of condition, or *ſtatus*, though a claſs of great extent, theoretically ſpeaking, is in practice reduced within narrow limits. Marriage may be diſſolved; children may be baſtardized; blood may be corrupted; the different kinds of truſt may be taken away; a perſon may be reduced to ſlavery; a community may be deprived of its rights and privileges. Outlawry may alſo be referred to this head.

There are other kinds of infliction, which every ſound principle teaches us to avoid where it is poſſible, and to diminiſh as much as poſſible, where, from the defects of all human contrivances, they inevitably mingle themſelves with the legitimate modes of puniſhment. Our author's ſyſtem arranges them in two claſſes; thoſe which are *miſplaced*, or which fall upon other perſons than the offender; and thoſe which are *complicated*, or preſent neither to the legiſlator, the judge, the party, nor the public, any fixed and definite idea. Thoſe puniſhments that are miſplaced, in the proper uſe of the term, or which the legiſlator enacts with the intention of puniſhing another perſon than the offender, either along with him, or in his place, conſiſt of four kinds; *viz. vicarious*, where the offender eſcapes;—*tranſitive*, where an innocent perſon is purpoſely puniſhed who is connected with the offender;—*collective*, where a body of innocent perſons ſuffer, in the preſumption of the guilty being among them;—and *fortuitous*, where an innocent perſon ſuffers as well as the offender, though unconnected with him. The only inſtance of *vicarious* puniſhments is that inflicted upon the families and creditors of ſuicides by the law of England. This, like all other abſurd and unjuſt laws, is evaded, in almoſt every inſtance, by perjury, and the exerciſe of diſcretion in a ſovereign. The example given of *tranſitive* puniſhment is the corruption of blood, the abſurdity of which is ably expoſed. The chief inſtances of *collective* puniſhments are thoſe in which corporations are puniſhed for the faults of certain individual corporations; a proceeding which can never be juſtified. The well-known examples of *fortuitous* puniſhments are taken from the law of England. The moſt notable is the forfeiture and eſcheat of freehold property, in caſes of attainder of treaſon and felony, where the confiſcation relates back to the commiſſion of the offence, and all meſne conveyances are avoided; ſo that a man may commit a ſecret crime, and ſell his eſtate to an ignorant and innocent purchaſer, in whoſe hands the crown or the lord afterwards ſeizes the eſtate upon the vendor's attainder; and as his goods and chattels are forfeited upon conviction, the only fund of compenſation is gone alſo. Deodands are another inſtance of ſimilar injuſtice; and the puniſhment of incapacitating a perſon from giving evidence, is manifeſtly one which may ſtrike more injuriouſly at parties wholly unconnected with the offender, than at himſelf; beſides, that it is by no means inflicted merely with the view of putting courts of juſtice on their guard againſt admitting a bad witneſs; for it is often the puniſhment of crimes which have no peculiar connection with violation of truth.

Among the evils of complicated puniſhments, we may reckon, beſides outlawry and incapacitation of giving evidence, *excommunication* and *felony*. Some groſs abuſes having occurred in the infliction of the puniſhment of excommunication, ſeveral diſtinguiſhed perſons have undertaken to ſubſtitute other procedure in its place; and ſir W. Scott brought a bill into parliament with this view, ſo that the evil is done away. The puniſhment of perſons as felons, comprehends a number of inflictions very different from each other, ſo that our author conſiders the puniſhing as a felon to be a vague and indefinite term. This comprehends two deſcriptions of puniſhment; the one capital, with forfeiture of lands and chattels; the other not capital, but conſiſting in forfeiture of chattels, and the form of burning in the hand; to which, by ſpecial enactment, impriſonment, tranſportation, or indeed any other puniſhment, may be ſuperadded. It muſt be acknowledged, that a much ſimpler and better manner of ſtating the puniſhment due to an offence would be, to tell at once of what it is to be compoſed; and inſtead of enacting that certain offences are felonies, which ſpecifies nothing, to prohibit them, and ſtate the preciſe inflictions which ſhall follow the commiſſion of them. For the general character and high commendation of the work, which has furniſhed the preceding materials, we refer to the Edinb. Rev. N° 43. p. 1—31.

Puniſhment, in *Theology*. It has been diſputed among divines, whether the puniſhment of the wicked in a future world be ſtrictly eternal or not. For the arguments on both ſides of the queſtion, ſee Hell.

PUNITORY Interest, in the *Civil Law*, ſuch intereſt of money, as is due for the delay of payment, breach of promiſe, &c.

PUNK, in *Natural Hiſtory*, the inward part of the excreſcence or exuberance of an oak. It is uſed by the Indians in Virginia for medicinal burning, as the Eaſt Indians uſe moxa. Phil. Tranſ. No. 454. ſect. 1.

PUNN. See Pun.

PUNO, in *Geography*, a town of Peru, now annexed to the viceroyalty of La Plata or Buenos Ayres, and capital of a diſtrict of the ſame name, called alſo Paucarcolla (not *Paucarcotta*, as it is miſprinted in that article). It is a rich and populous town, ſituated on the W. ſide of the lake Titicaca, and containing ſome illuſtrious families, as well as a beautiful church for the Spaniards, and another for the Indians, who weave great quantities of coarſe cloth, with which they ſupply the neighbouring countries. S. lat. 16° 20′. W. long. 70° 26′.

PUNT, in *Sea Language*, a ſort of oblong flat-bottomed boat, with a ſquare head and ſtern, whoſe floor reſembles the platform of a floating ſtage; and uſed by ſhip-wrights for breaming, caulking, or repairing a ſhip's bottom. It is alſo uſed in ſome canals.

PUNTA, in *Geography*, a town of South America, in the audience of Quito, and juriſdiction of Guayaquil.

Punta, *La*, a town of Mexico, in the province of New Biſcay; 40 miles N.N.E. of Durango.

Punta is alſo an epithet, diſtinguiſhing ſeveral capes, which are too numerous to be here recited; and this is the leſs neceſſary, as the principal of them occur under other appropriate titles.

Punta *Entornada*, a town on the N. coaſt of Spain. N. lat. 43° 34′. W. long. 5° 30′.

Punta *del Guda*, a ſea-port and capital of St. Michael, one of the Azores, defended by a caſtle.

Punta *de Tordera*, a town and cape of Spain, on the coaſt of Catalonia. N. lat. 41° 38′. E. long. 2° 37′.

PUNTO *del Monte*, a town of South America, in the province of Cordova; 15 miles S. of Cordova.

PUNUGGA, a village of Bootan, ſituated in a deep hollow, and ſurrounded with mountains, for the moſt part covered with pines, along whoſe ſides clouds are perpetually hovering. On the borders of this village are many large heaps of fir-leaves, which being left to ferment and rot, are uſed as excellent manure.

PUNUNAGUR, a town of Bengal; 10 miles W. of Nattore.

PUNWARY, a town of Hindooſtan, in the circar of Gohud; 18 miles E. of Raat.

PUOLANGO, a town of Sweden, in the government of Ulea; 40 miles S. of Cajana.

PUPA, in *Natural Hiſtory*, a name lately ſubſtituted in the room of chryſalis or aurelia, becauſe many inſects in this ſtate reſemble an infant in ſwaddling clothes; and all, except thoſe of the hemiptera order, take no nouriſhment. See Entomology.

PUPIGLIO, in *Geography*, a town of Etruria; 10 miles N. of Piſtoia.

PUPIL, Pupillus, in the *Civil Law*, a boy or girl not yet arrived at the age of puberty, *i. e.* under fourteen years of age for the boy, and under twelve for the girl.

While a minor remained under the direction of a tutor, he was called a pupil; after puberty, a curator being aſſigned him, he ceaſed to be called a pupil.

A tutor is obliged to pay intereſt for what monies of his pupil lie idle and unemployed. A tutor is allowed to do any thing for his pupil, but nothing againſt him.

Pupil is alſo uſed by way of extenſion, in *Univerſities*, &c. in the ſenſe of *alumnus*, for a youth under the education or diſcipline of any one.

Pupil, in *Anatomy*, the round opening in the iris, by which the rays of light are admitted into the eye. See Eye.

Pupil, in *Optics*. It is obſerved, that as we are forced to uſe various apertures to our optic glaſſes, ſo nature has made a like proviſion in the eyes of animals, whereby to ſhut out too much, and admit ſufficient light, by the changes in the aperture of the pupil.

The ſtructure of the uvea and iris is ſuch, as that, by their aperture, the pupil is contractible and dilatable at pleaſure, ſo as to accommodate itſelf to objects, and to admit more or fewer rays, as the object, being either more vivid and near, or more obſcure and remote, requires more or leſs light: it being a conſtant law, that the more luminous the object, the ſmaller the pupil; and again, the nearer the object, the ſmaller the pupil; and *vice verſâ*.

This fact has been long ago noticed by optical writers. B. Porta, about the middle of the ſixteenth century, in his treatiſe De Refractione, p. 74, obſerves, that the pupil is contracted involuntarily when it is expoſed to a ſtrong light, and opens of itſelf when the light is ſmall. A ſimilar obſervation was made by his countryman and contemporary, Father Paul of Venice. Galen, indeed, firſt obſerved the dilatation of the pupil of one eye, when the other was ſhut or loſt, and the contraction of it, when the other was opened or recovered; and in this opinion he was followed by all naturaliſts and philoſophers, till Fabricius ab Aquapendente, profeſſor at Padua, by obſerving the eye of a cat, found

found that the pupil not only dilated and contracted itself, when one of the eyes was shut, but also when both were open. F. Paul found, from repeated experiments, that the pupil not only of cats, but also of men, and other animals, always contracted itself when the eye was exposed to a bright light, and again dilated itself when the light was faint and languid. This he always observed, as well when both eyes were open, as when one of them was shut. The same remark had been made by Achillinus, in a treatise published in 1322; and the fact was known to the Arabians, Rhazes and Avicenna. That the pupil of the eye is enlarged, in order to view remote objects, and that it is contracted while we are viewing those that are near, is a fact with which Scheiner, in the beginning of the seventeenth century, was well acquainted, and which he proved by experiments, and illustrated by figures. When a needle, or any small object, is brought near to the eye of any person, who looks attentively at it, the pupil, he says, is plainly seen to contract; and it as constantly expands whenever it is withdrawn.

This alteration of the pupil is effected by certain muscular fibres on the outside of the uvea, which arrive from nerves detached hither from the sclerotica. These fibres proceeding straight from their origin towards the centre, terminate in the orbicular limb or verge of the pupil, which consists of orbicular fibres, whereby the figure and space of the pupil are defined. The first, or longitudinal fibres, dilate the aperture of the pupilla; the latter, or orbicular ones, constringe it.

Some authors, however, attribute the motions of the pupilla to the ligamentum ciliare; and others think, that both this, and the fibres of the uvea, concur herein. Dr. Derham adds, that while the pupil opens and shuts, the ligamentum ciliare dilates or compresses the crystalline, and brings it nigher to, or farther from, the retina, as the object is more or less remote.

There is no doubt that the change to which the pupil is subject is the effect of light upon the eye. Dr. Hartley, Obs. on Man, vol. i. p. 219, supposes, that the light which enters at the pupil has great efficacy in contracting both the greater and less rings of the iris, as may be concluded, he says, from the immobility of the pupil in a gutta serena; also because, on this supposition, the light which passes in at the pupil must, by contracting the less ring, become a check and guard against its own too free admission, which is agreeable to the tenor of nature in like instances. The retina, he observes, extends to the greater ring, and may send some nervous fibres to it, and even to the iris. Dr. Whytt also says, Essay on vital and involuntary Motion, p. 112, that the contraction of the pupil is not performed by the action of light upon the iris, but upon the retina; since whatever intercepts the rays of light, so as to prevent their reaching the retina, causes a preternatural dilatation of the pupil; because in a cataract, where the crystalline humour, being considerably opaque, intercepts a great part of the rays, the pupil loses a good deal of its contractile power. This author also observes, that the wideness of the pupil in a syncope, apoplexy, and confirmed gutta serena, shews that, in order to dilate the pupil to its largest size, no effort of the mind is necessary, but only the superior contractile power of the longitudinal fibres of the uvea, when its circular muscle is not excited into action by the stimulus of light on the retina. M. Mery informs us (Mem. Ac. Paris, for 1704) that, having plunged a cat in water, and exposing her eye to the strong light of the sun, the pupil was not at all contracted by it; whence he infers, that the contraction of the iris is not produced by the action of the light, but by some other circumstance. For he contends, that the eye in this situation receives more light than in the open air. M. de la Hire, in reply, endeavours to shew, (Mem. Ac. Par. for 1709) that fewer rays enter the eye under water, and that, in those circumstances, it is not so liable to be affected by them. Besides, it is obvious to be remarked, that the cat must be in great terror in this situation; and being an animal that has a very great voluntary power over the muscles of the iris, and being now extremely attentive to every thing about her, she might have her eyes open, notwithstanding the action of the light upon it, and though it might be very painful to her.

The figure of the pupil, in various animals, is wonderfully adapted to their various circumstances and occasions in some, *e. gr.* in man, it is round, that form being fittest for the position of our eyes, and the various uses we make of them in all directions.

In others, it is elliptical or oblong: in some of which, *e. gr.* the horse, sheep, ox, &c. the ellipsis is transverse, and the fissure large, to enable them to see laterally, and even with a little light; and thereby both to gather their food the better in the night, and to avoid dangers on either side. In others, *e. gr.* the cat, the ellipsis is erect, and is also capable of opening very wide, and shutting very close; by means of the latter of which states, that animal can exclude all, but, as it were, a single ray of light, and so avoid all the inconveniencies of the bright sun; and by the former, it can take in all the faintest rays, and thus avoid the inconveniencies of the night: an incomparable provision for these animals, which are to watch and way-lay their prey both by day and night, to see upwards and downwards, to climb, &c. See Eye and Vision.

Pupil, *Closure of.* A preternatural smallness of the pupil always renders the patient incapable of discerning objects well at night-time, and occasions a diminution of vision. The consequence of a complete closure of the pupil, a case termed *synizesis*, is total blindness. Both these affections only differ from each other in degree, and they originate from the same causes. The most frequent cause is a violent inflammation of the eyes, particularly when such disorder extends to the iris, and arises at a period when the anterior and posterior chambers of the aqueous humour contain none of this fluid. This case principally happens after the extraction of the cataract. Here the inflammation constantly affects the capsule of the crystalline lens, so as to make it opaque, and at the same time adhere behind the pupil to the iris; a circumstance which is well deserving attention. Not unfrequently, however, a closure of the pupil takes place during ophthalmy, notwithstanding both chambers of the eye are full of the aqueous humour. Wounds of the iris sometimes cause this unpleasant occurrence, especially when they continue open, and do not heal. It is observed to be most frequently produced by such wounds as divide the radiated fibres of the iris transversely. These wounds, however, do not invariably remain open: sometimes they close, and then the pupil undergoes no alteration. Even when such wounds do not unite, a closure of the pupil does not always follow. In these instances, the natural pupil has been remarked to become closed, and the preternatural aperture in the iris to be widened, when the eye was exposed to the light; and, on the contrary, immediately the light was diminished, the pupil became dilated, and the other opening was contracted and closed. Wounds of the iris in the other direction, even when they remain disunited, often cause little or no diminution of the natural motion of the pupil.

It sometimes happens, that a greater or lesser portion of the iris is detached from the circumference of the cornea;

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and, in this situation, an oval aperture is produced, through which the rays of light pass into the eye. A complete closure of the pupil is usually the consequence of such detachment of the iris. A blow on the eye, a kick of a horse, or some other external violence, attended with a violent concussion of the eye, is the common cause of this detachment of the iris. Janin has seen it brought on by a prolapsus of the iris through an ulcerated opening in the cornea. The iris was kept in a state of tension, and the patient was suffering constant pain in the eye; but, after a time, this pain suddenly ceased, when it was remarked, that the iris was torn from the upper edge of the cornea at five different points. The patient, who had been deprived of his sight by the closure of the pupil, now recovered it again. Through the aperture, formed by a separation of the iris from the cornea, patients commonly see distant objects tolerably well, notwithstanding the opening is immoveable, and not in the centre of the eye; but, in general, they can see only a half of such objects as are near. In cases where the iris is thus detached, the pupil sometimes continues open. Janin once noticed an alternate motion in the pupil and the preternatural opening. Between them the iris was thrown into folds, or wrinkles. Immediately a strong light entered the eye, the wrinkles diminished, the pupil contracted, and assumed a long narrow shape, while the preternatural opening grew larger and wider. In dark places, the latter became smaller, the pupil larger, and the part of the iris situated between them more wrinkled.

Sometimes the pupil becomes closed, in consequence of a spasmodic contraction of the iris. At first, the pupil is merely lessened in diameter; the power of seeing decreases; and at length the eye is very sensible of the light, though not at all inflamed. At last, the pupil is entirely closed. This case presents itself most frequently after operations for the cataract. The pupil occasionally undergoes a gradual diminution after such operations, and in the end is totally obliterated, without any particular cause, inflammation, or pain; and this event may happen several weeks, months, or years, after the time of those operations. It is remarked by surgical writers, that such persons as frequently read for a long while, and attentively look at shining, bright, strongly illuminated objects, run a risk of being attacked with this disorder. The pupil, which contracts itself very much during the inspection of these objects, at length becomes habituated to a state of contraction, and loses all power of expanding itself. Richter observes, that this form of the complaint is termed *synizesis ex consuetudine*.

Infants are sometimes born without pupils. In this case, the situation of these openings is occupied by the membrana pupillaris. By some this affection has been erroneously called *cataracta pupillaris*: as Richter observes, the term *synizesis congenita* is much more applicable to it. A prolapsus of the iris is commonly attended either with a diminution, or a total closure of the pupil. When the iris is reduced in time, the pupil generally expands again; but when the reduction is not effected till after a certain period, this opening remains closed, and this notwithstanding every portion of the iris be now replaced. A prolapsus of the vitreous humour sometimes occasions, and leaves after it, a contracted state of the pupil. Every long continued deficiency of the aqueous, or considerable loss of the vitreous humour, by whatsoever cause produced, is accompanied with risk of a permanent diminution, or even a total closure of the pupil: hence it is often a symptom of *atrophia oculi*.

Sometimes, though the pupil is of proper dimensions, it is obstructed by extraneous matter. This case is termed *synizesis spuria*. The substance producing the obstruction, is either a portion of coagulated blood, which is the consequence of an extravasation of this fluid in the anterior chamber; thick matter from a suppuration within the eye; or the remains of a diseased lens continuing after the operation of extracting the cataract. A white opaque membrane, like a cyst, is sometimes seen protruding through the pupil into the anterior chamber. The capsular cataract is occasionally so moveable, that, when the head is inclined forwards, it enters the pupil, and partly comes into the anterior chamber; but returns into its former position, as soon as the head is inclined backward again. Mauchart asserts, that he has seen a fungous excrescence growing from the edge of the iris, and filling up the pupil.

When the diminution or closure of the pupil is of long standing, it can never be relieved, except by an operation, whatever may be the nature of the cause from which it originates. When the pupil has been for a long while in a diminished or closed state, it loses entirely the power of expanding again, and continues lessened, or shut, notwithstanding the removal of the cause of the disorder. If the affection be congenital, or the consequence of inflammation, it can never be obviated except by an operation, however short the period of its duration may be. When it arises from irritation of the iris, or from intense observation of shining, bright objects, and has not existed a long time, it may be cured without an operation. Also, in cases where the operation is necessary, the mode of performing it differs according to circumstances.

Patients who become afflicted, in consequence of frequently observing bright, glittering objects, may obtain relief by a timely avoidance of every light that is too strong, wearing green spectacles, viewing objects with an opera glass, and frequently washing the eye with some warm emollient liquor, especially a decoction of mallows, hemlock, and poppy-heads. The peculiar virtue of the extract of belladonna, in making the pupil dilate, might here also be turned to great advantage. It is to be diluted and rubbed over the eye-lids and eye-brow, and allowed to remain applied a certain length of time every day. The same means are likewise proper in cases, where the disorder depends upon irritation. Richter speaks favourably of the good effects of antimonial wine, and the extract of aconitum, as internal medicines, together with warm bathing and blisters. Here the outward application of the extract of belladonna unquestionably merits a careful trial.

There is a preternatural contraction of the pupil, which alternately arises and then ceases again. This case sometimes lasts only a few hours; sometimes several days. During the attack, patients see more weakly than usual, or cannot see but very little, according as the pupil happens to be more or less diminished. In particular instances, the attacks come on at fixed times, and the complaint is then periodical. During the disorder, the pupil seems to be affected with spasm. Occasionally, indeed, spasmodic complaints, says Richter, take place at the same time in other parts. Here the disease is most commonly the consequence of irritation seated in the abdominal viscera, and requires aperient, and especially emetic medicines. When these means prove ineffectual, it is at length necessary to resort to the external and internal use of anodyne tonic remedies, valerian, bark, and small doses of ipecacuanha. The outward application of the extract of belladonna to the eyebrow and eye-lids promises also, in such cases, to be an useful auxiliary means. This sort of closure of the pupil has been observed as a symptom of hysteria.

The eminent Mr. Cheselden first made the proposal of perforating the iris, and also first put such an operation in execution.

execution. He introduced a flender knife, about one line from the margin of the cornea, through the coats of the eye, into the pofterior chamber, and pufhed it through the iris in the fituation of the clofed pupil, fo as to form in that membrane a fmall longitudinal incifion. It is alleged that this operation of Chefelden's has been repeatedly performed, and for the moft part unfuccefsfully. According to the obfervations of Janin and Warner, the incifion did not dilate, and became fhut up again foon after it had been made. In one example, Janin was prevented from completing the operation with accuracy, in confequence of hemorrhage rendering the aqueous humour turbid. The plan of introducing the knife into the pofterior, inftead of the anterior chamber, feems alfo to be difadvantageous; for, in this laft mode, the iris can be more eafily got at, and nothing is injured except the infenfible cornea. On the other hand, in Chefelden's method, all the coats of the eye, the lens and its capfule, and the ciliary proceffes, are all wounded. Befides, as the point of the knife is concealed behind the iris, one can never be certain that it is precifely oppofite the place where the perforation of the iris ought to be made.

It was the opinion of Janin, that when the incifion in the iris was made in a parallel direction to the radiated fibres of this membrane, it always very foon clofed again; and, on the contrary, that when it was made acrofs thefe fibres, it not only dilated, but continued permanently open. He, therefore, ufed to operate as follows: he firft divided the lower half of the cornea, as in the operation for the cataract; he then pufhed a finely pointed pair of fciffors into the iris, about one line from the lower edge of the cornea, and the incifion was made in a perpendicular direction on the infide of the pupil, without touching the pupil itfelf. The cut ufually became dilated immediately, and remained open. But care muft always be taken to make the wound in the iris on the fide of the pupil next the inner canthus, as making it on the oppofite fide might occafion fquinting. See Janin's Mémoires fur l'Œil.

Wenzel's plan is more modern. The knife is introduced into the cornea in the manner ufually done in the operation for the cataract; but when it has approached within half a line of the place of the clofed pupil, its point is to be depreffed to the depth of half a line through the iris. Three-quarters of a line from this puncture, towards the inner canthus, the point is to be elevated again; and the incifion of the cornea is then to be finifhed, as in operating for the cataract. In this way, a cut is made in the iris, refembling on a fmall fcale the incifion on the cornea; that is to fay, it is of a femilunar fhape, and forms a fmall flap; but it is rarely fo fmooth and even as that in the cornea. The flap is to be cut away with a fmall pair of fciffors, fo that a roundifh aperture, which is fure to remain open, is produced in the iris. When the flap cannot be got hold of, fo as to admit of being removed with fciffors, a fmall piece of the iris is to be cut out.

The method which we have next to take notice of, is that propofed by the eminent Scarpa. He conceives, that the artificial pupil may be moft eafily made, by detaching a certain extent of the circumference of the iris, next the nofe, from the ciliary ligament, by means of a couching needle. Others object, however, that this mode is not only difficult, but that the aperture is hardly ever permanent.

The laft way of operating, of which it remains for us to fpeak, is that recommended by Mr. Gibfon. This furgeon begins by making a puncture in the cornea, with a broad cornea knife, within a line of the fclerotica, to the extent of about three lines. All preffure is now to be removed from the eye-ball, and the cornea knife gently withdrawn. The confequence of this is, that a portion of the aqueous humour efcapes, and the iris falls into contact with the opening in the cornea, and clofes it, like a valve. A flight preffure muft now be made upon the upper and inner part of the eye-ball, and be gently increafed, or varied in direction, till the iris gradually protrudes, fo as to prefent a bag of the fize of a large pin's head. This protruded portion muft be cut off with a pair of fine curved fciffors, and, at the fame time, all preffure is to be removed. The iris will then recede within the eye, and the piece that has been removed will leave an artificial pupil more or lefs circular.

When the centre of the cornea is fo opaque, that the rays of light cannot enter the pupil, and the circumference of that membrane is tranfparent, vifion may be materially improved by removing a portion of the iris oppofite the undifeafed part of the cornea.

There can be no doubt that, with refpect to the comparative merit of the preceding modes of operating, Gibfon's plan ought in general to be preferred, as being nearer and fafer than the others. Confult Sharp's Treatife of the Operations; Janin's Mem. fur l'Œil; Wenzel on the Cataract; Scarpa fulle Malattie degli Occhi, capo 16; Richter's Anfangfgrunde, &c. band. 3. kap. 9; Gibfon's Pract. Obf. on the Formation of an artificial Pupil, &c.

Pupil, *Preternatural Dilatation of.* This affection, which is termed *mydriafis*, is ufually a fymptom of fome other difeafe, and is hardly ever an original complaint. It occurs in very different degrees. Sometimes the pupil is fo confiderably expanded, that the iris can juft be difcerned, like a fmall fold at the inner circumference of the margin of the cornea. In fome cafes, the pupil is totally immoveable; in others, it retains a certain degree of motion. Not unfrequently, it has loft its round fhape, and become of an oblong, or angular figure. In particular cafes, the affection is only in one eye; in the majority of inftances, it takes place in both. It is often accompanied with total blindnefs; occafionally, though lefs commonly, the patient retains the faculty of feeing. In the latter cafe, the patient has an averfion to the light, or is even quite blind in the day. He is alfo in conftant danger of being totally deprived of vifion in a gradual way by the gutta ferena. (See Gutta Serena.) To fome patients of this defcription, all objects appear to be fmaller and more diftant than they are in reality. The following are the difeafes of which mydriafis is commonly a fymptom. 1. Amaurofis, or the gutta ferena. Of this complaint, however, it is not an infeparable and conftant fymptom, the pupil fometimes retaining the power of motion, and being quite free from blemifh; and in cafes where it is dilated and motionlefs, it now and then recovers its natural fize and moveablenefs, although the amaurofis continues unchanged. 2. The cataract. Here mydriafis happens under two different ftates; namely, either when the cataract is adherent to the iris; or when the opaque cryftalline lens is preternaturally thick and large. In the firft cafe, it ufually happens that the pupil is at the fame time incapable of motion, and irregular; in the fecond, it fometimes can move in a certain degree, and the iris is convex and preffed forward toward the cornea. 3. Hydrophthalmia, or dropfy of the eye. Here the dilatation of the pupil arifes immediately from the diftended ftate of the eye-ball, and with this the diforder increafes or fubfides. (See Hydrophthalmia.) 4. In patients who are troubled with worms; who are in fwoons, who are afflicted with hydrocephalus, apoplexy, or any comatofe difeafe, the pupils are in general preternaturally

ternaturally dilated. In all ſuch caſes, the only indication is to endeavour to remove the original diſeaſe, of which the mydriaſis is merely a ſymptom.

In the caſe where mydriaſis is to be regarded as the only diſorder, the complaint ſeems to depend upon a weakneſs or paralyſis of the fibres which cloſe the pupil. Here it is commonly the conſequence of apoplexy, a blow on the eye, or a violent and ſudden diſtention of the pupil, as, for example, ſometimes happens in the extraction of a cataract. When the diſeaſe is of long ſtanding, there is little hope of cure, whatever may be the cauſe from which the complaint ariſes. When it is recent, the pupil will ſometimes regain the power of moving and contracting under the uſe of internal and external ſtimulating tonic remedies. The chief means of this claſs are, bliſters applied to the eye-brows, ethereal oil rubbed into the ſkin around the orbit, electricity, emetic medicines in ſmall and full doſes, and other ſimilar remedies, which are uſually preſcribed for the relief of paralytic affections of other parts. When theſe means prove unavailing, the practitioner muſt be content with recommending a palliative plan, which will be preſently noticed.

As the pupil naturally dilates in the dark, it follows, that when a perſon is kept a long while away from the light, a *mydriaſis ex conſuetudine* is produced, the pupil becoming habituated to the expanded ſtate, and loſing the power of contraction. In moſt inſtances, it gradually recovers its motion after the eye has been for a certain time expoſed to the light again. The light, however, muſt be allowed to get to the eye only by degrees, or elſe its ſudden operation on the eye, in the expanded ſtate of the pupil, would be apt to impair, or even deſtroy viſion altogether. When the pupil does not recover its power of motion, the patient muſt be ſatisfied with reſorting to palliative means. It has been remarked, that mydriaſis is ſometimes a congenital defect. All attempts at a radical cure muſt here be attended with extreme difficulty. When the light cannot be endured without inconvenience, the palliative plan is neceſſary. A blow on the eye ſometimes tears the pupil. The rent moſtly remains open, and the patient is in the ſame ſtate as if affected with mydriaſis. Here, as the laceration cannot be repaired, the indication is to prevent, by palliative means, viſion from being hurt by the too great ſtrength of the light.

Through a preternaturally dilated pupil the light enters the eye in ſuch quantity, that the patient is blinded. He not only ſees things very indiſtinctly in light places, but he alſo runs a riſk of being gradually entirely deprived of viſion, in conſequence of the too ſtrong action of the light upon the eye. The prevention of ſuch miſchief is the object of the palliative treatment. By it the light which falls upon the eye is to be diminiſhed, ſo that the patient may be enabled to ſee not only plainly and without inconvenience in light places, but alſo without any danger of loſing his ſight altogether. The uſual means recommended for this purpoſe are, eye-ſhades, by which the light, coming principally from above, is kept from entering the eye; black veils over the face; green ſpectacles, which leſſen the quantity of rays of light coming from objects which the patient is looking at; ſpectacles made with black cards, in the centre of which is left an opening of the ſize of the natural pupil. But the beſt and moſt proper means is a pair of tube-ſpectacles. This is a common pair of ſpectacles, which, inſtead of glaſſes, has adapted to its two rings two conical tubes, the baſes of which are to be put towards the eyes, and the narrower parts towards the objects which are looked at. Theſe tubes ought to be made of black leather, and they ſhould be three or four inches long. Their diameter at the baſe muſt be equal that of the circumference of the orbit; but their other ends need not be quite ſo wide. The edge of their baſes is to be cut in ſuch a way, that they will fit cloſely on the circumference of the orbit. The uſe of theſe tubes conſiſts in their keeping off all the rays of light coming laterally, and only admitting thoſe into the eye, which proceed from objects in the axis of viſion. Every ſurgeon will be able, according to circumſtances, to multiply and vary the contrivance here deſcribed. See Richter's Anfangſgr. der Wundarzneykunſt, band 3. kap. 10.

PUPILLARIS Membrana, in *Anatomy*, a circular membrane, by which the pupil is cloſed during the greater part of utero-geſtation. See Eye.

PUPILLARITY, or Pupillage, the ſtate of a pupil; in oppoſition to *puberty*.

PUPPET, in *Natural Hiſtory*. See Aurelia.

PUPPISOS, a name given by ſome authors to the os frontis. The future in this bone is alſo called by many anatomiſts the *ſutura puppis*.

PUPPOLA, in *Geography*, a town of Sweden, in the government of Ulea; 45 miles S. of Ulea.

PUPULÆ, a name uſed by ſome to expreſs the extremities of the fingers.

PUR, in *Geography*, a river of Ruſſia, which runs into the Tazovſkaia gulf. N. lat. 67° 40'. E. long. 78° 34'.

Pur *autre vie*, in our *Law-Books*, is uſed where lands are held for the life of another. See Occupant, and Tenant.

PURA *Eleemoſyna*, *pure alms*, denotes a tenure, whereby the churchmen hold lands in Scotland, ſomewhat on the footing of the primitive clergy.

Pura *Haſta*. See Hasta.

PURALLA Bay, in *Geography*, a bay on the coaſt of Chili. S. lat. 42° 10'.

PURANA, the common name of a ſeries of poetical romances, conſidered among the Hindoos as ſacred works, the offspring of inſpired writers, communicated for the inſtruction and benefit of mankind. They are aſcribed, in their preſent form, to a celebrated man in the literary hiſtory of the Hindoos, whom they call Vyaſa. (See Vyasa.) He is ſuppoſed to have reduced an immenſe maſs of inſpired writings into eighteen works, and to have arranged them as they now appear. The following are the titles of theſe eighteen books, to which the common denomination of Purana is appended when ſpoken of or referred to. 1. Brahm, or the Great One. 2. Padma, or the lotos. 3. Brahmanda. 4. Agni, or fire. 5. Viſhnu. 6. Garuda. 7. The transformations of Brahma. 8. Siva. 9. Linga. 10. Nareda. 11. Skanda. 12. Markandeya, or the immortal man. 13. Bhawiſhya, or the prediction of futurity. 14. Matſya. 15. Varaha. 16. Kurma. 17. Vamana. 18. Bhagavata. Of theſe, the firſt four relate to coſmogony; the next nine to the attributes and powers of the Deity. The ſixth is named after the vehicle or bird of Viſhnu, called Superna, as well as Garuda. (See Superna.) See Linga, for the myſterious ſymbol whence the ninth derives its name. Nareda, whoſe laws and hiſtory are detailed in the tenth, is a mythological ſon of Brahma. Skanda, the hero of the eleventh, is a name of *Kartikya*; ſee that article. The fourteenth and three following relate the hiſtories of four of the principal incarnations of Viſhnu the preſerver, called *Matſyavatara*, *Varahavatara*, *Kurmavatara*, and *Vamanavatara*. Under theſe articles reſpectively will be found a brief notice of the outline of their hiſtories. The eighteenth, called Sri Bhagavata, is the life of Kriſhna, (ſee Krishna,) with

with which the poet Vyafa is popularly imagined to have crowned the whole feries; though fome reafonably affign them different compofers; and the feries is differently arranged and named by other authorities. Every Purana treats of five fubjects. 1. The creation of the univerfe. 2. Its progrefs, and the renovation of the worlds. 3. The genealogy of gods and heroes. 4. Chronology, according to a fabulous fyftem. 5. Heroic hiftory, containing the achievements of demigods and heroes. Since each Purana contains a cofmogony, with mythological and heroic hiftories, they may, not unaptly, be compared to the Grecian theogonies.

A copy of, we believe, all the eighteen mythological poems, is preferved in the library of the Eaft India houfe. It is eftimated that the whole cannot confift of lefs than half a million of ftanzas. Hitherto no tranflation of any of them, or of any confiderable portion of either, hath been made from the original into any European language. They are, of courfe, written in the Sanfcrit tongue. In fome articles of this work a ftanza, or a brief outline of fome of the Puranic tales, elucidatory of the character or fubject under difcuffion, is occafionally introduced, and may perhaps give fome little idea of the ftyle of thefe extravagant poems. The reader, in this view, may confult the following, in addition to the other articles herein and thence referred to; JAMBAVANTA, KALPA, KARSHAGNI, KRITIKA, LILESWARA, LOTOS, MERU, MUNI, NAKSHATRA, NARAMEDHA, PAVAKA, PAVANA, PIKESWARI, POLLEAR, PRITHU, &c. &c.

As to thefe extravagant, and not always decent, tales of the Puranas, the probability is that phyfical or hiftorical facts are thus connected under a veil of allegory, carried through a feries of poetical narratives and adventures, related of the perfonified attributes of the Deity. The facts are either forgotten, or unknown to the vulgar; but the fables remain, and are generally and commonly alluded to in compofition and converfation. Taken literally, as the tranfactions of divine or holy perfons, nothing (bating the invention, imagery, and other poetical merits) can be more contemptible than thefe Puranic romances; but if we defire to extract the grains of ore that the mafs may probably contain, we muft be content to examine them as they are; and in cafe of failure, many inquifitive refearchers will deem their labour not loft, in the invention and other poetical beauties abounding in thefe wild compofitions.

We fhall briefly give an abftract of the contents of two or three of the Puranas, whence a judgment may be formed of the others. The Agni Purana is feigned to have been delivered by Agni, or Pavaka, the god of fire. (See PAVAKA.) It contains a great variety of fubjects, and feems to have been intended as an epitome of Hindoo learning. The poem opens with a fhort account of the feveral incarnations of Vifhnu, an enumeration of which, with a brief outline of their hiftory, will be found in the article VISHNU of this work, and thofe thence referred to. It dwells, however, chiefly on the incarnations of *Krifhna* and *Rama*. (See thefe articles.) Then follow a hiftory of the creation; a tedious differtation on the worfhip of the gods, with a defcription of their images, and directions for conftructing and fetting them up; a concife defcription of the earth, particularly of thofe places which are efteemed holy, with the forms of worfhip to be obferved at them; a treatife of aftronomy, or rather aftrology; a variety of incantations, charms, and fpells, for every occafion. One fpecies of this is named *mantra*, under which article a fufficient account is given of them; computations of the periods called *manwantara*, *kalpa*, &c. (fee KALPA); a defcription of the feveral religious modes of life called *aframa*, and the duties to be performed in each; rules for penance (on this head fee TAPAS); feafts and fafts to be obferved throughout the year; rules for beftowing charity; a differtation on the great advantages to be derived from the myftic word OM (under which article of this work the reader will probably find fufficient of myfticifm), with a hymn to Varifhta, of whom fomething occurs under that article. The next head relates to the office and duties of princes; under which are given rules for knowing the qualities of men and women; for choofing arms and enfigns of royalty; for the choice of precious ftones; and a treatife on the art of war. The next head treats of worldly tranfactions between man and man, as to buying and felling, borrowing and lending, giving and receiving, &c. &c. Then follow certain ordinances, according to the Veda, refpecting fecurity from misfortunes, &c. and for the worfhip of the gods. Genealogies of the two races of folar and lunar kings, called Suryavanfa and Chandravanfa (fee SURYA); of the family of Yadu and of Krifhna, with a fhort hiftory of the twelve years' war, defcribed in the Mahabarat. (See MAHABARAT.) A treatife on the art of healing, as applicable to man and beaft, with rules for the management of elephants, horfes, and cows; charms and fpells for curing various diforders; and the mode of worfhipping certain divinities; on the letters of the Sanfcrit alphabet; on the ornaments of fpeech, as applicable to oratory, poetry, and the drama; on the myftic fignification of the fingle letters of the Sanfcrit alphabet; a grammar and fhort vocabulary of that language. The whole of this defultory work is divided into 353 fhort chapters.

The Siva Purana is fometimes called alfo, after one of the forms of his confort, the Kalika Purana. (See KALI.) It is a mythological hiftory of that goddefs, including her adventures under various names and characters. Many of thofe names and characters are enumerated under the article PARVATI, her more common name; and Mr. Moor has given an extract under *Naramedha*, which word means a man-facrifice, the rites and ceremonies of that horrid offering being minutely laid down in this Purana. It is a curious and entertaining work, including as epifodes feveral beautiful allegories, particularly one founded on the motions of the moon. See Moor's Hindu Pantheon.

The Vayu Purana, as one of thefe poetical romances is varioufly called, but *which* we have not the means at this moment of afcertaining, is attributed to the regent of wind Vayu, otherwife and more commonly called Pavana (fee PAVANA); where the reafon is furmifed why the Purana is not called after that name. It contains, among a variety of other curious fubjects, a circumftantial detail of the creation of all things, celeftial and terreftrial, with the genealogy of the firft inhabitants; chronological computations as to the grand periods *manwantara*, *kalpa*, &c. before fpoken of; a defcription of the earth, as divided into iflands, continents, &c. and its dimenfions, and alfo of other planets and fixed ftars, their diftance, circumference of orbits, &c. &c. Under the article PAVANA, an extract is given from the Matfya Purana, directing how images or pictures are to be made of the god of wind. Moft of the Puranas contain directions of that fort.

A brief notice of one other of thefe infpired works will fuffice. The Nareda Purana is believed to have been delivered by the infpired Nareda, a mythological fon of Brahma. Under the article *Nareda*, (fee Hindu Pantheon) an account is given of him, with his genealogy, and the derivation of his name, from the Varaha Purana. Like the others, this poem opens with defcribing "how heaven and earth rofe out of chaos;" but it treats principally of the unity of God, and as it fectarially is written with the Vaifhnava bias (fee VAISHNAVA),

nava), it defcribes Vifhnu as the Deity. On this point, fee Sects *of Hindoos.* It argues that all other gods are but emblems of the works of Maha Vifhnu, and the female deities, or faktis, emblems or perfonifications of his powers. Other Hindoo fects fay the fame of the deity of their exclufive worfhip, as noticed under Krishna, Rama, Siva, &c. It ftates that the worfhip of the Trimurti, or either of the triad (fee Trimurti), whether the creator, preferver, or regenerator, is in effect worfhipping of Vifhnu. This Purana concludes with rules for the feveral tribes in their fpiritual and temporal conduct through life.

Thefe voluminous and certainly curious poems, are held in the general eftimation of the Hindoos, as fecond only to the Veda, their immediate fcripture. (See Veda.) In each of the Vedas are certain paffages interfperfed, relating chiefly to cofmogony, which are called Purana, but are wholly different from the eighteen mythological poems, the fubject more efpecially of this article.

With refpect to the age of the Puranas, orientalifts differ widely. Sir W. Jones fatisfied himfelf that they have been written about 2500 years. He does not ftate precifely the mode of reafoning, by which he arrived at this conclufion; he gives, however, the outline of the procefs, and afks the public to give him credit for a few very curious facts, which, although, he fays, capable of ftrict proof, could then be only afferted. We are not aware that the proofs were ever fubmitted to the public; and whatever they were, they have not wrought conviction on the minds of all. Mr. Colebroke, however, (Af. Ref. vol. vii.) leaves us to infer that he thought them very little inferior in point of antiquity to the age affigned them by his illuftrious predeceffor in the chair of the Afiatic Society. Mr. Wilford exprefsly fays, that "the Puranas are certainly a modern compilation from valuable materials, that I am afraid no longer exift: an aftronomical obfervation of the heliacal rifing of Canopus, mentioned in two of the Puranas, puts this beyond doubt." (Af. Ref. vol. v.) Mr. Bentley, after giving various reafons and calculations for the foundation of his opinion, fays, "It muft be evident that none of the modern romances, commonly called the Puranas, at leaft in the form in which they now ftand, are older than 684 (now 1813, about 695) years, but that fome of them are the compilations of ftill later times." (Ib. vol. viii.) As far, indeed, as the eighteenth Purana, called Sri Bhagavat, is concerned, Mr. Colebroke countenances Mr. Bentley's opinion. "I am inclined," he fays, "to adopt an opinion fupported by many learned Hindoos, who confider the celebrated Sri Bhagavata as the work of a grammarian, fuppofed to have lived about 600 years ago." Ib. (See Sri Bhagavat.) Be this as it may, the orthodox Hindoos have implicit faith in, and great veneration for, thofe celebrated poems, or "facred hiftories," as they call them; and it is authoritatively afferted, that "the Veda, the revealed fyftem of medicine, the Puranas, and the code of Menu, are four works of fupreme authority, which ought never to be fhaken by arguments merely human. (See Menu.) There are, however, many individuals of all the four tribes of Hindoos, feweft certainly in that of Brahmana, who correfpond with the Levites of Ifrael, who deny the divine origin of the Puranas, looking upon them in nearly the fame light as a rational critic of Europe may do.

PURANGURRAH, in *Geography*, a town of Bengal; 20 miles S.E. of Iflamabad.

PURARI, a name of the Hindoo deity *Siva*; which fee.

PURARYA, in *Geography*, a town of Hindooftan, in Oude; 32 miles N. Kairabad.

PURBACH, George, in *Biography*, an eminent mathematician and aftronomer in the 15th century, was born at Purbach, a town on the confines of Auftria and Bavaria, in 1423. He was educated at Vienna, where he manifefted great talents, and took his degree of M. A. with great applaufe. He directed his attention principally to mathematics, and advanced in that fcience with almoft incredible rapidity. For farther improvement, he vifited the moft celebrated univerfities of Germany, France, and Italy. He found a particular friend and patron in cardinal Cufa, and he formed an intimacy with John Blanchini of Bologna, who admiring Purbach's extenfive knowledge, and his ready method of communicating inftruction, wifhed to prevail upon him to deliver lectures on aftronomy at Ferrara; but Purbach preferred returning to Vienna, where he obtained the mathematical profefforfhip in that univerfity. About this time he received offers from Ladiflaus, king of Hungary, to become his aftronomer, accompanied with promifes of liberal rewards and diftinguifhed honours, which he declined.

The fame of Purbach, as a mathematical profeffor, was foon widely diffufed, and brought numerous ftudents to attend his lectures at Vienna. Among others was the celebrated Regiomontanus, who fecured the efteem of his mafter, and was chofen the affiftant and companion in his labours. From this time they maintained an union of ftudies, in their endeavours to improve the different branches of mathematical fcience, and more particularly aftronomy. This fcience they would, no doubt, have materially improved by their joint labours, had Purbach's life been prolonged. His firft effay was to amend the Latin tranflation of Ptolemy's Almageft. After this he wrote "An Introduction to Arithmetic," and proceeded to draw up another "On Gnomonics," or dialling, with tables fuited to the difference of climates and latitudes. This was followed by a fmall tract "Concerning the Altitudes of the Sun," with a table, and "Aftrolabic Canons." After this he made folid fpheres, or celeftial globes, and not only explained their conftruction and ufes, but added to them a new table of fixed ftars, with the longitude by which every ftar had increafed, from the time of Ptolemy to the middle of the fifth century. He alfo invented various other inftruments, among which was a "gnomon," or geometrical fquare, with canons, and a table for the ufe of it, which he fent to the archbifhop Strigonia, who was himfelf a man of great erudition, and entertained a high opinion of Purbach. Our author made confiderable improvements in trigonometry; prepared tables of the fixed ftars, and undertook to reform thofe of the planets, and conftructed fome entirely new ones. When thefe tables were finifhed, he drew up a kind of perpetual almanack, chiefly for the moon, anfwering to the periods of Meton and Calippus: alfo an almanack for the planets, or, as it was afterwards called, an Ephemeris for many years. He finifhed his "Theoriæ Novæ Planetarum," (fee Muller,) which was made a textbook in all the fchools, and was commented upon by fome of the moft eminent mathematicians. Purbach died in the 38th year of his age, in 1461.

PURBECK, *Ifle of*, in *Geography*, a diftrict in the Blandford divifion of the county of Dorfet, England, is bounded on the weft by Luckford lake; on the fouth by the Britifh channel; and on the other fide by the river Frome, and the bay of Pool. It is improperly called an ifland, being in fact only a peninfula, as it may be entered from Eaft Lulworth by an ifthmus, between the head of Luckford lake and the fea. This diftrict extends twelve miles in length, and varies from feven to ten in breadth.

It

It includes two hundreds, called Hazler and Rowbarrow, the former comprehending the eastern division of the isle, and the latter the western. These are subdivided into nine parishes, and contain one town, Corfe-castle, and several large villages and hamlets. The soil is every where calcareous; but the surface is much diversified by hill and dale. The quarries, shores, and cliffs, on the south side of the isle in particular, afford an inexhaustible fund of natural curiosities. Near Kington, Worth, Langton, and Swanwich, are extensive quarries of freestone; and in many parts is a stone that rises thin, and is used for tiling; also a hard paving stone, much of which was used in rebuilding London after the fire, and in paving the streets and courts. At Swanwich is a white stone full of shells, which takes a high polish, and looks like alabaster; and near Dunshay is dug up marble of various colours, but chiefly a grey kind, formed by a congeries of shells, and anciently much used for grave stones and monuments. It was likewise very generally employed for small columns in the churches which were erected during the 13th century. The cornua ammonis are frequently discovered here, some of them two or three feet in diameter.

In ancient times the whole of this isle was a forest, and was well stocked with red and fallow deer, and stags, especially in the west parts; but these were almost entirely destroyed in the civil wars. James I. was the last of our kings who hunted here. The whole isle was till lately governed by a lord-lieutenant, who was admiral of the isle, and had power to raise and muster a militia; but this office ceased when the regular militia act was passed. Formerly there were many gentlemen's seats dispersed all over the isle; which were probably built for the reception and accommodation of the nobility and gentry who attended the royal hunts, as most of the owners of estates in this part of the country had their principal seats elsewhere, and only came hither in the hunting seasons. These are now almost, without exception, converted into farm-houses. For an account of the only town in Purbeck, see Corfe-castle. Hutchins's History and Antiquities of the County of Dorset, 2d edit. by Gough. Beauties of England and Wales, vol. iv. by John Britton, and E. W. Brayley.

Purbeck *Stone*, the *saxum arenarium cinereum Purbecense* of Da Costa, and *psadurium friabile albido fuscum* of Hill, is an alkaline sand-stone, which is harsh and rough, of a disagreeable ashen colour, very heavy, and moderately hard, of a texture not very compact, but somewhat porous, and is composed of an angular grit, cemented together by an earthy spar: it cuts freely, and with a tolerable even or smooth surface, but will not take a polish. It will not strike fire with a steel, and burns to a white colour. The quarries of this stone are in the island of Purbeck, in Dorsetshire, whence it is brought to London in great quantities, and used in building, and for pavements. Its specific gravity is 2.68. There is also another kind of Purbeck stone, the *saxum fusco-albidum* of Da Costa, and the *sympexium durissimum, splendidum albido-fuscum* of Hill, which is alkaline, of a dull, disagreeable, pale, brownish, white colour, and is not capable of a polish, though it cuts to a very smooth surface: it is of a fine, close, compact texture, not quite destitute of brightness, but full of sparks of pure spar, and intimately mixed with vast quantities of small pectunculi, which are often saturated and filled with the same substance; it is very heavy and hard, and water does not pervade its texture; it does not strike fire with steel, and when burnt, acquires a clear ashen colour. This stone is brought from Purbeck, and used in building, pavements, &c. Hill informs us, that it is likewise found in many other parts of the kingdom, and that there are large strata of it in Yorkshire. Da Costa's Fossils, p. 128—152.

PURBUTTY, in *Geography*, a river of Hindoostan, which runs into the Chumbul; seven miles W. of Suisopour, in the country of Agimere.

PURCARI, a town of European Turkey, in Bessarabia, on the Dniester; 4 miles S.E. of Bender.

PURCELAIN. See Porcelain.

PURCELL, Henry, in *Biography*, an English musician of more extensive genius than perhaps our country can boast at any other period of time, was born in 1658. His father, Henry, and uncle, Thomas Purcell, were both musicians, and gentlemen of the chapel royal, at the restoration of king Charles II. There is a three-part song in Playford's "Musical Companion," by Henry Purcell, which, being printed in 1667, when our great musician was but nine years old, must have been the production of his father. There is likewise a chant in the first volume of Boyce's Collection, p. 289, N° II, called the "burial chant," by Thomas Purcell, his uncle, who continued in the service of the chapel till the time of his death, in 1682. Though these compositions promise no great hereditary genius, they are mentioned here, as mankind is naturally curious concerning every thing that is connected with eminent persons.

From whom Henry received his first instructions in music, cannot be very clearly ascertained. But his father dying in 1664, when he was no more than six years old, it is probable he was qualified for a chorister by Capt. Cook, who was master of the children from the restoration till the time of his death, in 1672. For, as Purcell was appointed organist of Westminster Abbey at eighteen years of age, he must have learned the elements of his art before his fourteenth year, at which time Pelham Humphrey, brought up in the royal chapel under Capt. Cook, was appointed his successor, as master of the boys. Purcell certainly continued to sing in the king's chapel, and to receive lessons from Humphrey till his voice broke, an accident which usually happens to youth at sixteen or seventeen years of age: after this, perhaps, he had a few lessons in composition from Dr. Blow, which were sufficient to cancel all the instructions he had received from other masters, and to occasion the boast inscribed on the tomb-stone of Blow, that he had been

"Master to the famous Mr. Henry Purcell."

But there is nothing more common than this petit larceny among musicians: if the first master has drudged eight or ten years with a pupil of genius, and it is thought necessary, in compliance with fashion or caprice, that he should receive a few lessons from a second, he instantly arrogates to himself the whole honour, both of the talents and cultivation of his new scholar, and the first and chief instructor is left to sing, *sic vos non vobis*.

Purcell is said to have profited so much from his first lessons and close application, as to have composed, during the time of his being a singing boy in the chapel, many of his anthems, which have been constantly sung in our cathedrals ever since. Eighteen was a very early age for his being appointed organist; that is, maestro di capella of Westminster Abbey, one of the first cathedrals in the kingdom for choral compositions and performance. It was not likely he would stop here: the world is, perhaps, more partial to promising youth than accomplished age: and at twenty-four, in 1682, he was advanced to one of the three places of organist of the chapel royal, on the death of Edward Low, the successor of Dr. Christopher Gibbons, in the same station.

After this, he produced fo many admirable compofitions for the church and chapel of which he was organift, and where he was fure of having them better performed than elfewhere, that his fame was foon extended to the remoteft parts of the kingdom.

From this time, his anthems were eagerly procured, and heard with pious rapture wherever they could be performed; nor was he fuffered long to devote himfelf totally to the fervice of the church. He was, very early in life, folicited to compofe for the ftage, and chamber, in both which undertakings he was fo fuperior to all his predeceffors, that his compofitions feemed to fpeak a new language; yet, however different from that to which the public had been long accuftomed, it was univerfally underftood. His fongs feem to contain whatever the ear could then wifh, or heart could feel.

We have been affured by a very good judge of mufic, who was nineteen years of age when Purcell died, and remembered not only his perfon very well, but the effect which his fongs had on himfelf and the public at that time, when many of them were firft heard; and ufed to fay, that "no other vocal mufic was liftened to with pleafure, for near thirty years after Purcell's death; when they gave way only to the favourite opera fongs of Handel."

The unlimited powers of this mufician's genius embraced every fpecies of compofition that was then known, with equal felicity. In writing for the church, whether he adhered to the elaborate and learned ftyle of his great predeceffors Tallis, Bird, and Gibbons, in which no inftrument is employed but the organ, and the feveral parts are conftantly moving in fugue, imitation, or plain counterpoint; or, giving way to feeling and imagination, adopted the new and more expreffive ftyle of which he was himfelf one of the principal inventors, accompanying the voice-parts with inftruments, to enrich the harmony, and enforce the melody and meaning of the words, he manifefted equal abilities and refources. In compofitions for the theatre, though the colouring and effects of an orcheftra were then but little known, yet as he employed them more than his predeceffors, and gave to the voice a melody more interefting and impaffioned than, during the feventeenth century, had been heard in this country, or perhaps in Italy itfelf, he foon became the darling and delight of the nation. And in the feveral fpecies of chamber mufic which he attempted, whether fonatas for inftruments, or odes, cantatas, fongs, ballads, and catches, for the voice, he fo far furpaffed whatever our country had produced or imported before, that all other mufical productions feem to have been inftantly configned to contempt or oblivion.

As many of his numerous compofitions for the church, particularly thofe printed in the fecond and third volumes of Dr. Boyce's Collection, are ftill retained in the king's chapel, and in our cathedrals, we fhall here acquaint the mufical reader in what manner we have been affected by fome of thefe productions. in a late attentive perufal of them.

It appears by Dr. Bayley's "Collection of the Words of Anthems ufed in his Majefty's Chapel Royal," that ten of Purcell's are ftill performed there; and in the late Rev. Mr. Mafon's "Copious Collection of the Words of fuch Anthems as are ufed in the Cathedral of York," that nearly twenty of his choral compofitions are ftill fung in that choir.

Purcell's four-part anthem, "O God, thou art my God," (Boyce's Collection, vol. ii. p. 148.) muft certainly have been one of his juvenile productions, before he had fufficiently refined his ear, or exercifed his judgment; as there are many crude harmonies, and falfe accents in it, which in riper years he would not have tolerated.

Of his fix-part anthem, "O God thou haft caft us out," the firft movement, in which there are many bold harmonies, is extremely elaborate, yet fpirited and pleafing. The verfe, "O be thou our help," is not only full of new and fine effects, but touching. By thofe who object not to the confufion in the words which arifes from fugue and imitation, while the feveral parts are finging different portions of the fame fentence, at the fame time, the words will appear perfectly well accented and expreffed.

The firft movement of his full anthem in eight parts, "O Lord God of hofts," is a noble compofition, *alla Paleftrina*, in which all the laws of fugue upon two, and fometimes more, fubjects, are preferved inviolable; the harmony, though bold, is, in general, chafte, and the effect of the whole fpirited and majeftic. The fecond movement is extremely pathetic and expreffive; but, both in that and the laft movement, he feems trying experiments in harmony; and, in hazarding new combinations, he feems now and then to give the ear more pain than pleafure.

The two-part anthem, "Thy way, O God, is holy," continues to be excellent mufic ftill, in the flow movements; the quick, however, feems fomewhat antiquated, and the melody to thefe words, "the air thundered," &c. feem too light and dramatic for the church at any period.

The three-part anthem, "Be merciful unto me, O God," is admirable throughout. Indeed, to our conceptions, there feems no better mufic exifting, of the kind, than the opening of this anthem, in which the verfe, "I will praife God," and the laft movement, in C natural, are in melody, harmony, and modulation, truly *divine mufic*.

The complete fervice of Purcell, in B flat, printed by Boyce, is a moft agreeable and excellent piece of counterpoint, of which the modulation frequently ftimulates attention by unexpected tranfitions, yet of fo fober a kind as never to give the ear the leaft uneafinefs, till we come to the bottom of p. 110, and then the fame crudities of the fharp 3d and flat 6th, and flat 3d, 4th, and 5th, which we have already cenfured in the works of Dr. Blow, occur; which we hope, in fpite of our partiality for Purcell, the organifts of our cathedrals fcruple not to change for better harmony.

Thefe two or three combinations, like fome words and phrafes which Shakfpeare tried unfuccefsfully to render current, have been rejected by pofterity; and it is in vain to attempt at forcing them upon the public by the mere weight of authority. The ear will patiently bear very rough ufage from an artift who in general makes it fuch ample amends; however, there are limits, beyond which it is unfafe to exercife cruelty of all kinds; and the auricular fenfe will be deadened, difgufted, or rendered indifferent to mufic's powers, by too harfh treatment.

The "Benedictus," as well as "Te Deum," and all the reft of the fervice, muft be extremely pleafing, in all other refpects, to every ear fenfible to harmony. The words are, in general, accented with great accuracy (except the contracting *higheft* into a monofyllable, to which only one note is given); and the few points of imitation are fragments of agreeable melody. In p. 121 of Boyce, the A ♭ and A ♮, at the word *befeech*, in the Kyrie, are peculiarly beautiful, as are the 7th with the 9th at "before all worlds," in the creed, and the clofe at "by whom all things were made." The point at "throughout all generations," in the Magnificat, is what the Italians call *ben tirato*, well-worked. In the laft line, however, of page 132, fo many exceptionable combinations

nations occur, that we cannot pafs them over without a ftigma. Yet, upon the whole, the abilities of Purcell, as a profound contrapuntift, appear perhaps more in the courfe of this fervice than elfewhere; as he has manifefted deep ftudy and meditation in a fpecies of writing to which it was not likely that his creative and impetuous genius would fubmit, having had the patience, as well as abilities, to enrich it with no lefs than four different canons, of the moft difficult conftruction, as of two, three, and four in one, by inverfion.

The fuperior genius of Purcell can be fairly eftimated only by thofe who make themfelves acquainted with the ftate of mufic previous to the time in which he flourifhed; compared with which, his productions for the church, if not more learned, will be found infinitely more varied and expreffive; and his fecular compofitions appear to have defcended from another more happy region, with which neither his predeceffors nor contemporaries had any communication.

Befides the whole fervice, with three full, and fix verfe anthems, in Dr. Boyce's Collection, there are nine verfe and full anthems, wholly different, ftill fung in the cathedral at York. And in Dr. Tudway's Collection, Britifh Mufeum, there are, befides a whole fervice in B flat, different from that in Boyce, eight full and verfe anthems, different from all the reft, four of which were compofed for the chapel royal of Charles II., and are accompanied with inftruments. And ftill, exclufive of thefe and the hymns printed in the two books of "Harmonia Sacra," in a manufcript bequeathed to Chrift-church college, Oxon. by Dr. Aldrich, there are two motets, and a "Gloria Patri" for four and five voices, in Latin, with feven pfalms and hymns for three and four voices, by our fertile and diligent compofer, that have all their peculiar merit, but of which fome may, without hyperbole, be faid to reach the true fublime of facred mufic.

To enter into a minute examination of thefe, and his admirable Te Deum and Jubilate, compofed for St. Cecilia's day, 1694, would extend this article to too great a length; though they merit much praife as well as critical remark; for which, on the Te Deum we refer our readers to the ample account of him and his works, in Burney's Hiftory of Mufic, vol. iii.

Purcell's theatrical compofitions, if we recollect the number and excellencies of his productions for the church, and the fhortnefs of his life, will furprife by their multiplicity as well as fingular merit. Of thofe dramas which are called operas, and of which mufic and decorations were the principal allurements held out to the public, a detailed account is given in fpeaking of the origin and progrefs of the mufical drama in England, previous to the ufe of the Italian language, mufic, and performers on our lyric ftage. (See Masques, and Matthew Lock.) And of Purcell's detached and incidental fongs, dialogues, and fcenes that were performed at our national theatre, or playhoufe, the principal will be mentioned in fpeaking of his "Orpheus Britannicus," or pofthumous collection of his mifcellaneous compofitions. But before we enter on an examination of this work, it feems neceffary to acquaint the reader, that the chief part of his inftrumental mufic for the playhoufe is included in a publication that appeared two years after his deceafe, under the title of "A Collection of Ayres compofed for the Theatre, and on other Occafions, by the late Mr. Henry Purcell. London, printed for Frances Purcell, Executrix of the Author, 1697." Thefe airs are in four parts, for two violins, tenor and bafe, and were played as overtures and act-tunes in our own memory, till they were fuperfeded by Handel's hautbois concertos, and thofe, by his overtures, while Boyce's fonatas, and Arne's compofitions, ferved as act-tunes. In procefs of time thefe were fupplanted by Martini's concertos and fonatas, which were thrown afide for the fymphonies of Van Maldere, and fonatas of the elder Stamitz. About this time, the trios of Campioni, Zanetti, and Abel, came into play, and then the fymphonies of Stamitz, Canabich, Holtzbauer, and other Germans, with thofe of Bach, Abel, and Giardini; which, having done their duty many years very pleafantly, "flept with their fathers;" and at prefent give way to Vanhall, Boccherini, Haydn, and Pleyel. "Sic tranfit gloria muficorum!"

Purcell feems to have compofed introductory and act-tunes to moft of the plays that were brought on the ftage during his time. The publication of thefe, in four parts, contains his mufic to the following dramas:

"Abelazor," 1677. The mufic of this confifts of an overture, and eight airs or tunes.

"The Virtuous Wife," 1680. Overture and feven airs.

"Indian Queen." The firft movement of this overture is equal to any of Handel's. There are likewife two or three trumpet-tunes, well calculated for the inftrument, and a rondeau at the end, which would now feem new, if played in a concert by a good band.

"Dioclefian, or the Prophetefs," 1690. The inftrumental mufic of this Englifh opera given here, confifts of an overture of two movements, the firft excellent in the ftyle of Lulli, and afterwards of Handel, with better fugues; *preludio*, accompaniment to a fong, trumpet-tune, air, hornpipe, country-dance, and *canaries*.

"King Arthur," 1691. Overture and twelve tunes.

"Amphitrion," 1691. Overture and eight tunes.

"Gordian Knot untied," 1691. Overture and feven tunes.

"Diftreffed Innocence, or the Princefs of Perfia," 1691. Overture and feven tunes, all proofs of the author's original genius.

"The Fairy Queen," 1692. Two overtures and fixteen tunes of different kinds. N° 12, an air, 4 in 2, is a very curious canon on two fubjects: the firft treble and bafe performing one, and the fecond and tenor the other. There is as much accent and fpirit in this compofition, as if it were in free counterpoint.

"The Old Bachelor," 1693. Overture and eight tunes.

"The Married Beau," 1694. Overture and eight tunes, among which is a very agreeable air for the trumpet, a march, and a hornpipe, that are characteriftic. This laft is very much in the ftyle of a Spanifh fandango.

"The Double Dealer," 1694. Overture and ten tunes. N° 6 and 9, pretty and curious.

"Bonduca," 1695. Overture and eight tunes, including "Britons ftrike home," and "To arms," in four parts.

Thefe are the contents of this pofthumous publication; but befides the mufic for thefe dramas, he compofed overtures, act-tunes, and fongs, for "Timon of Athens," 1678; for "Theodofius, or the Force of Love," 1680; for Dryden's "Tempeft," 1620; and for "Don Quixote," 1694.

But few of Purcell's fingle fongs feem to have been printed during his life. He publifhed the mufic to a mafque fung in the tragedy of "Oedipus," when it was revived in 1692. And "a mufical entertainment, performed Nov. 22, 1683, on St. Cecilia's day, printed in fcore by John Playford, with a dedication to the gentlemen of the mufical fociety, and particularly the ftewards, written by Henry Purcell, compofer of the mufic."

There

There are ſeveral of his ſongs in Playford's Collection, called "The Theatre of Muſic, 1687, fourth and laſt Book;" and though theſe are not in his beſt manner, they are more original and intereſting than the reſt. Among theſe, p. 50, "A new ſong to a Scotch tune," by our author, ſeems to us more pleaſing and leſs ſtolen, than any ſpurious Scotch tune, or imitation of the national melody of the northern inhabitants of this iſland, that has been ſince produced.

Page 62 of the ſame Collection, there is an admirable piece of recitative, in a truly grand ſtyle: "Amidſt the ſhades," &c. But the collection of his ſecular vocal muſic, which did him the greateſt honour, and long rendered his name dear to the Britiſh nation, was publiſhed by his widow two years after his deceaſe, by the title of "Orpheus Britannicus." Here were treaſured up the ſongs from which the natives of this iſland received their firſt great delight and impreſſion from the vocal muſic of a ſingle voice. Before that period we had cultivated madrigals, and ſongs in parts, with diligence and ſucceſs; but in all ſingle ſongs, till thoſe of Purcell appeared, the chief effects were produced from the words, not the melody. For the airs, till that time, were as unformed and mis-ſhapen, as if they had been made of notes ſcattered about by chance, inſtead of being caſt in an elegant mould. Excluſive admirers of modern ſymmetry and elegance, may call Purcell's taſte barbarous; yet in ſpite of ſuperior cultivation and refinement, in ſpite of all the viciſſitudes of faſhion, through all his rudeneſs and barbariſm, original genius, feeling, and paſſion, are, and ever will be, diſcoverable in his works, by candid and competent judges of the art.

To this admirable collection are prefixed ſeven copies of verſes to his memory, at the head of which is an ode, written on his death, by Dryden, which was ſet by Dr. Blow, and performed at the concert in York Buildings.

There are few ſongs in the "Orpheus Britannicus" but what contain ſome characteriſtic marks of the author's great and original genius. The melody, however, will at firſt ſeem to many at preſent uncouth and antiquated; but by a little allowance and examination, any one poſſeſſed of a great love for muſic, and a knowledge of our language, will feel, at certain places of almoſt every ſong, his ſuperior felicity and paſſion in expreſſing the poet's ſentiments which he had to tranſlate into melody.

The favourite ſongs with Purcell's admirers in our youth, were the following; and upon a late attentive peruſal of the book, they ſeem to have merited particular diſtinction. "Celia has a thouſand charms:" the firſt movement of this, like many of Purcell's ſongs, ſeems only *recitative* graced, or embelliſhed with the faſhionable *volate*, or *flouriſhes* of the times, which are now as antiquated as the curls of his own perruque, or the furbelows and flounces of queen Elizabeth. The ſecond movement, however, of this ſong, is plaintive and graceful; and at "I ſhould my wretched, wretched, fate deplore," is ſtill new and pathetic.

"You twice ten hundred deities," opens with what ſeems to us the beſt piece of recitative in our language. The words are admirably expreſſed throughout this ſong, by modulation as well as melody. And there is a propriety in the changes of movement, which does honour to Purcell's judgment, as much as the whole compoſition to his genius. The change of ſtyle and ſluggiſh motion given to the notes at theſe words, "from thy ſleeping manſion riſe," is a model of muſical imitation and expreſſion. The modulation is ſtill ſo excellent, that the beſt modern maſters are obliged to adopt it on almoſt all great occaſions.

Of the muſic to "King Arthur" we ſhall ſay but little, as it has been lately revived, well performed, and printed. If ever it could be ſaid with truth of a compoſer, that he has *devancé ſon ſiecle*, outſtript his age, Purcell is entitled to that praiſe; as there are movements in many of his works which a century has not injured, particularly the duet in King Arthur, "Two daughters of this aged ſtream," and "Faireſt iſles all iſles excelling," which contain not a ſingle paſſage that the beſt compoſers of the preſent times, if it preſented itſelf to their imagination, would reject. The dialogue in the "Propheteſs," "Tell me why, my charming fair," is the moſt pleaſing and ingenious of all the compoſitions of the kind which the rage of faſhion produced during fifty years. The firſt part of "O lead me to ſome peaceful gloom," is truly elegant and pathetic.

"From roſie bow'rs," is ſaid to have been "ſet in his laſt ſickneſs," at which time he ſeems to have realized the poetical fable of the ſwan, and to have ſung more ſweetly as he approached nearer his diſſolution; for it ſeems to us as if no one of his productions was ſo elevated, ſo pleaſing, ſo expreſſive, and throughout ſo perfect, as this. The variety of movement, the artful, yet touching modulation, and, above all, the exquiſite expreſſion of the words, render it one of the moſt affecting compoſitions extant to *every Engliſhman* who regards muſic not merely as an agreeable arrangement and combination of ſounds, but as the vehicle of ſentiment, and voice of paſſion.

There is more elegant melody, more elaborate harmony, more ingenious contrivance, in the motion and contexture of the ſeveral parts than in the works of many great compoſers; but to the natives of England, who know the full power of our language, and feel the force, ſpirit, and ſhades of meaning, which every word bears according to its place in a ſentence, and the ſituation of the ſpeaker, or ſinger, we muſt again repeat it, this compoſition will have charms and effects, which, perhaps, Purcell's muſic only can produce.

"When Mira ſings," is a duet that will ever be captivating, as long as the words remain intelligible; of which he has augmented the force, particularly at the end, by notes the moſt ſelect and expreſſive that the muſical ſcale can furniſh.

"Loſt is my quiet," another duet, which ſtill lives. And "Celebrate this feſtival," a birth-day ſong for queen Mary, which is graceful and pleaſing through all its old-faſhioned thoughts and embelliſhments. "I'll ſail upon the dog-ſtar," has all the fire of Handel's prime.

"Mad Beſs" is a ſong, or rather a cantata ſo celebrated, that it needs no panegyric, or renewal of public attention, as every captivating Engliſh ſinger in our memory has revived its favour. The firſt Mrs. Sheridan and Mrs. Bates never gave more exquiſite delight by their admirable performance, than when they regaled their friends with this ſong. Beard, forty years ago, uſed to acquire great applauſe by ſinging Purcell's "Roſy Bowers;" and Fraſi, by her performance of "Mad Beſs," in the concerts at Hickford's rooms, the Caſtle, and Swan concerts, where Stanley was juſtly admired for his ingenious and maſterly manner of accompanying them. "'Tis Nature's Voice," is an enigmatical ſong, ſeemingly on muſic, in which Purcell has crowded all the faſhionable paſſages of taſte and vocal difficulties of the times. Indeed, he ſeems to have anticipated many fantaſtical feats of execution and articulation in which great performers have ſince rioted; and this is the more wonderful, as the Italian opera was not eſtabliſhed, or even attempted here, during the life of Purcell; whoſe deceaſe preceded the arrival of Valentini and Nicolini, the firſt great ſingers imported from Italy, at leaſt ten years.

"Blow,

"Blow, Boreas, blow," was in great favour, during our youth, among the early admirers of Purcell; but this feems now more fuperannuated than any of his popular fongs.

"Let Cæfar and Urania live," was a duet in a birth-day ode, during the reign of king William and queen Mary, which continued fo long in favour, not only while thofe fovereigns jointly wielded the fceptre, but even when George II. had loft his royal confort, and there ceafed to be a queen, or Urania, for whom to offer up prayers, that Dr. Green, and afterwards Dr. Boyce, ufed frequently to introduce it into their own and the laureate's new odes. This duet, like many other productions of Purcell, was built on a *ground-bafe* of only two bars, which are invariably repeated to different paffages of the voice-parts that are in harmony with it, throughout the movement. The latter part of this duet is extremely beautiful, and does not feem at all to have fuffered from the voluntary reftraint under which the compofer laboured.

The compofing fongs on a ground-bafe, was an exercife of ingenuity, in which Purcell feems to have much delighted; but though it was as much a fafhion in his time, as the compofing maffes on the fubjects of old tunes in the days of Jufquin, and variations upon thofe tunes in the days of Bird and Dr. Bull, in which they all manifefted fuperior abilities, yet the practice was Gothic, and an unworthy employment for men poffeffed of fuch genius and original refources. The Italians ftarted this, as well as moft other mufical fafhions; for it appears by the works of Tranquinio Merula, publifhed 1635, that writing upon a ground-bafe was a favourite occupation with that capricious compofer, as well as our ingenious countryman.

Judges of mufical defign, modulation, and expreffion, will meet with many places to admire in fongs that have never been popular, yet have local beauties, and mark the fuperior powers of the compofer; particularly in the "Sighs for the death of king Charles II." In the "Dialogue in tyrannic Love," p. 158, there is a paffage upon which the late Mr. Bach has conftructed a favourite movement in one of his *Quartetti concertanti*.

"I attempt from love's ficknefs," is an elegant little ballad, which, though it has been many years dead, would foon be recalled into exiftence and fafhion, by the voice of fome favourite finger, who fhould think it worth animation.

"Let the dreadful engines:" this is the laft fong in the firft volume of the "Orpheus Britannicus," of which, though both the words and mufic of the firft movement are wild and bombaft, yet the fecond and laft difcover a genius for the graceful comic, as well as the tender and fublime ftyle of compofition; and there are feveral paffages in this cantata fufficiently gay and new for a modern burletta.

In 1702, a fecond, and more correct, edition, of the firft volume of this work was publifhed, with more than thirty fongs that were not in the firft impreffion; but, in order to make room for which, fome of the former were excluded.

The fame year was likewife publifhed a fecond volume of "Orpheus Britannicus," by Henry Playford, which he dedicated to the earl of Hallifax. The fong of this fecond volume, p. 4, beginning, "Ah! cruel nymph!" has great ingenuity in the firft movement, and grace in the fecond. And the next air, "Crown the altar," feems the moft pleafing of any that he has compofed on a ground-bafe. "May the god of wit infpire," for three voices, is natural and pleafing, and the echoes in the fecond part are very ingenioufly contrived.

"Thus the gloomy world," accompanied with the trumpet, and violin alternately, is mafterly, and well defigned to difplay the trueft and moft brilliant tones of the trumpet, though but little is given to the violin, which fo much better deferves employment, than an inftrument of fuch falfe intonation as the trumpet.

Thofe that can relifh good mufic of every age and country, and have no exclufive partiality to individuals of either, will find amufement in the performance or perufal of Purcell's "Four Seafons," in the "Fairy Queen," which comprehend merit of various kinds.

"To arms, to arms," is an admirable military fong, accompanied by a trumpet, which is fo confined an inftrument, that nearly the fame paffages muft be ufed in all ages, fo that time has robbed this fong of but little of its novelty. Indeed, the divifions of this air have been revived of late years, and are now as fafhionable, in frivolous and unmeaning melody, as ever.

There are many excellent fongs in this volume; however, thefe and their peculiar beauties we muft pafs over, or our commentary will encroach too much on the limits of our biographical articles, as well as on the time and patience of thofe readers to whom the name and productions of our Britifh Orpheus are alike unknown or indifferent. Yet we muft obferve, that there is a compofition in Purcell's "Bonduca," in which he has anticipated a fpecies of dramatic mufic, which has been thought of late invention; the words are "Hear ye gods of Britain!" which he has fet in an *accompanied recitative, á tempo*, or *aria parlante*. The beginning, however, with the bafe *à pedale*, has the true characteriftic of recitative. Afterwards, when the bafe is put in motion, the whole has the properties of an air, ingenioufly and fpiritedly accompanied by two violins and a bafe. Befides the true dramatic caft of this compofition, there are new harmonies hazarded, which we do not recollect having feen in anterior contrapuntifts, at leaft of our own country.

We dare proceed no further in analyzing the works of our illuftrious countryman, though it would afford us great pleafure, as we never look at them without feeing a merit very fuperior to that of any of his contemporaries out of Italy, and even there, only the vocal compofitions of Cariffimi and Stradella feem to furpafs them in grace and elegance. Cariffimi appears to have been his model in his beft recitatives, and Lulli in the worft; and it is manifeft that he was fond of Stradella's manner of writing, though he never pillaged his paffages.

We muft not quit his vocal mufic without an honourable and grateful memorial of his catches, rounds, and glees, of which the humour, ingenuity, and melody, were fo congenial with the national tafte, as to render them almoft the fole productions of the facetious kind that were in general ufe for near fourfcore years. And though the countenance and premiums beftowed of late years upon this fpecies of compofition, as well as modern refinements in melody and performance, have given birth to many glees, of a more elegant, graceful, and exalted kind, than any which Purcell produced; yet he feems hardly ever to have been equalled in the wit, pleafantry, and contrivance of his catches.

Of fifteen anthems, with fymphonies and inftrumental parts, with innumerable odes and mifcellanies, we have room to fay nothing, though much praife is due to many of them.

An abfurd cuftom prevailed in Purcell's time, which he carried to greater excefs, perhaps, than any other compofer, of repeating a word of one or two fyllables an unlimited number of times, for the fake of the melody, and fometimes before the whole fentence has been heard. Such as no, no, no, —all, all, all—pretty, pretty, pretty, &c. *ad infinitum*. But there is equal redundance and obfcurity in the ufe which the Italians make at prefent of *sì, sì, sì*, and *nò, nò, nò*, in their fongs.

Purcell

Purcell was ſo little acquainted with the unlimited power of the violin, that we have ſcarcely ever ſeen a becoming paſſage for that inſtrument in any one of his works; the ſymphonies and ritornels to his anthems and ſongs being equally deficient in force, invention, and effect. And though his ſonatas contain many ingenious, and, at the time they were compoſed, new traits of melody and modulation, if they are compared with the productions of his contemporary, Corelli, they will be called barbarous. But Corelli wrote for an inſtrument of which he was a great maſter: and who ever entirely ſucceeded in compoſing for one of which he was ignorant? When a great performer on keyed inſtruments condeſcends to compoſe for the violin, upon which he has never been a good player, or the voice, without knowing in what good ſinging conſiſts, the paſſages all come from the head, and none from the hand, except the hand of a harpſichord player, which is ever unfit to ſuggeſt ideas either for a voice, or for any other inſtrument than his own. Such a compoſer for the violin muſt inevitably embarraſs the player with perpetual aukwardneſſes and difficulties without effect, which diſcover an utter ignorance of the finger-board.

If Purcell, by travelling, or by living longer at home, had heard the great inſtrumental performers, as well as great ſingers, that arrived in this country ſoon after his deceaſe, and had ſuch to compoſe for, his productions would have been more regular, elegant, and graceful; and he would certainly have ſet Engliſh words better than it was poſſible for any foreigner to do, for our feelings, however great his genius, or excellent, in other reſpects, his productions. But Purcell, like his ſucceſſor, Arne, and others who have compoſed for the playhouſe, had always an inferior band to the Italian opera compoſers, as well as inferior ſingers, and an inferior audience to write for.

The diligent and candid Walther, by not having aſſigned to Purcell a niche in his Muſical Dictionary, ſeems never to have heard of his exiſtence; but Purcell was ſo truly a *national* compoſer, that his name was not likely to be wafted to the continent; and the narrow limits of his fame may be fairly aſcribed, not only to the paucity and poverty of his compoſitions for inſtruments, for which the muſical productions are an intelligible language to every country, but to his vocal compoſitions being ſolely adapted to Engliſh words, which render it unlikely for their influence to extend beyond the ſoil that produced them.

We ſhould, however, have known as little of Lulli, as the French or Italians of Purcell, but for the partiality which Charles II. acquired, by his long reſidence on the continent, for the arts and amuſements of France. The firſt attempts at operas here, after the Reſtoration, were either in French, or on the model of thoſe that were then in high favour at Verſailles. And whoever is equally acquainted with the recitative, we had almoſt ſaid the general melody of Lulli and Purcell, muſt perceive a ſtrong reſemblance.

Purcell, however, having infinitely more fancy, and, indeed, harmonical reſources, than the Frenchified Tuſcan, his productions now afford far greater pleaſure and amuſement to a liberal lover of muſic, than can be found, not only in the productions of Cambert and Grabu, whom Charles II. and to flatter his majeſty, Dryden, patronized in preference to Purcell, but in all the noiſy monotony of the rhapſodiſt of Quinaut.

Let thoſe who ſhall think Purcell has ſacrificed the national honour by confeſſing his reverence for the productions of Italy, compare the ſecular productions of Engliſh muſicians, from the death of queen Elizabeth to the year 1683, with thoſe of Cariſſimi, Ceſti, Stradella, and innumerable others of great abilities, and if they do not equally hate muſic and truth, they will admire Purcell's probity, as well as his genius.

Indeed, muſic was manifeſtly on the decline, in England, during the ſeventeenth century, till it was revived and invigorated by Purcell, whoſe genius, though leſs cultivated and poliſhed, was equal to that of the greateſt maſters on the continent. And though his dramatic ſtyle and recitative were formed in a great meaſure on French models, there is a latent power and force in his expreſſion of Engliſh words, whatever be the ſubject, that will make an unprejudiced native of this iſland feel, more than all the elegance, grace, and refinement of modern muſic leſs happily applied, can do. And this pleaſure is communicated to us, not by the ſymmetry or rhythm of modern melody, but by his having fortified, lengthened, and tuned, the true accents of our mother-tongue; thoſe notes of paſſion, which an inhabitant of this iſland would breathe, in ſuch ſituations as the words he has to ſet deſcribe. And theſe indigenous expreſſions of paſſion Purcell had the power to enforce by the energy of modulation, which, on ſome occaſions, was bold, affecting, and ſublime.

Theſe remarks are addreſſed to none but Engliſhmen: for the expreſſion of words can be felt only by the natives of any country, who ſeldom extend their admiration of foreign *vocal* muſic, farther than to the general effect of its melody and harmony on the ear; nor has it any other advantage over *inſtrumental*, than that of being executed by the human voice, like *ſolfeggi*. And if the Italians themſelves did not come hither to give us the true expreſſion of their ſo•gs, we ſhould never diſcover it by ſtudy and practice.

It has been extremely unfortunate for our national taſte and our national honour, that Orlando Gibbons, Pelham Humphrey, and Henry Purcell, our three beſt compoſers during the laſt century, were not bleſt with ſufficient longevity for their genius to expand in all its branches, or to form a ſchool, which would have enabled us to proceed in the cultivation of muſic without foreign aſſiſtance.

Orlando Gibbons died 1625, at forty-four.

Pelham Humphrey died 1674, at twenty-ſeven.

And Henry Purcell died 1695, at thirty-ſeven.

If theſe admirable compoſers had been bleſt with long life, we might have had a muſic of our own, at leaſt as good as that of France or Germany; which, without the aſſiſtance of the Italians, has long been admired and preferred to all others by the natives at large, though their princes have uſually foreigners in their ſervice. As it is, we have no ſchool for compoſition, no well-digeſted method of ſtudy, nor, indeed, models of our own. Inſtrumental muſic, therefore, has never gained much by our own abilities; for though ſome natives of England have had hands ſufficient to execute the productions of the greateſt maſters on the continent, they have produced but little of their own that has been much eſteemed. Handel's compoſitions for the organ and harpſichord, with thoſe of Scarlatti and Alberti, were our chief practice and delight for more than fifty years; while thoſe of Corelli, Geminiani, Albinoni, Vivaldi, Teſſarini, Veracini, and Tartini, till the arrival of Giardini, ſupplied all our wants on the violin, during a ſtill longer period. And as for the hautbois, Martini and Fiſher, with their ſcholars and imitators, are all that we have liſtened to with pleaſure.

If a parallel were to be drawn between Purcell and any popular compoſer of a different country, reaſons might be aſſigned for ſuppoſing him ſuperior to every great and favourite contemporary muſician in Europe.

Cariſſimi and Stradella, if more poliſhed in their ſtyle, were certainly leſs varied, and knew ſtill leſs of inſtruments, than

than our countryman. They had both, perhaps, more grace and regularity, but infinitely lefs paffion and fire.

The elder Scarlatti was more *recherché* and learned, but never fo natural and effecting.

In Germany, if Keifer, during an active and much longer life, furpaffed him in the number and excellence of his dramatic compofitions, his productions for the church, could they be found, would, we believe, bear no comparifon.

Lulli, bleft likewife with fuperior longevity, compofed alfo more operas than Purcell, and was the idol of the nation for which he laboured; but though his overtures long ferved as models, even to Purcell, as well as to the compofers of all the reft of Europe, and his mufic was performed by better fingers, and a more numerous band, fupported by the patronage of a court, and all the fplendour of ingenious and coftly exhibition; it is eafy to fee that even his theatrical works are more *manierées*, monotonous, and uninterefting in themfelves, than thofe of Purcell; but in relinquifhing the ftage, and ftepping on holy ground, we fhould have found, even in France, during all his glory, and the enthufiafm he raifed, none of his votaries who would attempt to put his facred mufic in comparifon with that of our countryman.

Rameau, the fucceffor of Lulli in court and popular favour, and who had more learning and theoretical knowledge in the art, than perhaps any practical mufician of modern times; yet, in pathos and expreffion of words and the paffions, he was Purcell's inferior, even upon the ftage; and in the church, he had no claim to celebrity.

Handel, who flourifhed in a lefs barbarous age for his art, has been acknowledged his fuperior in many particulars; but in none more than the art and grandeur of his chorufes, the harmony and texture of his organ fugues, as well as his great ftyle of playing that inftrument; the majefty of his hautbois and grand concertos, the ingenuity of the accompaniments to his fongs and chorufes, and even in the general melody of the airs themfelves; yet in the accent, paffion, and expreffion of *Englifh words*, the vocal mufic of Purcell is, fometimes to our feelings, as fuperior to Handel's as an original poem to a tranflation.

PURCHAS, Samuel, was born at Thaxtead, in Effex, in 1577. He was educated at Cambridge, and was prefented to a vicarage in his native county. This cure he refigned to his brother, and came to live in London, for the purpofe of conducting the great work he had undertaken. The firft volume folio appeared in 1613, under the title of "Purchas his Pilgrimage, or Relations of the World and the Religions obferved in all Ages and Places difcovered from the Creation unto this Prefent:" the other four volumes were publifhed in 1625. To thefe the general title is "Hakluytus Pofthumus, or Purchas his Pilgrims: containing a Hiftory of the World in Sea-voyages and Land-travels by Englifhmen and others:" the name of Hakluyt is introduced, becaufe Purchas became poffeffed of the papers which he left behind him. This great work, of which the object is to connect ancient and modern hiftory, was well received, but probably involved the author in debt. He had been collated to the rectory of St. Martin's Ludgate, and was chaplain to Abbot, archbifhop of Canterbury. He died about the year 1628, at the age of fifty-one. Biog. Brit.

PURCHASE, in *Law*, in its largeft and moft extenfive fenfe, is defined by Littleton to be the poffeffion of lands and tenements, which a man hath by his own act or agreement, and not by defcent from any of his anceftors or kindred. In this fenfe, it is contradiftinguifhed from acquifition by right of blood, and includes every other method of coming to an eftate, but merely that by inheritance; in which the title is vefted in a perfon, not by his own act or agreement, but by the fingle operation of law. (Co. Litt. 18.) Purchafe, in its vulgar and confined acceptation, is applied only to the acquifition of goods, lands, tenements, or the like, by means of money, or fome other valuable confideration.

What we call *purchafe*, *perquifitio*, the feudifts call *conqueft*, *conquæftus*, or *conquifitio*, (fee Conquest); both denoting any means of acquiring an eftate out of the common courfe of inheritance; and this is ftill the proper phrafe in the law of Scotland. The difference, in effect, between the acquifition of an eftate by defcent and by purchafe, confifts principally in thefe two points. 1. That by purchafe the eftate acquires a new inheritable quality, and is defcendible to the owner's blood in general, and not the blood only of fome particular anceftor. 2. An eftate taken by purchafe will not make the heir anfwerable for the acts of the anceftor, as an eftate by defcent will. According to this legal fignification of the word *perquifitio*, or purchafe, it includes the five following methods of acquiring a title to eftates, viz. *efcheat*, *occupancy*, *prefcription*, *forfeiture*, and *alienation*, conveyance, or purchafe, in its limited fenfe: under which latter head may be comprifed any method in which eftates are voluntarily refigned by one man, and accepted by another: whether that be effected by fale, gift, marriage-fettlement, devife, or other tranfmiffion of property, by the mutual confent of the parties. See the feveral articles, and Title.

Natural perfons, incorporate perfons, fole or aggregate, deaf, dumb, and blind perfons, minors, and all reafonable creatures, may purchafe, except in fome cafes; but fome have capacity to purchafe, and not to hold, as aliens, felons, &c.; and others have ability to hold or not to hold upon a purchafe, at the election of themfelves or others, as infants, and feme coverts. 1 Inft. 2, 3. 11 Rep. 77. 7 Rep. 17.

Purchase *and value of land*. See Valuation *of Land*, and Political *Economy*.

Purchase *of writs*. See Writ.

Purchase, in the *Sea Language*, has the fame fignification with *draw in*, at land. Thus, they fay, the capftern purchafes apace, *i. e.* draws in the cable apace; and when they cannot draw or hale any thing in with the tackle, they fay, the tackle will not purchafe.

Purchase is alfo a name given by failors to any mechanical power employed in raifing or removing heavy bodies, or in fixing or extending the fhip's rigging. Such are the tackles, windlaffes, capfterns, fcrews, and handfpikes.

Purchase-*Book*, among *Traders*, is the name given to a book, which is a kind of journal, containing an account of all the purchafes made, or things bought in the day.

PURCHASER, First, *Perquifitor*, in *Law*, denotes the perfon who firft acquired an eftate to his family, whether the fame was transferred to him by fale or by gift, or by any other method, except only that of defcent. See Descent.

PURCHASING *of Eftates*, in *Agriculture*, the bufinefs of buying landed property. In order to perform this fort of bargain with propriety, and to the beft advantage, attention is neceffary to be had to a great variety of circumftances of different kinds, which refpect the nature, quality, fituation, condition, value, and conveniences of the property. See Valuation *of Land*.

But it is probably beft done, when to any extent, by a furveyor or other perfon who is perfectly converfant with the nature of the bufinefs, and fully acquainted with the real value of landed property in the diftrict where the purchafe may be fituated or met with.

It has been obferved by Mr. Marfhall, that there are two methods of making bargains of this kind, the one by public biddings, the other by private treaty or contract: in either of which, a certain degree of caution is common prudence. In the former, however, the conditions being fixed, an accurate valuation is the beft fafeguard; and, in the latter, among honeft men little more is required.

In purchafing by private contract, the particulars which may be previoufly required to be furnifhed by the feller, are the quantities of the feveral pieces of the lands which are on fale, together with the maps, or rough drafts, of the fame; the tenure under which they are held; fome affurance as to the title of the feller; and his right of alienation; the tenancy under which the feveral farms are let; and, if on lives, the ages of the nominees; if for a term of years, the number which are unexpired; if at will, the notices with which the tenants have been ferved, if any have been given.

An abftract of the covenants under which they are let; particularly of thofe which relate to taxes and repairs, to the expenditure of produce, to the ploughing of grafslands, &c. &c.

The exifting rents and profits receiveable; whether for tenanted lands, appurtenances, or abftract rights; with the eftimated value of the demefne, and the woodlands in hand; together with the eftimated value of the timber growing upon the eftate on fale; as well as of the minerals and foffils which it may contain.

The outgoings to which the eftate is liable; the propofed time of the delivery of poffeffion; the price and the mode of payment which are expected.

And next, it will be proper to fet down the particulars of the inftructions to be given to a furveyor, or other valuer, of the eftate to be purchafed. It will be right, however, to premife, that much, in this refpect, depends on the probability of purchafing; and on the time which is allowed for making the eftimate. In cafes of fale by public auction, when there can be no certainty as to purchafe, and where the time for valuation is limited, a rough eftimate of each farm, and a general idea of the value of the timber and other appurtenances, may be all that can be prudently afcertained. But in a fale by private contract, where the refufal of an eftate is granted, and time allowed for deliberate furvey, a more minute inveftigation may be proper; efpecially where there is every reafon to believe that a bargain will take place. For the fame report will not only ferve as a guide to the purchafe, but will become a valuable foundation, on which to ground the future management of the eftate. And for thefe and other reafons, a purchafe by private contract is moft to be defired by one who is not in the habit of perfonally attending public fales, and is unacquainted with the bufinefs of an auction room.

It may be noticed, that the particulars to be required from a furveyor, or furveyors, in thefe cafes, are principally thefe: the rental value of each field or parcel of land, with the ftate in which it lies, as to arable, meadow, pafture, or woodland: the value of the timber and other appurtenances: the characteriftic, and the ftate of management of each farm or tenement, with the eligibility of the occupier; together with the ftate of repair of buildings, gates, fences, water-courfes, and roads, the amount of the encumbrances and outgoings. And, laftly, the probable value of the improvements of which the eftate may appear to be capable; whether by the feveral means that are commonly practifed, or by new regulations and improved modes of agricultural management, that may admit of being introduced.

It is added, that thefe feveral particulars of information being procured, the fubjects of treaty are few. The two ftatements having being duly compared, fo that no mifunderftanding can take place between the parties, the price, and the times and mode of payment, are the principal matters of agreement. A clear underftanding refpecting the cuftody of title deeds and the expences of conveyance, require, however, to be enumerated among the preliminaries of purchafe.

In thefe tranfactions, it is alfo fuppofed, the bufinefs of negociation is beft carried on by letters; which become vouchers of facts. Whatever is done by interview, requires to be reduced to writing, and to be read by or to the parties before they feparate, that no poffibility of mifconception may arife. And, added to thefe precautions, it is proper in large purchafes, and when abftracts of intricate title deeds are to be made out, and examined, that a legal contract or memorandum of agreement fhould be entered into, for the mutual fatisfaction and furety of the parties. This contract and the deed of conveyance, which is the inftrument which is legally to transfer the property from the feller to the purchafer, may be faid to conclude and ratify the bufinefs of purchafe. And in this part of it, legal affiftance is effentially neceffary; to examine exifting deeds, and fee that the feller has a legal right and clear title to the land, and a legal power to difpofe of it; as well as to draw up or examine the frefh deed of conveyance, and fee that it is fufficient to transfer the property legally and adequately to the purchafer.

PURCHENA, in *Geography*, a town of Spain, in the province of Grenada; 60 miles E. of Grenada. N. lat. 37° 19′. W. long. 2° 30′.

PURE, fomething free from any admixture of foreign or heterogenous matters.

PURE *Fire*. See FIRE.

PURE *Hyperbola*, in *Conics*, is an hyperbola without any oval, node, fpike, or conjugate point. See CURVE.

PURE *Mathematics*. See MATHEMATICS.

PURE *Propofition*. See PROPOSITION.

PURE *Quadratics*. See QUADRATIC.

PURE *Refignations*. See RESIGNATION.

PURE *Villenage*. See VILLENAGE.

PUREA, or PURAN, in *Geography*, a town of Chili; 80 miles S.S.E. of La Conception.

PUREEWAR, a town of Hindooftan, in Oude; 10 miles N. of Bahraitch.

PUREG, anciently *Pura*, once the capital of Gedrofia (Mekran), and termination of the toilfome march of Alexander towards the frontiers of Caramania, is now a mean village.

PURENDERA, in *Mythology*, a name of Indra, the Hindoo regent of the firmament. (See INDRA.) The word is faid to mean *deftroyer of towns*, the Indian Jupiter having, in revenge for facrificial flights or negligences, frequently, according to the Hindoo books, affumed that character. The ancient city of Ougein, the capital of Malwa, was, according to tradition, deftroyed by Indra. See OUGEIN.

PURESIL, in *Geography*, a town of Hindooftan, in the circar of Cicacole; 40 miles N.W. of Vizniagram.

PURETTA, a name given by fome writers to the common fhining black fand, ufed to ftrew over writing, and erroneoufly called by fome *fteel-duft*.

It is a natural mineral fubftance, found on the fhores near Genoa, and in other places.

PURFLED,

PURFLED, ornamental work, whether in ftone or other materials, reprefenting embroidery or lace work.

PURFLEW, a term in *Heraldry*, expreffing ermines, peans, or any of the furs, when they compofe a border round a coat of arms.

Thus they fay, he beareth gules a border, purflew, vairy; meaning, that the border is vairy.

PURG, or Forg, in *Geography*, a town of Perfia, in the province of Lariftan; 60 miles N.E. of Lar. N. lat. 28° 30′. E. long. 54° 40′.

PURGATION, Purgatio, the act of purging, fcouring, or purifying any thing, by feparating and carrying off any impurities found therein.

Purgation, in *Pharmacy*, is the cleanfing of a medicine by retrenching its fuperfluities; as taking the wood and feeds out of caffia, and the ftones out of dates, tamarinds, and other fruits.

Purgation is alfo ufed, in *Chemiftry*, for feveral preparations of metals and minerals, intended to clear them of their impurities; more ufually called *purification* and *refining*.

The ordinary purgation of mercury is performed, by paffing it through a chamois fkin. (See Mercury.) Gold is purged by the coppel, cementation, &c. See Gold, Coppel, &c.

Purgation, in other metals, is performed by repeated fufion, &c.

Purgation, *Catharfis*, in *Medicine*, the evacuation of the alimentary canal of its fæcal contents, by means of fubftances which ftimulate its fibres, and excite them to a more active periftaltic motion. Purgation is alfo fometimes carried farther, and, by caufing a copious difcharge of fluids from the exhalent veffels of the inner furface of the bowels, produces a confiderable evacuation from the fyftem at large. For an elucidation of the doctrine of purgation, fee Cathartic.

Purgation, in *Law*, is the clearing one's felf of a crime, whereof publicly fufpected or accufed before a judge, called alfo *judicium Dei*.

Of thefe purgations there was anciently much ufe in England, efpecially touching matters of felony charged on clerks; and there is fomething of them ftill retained in the ecclefiaftical court on fufpicion of incontinency, &c. Purgation is either *canonical* or *vulgar*.

Purgation, *Canonical*, is that prefcribed in the canon law, the form of which, obtaining in the fpiritual court, is, that the party fufpected fhall take his oath that he is clear of the fact objected againft him; and bring fo many of his honeft neighbours, not above twelve, as the court fhall affign him, to fwear, on their confciences, that they believe he fwears truly.

The canonical doctrine of purgation, whereby the parties were obliged to anfwer upon oath to any matter, however criminal, that might be objected againft them, continued till the middle of the 17th century to be upheld by the fpiritual courts; when the legiflature was obliged to interpofe, to teach them a leffon of fimilar moderation. By the ftatute of 13 Car. II. cap. 12. it is enacted, that it fhall not be lawful for any bifhop, or ecclefiaftical judge, to tender or adminifter to any perfon whatfoever, the oath ufually called the oath *ex officio*, or any other oath whereby he may be compelled to confefs, accufe, or purge himfelf of any criminal matter or thing, whereby he may be liable to any cenfure or punifhment. But this doth not extend to oaths in a civil fuit; and, therefore, it is ftill the practice both in the fpiritual courts, and in equity, to demand the perfonal anfwer of the party himfelf upon oath. Yet if in the bill any queftion be put, that tends to the difcovery of any crime, the defendant may thereupon demur, and refufe to anfwer. Anciently, upon the allowance of the benefit of clergy, the perfon accufed was delivered to the ordinary, to make his purgation, which was to be before a jury of twelve clerks, by his own oath affirming his innocence, and the oaths of twelve compurgators as to their belief of it. But now, by the ftat. 18 Eliz. cap. 7. this kind of purgation is alfo taken away; and the perfon admitted to his clergy fhall not be delivered to the ordinary.

Purgation, *Vulgar*, being the moft ancient manner, was by fire, or water, or combat; ufed by infidels, and by Chriftians too, till abolifhed by the canon law. See Ordeal, and Corsned.

Combat, though now difufed, may yet be ftill practifed by the laws of the realm, in cafes where evidence is wanting, and where the defendant rather choofes combat than any other trial. See Combat.

Terris bonis, &c. *redhabendis poft Purgationem*. See Terris.

Purgation, in *Rhetoric*, is ufed for that kind of defence which takes place when the accufed perfon owns the fact, but denies that he did it with defign, or with any bad intention.

Purgation, in *Tragedy*, is a term which Ariftotle ufes for the effect of tragedy on the mind.

That philofopher obferves, that tragedy, by means of the terror and compaffion which it excites, purges paffions out of the foul.

Indeed, Corneille adds, that tragedy frequently creates paffions, inftead of purging them; fo that he takes Ariftotle's purgation to be no more than a chimera.

Purgations, *Menftrual*, the catamenia or menfes of women.

PURGATIVE, or Purging-*Medicine*, a medicament, which evacuates the contents of the bowels by ftool. See Cathartic.

PURGATORY, Purgatorium, in the Romifh church, a place where the juft are fuppofed to fuffer the pains due to their fins, for which they have not fatisfied in this world.

It is by the mercy of God, the indulgences of the church, and the prayers of the faithful, that people are fuppofed to be delivered out of purgatory.

This doctrine of purgatory, which fome derive from the Platonic fancies of Origen, the Montanifm of Tertullian, pretended vifions, and pagan ftories, rhetorical flourifhes, and doubtful expreffions of the later fathers, and in which we may difcern an obvious refemblance to the famous pagan doctrine, concerning the purification of departed fouls by means of a certain kind of fire, was partly introduced, at leaft in the fpirit of it, towards the clofe of the fifth century, and by Gregory the Great in the fixth century; but it was not, however, pofitively affirmed till about the year 1140, nor made an article of faith till the council of Trent. Seff. 25. Decret. de Purgat. See Papists and Popery.

In Ireland is a place called "St. Patrick's purgatory," where, as the legend has it, at the prayers of St. Patrick, bifhop of the place, there was made a vifible reprefentation of the pains which the wicked undergo after death, in order to deter finners, &c.

PURGATTY, in *Geography*, a town of Hindooftan, in the circar of Cicacole; 40 miles N.W. of Vizniagram.

PURGE, in *Medicine*, a term frequently ufed for a dofe of fome purgative medicine.

PURGING Ale, *Butler's*. See Ale.

Purging *Grain, Oily*, in *Botany*. See Sesamum.

Purging *Nut*, in *Botany*. See Jatropha.

Purging *Thorn*. See Buckthorn.

PURGLITZ, or Krziwoklad, in *Geography*, a citadel of Bohemia, in the circle of Rakonitz, where the royal treaſures were anciently kept, and ſtate priſoners confined; ſeven miles S.E. of Rakonitz.

PURGOT, a town of Hindooſtan, in Coimbetore; 35 miles W. of Ardenelle.

PURGOW, a town of Hindooſtan, in Baglana; 25 miles E.N.E. of Baſleen.

PURGSTALL, a town of Auſtria; four miles N. of Scheibs.

PURIFICATION, in *Chemiſtry*, &c. the act of purifying or refining natural bodies; or of ſeparating the fæces and impurities from them.

For the methods of purifying metals, gold, ſilver, iron, copper, tin, &c. ſee Gold, Silver, &c. and Refining.

For the purification of ſemi-metals, minerals, and other matters, as antimony, ſulphur, camphor, ſaltpetre, &c. ſee Antimony, Sulphur, Camphor, &c.

Purification, in *Pharmacy*. See Trying.

Purification, in *Matters of Religion*, denotes an offering made the prieſt by women riſing out of child-bed, before they are re-admitted into the church.

By the law of Moſes, a woman, after bringing forth a male child, was unclean forty days; after a female, eighty days; during which time, ſhe was not to touch any thing holy, nor to go near the temple, but was to continue within doors, ſeparate from all company, and commerce of others.

This term expired, ſhe was to preſent herſelf at the temple, and at the door of the tabernacle, to offer a lamb, as an holocauſt, and a pigeon or turtle; which the prieſt taking, offered to God, and prayed for her, that ſhe might be purified.

This ceremony, which conſiſted of two things, an holocauſt, and a ſacrifice of expiation, was called טהר טהרה, *purificatio, purgatio.*

The holy Virgin, though, according to the fathers, exempt from the terms of the law, yet complied with it, and, at the time preſcribed, went to the temple, and accompliſhed the law; in commemoration of which the church yearly ſolemnizes the feaſt of the Purification of the Virgin, on the ſecond of February; called alſo the Feaſt of Candlemas.

Purification, *The Feaſt of the*, ſeems to be very ancient. It is ordinarily ſaid to have been inſtituted in the time of Juſtinian, in the year 542, and this on occaſion of a mortality, which that year diſpeopled almoſt the whole city of Conſtantinople. Yet there are ſome, who imagine it to have been obſerved before, though in another manner, and on a different day from that fixed by Juſtinian; *viz.* between the Circumciſion and Epiphany. See Candlemas.

The ſame day is the preſentation of our Saviour in the temple.

Purification, in *Geography*, a town of Mexico, in the province of Xaliſco; eight miles S. of Compoſtella Nuova. N. lat. 19° 58′. W. long. 105° 46′.

PURIM, a ſolemn feaſt held among the Jews on the fourteenth and fifteenth of March, in memory of their deliverance from the conſpiracy of Haman by Eſther. See Esther.

This feaſt, which derives its name from the Perſian word *purim*, q. d. *lots*, becauſe it was by the caſting of lots that Haman determined this time for the deſtruction of the Jews, is the Bacchanals of theſe people, which they celebrate with all manner of rejoicing, mirth, and jollity; indulging themſelves with every kind of luxury, eſpecially in drinking wine even to drunkenneſs, which they conſider as part of the duty of the ſolemnity; becauſe it was by means of the wine banquet (they ſay) that Eſther made the king's heart merry, and brought him into that good humour, which inclined him to grant the requeſt preſented by her for their deliverance; and, therefore, they think they ought alſo to make their hearts merry, when they celebrate the commemoration of it. During this feſtival the book of Eſther is ſolemnly read in all their ſynagogues from the beginning to the end, at which they are all to be preſent, men, women, children, and ſervants, becauſe all ſhared in the benefit of the deliverance which Eſther obtained for them. And as often as the name of Haman occurs in the reading of this book, the cuſtom is for all to clap with their hands, and ſtamp with their feet, and cry out, Let his memory periſh. Prideaux's Conn. vol. ii. p. 456.

PURITANS, in *Eccleſiaſtical Hiſtory*. See Cathari and Novatians.

Puritans is alſo a term anciently uſed for the Calviniſts of Great Britain, from their profeſſing to follow the pure word of God, in oppoſition to all traditions, human conſtitutions, and other authorities.

The ſeparation, whence this diſtinguiſhing appellation took its riſe, commenced on the following occaſion. Upon the acceſſion of queen Mary, it is well known that popery revived in this kingdom; the ſtatutes of king Edward were repealed, and the penal laws againſt heretics were put in execution againſt the reformers. Many ſuffered at home; and others eſcaped the fury of perſecution by ſeeking refuge in foreign countries. Some went into France and Flanders; ſome to Geneva; and others into thoſe parts of Germany and Switzerland, where the reformation had taken place, and where the magiſtrates received them with great humanity, and allowed them places for public worſhip. The exiles were moſt numerous at Frankfort; and there that conteſt and diviſion began, which gave riſe to the Puritans, and to that ſeparation from the church of England, which continues to this day. In the year 1554, ſome of the Engliſh fugitives ſettled in this city; and agreed to conduct their worſhip, without anſwering aloud after the miniſter, and without uſing the liturgy and ſurplice; to begin the public ſervice with a general confeſſion of ſins, then to ſing a pſalm, after which the miniſter prayed for the divine aſſiſtance, and next proceeded to the ſermon; after ſermon, a general prayer for all eſtates, and particularly for England, at the end of which was ſubjoined the Lord's prayer, and a rehearſal of the articles of belief; then the people were to ſing another pſalm, and the miniſter to diſmiſs them with a bleſſing. Such was the order which they had unanimouſly adopted; and having choſen a miniſter and deacons, they invited their diſperſed brethren to join with them. In the year 1556, Dr. Cox, afterwards biſhop of Ely, came to ſettle at Frankfort with ſeveral of his friends; who interrupting the public ſervice by anſwering aloud after the miniſter, and reading the whole litany, in violation of the agreement upon which the congregation was formed, overpowered the firſt ſettlers; and obtaining leave of the magiſtrates for the free uſe of king Edward's ſervice-book, performed divine worſhip according to the rites that had been authoriſed by that prince; while others, who preferred the Genevan method of worſhip, as more pure and ſimple, left the city of Frankfort, and removed to Baſil and Geneva. Thus commenced the diſtinction of Puritans and Conformiſts, by which the two parties were afterwards known. The former were called Conformiſts, on account of their compliance with the eccleſiaſtical laws enacted by Edw. VI. and the denominations of Nonconformiſts and Puritans were given to the latter, from their inſiſting upon a form of worſhip, more exempt from ſuperſtition, and of a purer kind than the liturgy of Edward feemed to them to be. Upon the acceffion of queen Elizabeth, the exiles returned to England, where each party ftrove to advance the reformation according to their own ftandard. The queen, with thofe who had weathered the ftorm at home, were only for reftoring king Edward's liturgy; but the majority of the exiles were for the worfhip and difcipline of the foreign churches, and refufed to comply with the old eftablifhment, declaiming loudly againft the popifh habits and ceremonies. However, the queen's party prevailed; and in 1559 a committee of divines was appointed to review king Edward's liturgy, who were inftructed to ftrike out all offenfive paffages againft the pope, and to make people eafy about the belief of the corporal prefence of Chrift in the facrament. But no alterations were made in favour of thofe who now began to be called Puritans, from their attempting a purer form of worfhip and difcipline than had yet been eftablifhed; and whofe fentiments in many points were agreeable to thofe maintained by John Wickliffe, the firft reformer. For they agreed with him in opinion, that in the facrament of orders there ought to be but two degrees, prefbyters or bifhops, and deacons; that all human traditions are fuperfluous and finful; that we muft practife and teach only the laws of Chrift; that myftical and fignificant ceremonies in religious worfhip are unlawful; and that to reftrain men to a prefcribed form of prayer is contrary to the liberty granted them by God. The old feftivals, with their eves and the popifh habits, were continued as they were in the fecond year of king Edward VI. In 1558 the act of fupremacy was paffed, in which there is a remarkable claufe, that gave rife to the court of high-commiffion, which proved afterwards fo oppreffive; and in 1559 was paffed an act for the uniformity of common prayer, and fervice in the church, and adminiftration of the facraments. The Puritans remonftrated againft thefe proceedings, and complained, that the grofs fuperftitions of popery, which they had looked upon as abrogated and abolifhed, were now revived, and even impofed by authority. Some required nothing lefs than that the church of England fhould be exactly modelled after that of Geneva; others only defired liberty of confcience, with the privilege of celebrating divine worfhip in their own way; but neither party obtained the object of their wifhes. The queen, intent upon the fuppreffion of this troublefome fect (as fhe was ufed to call it), permitted its enemies to employ for that purpofe all the refources of artifice, and all the feverity of the laws. The court reformers pleaded, that every prince had authority to correct all abufes of doctrine and worfhip within his own territories; the Puritans, on the other hand, whilft they difowned all foreign authority and jurifdiction over the church, could not admit of that extenfive power which the crown claimed by the fupremacy; apprehending it unreafonable, that the religion of a whole nation fhould be at the difpofal of a fingle lay perfon. However, they took the oath, with the queen's explication in her injunctions, as reftoring her majefty only to the ancient and natural rights of fovereign princes over their fubjects.

Farther, the court reformers allowed, that the church of Rome was a true church, though corrupt in fome points of doctrine and government; that all her miniftrations were valid, and that the pope was a true bifhop of Rome, though not of the univerfal church. But the Puritans affirmed the pope to be antichrift, the church of Rome to be no true church, and all her miniftrations to be fuperftitious and idolatrous; they renounced her communion, and durft not fufpend the validity of their ordinations upon an uninterrupted line of fucceffion from the apoftles through her hands. Moreover, it was agreed by all, that the holy fcriptures were a perfect rule of faith; but the bifhops and court reformers did not allow them to be the ftandard of difcipline or church government; affirming that our Saviour and his apoftles left it to the difcretion of the civil magiftrate, in thofe places where Chriftianity fhould obtain, to accommodate the government of the church to the policy of the ftate. But the Puritans apprehended the holy fcriptures to be a ftandard of church difcipline as well as of doctrine; at leaft that nothing fhould be impofed as neceffary but what was exprefsly contained in, or derived from them by neceffary confequence, and, befides, they maintained that the difcretionary power was not lodged with the civil magiftrate, but with the fpiritual officers of the church. Farther, the court reformers maintained, that the practice of the primitive church for the firft four or five centuries was a proper ftandard of church government and difcipline, and in fome refpects a better than that of the apoftles, which (according to them) was only accommodated to the infant ftate of the church while it was under perfecution, whereas theirs was fuited to the grandeur of a national eftablifhment. Whereas the Puritans were for adhering to the bible in the main principles of church government, and for admitting no church officers or ordinances, but fuch as are herein mentioned; and they apprehended, that the apoftles, in eftablifhing the firft Chriftian church on the ariftocratical plan then obferved in the Jewifh fanhedrim, defigned it as an unchangeable model to be followed in all times and places. The court reformers alfo maintained, that things indifferent in their own nature, which are neither forbidden nor commanded in the holy fcriptures, fuch as rites, ceremonies, habits, &c. might be fettled, determined, and made neceffary by the command of the civil magiftrate, and that in fuch cafes it was the indifpenfible duty of all fubjects to obferve them. But the Puritans infifted, that thofe things which Chrift had left indifferent, ought not to be made neceffary by any human laws, and that fuch rites and ceremonies as had been abufed to idolatry, and had a manifeft tendency to lead men back to popery and fuperftition, were no longer indifferent, but to be rejected as unlawful. Neverthelefs, both parties agreed too well in afferting the neceffity of an uniformity of public worfhip, and of calling in the fword of the magiftrate for the fupport and defence of their feveral principles; which they made an ill ufe of in their turns, as they could grafp the power into their hands. The ftandard of uniformity, according to the bifhops, was the queen's fupremacy, and the law of the land; according to the Puritans, the decrees of provincial and national fynods, allowed and enforced by the civil magiftrate; but neither party was for admitting that liberty of confcience, and freedom of profeffion, which is every man's right, as far as is confiftent with the peace of the government under which he lives.

In the year 1564, upon a report that the habits, enjoined on the clergy, were generally neglected, and alfo of inattention to other impofed forms, the queen directed the ecclefiaftical commiffioners to confult fome proper methods to reduce them to an exact uniformity; upon which they agreed on certain *advertifements* (as they were called), partly for due order in preaching and adminiftering the facraments, and partly for the apparel of ecclefiaftical perfons. To thefe advertifements certain proteftations were annexed, to be made, promifed, and fubfcribed by fuch as fhould hereafter be admitted to any office or cure in the church. The queen, though fhe would give no authority to the advertifements, which had occafioned much remonftrance and complaint, iffued out a proclamation in 1565, peremptorily requiring uniformity in the habits, upon pain of prohibition from preaching, and deprivation. Parker, the archbiſhop of Canterbury, was violent and unrelenting; and by various methods of ſeverity, haraſſed, ſilenced, and deprived many of thoſe who ſcrupled the uſe of the habits. The ſuſpended miniſters, finding that renewed applications to the queen and her commiſſioners were ineffectual, publiſhed, in 1566, a ſmall treatiſe in vindication of their conduct; in which they allege, that neither the prophets of the Old Teſtament, nor the apoſtles of the New, were diſtinguiſhed by their garments; that a diſtinction of garments in the Chriſtian church did not generally obtain till long after the riſing of antichriſt; that the garments againſt which they objected, had been abuſed to idolatry, ſorcery, and all kinds of conjurations; that they were an offence to weak Chriſtians, an encouragement to ignorant and obſtinate papiſts, and the uſe of them an affectation of returning to their communion; that at beſt they were only human appointments, ſubject to the apoſtle's reproof, Col. ii. 20—22; that allowing them to be indifferent (which they did not grant), yet they ought not to be impoſed, becauſe it was an infringement of the liberty with which Chriſt had made them free; and finally they urged the ſuffrage of foreign divines, who all condemned the habits, though they were not willing to hazard the reformation in its infancy, on account of them.

If, at this time, the habits and a few ceremonies had been left indifferent, both miniſters and people would have acquieſced; but it was the compelling of theſe things by law that made them ſeparate from the eſtabliſhed church. Accordingly, in 1566, they came to a reſolution, alleging it to be their duty, in their preſent circumſtances, to break off from the public churches, and to aſſemble, as they had opportunity, in private houſes, or elſewhere, to worſhip God in a manner that might not offend againſt the light of their conſciences; and it was debated among them, whether they ſhould uſe as much of the common prayer and ſervice of the church as was not offenſive, or reſolve at once, ſince they were cut off from the church of England, to ſet up the pureſt and beſt form of worſhip, moſt conſonant to the holy ſcriptures, and to the practice of the foreign reformers. The latter of theſe meaſures was concluded upon; and accordingly they laid aſide the Engliſh liturgy, and made uſe of the Geneva ſervice-book. However, it is neceſſary to obſerve, that though all the Puritans of theſe times would have remained in the church, if they might have been indulged in the habits and a few ceremonies, yet they were far from being ſatiſfied with the hierarchy. They had other objections beſides thoſe for which they were deprived; of which we ſhall here ſubjoin a ſummary. They complained of the biſhops affecting to be thought a ſuperior order to preſbyters, and claiming the ſole right of ordination, and the uſe of the keys; and aſſuming, in connection with their office, temporal dignities, titles, and employments. As long, however, as the Engliſh biſhops pretended to derive their dignity and authority from no other ſource than the laws of their country, and pleaded a right, merely human, to the rank they held in the church and ſtate, the controverſy was carried on without exceſſive animoſity and zeal; but the flame broke out with redoubled fury in the year 1588, when Bancroft, afterwards archbiſhop of Canterbury, ventured to aſſert that the order of biſhops was ſuperior to the body of preſbyters, not in conſequence of any human inſtitution, but *jure divino*, or by the expreſs appointment of God himſelf. Farther, the Puritans excepted againſt the titles and offices of archdeacons, deans, chapters, and other officials, belonging to cathedrals, as having no foundation in ſcripture, or primitive antiquity, and intrenching upon the privileges of the preſbyters in the ſeveral dioceſes. They complained of the exorbitant power and juriſdiction of the biſhops and their chancellors in their ſpiritual courts, as derived from the canon law of the pope, and not from the word of God, or the ſtatute law of the land. They lamented the want of a godly diſcipline, and were uneaſy at the promiſcuous and general acceſs of all perſons to the Lord's table. Though they did not diſpute the lawfulneſs of ſet forms of prayer, provided a due liberty was allowed for prayers of their own compoſure before and after ſermon, yet they diſliked the frequent repetition of the Lord's prayer in the liturgy, the interruption of the prayers by the frequent reſponſes of the people, ſome paſſages in the office of marriage, as *With my body I thee worſhip*, and in that of burial, as *In ſure and certain hope of the reſurrection to eternal life*, pronounced over the worſt of men, if not excommunicated, &c. They alſo objected againſt the reading of the apocryphal books in the church, while ſome parts of canonical ſcripture were omitted; and though they did not diſlike the homilies, they thought that no man ſhould be ordained a miniſter in the church who was not capable of preaching and expounding the holy ſcriptures. They diſapproved of ſeveral of the church feſtivals or holidays, as having no foundation in ſcripture, or primitive antiquity; and they diſallowed of the cathedral mode of worſhip; nor did they approve of muſical inſtruments in the church ſervice. Finally, they ſcrupled conformity to certain rites and ceremonies, which were enjoined by the rubric, or the queen's injunctions; as the ſign of the croſs in baptiſm, baptiſm by midwives, or other women, in caſes of ſickneſs, and the mode of churching women; the uſe of god-fathers and god-mothers, to the excluſion of parents from being ſureties for the education of their own children; the cuſtom of confirming children, as ſoon as they could repeat the Lord's prayer and their catechiſm, by which they had a right to come to the ſacrament, without any other qualification, and the impoſition of hands, as a ſign of the divine favour, which ſeemed to them to imply a ſacramental efficacy in this ceremony; kneeling at the ſacrament of the Lord's ſupper, whilſt they conſidered that Chriſt gave it to his diſciples rather in a poſture of feaſting than of adoration; that it had no foundation in antiquity; that it had been groſsly abuſed by the papiſts to idolatry in their adoration of the hoſt; and that, if the poſture were indifferent, it ought not to be impoſed as a neceſſary term of communion; nor did they approve of adminiſtering either of the ſacraments in private, even in caſes of danger; bowing at the name of Jeſus; giving the ring in marriage, which they conſidered as derived from the papiſts, who made marriage a ſacrament, and the ring a ſort of ſacred ſign or ſymbol; the prohibition of marriage during certain times of the year, and the licenſing it for money; and, laſtly, the wearing of the ſurplice, and other veſtments to be uſed in divine ſervice.

In points of doctrine there was, at this time, no difference between the Puritans and Conformiſts; and if we add one article more to the preceding, we ſhall have the principal heads of controverſy between the church of England and the Proteſtant Diſſenters, at this day; *viz.* the natural right which every man has to judge for himſelf, and make profeſſion of that religion he apprehends moſt agreeable to truth, as far as it does not affect the peace and ſafety of the government under which he lives; without being determined by the prejudices of education, the laws of the civil magiſtrate, or the decrees of councils, churches, or ſynods. See *Proteſtant* DISSENTERS.

Towards the latter end of queen Elizabeth's reign, there aroſe a party, which were firſt for ſoftening, and then for overthrowing,

overthrowing, the received opinions concerning predeftination, perfeverance, free-will, effectual grace, and the extent of Chrift's redemption. The clergy of the epifcopal church began to lean towards the notions concerning thefe intricate points, which Arminius propagated fome time after this; while on the other hand, the Puritans adhered rigoroufly to the fyftem of Calvin. Several epifcopal doctors remained attached to the fame fyftem in the reign of James I. &c. and all thefe abettors of Calvanifm, whether epifcopal or prefbyterian, were called *doctrinal* Puritans. At length, according to Mr. Fuller, (Church Hift. book ix. p. 97. book x. p. 100.) the name was extended to ftigmatize all thofe who endeavoured in their devotions to accompany the minifter with a pure heart, and who were remarkably holy in their converfation; fo that a Puritan was a man of fevere morals, a Calvinift in doctrine, and a Non-conformift to the ceremonies and difcipline of the church, though he did not totally feparate from it.

Queen Elizabeth was violent in her oppofition to the Puritans through the whole courfe of her reign; and befides the ordinary courts of the bifhops, fhe erected, as we have already obferved, a new tribunal, called the court of high-commiffion, which fufpended and deprived men of their livings, not by the verdict of twelve men upon oath, but by the folemn determination of three commiffioners of her own nomination, founded not upon the ftatute law of the realm, but upon the canon law; and inftead of producing witneffes in open court to prove the charge, they affumed a power of adminiftering an oath *ex officio*, by which the prifoner was obliged to anfwer all queftions the court fhould put to him, though never fo prejudicial to his own defence. If he refufed to fwear, he was imprifoned for contempt; and if he took the oath, he was convicted upon his own confeffion.

During the reign of James I. from whom the Puritans expected more indulgent treatment, they were treated with great feverity, and many of them were obliged to leave the kingdom, and retire to Holland; and from thence confiderable numbers migrated to America in the year 1620. All were Puritans, in the eftimation of king James, who adhered to the laws of the land in oppofition to his arbitrary government, though otherwife ever fo good churchmen. Thefe were called *Puritans in the ftate;* and thofe who fcrupled the ceremonies, and adhered to the doctrines of Calvin, were *Church* Puritans, who, though comparatively few, yet being joined by thofe of the other clafs, became the majority of the nation. The fuccefs that attended the firft emigrators, who fettled in that part of America afterwards called New Plymouth, engaged great numbers of Puritans, who groaned under the oppreffion of the bifhops, and the feverity of a court, by which this oppreffion was authorifed, to follow the fortunes of thefe religious adventurers; and this produced a fecond emigration in the year 1629, which gave birth to the fecond grand colony, commonly known by the name of the Maffachufett's Bay. The colony of Connecticut was formed by emigrants of the fame clafs in 1636, and that of New Haven in 1637, who fled from the perfecution of Laud, and the oppreffions of the ftar-chamber and high-commiffion courts. Afterwards, when the Puritans were not allowed to tranfport themfelves to New England, many of them removed, with their families, into the Low Countries.

After the reftoration of Charles II. in the year 1662, the name of Puritans, fays bifhop Burnet, was changed into that of Proteftant Non-conformifts, who were fubdivided into Prefbyterians, Independents, Anabaptifts, and Quakers. At this time a public law, called the Act of Uniformity, was enacted, by which all who refufed to obferve the rites, and fubfcribe the doctrines of the church of England, were entirely excluded from its communion. From this period until the reign of king William III. the Non-conformifts were in a precarious and changing fituation, fometimes involved in calamity and trouble, and at other times enjoying fome intervals of tranquillity and certain gleams of hope, according to the varying fpirit of the court and miniftry, but never entirely free from perplexities and fears. But in the year 1689, their affairs took a favourable turn, when a bill for the toleration of all Proteftant Diffenters from the church of England, except the Socinians, paffed in parliament, almoft without oppofition, and delivered thofe who could comply with the conditions it impofed, from the penal laws to which they had been fubjected by the act of uniformity, and other acts paffed under the houfe of Stuart. For the prefent ftate of the toleration, fee Toleration. See alfo Corporation *Act* and Test. Neal's Hift. of the Puritans, in 4 vols. 8vo. paffim.

PURITY, in *Oratory*, is one of the conftituent parts of elegance, and denotes the choice of fuch words and phrafes as are fuited and agreeable to the ufe of the language in which we fpeak. Grammarians reduce the faults which they oppofe to it to two forts, which they call barbarifm and folecifm; the former of which refpects fingle words, and is an offence againft etymology, and the reproach of it is incurred by the ufe of words entirely obfolete, by the ufe of words entirely new, or by new formations and compofitions, from fimple and primitive words in prefent ufe. The latter refpects the conftruction of words, and is an offence againft fyntax: to which Dr. Campbell adds a third clafs of faults, under the denomination of *impropriety*, which is an offence againft lexicography, the bufinefs of which is to affign to every word of the language the precife meaning or meanings which ufe hath affigned to it. This impropriety occurs both in fingle words and in phrafes. Dr. Ward recounts the principal things that vitiate the purity of language. It often happens, he fays, that fuch words and forms of fpeaking, as were introduced by the learned, are afterwards dropped by them, as mean and fordid, from a feeming bafenefs contracted by vulgar ufe: and it is common to language, with all other human productions, that it is in its own nature liable to a conftant change. (Hor. Art. Poet. v. 68.) We muft, therefore, no lefs abftain from antiquated, or obfolete words and phrafes, than from fordid ones. On the other hand, we fhould refrain from new ones, or fuch, whofe ufe has not been yet fufficiently eftablifhed, at leaft among thofe of the beft tafte. Befides, any miftake in the fenfe of words or their conftruction, is oppofed to purity: for to fpeak purely is to fpeak correctly. And farther, a diftinction ought to be made between a poetic diction, and that of profe writers: for poets in all languages have a fort of peculiar dialect, and take greater liberties, not only in their figures, but alfo in their choice and difpofition of words: fo that what is a beauty in them, would often appear unnatural and affected in profe. Ward's Or. vol. i. p. 308, &c. Campbell's Phil. of Rhet. vol. i. p. 409, &c.

PURKI, in *Geography*, a town of Hindooftan, in Bahar; 33 miles N. of Ramgur.

PURLIEU. See Purlue.

Purlieu-*Woods*, fuch as formerly conftituted parts of the royal forefts, but of which the owners have obtained grants from the crown, and permiffion to disforeft them, and which not being now fubject to any of the laws or regulations by which different interefts in foreft woods are conducted, may, Mr. Donaldfon fays, be to all intents and purpofes confidered as private property. And, he adds, that

that the manner in which these woodlands are occupied is exactly the same as that of many of the royal forests, with the exception of the right of pasturage, and for that reason much more productive and beneficial. See Woods and Royal *Forests*.

PURLINS, in *Building*, those pieces of timber that lie across the rafters on the inside, to keep them from sinking in the middle of their length.

PURLUE, Purlieu, or Pourallee, formed from the French *pur*, *pure*, and *lieu*, *place*, is all that ground near any forest, which, being added to the ancient forest by our kings, was, by perambulation, granted by some of their successors, severed again from the same, and made purlieu, *i. e.* pure and free from the laws and obedience of the forest.

A purlieu, or pourallee, is defined a circuit of ground adjoining to the forest, and circumscribed with immoveable boundaries, known only by matter of record; which compass of ground was once forest, and afterwards was disafforested by the perambulations made for severing the new forest from the old.

Purlieus, or pourallees, commenced after the manner following. King Henry I. at his accession to the crown in 1154, took so much delight in the forests of this kingdom, that, not being contented with those he found here, though many and large, he began to enlarge divers of them, and to afforest the lands of his subjects nearly adjoining to the same.

His successors, Henry II. and Richard I., far from retrenching or restoring any thing, made still farther encroachments: and thus did the lands continue till the 17th year of king John; at which time, the grievance being grown notorious, and generally felt by all degrees of people, divers noblemen and gentlemen besought the king to grant, that they might have all those new afforestations made by his predecessors aforesaid, and by himself, disafforested again; and the king, after much solicitation, was at length prevailed on to subscribe and seal such articles concerning the liberties of the forest, as they then demanded; being, for the most part, such as are now contained in the Charter of the Forest.

Hereupon choice was made of divers noblemen, &c. to the number of twenty-five, who were sworn, with others their assistants, to see the said liberties, so granted and confirmed by the king, to be in every point observed.

But, before any thing was done to the purpose, king John died; and king Henry III. succeeding, fresh solicitations were made to him; who, for the better accomplishing of the said disafforestation, ordered inquisitions to be taken, by substantial juries, for severing all the new forests from the old: upon which, two commissioners were sent to take those inquisitions; in virtue whereof, many great woods and lands were not only disafforested, but were improved to arable lands by the owners thereof. After this charter was made and confirmed, some of these new afforestations were perambulated, and proper inquisitions taken, and the certainty was determined by matter of record, which were the old, and which the new: though it appears, that the greatest part of the new afforestations were still remaining during the life of king Henry III.

Under Edward I. fresh petitions and solicitations being set on foot, three bishops, three earls, and three barons, were at length appointed to see those perambulations performed and continued; who caused them to be made accordingly, and inquisitions to be taken thereupon, and returned into the court of chancery; and all those that were ancient forest to be meered, and bounded with irremoveable boundaries, to be known by matter of record for ever.

Those woods and lands, that had been newly afforested, the king likewise caused to be separated from the old, and to be returned into the chancery by marks, meres, and bounds, to be known in like manner by matter of record for ever.

Thus it appears how the purlieus, or pourallees, had their first beginning; for all such woods and lands as were afforested by Henry II. Richard I. or king John, and, by perambulations, severed from the ancient forests, were, and yet are, called *pourallees*, *q. d.* woods and lands severed from the old forests, and disafforested by perambulation; *pourallee* being the same as *perambulatio*, in Latin.

But, notwithstanding such new afforestations were disafforested by perambulation, whereby the same became pourallee, or purlieu, yet they were not thereby so disafforested as to every man, but that they do, in some sense, continue forest still as to others. For, by the words of *Charta de Foresta*, if the king has afforested any woods or lands of his subjects, to the damage of the proprietors, they should forthwith be disafforested again; that is, only as to those persons whose woods and lands they were: who, as the proper owners thereof, might fell and cut down their woods at their own pleasure, without any licence from the king; as also convert their meadows and pastures into tillage, or otherwise improve their ground to the best advantage. So also they might hunt, and chase the wild beasts of the forest towards the same, &c. But no other person should claim such benefit of hunting in the pourallee, besides the proper owner of the soil thereof, who is left at liberty to suffer the pourallee to remain forest still, as some, in effect, have thought most expedient, because hereby entitled to the benefit of the common within the forest, which otherwise they were excluded from. Hence, if the beasts chance to wander out of the forest into the pourallee, the king hath a property in them still, against every man, but the owner of the ground wherein they are, who hath a special property in them, *ratione soli*; yet so as he may only take them by hunting, or chasing with his greyhounds or dogs, without any forestalling or foresetting them in their course again towards the forest.

Beside what hitherto has been said of the difference between forest and purlieu, or pourallee, there is this farther diversity, that all the woods and lands within the regard of the forest are absolutely within the bondage or charge of the forest, as well in respect to the owners thereof, as of any other person; for no one may cut down his own woods, or improve his own lands, within the regard of the forest, without licence from the king or his chief justice in eyre of the forest. Neither shall any person hunt, chase, or molest the wild beasts of the forest in his ground, within the regard of the forest, without licence or warrant from the king, or his chief justice of the forest so to do.

But those, whose grounds are within the pourallees, are not subject to these restrictions. Yet are not the woods and lands in the pourallees absolutely freed from the bondage of the forest, in respect of the wild beasts having their haunts therein, when they happen to stray out of the forest; but as they were once absolutely forest, so they are still conditionally so.

Purlue-*Man*, or *Purlieu-man*, or *Pourallee-man*, is one who has land within the purlue; and is allowed or qualified to hunt or course within the same, though under certain restrictions.

By stat. 13 Ric. II. he who may lawfully hunt in any pourallee, ought to have woods or lands of freehold within the pourallee, to the yearly value of 40*s.* By stat. Jac. I. he ought to have lands of inheritance of the yearly value of 10*l.* or lands of freehold of the yearly value of 30*l.* or have

have goods worth 200*l.* or be the fon of a knight or baron, or perfon of a higher degree, or fon and heir apparent of an efquire. But, by a later act, Car. II. no man may keep greyhounds within the pourallee, or elfewhere, within England or Wales, unlefs he have a free warren, or be lord of a manor, or fuch a freeholder as is feifed, in his own right, or in right of his wife, of lands, tenements, or hereditaments of the clear yearly value of 40*l.* over and above all charges and reprifes of fuch eftate of inheritance; or of lands, tenements, or hereditaments, in his own right, or in right of his wife, for term of life or lives, of the yearly value of 80*l.* over and above all charges and reprifes, or that is worth in goods or chattels 400*l.*

The pourallee, or purlieu, then, is faid to be for him that is fo qualified: others, not qualified, and therefore not purlieu-men, yet having land in the pourallee, may, if they find any wild beafts of the forefts in their own grounds within the pourallee, chafe them thereout with little dogs; but not with greyhounds, or other dogs.

Nor is the purlieu-man left at large to hunt at his own difcretion; but he is tied down to feveral rules: as,

1. That he always begins his chafe in his own ground; and, that, though he finds fuch wild beafts in his own pourallee, and in refpect thereof, hath a property in them, *ratione foli,* againft all perfons, but the king; yet fuch his property is only on this condition, that he can ftay them with his dogs in chafe, without foreftalling them, before they can recover the foreft. If they be within the lift of the foreft, before the dogs faften on them, they are the king's, or other owner of the foreft.

2. But if the pourallee-man firft make his chafe in his own freehold, he may purfue the fame through every man's ground within the pourallee, and his dogs faften on a wild beaft, before he can get within the bounds of the foreft, and the beaft draw the dogs into the foreft, and is there flain by them; here the pourallee-man fhall not enter into the foreft, nor take the beaft fo killed, becaufe his courfe was irregular from the beginning, as he could claim no property in the beaft, *ratione foli.*

3. A pourallee-man may hunt in his own pourallee with no more company than his own fervants; neither may he appoint, licenfe, or warrant any other perfon, except his fervants, to hunt by his commandment in his pourallee.

4. Every pourallee-man is forbidden, by the laws of the foreft, to hunt in his own grounds within the pourallee every day, or oftener than three days in any one week, Sunday excepted.

5. Nor is any man to difturb, or make a courfe after any deer found in his pourallee, within forty days after the king hath made a general hunting in the foreft adjoining thereunto; becaufe then the wild beafts of the foreft come not into the pourallees of their own accord, but as they are forced into the fame by the hunters, with clamours, and blowing of horns, fo that they fly thither for refuge.

6. No man fhall hunt within feven miles of the borders of the foreft, or in his own pourallee, within forty days next before the king hath iffued out his proclamation, declaring his royal will and pleafure to make a general hunting in that foreft.

Inafmuch as the pourallees were once, and in fome fenfe ftill are foreft, it was neceffary to have officers to attend, and take on them the charge of the prefervation of the game that may happen to wander out of the foreft into the pourallees; fince otherwife the laws of the pourallees could not be executed, but the foreft itfelf would foon be deftroyed by the pourallee-men.

For this reafon, rangers were firft appointed, who, though not officers in the foreft, yet appertain thereto; for all officers in the foreft have charge of the vert and venifon of the foreft; but a ranger hath no charge of the vert, but only of venifon coming out of the foreft, into the pourallees, his place of charge; from whence his office is to conduct the fame back again into the foreft.

This officer is appointed by the king, or his chief juftice in eyre, and is made by patent, with a fee commonly of twenty, thirty, or forty pounds, or more, by the year, payable out of the exchequer, as alfo certain fee-deer, both red and fallow, to be taken annually, at proper feafons, out of the foreft.

The fubftance of his oath is, to rechafe, and with his hounds drive back, the wild beafts of the foreft, as often as they range out of the fame into his pourallee; to prevent all unlawful hunting and hunters of wild beafts of venery and chafe, as well within the pourallees, as within the foreft; and to prefent thofe and other offences, at the next court of attachments or fwainmote, which fhall firft happen.

Rangers, it is to be obferved, belong only to fuch pourallees as were once the woods and lands of the fubject, and were afterwards difafforefted again, and fo became pourallees. Hence, as there are fome forefts in England, which never had any enlargement by new afforeftations, and therefore have no pourallees at this day, there can be no rangers belonging to them. Manwood's Foreft Laws, part 2. c. 20. 4 Inft. 303, 4. 1 Jones's Rep. 278. Moor. 706. 987.

PURMALL, in *Geography,* a town of Hindooftan; 15 miles W.S.W. of Allahabad.

PURMERENT, a town of North Holland, on a brook of the fame name, governed by a council, bailiff, and burgomafters. The town had a voice in the affembly of the ftates; 10 miles N. of Amfterdam. N. lat. 52° 33′. E. long. 4° 46′.—Alfo, a fmall ifland near the coaft of Java, on which lies an hofpital for the difeafed poor of Batavia.—Alfo, a fmall ifland in a large bay on the N. coaft of New Guinea. S. lat. 2° 16′. E. long. 135° 12′.

PURNA. See PANNAH.

PURNEAH, a circar of Bengal, bounded on the N. by Morung, on the E. by Dinagepour, on the S. by Rajemal, and on the W. by Bahar; about 80 miles long from N.E. to S.W., and 70 from N.W. to S.E. The capital of the fame name is fituated on a river which runs into the Ganges; 200 miles N. of Calcutta. N. lat. 25° 48′. E. long. 87° 40′.

PURNITZ, a town of Moravia, in the circle of Iglau; 7 miles S.E. of Iglau.

PURPARTY (Fr. *pour part,* i. e. *pro parte*) is that part or fhare of an eftate, firft held in common by parceners, which is by partition allotted to any of them. To make purparty is to divide and fever the lands that fall to parceners, which till partition they held jointly, and *pro indivifo.* Old Nat. Br. 11.

PURPLE, PURPURA, πορφυρα, a red colour, bordering on violet; now dyed chiefly with cochineal.

Purple was much efteemed among the ancients; efpecially the Tyrian purple, which underwent more dyes than the reft, and which was almoft peculiar to the emperors and kings. Yet this purple did not exceed that now in ufe. The chief reafons why the ancient purple dye has been difufed are, that the latter is both cheaper and finer.

The ancient purple was tinged or given with the blood or juice of a precious turbinated teftaceous fea-fifh, called by the Greeks πορφυρα, and by the Latins *purpura;* of which we have defcriptions in feveral authors, and fhells in moft of the cabinets of the curious. See PURPLE-*Fifh.*

The

The method of obtaining the colour, Mr. Cole (see PURPLE-*Fish*) describes thus:

The shell, which is very hard, being broken, (with the mouth of the fish downwards, so as not to crush the body,) and the broken pieces being picked off, there appears a white vein lying transversely in a little furrow or cleft next the head of the fish.

In this vein is the purple matter lodged; some of which, being laid on linen, appears at first of a light green colour; and, if exposed to the sun, soon changes into a deep green, and in a few minutes, into a sea-green, and, in a few more, into a blue; thence it soon becomes of a purplish-red, and, in an hour more, of a deep purple red.

And here the sun's action terminates; but by washing in scalding water and soap, and drying it, the colour ripens to a most bright and beautiful crimson, which will bear washing admirably without the addition of any styptic. While the cloth marked with this colour lies in the sun, it will yield a very strong and fœtid smell, as if garlic and assa fœtida were mixed together.

The juice which gives this beautiful purple colour is, says M. du Hamel, while it remains in the body of the animal, and while that is in health, wholly white; but no sooner is it exposed to the sun, than it begins to change colour, and in less than five minutes goes through the several changes of pale green, yellowish, and a beautiful emerald green; after this it becomes of a deeper and duskier green, then blueish, reddish, and finally a deep and very beautiful purple. Sometimes the juice is found naturally green in the animal: this is probably from the creature's being in a diseased state. But when it is naturally thus, it immediately becomes red, and afterwards purple, on being exposed to the sun; its several preceding changes seeming to have been made already in the body of the animal.

If a piece of linen be rubbed over with this juice, and part of it exposed to the sun, part not, that only will turn red which is so exposed, the other remaining green without any alteration; and it is observed, that the stronger the sun shines, the quicker the change appears, and probably the colour is in proportion also the more beautiful and lively. And it is very remarkable, that if a needle, or any other opaque body, be laid upon the linen which is yet green, and is to become red on being exposed to the sun; after such an exposure, the whole shall be changed red or purple, excepting only that small spot which is covered by the needle, which will still remain green.

A plate of glass, though it be three inches thick, will not prevent the colour from changing purple by being laid over it; but the thinnest piece of metal will keep it wholly green. The one being opaque, and the other pellucid, are evidently the only reasons for this difference.

If the coloured linen be successively covered by three pieces of paper, the one blacked with ink, the other in its natural state, and the third rubbed over with oil, it will change colour on being exposed to the sun in different degrees; and that exactly in proportion to the degree of transparence in each of the papers: most of all in that which was covered with the oiled paper; something less in that covered by the paper in its natural state; and least of all in that which was covered with the blacked paper, as that is least transparent.

The common heat of a fire, or that of a red-hot iron, produces no change at all in the colour when green. The vapour of burning sulphur produces a little; but the green, which had not changed to purple by these experiments, immediately changed to it on being exposed to the rays of the sun.

These experiments were all made in the months of January and February, by M. du Hamel, in Provence; and the sun having power to change the colour so speedily there in these cold months, probably in a warmer climate or season the air would have been sufficient for the purpose, without the open sun; since it seems, from experiment, that both the solar rays, and the light alone in a cloudy day, can act upon this colour. The light and heat of the sun both act on this colour: light is always sufficient to produce the effect, but the heat may easily be too great or too little; and to do the whole in perfection, it must be at a certain middle degree.

This beautiful purple, if it can ever be brought into use in dyeing, will have one very great advantage from its viscosity. The pieces of cloth that had been stained by it retained their colour, in spite of several boilings in different liquors, which M. du Hamel made them pass through; and the colour, on examination, was found not to be superficial, but penetrated the whole body of the stuff, which was tinged by it. There are many inconveniences which must naturally attend the use of this substance as a dye, but they may, perhaps, all be got over by care and application. It is very certain, that it is of too viscid a nature easily to penetrate many substances; but it is also certain, that this might be obviated by dissolving it in some proper liquor. It appears very plainly, that the ancients had a method of thus dissolving their purple; but we neither know what was their purple, nor what was its dissolvent; nor, which would be of much more consequence to us at present, what is the proper dissolvent for our own. Mem. Acad. Scien. Par. 1736.

M. Reaumur has also discovered another very different kind of purple. This is produced in oval grains about a quarter of an inch long, full of white liquor bordering on yellow, which cover certain stones or sands, about which the buccina of Poictou usually assemble.

By the experiments M. Reaumur has made, it appears that these grains are neither the eggs of the buccinum, nor the seeds of any sea-plants, nor any rising plants, but the eggs of some other unknown fish.

These grains, being bruised on a white linen, at first only tinge it yellow, and that insensibly; but in three or four minutes they give it a very beautiful purple red, provided the linen be exposed to the open air; for the air of a room, even though the windows be open, will not do. This colour fades, however, a little by repeated washings.

M. Reaumur concludes, from some experiments he made, that the effect of the air on the liquor does not consist in its taking away any particles of it, nor in giving it any new ones, but only in its agitating it, and changing the arrangement of the parts that compose it. He adds, that the liquor of the buccinum, and that of the grains, seem to be nearly of the same nature; except that the latter is more watery, and only saline; whereas the other is hot, and pungent.

P. Labat gives us the description of another purple dye, produced by a tree growing in the Antilles. The juice of this tree, when cut standing, is of a blood-red, and communicates the same colour to cloths; though, like the former, it loses much in often washing.

PURPLE, *Dyeing*. See DYEING.

PURPLE *Gold*. See GOLD *Precipitate*, &c.

PURPLE, in *Medicine*, an epithet applied to every disease, in which eruptions of purple spots, or *petechiæ*, appear, and these being usually the accompaniments of fevers of every kind in their worst and most dangerous forms, so *purple* fever was nearly fynonimous with *putrid*, or *malignant* fever. See PETECHIÆ, and PURPURA.

PURPLE *Apple*, in *Botany*. See ANNONA.

PURPLE *Fifh*, *Purpura*, in *Natural Hiftory*, the name of a genus of fhell-fifh, the characters of which are thefe: it is an univalve fhell, jagged and befet from head to tail with fpines, tubercles, umbos, or ftriæ. The mouth is fmall and roundifh; the tail is fhort, and ufually the bafe runs out into a long beak. See DYEING.

It has been ufual with moft authors to confound together the genera of the murex and purpura, and to ufe the words as fynonimous: but though there is fome external refemblance between many of the fhells of the two genera, yet they are eafily diftinguifhed by this, that the mouth of the purpura is lefs long, and is lefs dentated and alated than that of the murex. The body and the head of the fhells of this genus are not fo elevated as thofe of the murex kind, and are not covered with points or buttons at the mouth. If a fhell is therefore found to have a fmall, fmooth, and round mouth, and a body covered with undulated leaves, as it were, like thofe of favory or endive, and fometimes with long points, and its tail, whether long or fhort, be hollowed and fomewhat bent, this may be called a purpura, and not a murex. Linnæus makes the purpura a fpecies of the murex.

The ancients diftinguifhed three kinds of purpura; one which had a long and crooked tail, made hollow like a tube or pipe; a fecond which had either no tail at all, or at the moft a very fhort one; and a third which had no fpiral head, or, as we fhould exprefs it, no clavicle.

On examining the whole family of the purpuræ, we may diftinguifh four remarkable fpecific differences among them. The firft of thefe comprehends thofe purpuræ which have the body of the fhell garnifhed with a fort of undulated foliage in clouded ridges, and have a fhort and crooked tail. The fecond comprehends thofe which have the body of the fhell covered with acute points, and have a long tail. The third comprehends thofe which have as long a tail as the former, but have a fmooth body, or at the utmoft have only a few flight protuberances and wrinkles on it. And the fourth takes in thofe which are fmall, and have an elevated clavicle, a fhort crooked tail, and the body of which is covered either with flender fpines or hairs.

This fpecies of fifh, as well as the murex, ferved among the ancients to dye the fine purple colour they were fo fond of, and fome of the buccina (*e. g.* the *lapillus* of Linnæus) have been of late found to have the fame juice. The purpura and murex are both fifhed up in great plenty in the gulf of Tarentum; but the fmall quantity of the coloured juice which each fifh contains, and the neceffity of ufing it before the animal dies, makes it impoffible to bring it to any regular article of traffic. The ancients ufed this colour only on cotton and woollen ftuffs; whereas our cochineal, which was unknown to the ancients, ftrikes equally well on filks and ftuffs. Thefe fhells are alfo found in various parts of the Mediterranean.

In the feas of the Spanifh Weft Indies about Nicoya, is found a fhell-fifh, which perfectly refembles the ancient purpura, and, in all probability, is the very fame. This fifh, Gage tells us, ufually lives feven years; it hides itfelf a little before the dog days, and continues to difappear for three hundred days running.

They are gathered plentifully in the fpring, and, by rubbing one againft another, they yield a kind of faliva or thick glair, refembling foft wax: but the purple dye is in the throat of the fifh, and the fineft part is lodged in a little white vein; the reft of the body is of no ufe. He adds, that the chief riches of Nicoya confift in this fifh. Cloth of Segovia, dyed with it, is fold for twenty crowns the ell; and none but the greateft Spanifh lords ufe it.

There are alfo found upon the coafts of the South-fea, near the equator, in the neighbourhood of point St. Helena, in the province of Guayaquil, certain fea-fnails, as Don Antonio de Ulloa calls them, fticking to the ftones, and covered by the fea at high water, about the fize of fmall nuts, which contain a liquor or juice that has the true colour of purple. The colour is very bright, and fo durable, that wafhing rather increafes than diminifhes its luftre, nor does it fade or decay by ufe and wearing. Woven ftuffs are not dyed with it, but only cotton threads. As foon as a fufficient quantity of the liquor is fqueezed from the fifh, the cotton thread is drawn through it, and it takes and retains the tincture without any farther trouble; but the purple colour is not difcovered till the thread is dry, the juice being of a milky colour at firft, but it foon changes into green, and at laft fettles in a purple.

Befides the Indian purple fifhes, we have others much nearer home. In the Philofoph. Tranfact. abr. vol. ii. p. 823, we have an account of purple fifh difcovered in 1684, by Mr. W. Cole, on the coafts of Somerfetfhire, South Wales, &c. where it is found in great abundance. The modern purple fifh, M. Reaumur obferves, is a kind of buccinum, a name given by the ancients to all fifhes whofe fhell bears any refemblance to a hunting-horn; and it appears from Pliny, that part of the ancient purple was taken from this kind of fhell-fifh: fo that this may be efteemed a recovery of what had been fuppofed entirely loft. See DYEING.

The fifh, he obferves, is good; and adds, that there are feveral kinds of it differing in fize and fhell, and alfo in the colour of the tinging liquor. There are fome found on the coafts of Poictou.

The Caribbee iflands have likewife their purple fifh. This is called *burgan*, being of the fize of the end of the finger, and refembling our periwinkles; its fhell is of a brownifh azure, its flefh white, its inteftines of a very bright red, the colour of which appears through the body; and it is this that dyes the froth, which it cafts forth when taken, and which is at firft of a violet hue, bordering on blue.

To oblige them to yield the greater quantity of froth, they lay them on a plate, and fhake and beat them againft one another; upon which the plate is immediately covered with the froth, which is received on a linen cloth, and becomes purple in proportion as it dries.

P. Labat obferves, that if this be the real Tyrian purple, the fecret of preparing and fixing it is loft; this colour being found to dwindle and diffipate, in proportion as the linen dyed with it is wafhed.

The purpura lives on other fifh. It ufually hides itfelf at a fmall depth in the fand, fometimes even in frefh-water rivers, and as it lies hid, it thrufts up a pointed tongue, which wounds and kills any thing that comes over it. We frequently find fea-fhells with round holes bored through them, as regularly as if made with a boring inftrument: thefe are generally allowed to be made by the tongue of the purpura, in order to its feeding on the fifh within.

The purpura has two horns like that of a fnail; and Fabius Columna fays, that they have eyes in thefe, not placed at the ends, as in the fnail, but in the middle of each horn.

The purpura is a fhell-fifh very well known, and has been known alfo in almoft all times to afford a purple liquor; but as there has been no method difcovered of bringing this liquor into ufe in dyeing, the fifh has been neglected, and its juice never attempted to be brought into ufe.

PURPLE-*Wort*, in *Botany*, a name given to feveral fpecies of trefoil.

PURPRESTURE, in our *Ancient Law Books*. See POURPRESTURE.

PURPRISUM, of the French *pourpris*, denotes a clofe, or inclofure: alfo the whole compafs or extent of a manor or place.

"Donavi eis meum purprifum de Kirkeham, & domos meas, & molendinum, & prata, &c." Charta Walteri Efpec. Priorat de Kirkeham.

PURPURA, PERSIAN, the fame with the Perfian fhell, a fpecies of dolium.

PURPURA, in *Medicine*, in the nomenclature of cutaneous difeafes propofed by Dr. Willan, fignifies an eruption of purple fpecks and patches, that is of *petechiæ*, *ecchymomata*, and *vibices*, accompanied with general debility, but not always with fever.

Under this limitation, the purpura is fynonimous with the "petechiæ fine febre" of fome medical writers, (fee Rombergius, Ephem. Natur. Curiof. dec. iii. ann. 9 and 10, obf. 108; and Dr. Graaf, Diff. Inaug. de Petechiis fine Febre, Gött. 1775); with the "hæmorrhæa petechialis" (fee Dr. Adair, Diff. Inaug. Edin. 1789, and Dr. Bateman, Diff. Inaug. ibid. 1801); with the "land-fcurvy," &c. of others. Riverius, Diemerbroeck, Sauvages, Cullen, and one or two others, appropriated the term *purpura* in like manner to *petechial* fpots only, and rightly excluded from this appellation all other eruptions of a character effentially different.

In thus limiting the acceptation of the term, however, it is proper to mention, that in the writings of many phyficians it is applied to various other eruptive difeafes, which have no affinity with petechial blotches, and very little with each other. Thus, under the name of purpura, the red-gum, or ftrophulus, is defcribed by Etmuller,—the fcarlet fever by Schultz and Juncker,—the meafles by Hafenreffer and Morton,—the nettle-rafh, miliary veficles, and lichen, by Hoffmann and others. See Willan on Cutan. Dif. p. 452.

The purpura occurs under various degrees of violence, which induced Dr. Willan to make two fpecies, which he denominated *fimplex* and *hæmorrhagica*, according as the eruption occurred alone, or with difcharges of blood. It is impoffible, however, to draw fo diftinct a line, where nature prefents no clear difference. We can only ftate that, in the milder degrees, there is an eruption of petechiæ only, chiefly appearing on the extremities and breaft, and feldom affecting the face. The complexion is generally pallid or fallow, and there is a confiderable degree of debility and languor, and fometimes pains in the limbs.

In the more fevere cafes of the difeafe, the failure of ftrength is confiderably greater, and often precedes, for fome time, the appearance of the eruption. The fpots commonly appear firft on the legs, where they are ufually the largeft and moft numerous, and are often accompanied with anafarcous fwellings. When they firft appear, they are of a bright red hue, but they gradually become purple or livid, and when about to difappear, they change to a brown or yellowifh hue; fo that in the progrefs of the difeafe, as the fpots appear and fade in fucceffion, the fkin prefents a confiderably variegated appearance. In the more fevere forms, the petechiæ are intermixed with *ecchymofes* and *vibices*, or livid patches and ftripes, refembling the effects of a bruife, or of the ftrokes of a whip. In this ftate, fometimes, when thefe patches do not appear fpontaneoufly, the gentleft preffure on the fkin, fuch as is applied in feeling the pulfe, will produce a purple blotch, like that which follows a fevere blow.

When the difeafe is ftill more fevere, in addition to thefe effufions of blood under the cuticle, confiderable difcharges of blood take place from thofe parts which are defended by a very delicate cuticle; whence thefe hæmorrhages originate particularly from the internal paffages and organs, and are occafionally very profufe, endangering, and occafionally deftroying life. Moft frequently, however, the bleeding is flow, and in fmall quantity, fometimes almoft a conftant oozing, and fometimes returning at intervals. Thefe hæmorrhages take place from the gums, noftrils, throat, the infide of the cheeks, the tongue, and lips; fometimes from the lining membrane of the eye-lids, the urethra, and the external ear; and often from the internal cavities, the lungs, ftomach, bowels, kidnies, uterus, and bladder. There is great variety, however, in the periods of the difeafe at which the hæmorrhages commence and ceafe, and as to the proportion which they bear to the cutaneous efflorefcence.

This fingular difeafe occafionally appears fuddenly, in the midft of good health, attacking during the night. It is always accompanied by great feeblenefs and depreffion of fpirits; and often by pains in the cheft, loins, or abdomen, by irregularity of bowels, or by cough; and the pulfe is fometimes flightly quickened and very feeble, as in a moderate hectic. But in fome cafes thefe functions are not perceptibly difturbed. The duration of the difeafe is equally uncertain: in fome inftances it has terminated in a few days, while in others it has continued not only many months, but years. When it terminates fatally, it is commonly in confequence of a copious hæmorrhage, either fuddenly from fome important organ, or more flowly from feveral parts at the fame time.

The caufes of this difeafe are not clearly afcertained, nor its pathology well underftood. It occurs at every period of life, and in both fexes; but moft frequently in women, and in boys before the age of puberty, particularly in thofe who are of a delicate habit, who live in clofe and crowded fituations, and on poor diet, or are employed in fedentary occupations, and fubject to grief, anxiety, fatigue, and want of fleep. It has likewife attacked thofe who are left in a ftate of debility by previous acute and chronic difeafes, as after meafles or fmall-pox, or during confinement in the puerperal ftate, or after a violent falivation from mercury. On the other hand, however, the difeafe appears occafionally in its moft fevere and fatal form, where none of thefe circumftances had previoufly exifted: for inftance, in young perfons living in the country, and fuffering no privation of any of the comforts of life, and previoufly enjoying good health. This fact tends greatly to obfcure the pathology of the difeafe: for it renders the operation of thefe alleged caufes extremely queftionable, and feems to eftablifh an effential difference between purpura and fcurvy, in the origin and nature of the morbid actions which conftitute the difeafe. In fcurvy (by which we mean the *fcorbutus*, or true fcurvy, formerly prevalent among feamen in long voyages, and among people in befieged towns, and other fituations, when living upon putrid, falted, dried, or otherwife indigeftible food, yielding imperfect nutriment,) the refteration of the proper nourifhment, with the ufe of frefh vegetables and acids, invariably removes the fymptoms, and they never commence where fuch diet can be obtained: while, in many cafes of purpura, this diet has been taken abundantly, without the fmalleft alleviation of the complaint, and the difeafe has come on, where there had been no deficiency. "On the other hand, the rapidity of the

the attack, the acuteneſs of the pains in the internal cavities, the actual inflammatory ſymptoms that ſometimes ſupervene, the occaſional removal of the diſeaſe by ſpontaneous hæmorrhage, the frequent relief derived from artificial diſcharges of blood, (ſee two caſes of purpura by Dr. Parry, Edin. Med. and Surg. Journ. for Jan. 1809), and from purging, all tend to excite a ſuſpicion that ſome local viſceral congeſtion or obſtruction is the cauſe of the ſymptoms in different inſtances." (Bateman's Practical Synopſ. of Cutan. Diſ. p. 110.) Several facts in proof of theſe obſervations are ſtated in the work juſt quoted; but a ſufficient number has not yet been collected to afford any general inference reſpecting the nature of the diſeaſe.

The cure of purpura is, therefore, not eſtabliſhed upon any clear principle, and there has been conſiderable difference of opinion upon the ſubject. Dr. Willan has given a very imperfect view of this point. All that he ſays relative to the cure of the worſt form of purpura, is compriſed in theſe few lines. "In the treatment of this diſeaſe, we ſhould recommend moderate exerciſe in the open air, a generous diet, and the free uſe of wine, Peruvian bark, vitriolic acid, &c. Without air, exerciſe, and an eaſy ſtate of mind, the effect of medicines is very uncertain." (On Cutan. Diſeaſes, p. 461.) Of this, indeed, he has given an ample proof in the next ſentence, where he tells us that a patient "took for *two or three months* Peruvian bark in conſiderable quantities, the vitriolic and marine acid, and wine, without much advantage." In truth, the cure of purpura is, we believe, not to be effected by theſe means. In the ſlighter degrees of the diſeaſe, occurring in children who are ill fed and nurſed, and excluded from the air and from all exerciſe, theſe tonics may ſeem to do good, when combined with air and exerciſe. "But," as Dr. Bateman obſerves, "when it occurs in adults, eſpecially in thoſe already enjoying the benefits of exerciſe in the air of the country, and who have ſuffered no privation in reſpect to diet; or when it appears in perſons previouſly ſtout, or even plethoric; when it is accompanied with a white and loaded tongue, a quick and ſomewhat ſharp, though ſmall, pulſe, occaoſinal chills and heats, and other ſymptoms of feveriſhneſs, however moderate;—ſymptoms which may be preſumed to indicate the exiſtence of ſome local congeſtion; —then the adminiſtration of tonic medicines, particularly of wine, cinchona, and other warmer tonics, will be found inefficacious, if not decidedly injurious. In ſuch caſes, free and repeated evacuations of the bowels, by medicines containing ſome portion of the muriate of mercury, will be found moſt beneficial. The continuance or repetition of theſe evacuants muſt, of courſe, be regulated by their effects on the ſymptoms of the complaint, or on the general conſtitution, and by the appearance of the excretions from the inteſtines. If the pains are ſevere and fixed, and if the marks of febrile irritation are conſiderable, and the ſpontaneous hæmorrhage not profuſe, local or general blood-letting may doubtleſs be employed with great benefit, eſpecially in robuſt adults." Pract. Synopſis, before quoted, p. 114.

The importance of free purgation in purpura has been clearly ſtated in a ſhort but valuable communication from Dr. Harty, of Dublin, publiſhed in the Edinburgh Medical and Surgical Journal, for April, 1813: in more than a dozen caſes treated in this manner by Dr. Harty, the hæmorrhages ceaſed, and the purple ſpots diſappeared, after a few doſes of calomel and jalap had been taken. In the two caſes related in the ſame uſeful journal by Dr. Parry, of Bath, before alluded to, and which were ſpeedily cured by two bleedings from the arm, the blood drawn exhibited a tenacious contracted coagulum, covered with a thick coat of lymph, as in diſeaſes of an inflammatory nature. The patients were a lady and an officer, the latter of whom was accuſtomed to free living: in both caſes ſome degree of feveriſhneſs accompanied the purpura.

There is one variety of the diſeaſe, which Dr. Willan diſtinguiſhed as a third ſpecies, by the title of purpura *urticans*, becauſe the eruption commences in the form of rounded and reddiſh elevations of the cuticle, reſembling the wheals of nettle-raſh; but they are not accompanied by the ſame ſenſations, tingling and itching, which belong to the nettle-raſh. Theſe little tumours gradually dilate; but within one or two days they ſubſide to the level of the ſurrounding cuticle, and at the ſame time their hue becomes darker and at length livid, or purple. As theſe ſpots are not permanent, but appear in ſucceſſion in different places, they are commonly ſeen of different hues; the freſh and elevated ones being of a brighter red, while the level ſpots exhibit different degrees of lividity, and become brown as they diſappear. They are moſt common on the legs, where they are frequently mixed with petechiæ; but they ſometimes appear on other parts of the body.

The duration of the purpura urticans is various, from three to five weeks, in the courſe of which time the hands and ankles are affected with œdematous ſwellings: there is alſo a diſtreſſing degree of languor and debility, and a loſs of appetite, but ſeldom hæmorrhage. It generally appears in ſummer and autumn, affecting thoſe who are expoſed to fatigue, and live on poor diet, and delicate young women of indolent and luxurious habits. The ſame precepts, as to treatment, are applicable to this as to the other varieties of purpura.

When purple ſpots occur as ſymptomatic of bad fevers, they require no peculiar treatment. They are much leſs frequent concomitants of fevers than they were formerly; a circumſtance which is probably to be aſcribed partly to the more liberal uſe of purgatives at preſent in all febrile diſeaſes, and partly to the more free admiſſion of freſh air, to the ſuperior cleanlineſs, &c. now obſerved in theſe maladies. The appearance of theſe ſpots has been occaſionally noticed by various authors in agues, remittent fevers, palſies, dropſy, and atrophy. Dr. Willan obſerves, that in the laſt ſtage of pulmonary conſumption they ſometimes occur as the immediate forerunners of death. (See Petechiæ.) For hiſtories and caſes of purpura, ſee Duncan's Med. Comment. vols. xiv. and xx. and Med. Caſes and Obſerv. p. 90. Annals of Medicine, vol. ii. Memoirs of the Med. Society of London, vol. iii. art. 20; and vol. iv. art. 17. Medical Tracts and Obſ. vol. ii. Willan's Reports on the Diſeaſes of London.

PURPURATI, in our *Ancient Hiſtorians*, denote the ſons of emperors and kings.

PURPURE, Pourpre, or *Purple*, in *Heraldry*, according to ſome, is one of the five colours of armories, mixed or compounded of gules and azure, bordering on violet; and, according to others, of a little black and much red colour. It is, by the heralds, ſuppoſed a ſymbol of temperance, liberality, dignity, authority, faith, and piety. Moſt authors in heraldry, as Favyn, Geliot, Monet, and Meneſtrier, do not allow purple for a colour, in regard it is not ſimple, but compoſed of a mixture of other colours. They rather eſteem it a kind of intermediate tincture, ſometimes metal, and ſometimes colour: hence the Spaniards call it *una miſtion:* ſo that one cannot lay it on metal and colour without falſifying the arms.

Add, that many take the purple, as it is accounted, on many ancient bearings, by which ſome of the moderns would evince the regularity and legitimacy of this colour in armory, to be no other than filver tarnifhed.

Spelman, however, in his Afpilogia, allows purple the preference before all other colours, as having been an enfign of royalty for many ages; yet even he allows it to have been excluded, by the ancient heralds, as only an imperfect colour.

It is reprefented in engraving, by diagonal lines drawn from the finifter chief to the dexter bafe point. In the coats of noblemen it is called *amethyft;* and in thofe of princes, *Mercury.*

PURPURINA, a name ufed by Caneparius, and fome other authors, for the aurum mofaicum, or aurum mufivum of the fhops, the prefent preparation of which differs from that of that author only in the proportions of the ingredients.

PURPURISSUS, in the *Ancient Writers*, both Greek and Roman, the name of a compound colour or fucus of a fine purplifh red, ufed to paint women's cheeks.

It feems by the compofition to have been fomewhat like our rofe pink, as it is called by the colourmen. It was made of the creta argentaria, or fine white kind of chalk, diffolved in a ftrong purple tincture of fome of the roots of wood which dyed red; and when the coarfer part was fubfided to the bottom of the veffel, the liquor, while yet thick, was poured off into another veffel; and what fubfided from this, which was as fine as flour, was of a beautiful pale purple, and was the purpuriffus faved for ufe.

PURREL, anno 35 Eliz. cap. 10. a lift ordained to be made at the ends of kerfeys, to prevent deceit in diminifhing their length.

PURRONGUR, in *Geography*, a town of Hindooftan, in the circar of Bilfa; 20 miles S.E. of Bilfa.

PURROWNAH, a town of Hindooftan, in Oude; 28 miles E. of Gooracpour. N. lat. 26° 57'. E. long. 84° 17'.

PURRUAH, a fmall circar of Bengal, about 16 miles in circumference; N. of Mauldah.—Alfo, a town of Bengal, and chief town of the faid circar; 26 miles E.S.E. of Burdwan. N. lat. 23° 4'. E. long. 88° 25'.

PURSAH, a town of Hindooftan, in Bahar; 18 miles N.W. of Chuprah.

PURSAUMMAH, a town of Hindooftan, in Bahar; 35 miles E. of Durbungah.

PURSE, a manner of accounting; or, as fome call it, a fpecies of money of account, much ufed in the Levant, particularly at Conftantinople, where it is 500 afpers; three afpers being equal to a para, and forty paras equal to a piaftre, called by the Turks grouch, and by the Englifh dollar. By the regulations of 1780, the purfe of 500 piaftres was to weigh $2812\frac{1}{2}$ Turkifh drams. A fingle piaftre weighed $5\frac{5}{8}$ drams, or 277 Englifh grains; and the other pieces in proportion. Their ftandard of finenefs was reduced at the fame time to 50 carats (or hundredth parts) of fine filver, and 50 of alloy: which gave the value of the piaftre at $19\frac{1}{4}d.$ fterling, and the other filver coins in proportion. But fince that period the Turkifh coins have undergone a deterioration, fo that a piaftre of the lateft coinage being weighed and affayed by the king's affay mafter of the Mint, appeared to be in weight 8 dwt. 6 gr.; in finenefs, 5 oz. 6 dwt. worfe than the Englifh ftandard. This gives its finenefs 47 carats 2 grains Turkifh, and its value, in fterling, $13\frac{1}{8}d.$ Kelly's Un. Cambift.

This money of account is called purfe, becaufe all the grand fignior's treafure in the feraglio is kept in leather bags of this value.

In this, however, there is fome difference; for the purfe in Egypt is 25,000 medinis, or 75,000 afpers; and in other parts of Turkey it is only 20,000.

This method of accounting the Turks derive from the Greeks, and they from the Romans; the emperors of which brought it to Conftantinople, as appears from a letter of Conftantine to Cecilian, bifhop of Carthage, quoted by Eufebius and Nicephorus. See Follis.

Purse-*Net*, in *Rural Economy*, a net ufed for taking both hares and rabbits at certain times; and three or four dozen of them are fufficient to lay over their holes: they are to be faftened, by tying ftrings to fticks thruft into the earth, otherwife when the rabbits bolt out, they will run away and get out of the nets; but when the nets are fixed, and all things are in order, there muft be one or two perfons to lie clofe, to fee what game comes home; while, in the mean time, you beat the bufhes, to force them homewards. But another way to take rabbits with thefe nets is, at their coming out of their parraces: and they fhould be fecreted in this manner. Firft hunt them up and down, to force them all in, then put in a ferret, with a bell about her neck, which gives the rabbit notice of her coming, who, in endeavouring to avoid the ferret, runs into the net.

PURSER, an officer aboard a man of war, appointed by the lords of the admiralty, who receives her victuals from the victualler; and is to take care that it be in good condition, and well laid up and ftowed. He is alfo to fee that they are carefully diftributed to the officers and crew, according to the inftructions which he has received from the commiffioners of the navy for that purpofe. To him alfo belongs the diftribution of flops, &c.

He is alfo to keep a lift of the men and boys belonging to the fhip, and to fet down, exactly, the day of each man's admittance into pay; that the paymafter or treafurer of the navy may iffue out his difburfements, and pay off the men according to the mufter-book.

PURSIVENESS, or Pursiness, among *Farriers, thicknefs of wind*, a name common to all thofe difeafes in horfes which arife from obftructions in the paffages of the lungs.

Purfivenefs, fometimes alfo called *broken wind*, may proceed from an ulcer, or fome inward walling of the lungs, in which the fmall veffels are worn or abraded by the fharpnefs or acrimony of the common difcharges.

The like diforder may alfo arife from a ftagnation, hindering the air from penetrating fo as to lift up the lungs in the act of refpiration; or from fome tough and mucilaginous matter feparated in the branches of the wind-pipe.

The ufual occafions are cold, furfeits, and other difeafes not thoroughly carried off. Purfive diforders may alfo arife from unwholefome food, bad air, and hard riding when a horfe is full. The figns are commonly a heaving and beating of the flanks; a wheezing and rattling. Sometimes the kernels about the throat will fwell, and there will be a glandulous running at the nofe, which is the utmoft ftage of the difeafe, and ufually reputed defperate.

PURSLANE, in *Botany*. See Portulaca.

Purslane, *Horfe*. See Trianthema.

Purslane, *Sea*. See Atriplex.

Purslane *Tree*. See Portulacaria.

Purslane, *Water*. See Peplis.

PURSOTTUMPOUR, in *Geography*, a town of Hindooftan, in Bahar; 35 miles W.S.W. of Arrah.

PURSOYAH, a town of Hindooftan, in Bahar; 25 miles W.S.W. of Gayah.

PURSUIVANT. See Poursuivant.

PURSUR, in *Geography*, a town of Hindooftan, in Oude; 13 miles N. of Mahomdy.

PURVER, Anthony, in *Biography*, was born at Up-

 Hurfborn,

Hurſborn, in Hampſhire, about the beginning of the 18th century. His education was extremely limited, but he exhibited a ſtriking proof of his capacity for learning while he was very young; for, being prevented by illneſs from attending ſchool almoſt ſix weeks, he applied, by himſelf, during that time, with ſuch diligence and ſucceſs to the ſtudy of arithmetic, that upon his return to ſchool he was able to explain the proceſſes of evolution to his maſter, whoſe attainments had not carried him ſo far. At this time of life he exhibited great powers of memory, by committing to it twelve of the longeſt chapters in the bible in as many hours. He was put apprentice to a ſhoe-maker, who was alſo a dealer in ſheep, and employed Anthony a good deal in looking after his flock. This was not by any means an irkſome buſineſs, as it afforded him an opportunity for reading the ſcriptures, to which he was particularly attached. As he advanced in years, he found that his favourite book contained doctrines that were very differently interpreted by different perſons, and he was reſolved to ſtudy the Old and New Teſtament in their original languages. Having renounced the occupation for which he was originally intended when he was about twenty years of age, he commenced teacher in a ſchool, but afterwards removed to London, for the ſake of more eaſily acquiring the means of proſecuting his ſtudies. Here he probably reſided in 1727, when he publiſhed his work, entitled "The Youth's Delight." While at London he became a Quaker, and officiated among the friends in the character of a miniſter. He returned to Hurſborn, and reſumed his ſchool in 1727, and probably continued it for ſome time, during which he began to tranſlate the books of the Old Teſtament, from the original Hebrew. While thus employed, he felt it his duty to become a miſſionary, and travelled through ſeveral counties of the kingdom, till he came to Stambrook, near Briſtol, towards the latter part of the year 1738. Here he reſided at the houſe of a maltſter, whoſe ſon he inſtructed in claſſical learning, while he devoted his leiſure to his favourite employment of tranſlating the ſcriptures. In 1746 he made an attempt to publiſh his tranſlation of the Old Teſtament in numbers; but for want of encouragement he did not proceed beyond two or three numbers. When he had completed the tranſlation of the whole bible, he could find no bookſeller who would embark in the publication. Thus was the labour of thirty years likely to be loſt, till Dr. Fothergill made him a preſent of 1000*l.* for the copy, and took upon himſelf the expence of printing the work. Under his auſpices, it made its appearance in the year 1764, with the title of "A new and literal Tranſlation of all the Books of the Old and New Teſtament, with Notes critical and explanatory," in 2 vols. folio. It was the author's intention to have publiſhed a ſecond edition, with various corrections and alterations, but he did not live to accompliſh the deſign. He died in 1777, about the age of 75. Purver was deſcribed by Dr. Fothergill as "a man of great ſimplicity of manners, regular conduct, and a modeſt reſerve: he is ſteadily attentive to truth, hates falſehood, and has an unconquerable averſion to vice; and to crown the portrait, he is not only greatly benevolent to mankind, but has a lively ſenſe of the divine attributes, and a profound reverence of, and ſubmiſſion to, the Supreme Being." Gent. Mag.

PURVEYANCE. See Pourveyance.

PURVEYOR. See Pourveyor.

PURVIEW, from the French, *pourveu*, *a gift*, *grant*, *proviſion*, &c. a term frequently uſed, by ſir Edward Coke, for the body of an act of parliament, or that part which begins with *Be it enacted*, &c. as contradiſtinguiſhed from the *preamble*.

The ſtatute of 3 Hen. VII. ſtands upon a preamble and a purview. 12 Rep.

PURULENT, Purulentus, in *Medicine*, ſomething mixed with, or partaking of, pus or matter.

Phthiſical people frequently ſpit a purulent matter. In a dyſentery, the ſtools are purulent: when there is an ulcer in the reins or bladder, the urine is purulent.

PURUSHA, in *Mythology*. See Parusha.

PURUZ, in *Geography*, a river of La Plata, which riſes about S. lat. 17° 20′, taking the name of "Rio Beni," and afterwards called "Amaru-Mayu," or "The Serpent:" from S. lat. 12° its courſe is not aſcertained till it comes to S. lat. 6°, after which it aſſumes the name of Puruz, and runs into the river of the Amazons, or Maranon, S. lat. 3° 44′. W. long. 45° 6′. Its whole courſe is northerly about 800 miles.

PURWAR, a town of Hindooſtan, in Lahore; 14 miles S. of Sealcot.

PURYSBURG, a handſome town of South Carolina, in Beaufort diſtrict, which diſtrict contains 25,887 inhabitants, on the E. ſide of Savannah river, 37 miles from the ocean, and 20 from Savannah. It derives its name from a Swiſs, John Peter Pury, who ſettled a colony of his countrymen here about the year 1735, with a view to the culture of ſilk. The mulberry-trees are ſtill ſtanding, and ſome attention is paid to the raiſing of ſilk. The town contains between 40 and 50 dwelling-houſes, and an epiſcopal church; 64 miles W.S.W. of Charleſtown. N. lat. 32° 23′. W. long. 81° 12′.

PUS, from πυον, *matter*, the fluid contained in abſceſſes, and diſcharged from ulcerated ſurfaces, and ſometimes from membranous ſurfaces which are merely inflamed, and quite free from ulceration, as is illuſtrated in caſes of gonorrhea, empyema, &c. Pus is formed by a peculiar proceſs, which is termed *ſuppuration*, of which we ſhall have occaſion to ſpeak in a future volume of this work.

In the preſent place, we ſhall content ourſelves with inſerting a few obſervations on the qualities and uſes of pus, chiefly taken from the writings of Mr. Hunter.

True pus has certain properties, which, when taken ſingly, may belong to other ſecretions, but which, conjointly, form the peculiar character of this fluid, *viz.* globules ſwimming in a fluid, which is coagulable by a ſolution of ſal ammoniac, which no other animal ſecretion is, and, at the ſame time, a conſequence of inflammation.

The colour and the conſiſtence of pus are the two qualities which firſt attract the notice of every, the moſt ſuperficial, obſerver. The colour ariſes from the largeſt portion of this fluid being compoſed of very ſmall round bodies, very much like thoſe little globules which, ſwimming in a fluid, make cream. The fluid in which the globules of pus ſwim, we might at firſt ſuppoſe to be the ſerum of the blood, for it coagulates with heat, like the latter fluid. Pus is alſo probably mixed with a ſmall quantity of coagulating lymph; as it partly coagulates after it is ſecreted.

The fluid part of pus, however, is known to have properties which ſerum has not. There being a ſimilarity between pus and milk, experiments have been made to aſcertain whether the fluid of pus could be coagulated with the gaſtric juice of animals; but no coagulation could be effected in this manner: a ſolution of ſal ammoniac made the fluid part of pus coagulate; but not any other ſecretion, or natural fluid; and hence it was concluded, that whenever globules were found swimming in a fluid, coagulable by fal ammoniac, the matter was to be confidered as pus.

The proportion which the white globules bear to the other parts of pus, depends on the health of the parts producing the difcharge. When the globules are very abundant, the matter is thicker and whiter, and is called healthy pus; the meaning of which is, that the folids, which produced it, are in good health; for thefe appearances in the matter are no more than the refult of certain falutary proceffes going on in the folids, the effect of which proceffes is to produce the difpofition, on which both fuppuration and granulation depend.

Pus is fpecifically heavier than water, and is probably about as heavy as blood.

Befides the above properties, pus has a fweetifh mawkifh tafte, very different from that of moft other fecretions, and the fame tafte takes place, whether it is pus from a fore, or an irritated inflamed furface.

Pus has a fmell in fome degree peculiar to itfelf; but this differs in different cafes. Some difeafes, it is faid, may be known by the fmell, as, for inftance, a gonorrhœa.

Pus finks in water; mucus floats. Pus communicates to water an uniformly troubled white colour; mucus gives the appearance of ftringy portions floating in it. Mucus is faid to be more readily diffolved by fulphuric acid than pus is. It has alfo been afferted, that if water be added to fuch folutions, the pus is precipitated to the bottom of the veffel; while the mucus, inftead of being completely precipitated, forms fwimming flakes. A folution of cauftic alkali diffolves both pus and mucus; but when water is added, the pus is faid to become feparated, but not the mucus.

Though folutions in chemical menftrua and precipitations have been thought a teft of the diftinction between thefe two fluids; yet the method has been thought abfurd and unphilofophical. It has been conceived, that all animal fubftances whatever, when in folution, either in acids or alkalies, would be in the fame ftate, and therefore, that the precipitation would be the fame in all. Calcareous earth, when diffolved in muriatic acid, is in that acid in the fame ftate, whether it has been diffolved from chalk, limeftone, marble, or calcareous fpar, and precipitations from all are the fame. Hence experiments were made on organic animal matter, fuch as mufcle, tendon, cartilage, liver, and brain; and on inorganic, fuch as pus and the white of an egg. All thefe fubftances were diffolved in fulphuric acid, and precipitated with the vegetable alkali. Each precipitation was examined with fuch magnifiers as plainly fhewed the forms of the precipitates, all which appeared to be flaky fubftances. The precipitate by the volatile alkali had exactly the fame appearance. The fame appearances were feen when the above kinds of animal matter were diffolved in the vegetable cauftic alkali, and precipitated with the muriatic acid. A flaky fubftance, void of any regular form, compofed each precipitate.

Pus does not irritate the particular furface which fecretes it, though it may be irritating to any other. Hence no fuppurating furface, of any fpecific kind, can be kept up by its own matter. If this had not been the cafe, no fore of a fpecific quality, or producing matter of an irritating kind, could ever have been healed. This is fimilar to every other fecretion of ftimulating fluids, as the bile, tears, &c. which fluids do not ftimulate their own glands or ducts, but are capable of ftimulating any other part of the body.

Whenever a real difeafe attacks either the fuppurating furface or the conftitution, the production of true pus ceafes, and the fluid becomes changed in fome meafure, in proportion to thefe morbid alterations. In general it becomes thinner and more tranfparent, and it partakes more of the nature of the blood, as is the cafe in moft other fecretions under fimilar circumftances. *Sanies* is the term ufually applied by furgeons to pus in this degenerated ftate. This unhealthy fort of matter has more of the ferum, and frequently more of the coagulating lymph in it, and lefs of the combination, which renders it coagulable by a folution of fal ammoniac. It has alfo a greater proportion of the extraneous parts of the blood, which are foluble in water, fuch as falts; and it has a greater tendency than true pus to become putrid. Such unhealthy matter may even be irritating to the furface which produces it.

The difcharge, when of an irritating fort, is more ftimulating to the adjoining parts with which it comes in contact, than to its own fecreting furface. In this manner it frequently produces excoriation of the fkin and ulceration. Thus the tears excoriate the fkin of the cheek, in confequence of the quantity of falts which they contain. From this effect, matter has been called corrofive, a quality which it has not; the only property which it poffeffes being that of irritating the parts which it touches, fo as to caufe their abforption.

When the veffels thus lofe the power of producing good pus, they alfo lofe more or lefs the power of forming granulations. This may depend on fome deviation from the due ftructure and action which fuch veffels fhould poffefs, in order to be qualified for the performance of thefe two operations.

Pus, from feveral circumftances, would appear in general to have a greater tendency to putrefaction than the natural juices have; but, perhaps, this is not the cafe with pure pus, which, when firft difcharged from an abfcefs, is commonly perfectly fweet. There are, however, fome exceptions to this, but thefe depend on circumftances entirely foreign to the nature of pus itfelf. Thus, if the abfcefs had any communication with the air, while the matter was confined in it; or if the collection has been fo near the colon, or rectum, as to have been infected by the feces, then we cannot wonder that the matter fhould become putrid. When blood is blended with pus; when floughs are mixed with it; when the parts forming the feat of the abfcefs are in a gangrenous ftate from an eryfipetalous affection; the matter has a greater tendency to putrify than the pure pus difcharged from found abfceffes, or healing fores. Pure matter, though eafily rendered fufceptible of change by extraneous additions, is in its own nature tolerably uniform and immutable. It appears fo unchangeable, that we find it retained in an abfcefs for weeks, without having undergone any alteration. Thefe qualities, however, only belong to perfect pus.

In the preceding paragraph it is ftated, that matter remains very often unchanged in abfceffes for weeks. This expreffion of Hunter's is not ftrictly correct; for it is well known, that the furfaces of the cavities of abfceffes are always abforbing, as well as fecreting ones; confequently there muft be a continual mutation going on in the contained matter.

When there are difeafed bones, or other extraneous bodies, exciting irritation, fometimes even to fo great a degree as to make the veffels bleed, and often wounding the veffels of the part, the matter is always found to be very offenfive. This ftate of the difcharge is one mark of a difeafed bone.

The

The discharge of an unhealthy sore blackens silver probes, and preparations of lead. This effect is imputed by Dr. Crawford to the sulphurated hydrogen gas generated in the matter. Phil. Transf. vol. lxxx. for the year 1790. p. 391, &c.

Use of Pus.—By some it is supposed to carry off humours from the constitution. Suppuration is sometimes regarded as a constitutional disease, changed into a local one, which constitutional malady is discharged, or thrown out of the body, either in the form of pus, or together with this fluid. Critical abscesses have been thought to be cases of this sort. Suppuration has also been imagined to carry off local complaints from other parts of the body, on the old principle of derivation or revulsion. For this reason, sores or issues are made in sound parts before allowing other sores to be dried up. Suppuration is sometimes excited with a view of making parts, such as indurated swellings, dissolve into pus; but we have endeavoured to shew that no dissolution of the solids is concerned in the production of pus.

A secretion of pus is looked upon as a general prevention of many, or of all, the causes of disease. Hence issues are made to keep off both universal as well as local diseases. However, the use of pus is perhaps unknown; for it is formed most perfectly from healthy sores, and in healthy constitutions; and large discharges from parts not very essential to life, produce very little change in the constitution, and as little upon being healed up, whatever some may suppose to the contrary.

This is certainly the case with many old ulcers, the suppuration from which seems to have little or no effect in impairing the health. Nor is there any real reason to be afraid of healing such ulcers, when possible, lest a worse disease should follow from the stoppage of the discharge, to which the system is supposed to be habituated so much, that the continuance of such discharge is essential to health.

Every one knows, that when there is no interference of art, that is, when the surface of a sore is left uncovered, the thin part of the matter evaporates, and the thick part dries and forms a scab. Nature, therefore, seems to have designed, that one use of pus should be to make a cover or protection for ulcerated surfaces.

Among the secondary uses of suppuration may be mentioned, opening a communication between a disease and the external surface of the body; forming a passage for the exit of extraneous bodies, &c.

PUSA, in *Geography*, a town of Hindoostan, in Bahar; 12 miles E. of Hajypour.

PUSBACH, a town of Germany, in the principality of Culmbach; 12 miles S. of Culmbach.

PUSCHENGA, a river of Russia, which rises in lake ...rus, in the government of Archangel, and runs into the ...nega near Kevrol.

PUSCHIAVO, a town of Switzerland, in the Grisons, from which is derived the name of one of the jurisdictions ...ded by the duke of Milan, in the year 1436. The greater number of the inhabitants consists of Roman Catholics. The town lies three miles N. of a lake of the same name, abounding in fish, and distant 14 miles S.W. of Bormio, and is situated 17 miles W.S.W. of the same town, and 20 miles E. of Chiavenna.

PUSCHIMA, a town of Russia, in the government of Novgorod; 40 miles N.N.E. of Bielozersk.

PUSHAN, in *Mythology*, a name for Surya, a personification of the sun, among the Hindoos, and a name also of their god Siva.

PUSHENG, in *Geography*. See KOOSHINJEE.

PUSHERS, a name given to Canary birds when new flown. See BRANCHER, and CANARY *bird*.

PUSHING, in *Geography*, a considerable town of Persia, in the province of Khorasan, a little to the N. of Herat, built on the banks of the Herirood, and celebrated for the beauty of the cypress trees which grow in its vicinity.

PUSHPADANVA, in *Mythology*, one of the names of the Hindoo deity Kama, the cupid of their mythology. It means with a flowery bow; his bow, which is made of a sugar cane, having its string composed of flowers and bees. See KAMA.

PUSHPAKA, the name of a flowery car, in which the Hindoo Plutus, named Kuvera, is conveyed. See KUVERA.

PUSILLATUM, a word used by some medical writers to express a coarse powder, or any medicinal substance, beat into small pieces for infusion, or the like purposes.

PUSTING, in *Geography*, a town of Hungary, on the Waag; eight miles N.N.W. of Leopoldstadt.

PUSTOMERZ, a town of Moravia, in the circle of Brunn; 16 miles E.N.E. of Brunn.

PUSTOZIRSK, a town of Russia, in the government of Archangel, near the Petchora. N. lat. 67° 15'. E. long. 51° 14'.

PUSTULE, PUSTULA, in *Medicine*, a small elevation of the cuticle, upon an inflamed base, containing *pus*.

Pustules originate from an inflammation of the skin, and the consequent partial effusion of purulent matter under the cuticle, by which the latter is elevated into small circumscribed tumours. Pustules are of various sizes, sometimes very minute, and sometimes extending to half an inch in diameter; and they terminate either in small ulcerations, or more commonly in scabby crusts. Dr. Willan constituted an order of cutaneous diseases under the head of *pustules*, including five genera, impetigo, porrigo, ecthyma, variola, and scabies; but he never completed this part of his work, a brief compendium of which has been drawn up by Dr. Bateman. (See his Practical Synopsis of Cutaneous Diseases, 1813.) See also IMPETIGO, PORRIGO, SMALL-POX, and ITCH.

By many writers the use of the word *pustule* is very general, including not only *purulent* elevations of the skin, but vesicles and even pimples; and it must be admitted that the best ancient authority sanctions even a more extensive acceptation of the word, including even wheals, "quæ ex urticâ vel sudore nascuntur." (Celsus, lib. v. cap. 28.) But not only the etymology (quasi *pus tulit*), but accuracy of language would lead us to limit the term to *purulent* eruptions, as in the above definition, and as some correct writers have done. See Prof. Arnemann, Comment. de Aphthis. Linnæus, Gen. Morbor. class xi. ord. 4, &c.

PUSTVOLA, in *Geography*, a river of Asiatic Turkey, which runs into the sea of Marmora; 16 miles W. of Artaki, in the province of Natolia.

PUSU, in *Botany*, the name of a famous plant growing in China, and greatly esteemed there. This and the ginseng these people a long time kept to themselves; but at length it was discovered, that the one was esteemed a certain prolonger of life, and the other a preservative against all diseases.

They, in their manner of speaking, say, that the pusu gives immortality. We have not been so happy to obtain any of this famous plant for the trial, but the ginseng having been brought over, and found not to possess those great virtues they ascribe to it, and the people in China, who are possessed of the pusu, dying, as well as those who have it not, we find, that the virtues of both are so greatly exaggerated

exaggerated by the eaftern dialect, that there is not much to be expected from them.

PUSULA, in *Geography*, a town of Sweden, in the province of Nyland; 37 miles N.N.W. of Helfingfors.

PUT, in the *Manege*, called in French *mettre*, is ufed for the breaking or managing of a horfe: thus,

To put a horfe to corvets, or caprioles, is to teach him thofe parts of the manege.

To put a horfe upon his haunches, called in French *affeoir*, is to make him bend them handfomely in galloping in the manege, or upon a ftop. See HAUNCHES.

To put a horfe to the walk, trot, or gallop, is to make him walk, trot, or gallop.

To put a horfe under the button, fee BUTTON.

PUTAGE, PUTAGIUM, in our old *Law Books*, denotes whoredom or fornication on the part of a woman.

The word is formed from the French *putte, whore; putagium*, q. d. *putam agere*. "Quod autum generaliter folet dici, putagium hæreditatem non adimit; illud intelligendum eft de putagio matris; quia filius hæres legitimus eft, quem nuptiæ demonftrant." Glanv. lib. vii. cap. 12.

PUTALA, in *Geography*. See PATELI.

PUTALLOM, a town on the coaft of Ceylon, near Calpenteen, remarkable for its falt-pans. This place, before the arrival of Europeans on the ifland, fupplied the natives with falt; and on account of its convenient fituation, was pitched upon by the Dutch for the manufacture of the falt with which they fupplied the king of Candy's dominions, according to the articles of their treaty with him. The falt-pans are formed by an arm of the fea which overflows part of the country between Putallom and Calpenteen. A very large quantity of falt was manufactured here by the Dutch; they looked upon it as of the higheft importance to their interefts in the ifland, and the moft formidable weapon which it was in their power to employ againft the native king, as it was impoffible for him to procure any but through their means. Since the Britifh have obtained poffeffion of the ifland, this manufacture has been almoft entirely neglected. It is capable, however, of being rendered very profitable, as it is the only one of the kind on this fide of the ifland, and the moft conveniently fituated for fupplying the king of Candy's dominions. The Dutch enacted very fevere laws to prevent individuals from manufacturing or trading in this article; the government taking upon itfelf the management of the works, and the care of fupplying both its own fubjects and the Candians. In order to keep a conftant check on the latter, the Dutch were careful not to allow them too great a quantity at once; and whatever remained at Putallom, after fupplying the demands of each year, they deftroyed, that it might not be feized upon by furprife.

PUTANGES, a town of France, in the department of the Orne, and chief place of a canton, in the diftrict of Argentan; nine miles N.W. of Argentan. The place contains 502, and the canton 11,934 inhabitants, on a territory of $212\frac{1}{2}$ kiliometres, in 31 communes.

PUTANISM, PUTANISMO, an Italian term, naturalized by fome Englifh writers, fignifying *whoredom*, or the life or condition of a courtezan.

The word we borrow immediately from the French, *putanifme*; and they from the Italian *puttana, whore*; of *putta, girl*.

PUTAO, in *Geography*, a town on the S. coaft of the ifland of Luçon. S. lat. 13° 6′. E. long. 123° 28′.

PUTATIVE, SUPPOSITIVE, fomething reputed to be what it really is not.

The word is feldom ufed but in the phrafe putative father. Thus we fay, Jofeph was the putative father of Jefus Chrift.

PUTAVERI, in *Biography*, a native of Otaheite, brought into France by the circumnavigator Bougainville: of whom a gentleman, who had refided a confiderable time in Italy, and was an excellent judge of mufic, affured us that the effects of French mufic, when fairly tried upon him immediately on his arrival, were not thofe of rapture, but ridicule. He danced to it, indeed, as we would to a marked meafure beat on a drum or a table; for as foon as he returned from the great opera, whither he was carried, he mimicked what he had heard and feen in the moft natural and ridiculous manner poffible; giving the company a fpecimen of the French opera, which was the moft admirable parody imaginable of French finging, or rather of the fcreams and howlings at the Académie Royale de la Mufique in the time of Louis XV. Our friend wifhed to try the effects of Italian mufic upon this demi-favage native of Otaheite; but there was no opportunity, for how could it be properly executed at Paris? However, according to the late lord marfhal, the experiment had been fairly made on another occafion.

A young Greek lady being brought from her own country to Paris, fome years fince, was, foon after her arrival in that city, carried to the opera by fome French ladies, fuppofing, as fhe had never heard cultivated mufic, that fhe would be in raptures at it; but, contrary to thofe expectations, fhe declared that the finging only reminded her of the hideous howlings of the Calmuc Tartars, and as to the machinery, which it was thought would afford her great amufement, fhe proclaimed her diflike of many parts of it, and was particularly fhocked by what fhe called the impious and wicked imitation of God's thunder. Soon after this experiment fhe went to Venice, where another trial was made on her unprejudiced ears, at an Italian opera, in which the famous Gizziello fung, at whofe performance fhe was quite diffolved in pleafure, and was ever after paffionately fond of Italian mufic.

PUTAWATAMES, or POOTOOTAMIES, in *Geography*, Indians who inhabit between St. Jofeph's and Detroit in North America, and can furnifh about 500 warriors. There are two tribes of this name, the one of the river St. Jofeph, and the other of Huron. At the treaty of Greenville, Auguft 3d, 1795, they ceded lands to the United States, who paid them a fum of money, and engaged to give them goods to the value of 1000 dollars *per annum*, for ever.

PUTBUS, a town and fort of the ifland of Rugen; five miles S. of Bergen.

PUTCABARY, a town of Hindooftan, in Bengal 45 miles S.E. of Moorfhedabad.

PUTEA, in *Ancient Geography*, a town of Africa propria, S. of Adrametum, between Campfa and Caraga, according to Ptolemy.—Alfo, a town of Syria, in the Palmyrene, between Oriza and Abada. Ptol.

PUTEAL, among the Romans, a fmall kind of edific raifed in the place where a thunder-bolt had fallen. Se BIDENTAL.

PUTELKAW, in *Geography*, a town of Pruffia, i the province of Ermeland; fix miles S.W. of Frawer burg.

PUTEMAHRY, a town of Hindooftan, in Bengal 16 miles N. of Kifhenagur.

PUTEOLANUS PULVIS. See POZZOLANA.

PUTHLOSE, or PUTLOS, in *Geography*, a town the duchy of Holftein; four miles N.W. of Oldenburg.

PUTI, or POTI, a town of the principality of Guri at the mouth of the Rione, on the Black fea; 80 miles W.S.W. of Cotatis. N. lat. 42°. E. long. 41° 28′.

PUTICULI, among the Romans, ditches or holes in the earth, a little without the Efquiline gate, in which the poorer fort of people were buried.

PUTIGNANO, in *Geography*, a town of Naples, in the province of Bari; 33 miles S.E. of Bari.

PUTIVLI, a town of Ruffia, in the government of Kurfk, on the Sem; 72 miles W.S.W. of Kurfk. N. lat. 51° 20′. E. long. 34° 14′.

PUTLACH, a town of Bavaria, in the bifhopric of Bamberg; five miles E. of Goffweinftein.

PUTLITZ, or PUDLITZ, a town of Brandenburg, in the Mark of Pregnitz; 10 miles N. of Perleberg. N. lat. 53° 16′. E. long. 12° 3′.

PUTLOGS, or PUTLOCKS, in *Building*, fhort pieces of timber, about feven feet long, ufed in building fcaffolds. They lie at right angles to the wall, with one of their ends bearing upon it, and the other upon the ledges or poles which ftand parallel to the fide of the wall of the building.

PUTNA, in *Geography*, a town of Moldavia; 32 miles W. of Suczava.—Alfo, a river of Moldavia, which runs into the Milcow, at Focfani.

PUTNAM, a county of America, in the fouthern diftrict of Georgia, containing 6809 free perfons, and 3220 flaves. Its chief town is Eatonton.

PUTNEY, a town of America, in Windham county, and ftate of Vermont, containing 1607 inhabitants.

PUTNEY, a village and parifh in the weft half hundred of Brixton, and county of Surrey, England, is fituated on the fouth bank of the river Thames, at the diftance of four miles from Hyde Park corner, London. The parifh contains 1630 acres, of which the greater proportion is an open common or heath. In the time of the civil wars it was the fcene of fome very interefting tranfactions. The parliamentary army lay at Putney, for a confiderable time, in the year 1747; and here the general officers, after long debates in the church, completed their propofitions for the future government of the kingdom, and fent them to the king at Hampton Court. Here alfo were born two celebrated ftatefmen, Nicholas Weft, bifhop of Ely, and Thomas Cromwell, earl of Effex, the protegée of Wolfey, and the fucceffor to his power and misfortunes. In this parifh are many agreeable villas; in one of which the late illuftrious William Pitt breathed his laft. The church was originally built as a chapel of eafe to Wimbledon, not long after the conqueft; but was, in a great meafure, re-erected in the reign of Henry VII. It is a fmall edifice, with a ftone tower at the weft end. A little chapel at the eaftern extremity of the fouth aifle, built by bifhop Weft, is, however, its chief ornament. Monuments and infcriptions are numerous, but few of them deferve notice. Over the Thames, in this parifh, is a wooden bridge, conftructed in the year 1729, at the expence of 23,975*l.* and yielding a revenue, by tolls, to the proprietors, of above 3000*l.* *per annum.* A fifhery here was poffeffed by the lord of the manor, previous to the conqueft; and is now rented for a confiderable fum. All fturgeons and porpufes are claimed by the lord mayor of London, but the fifhermen receive 13*s.* for each of the former, and a guinea for each of the latter, when delivered to the water bailiff. On the common ftands an obelifk, erected, in 1786, in memory of Hartley's invention for fecuring buildings againft fire.

According to the parliamentary returns of 1811, this parifh contains 492 houfes, and 2881 inhabitants. Lyfons's Environs of London, vol. i. 1795. Supplement, 1811.

PUTNOK, a town of Hungary; 36 miles W.N.W. of Tokay.

PUTORIUS, in *Zoology*, the *Pole-cat*, a fpecies of *Muftela*; which fee. See alfo POLE-CAT.

PUTORIUS *Serpens*, a name given by fome to that fpecies of ferpent called by others *dryinus*.

PUTREFACTION, or PUTRIFACTION, in *Chemiftry*, is a fpecies of *fermentation* (which fee); being the laft ftage of the fermentatory procefs, and confifting not merely in the decompofition and tranfpofition of the particles of putrefying fubftances, whether animal or vegetable, by which new combinations are produced, but alfo in the extrication and expulfion of fome of the conftituent parts of thefe fubftances.

This decompofition or derangement of the conftituent parts of vegetable fubftances is ufually called *fermentation*, and that of animal bodies, is denominated *putrefaction*. The agents that produce both kinds of decompofition, and the circumftances that attend them are, in various refpects, very fimilar, and the chief difference of the products that are obtained from both depends upon the diverfity of their conftituent parts. The procefs of putrefaction, and its effect in diffolving the combination of the conftituent parts of bodies, are fufficiently obvious to fenfe; but the rationale of the procefs, and the mode in which gafeous and volatile compounds are feparated from bodies that are diforganized and afterwards form new combinations, are ftill involved in confiderable obfcurity; and different writers have difagreed in their explication of them. Several facts, however, are univerfally acknowledged; and of thefe we fhall give a brief account in the fequel of this article, together with a detail of fome of thofe principles and theories that have been adopted for explaining them. Becher long ago obferved, in his "Phyf. Subt. l. i. §. 5." that air is the principal agent of decompofition, but that water and heat very much facilitate its action. Thus he fays, "Fermentatio ergo definitur quod fit corporis denfioris rarefactio, particularumque aërearum interpofitio; ex quo concluditur debere in aëre fieri nec nimium frigido, ne rarefactio impediatur; nec nimium calido, ne partes raribiles expellantur."

An animal fubftance may be preferved from putrefaction by depriving it of the contact of the air; and this procefs may be accelerated or retarded by varying or modifying the purity of the fame fluid. When we obferve putrefaction occurring without the accefs of atmofpherical air, the effect is produced by the water which impregnates the animal fubftance, becomes decompofed, and affords the element and the agent of putrefaction. Hence it appears, that moifture is an indifpenfible requifite to facilitate putrefaction. A moderate degree of heat is alfo a condition favourable to animal decompofition.

Dr. Hales, it is well known, afcribed the cohefion and folidity of bodies to the air, which exifts in them in a fixed ftate, and forms, as he expreffes it, the cement or bond of union between their feveral conftituent particles. To this purpofe he obferves, that air abounds much more in folid than in liquid bodies; and that folid bodies being generally denfer than water, the attraction of the air of thefe folid bodies in a fixed ftate, and its repulfion when in an elaftic ftate, are greater than the attraction and repulfion of the lighter watery particles in a fixed and in an elaftic ftate; and hence the particles of air are fitter to be the principal bond of union in folid bodies, than the particles of water. This opinion was afterwards adopted by baron de Haller, who maintains, that air is the *vinculum elementorum primarium*, or the true cement which binds together the earthy particles

particles of bodies. Mr. Macbride, as we have elsewhere shewn, has taken occasion, by a variety of experiments, to illustrate and establish this opinion; and in support of it he alleges, that the preservation of firmness and soundness in bodies depends on restraining the escape of that principle, since known by the name of fixed air, and which he supposes to be the immediate cause of cohesion: for the moment it flies off and resumes its elasticity, the other constituent particles, *viz.* the earthy, the saline, the oily or inflammable, and the aqueous, being thereby put in motion, immediately begin to exert their several peculiar attractive and repulsive powers, and run into new combinations, which first change, and at length altogether destroy the texture of the substance they formerly composed; provided that this substance contained in itself a sufficient quantity of water to allow of the intestine motion, by giving the proper degree of fluidity; for without fluidity there can be no intestine motion; and without intestine motion there can be no change of combination: because we see that such animal and vegetable bodies as are suddenly deprived of their water, or naturally contain very little, are almost as durable and unchangeable in their texture as minerals. Hence Acosta observes, that in Peru, and others have observed the same in Egypt, where it very rarely rains, every thing will continue a long time uncorrupted; unless we should rather ascribe this effect to the abundance of nitrous salt in the air of those places, which is known to resist putrefaction. Indeed all putrefactions, both of animal and vegetable bodies, are affirmed by the learned Boerhaave to be performed by means of water alone. Take, says he, a pound of fresh flesh, and keep it in a heat like that of our body, and, in a few days the putrefaction will be completed; but if you first drain out, or exhale, all the watery part from the same in some chemical vessel, though the salt and oil remain, the flesh will harden like a stone, and may be kept for ages without putrefaction. Though when thus hardened, water poured on it, or even the common dew, will soon set it a putrefying. Thus Villaris and Cazalet of Bourdeaux, as Chaptal informs us, dried meat by means of stoves, which was preserved for several years without contracting any bad flavour.

By such means, bread, flesh, or the like foods, may be preserved for many ages; provided regard be had to the place. Hence it is that in dry countries, as Egypt, dead carcases never putrefy, but dry and harden uncorrupted: as we see also in the mummies found buried under the sand.

The sands and light porous earths preserve human bodies by exhausting their juices and drying the solid parts. Hence it is, that entire caravans have been discovered in Arabia, consisting of men and camels, preserved in the sands under which the impetuous winds have buried them. In the library of Trinity college, Cambridge, a human body may be seen in a perfect state, which was found under the sand in the island of Teneriffe. Hence substances putrefy much more slowly when exposed to a drying wind, than in a sheltered place.

Nevertheless, too much humidity impedes putrefaction. To this purpose Becher observes: "Nimia quoque humiditas a putrefactione impedit, prout nimius calor; nam corpora in aqua potius gradatim consumi quam putrescere, si nova semper affluens sit, experientia docet: unde longo tempore integra interdum submersa prorsus a putrefactione immunia vidimus; adeo ut nobis aliquando speculatio occurreret, tractando tali modo cadavera anatomiæ subjicienda, quo diutius a fœtore et putrefactione immunia forent." Accordingly it is necessary, that in order to a body's putrefying by moisture, that the water should impregnate but not inundate it. It is also necessary, that it should remain in the texture of the animal body, without being renewed; for thus the lymph is dissolved, and the most putrescible substance is presented to the air with the greatest extent of surface; and the water itself is decomposed, and by this means affords the putrefactive principle.

Even human blood, which, naturally, is so prone to putrefaction, if you deprive it of its watery part, may be kept for fifty years. Goat's blood, we actually find kept so long in the shops, without corrupting; though, if you dissove it in water, and expose it to a gentle warmth, it will putrefy immediately. Blood is said to be the most putrescent animal substance that is known; and this property is ascribed partly to its fluidity and partly to the large quantity of fibrin and uncondensed albumen, which it contains, and especially to the former. See Blood.

We shall here add, that animal substances seem to be (cæteris paribus) more putrescent in proportion to the number of constituent parts which they contain. The substances either absolutely or nearly imputrescible are bone and condensed albumen, the latter being such as exists in cuticle, nail, hair, &c. which long remain unaltered in the midst of putrefying substances. Animal oil also putrefies with great difficulty, and hence the people that live in the most northern parts of America, the Esquimaux and others, preserve fish and meat to a certain degree from putrefaction by immersion in fish-oil.

In putrefaction there is a great intestine motion, which, when carried to an extreme, and when the putrefying substance is much compressed, is accompanied with heat and smoke, and sometimes flame. However, M. Beaumé affirms, that putrefaction is not attended with any sensible heat: when, indeed, it proceeds slowly, and the quantity of putrefying matter is but small, the heat, if any, is very little. That putrescent substances emit light, is an unquestionable fact; and on this principle philosophers account for the luminousness of the sea, the ignis fatuus, &c. To this purpose M. Ant. Martin (Swed. Abhad. vol. xxiii. p. 225, cited by Dr. Priestley, in his History of Light, &c. p. 576.) observes, that human bodies have sometimes emitted light about the time they begin to putrefy; and that the walls and roof of a place in which dead bodies had often been exposed, had a kind of dew or clamminess upon them, which was sometimes luminous. And he imagines, that the lights which are said to be seen in burying grounds may be owing to this cause. It has been observed, that heat extinguishes the light of putrescent substances; Mr. Canton, attending to this circumstance in some experiments for ascertaining the cause of the luminousness of the sea, remarks, that though the greatest summer-heat is well known to promote putrefaction, yet twenty degrees more than that of the human blood seems to hinder it; for putting a small piece of luminous fish into a thin glass ball, he found that water of the heat of one hundred and eighteen degrees would extinguish its light in less than half a minute; but that on taking it out of the water, it would begin to recover its light in about ten seconds: but it was never afterwards so bright as before. See Light.

It has been observed, that a temperature from about forty degrees to the highest natural heat is favourable to the putrefaction of animal matter, whereas a freezing temperature is known to stop putrefaction, as it is the custom in cold countries to bring victuals frozen to market, and in this state they are kept for any length of time without any other preparation; and besides, bodies of men or of other animals remain unaltered under ice for many weeks. We might

might allege many other circumſtances of a ſimilar nature. On the other hand, a ſcorching heat alſo prevents putrefaction; probably by expelling the moiſture which is eſſential to the proceſs, becauſe by an inferior degree of heat putrefaction is promoted. The influence of temperature on animal putrefaction is thus ſtated by Becher: "Aër calidus et humidus maximè et putrefactionem facit—corpora frigida et ſicca difficulter, imo aliqua prorſus non putreſcunt: quæ ab imperitis proinde pro ſanctis habita fuere; ita aër frigidus et ſiccus, imprimis calidus et ſiccus, a putrefactione quoque preſervat: quod in Hiſpania videmus, et locis aliis calidis, ſicco, calido aëre præditis, ubi corpora non putreſcunt et reſolvantur; nam cadavera in oriente in arena, imo apud nos arte in furnis, ſiccari, et ſic ad finem mundi uſque à putredine præſervari, certum eſt: intenſum quoque frigus à putredine præſervare: unde corpora Stockholmiæ tota hyeme in patibulo ſuſpenſa ſine putredine animadvertimus." From the facts already ſtated, we may deduce the moſt effectual means of preventing, and increaſing putrefaction, and alſo of modifying it at pleaſure. A body may be preſerved from putrefaction by depriving it of the contact of atmoſpherical air: for this purpoſe nothing more is required than to place the body in a vacuum, or to envelope it in a covering, which may defend it from the immediate action of air; or alſo to envelope it in an atmoſphere of ſome gaſeous ſubſtance, which does not contain vital air. Putrefaction may alſo be favoured by keeping bodies at a ſuitable temperature. A degree of heat from between ſixty-five and ninety degrees diminiſhes the adheſion of the parts, and favours the action of the air; but if the heat be greater, ſays Chaptal, it volatilizes the aqueous principle, dries the ſolids, and retards the putrefaction. Hence it is inferred, that for the decompoſition of an animal ſubſtance, it is neceſſary that it ſhould have the contact of atmoſpheric air, and that the purer the air is, the more ſpeedy will be the putrefaction: that it be expoſed to a moderate degree of heat: and that its texture be impregnated with humidity.

The moſt ſudden and remarkable changes produced upon a body by putrefaction, are upon its colour, ſmell, and taſte. Fleſh beginning to putrefy, is well known to exhale very ſoon after a penetrating fœtid ſmell, its colour becomes pale, then inclining to blue, and afterwards livid and black, and its taſte nauſeous. Tranſparent liquor, as urine and broth, during putrefaction, becomes alſo turbid: as the putrefaction advances, the ſmell becomes more and more fœtid, and it alſo acquires great pungency, which is cauſed by a large quantity of volatile alkali, diſengaged from thoſe ſubſtances that are completely putrefied. Solid bodies, whilſt they are putrefying, ſwell, become ſoft, loſe the coheſion of their parts, and are laſtly reduced to a very diſagreeable putrid pulpy maſs: the fluids become turbid, and the effluvia are loathſome and ſickening, and after a time a putrid gas is diſengaged in a ſlow but ſenſible efferveſcence. A foul and brown ſerum then ſweats out from the pulpy maſs, and about this time the effluvium is very ſenſibly ammoniacal, which is indicated by its effects on the eyes and throat, and by forming a white vapour with muriatic acid gas. For ſome time a large part of the putrid ſubſtance is evaporated, and carried off in the putrid gas and diſperſed in the atmoſphere, after which the extreme fœtor ſubſides; and finally the proceſs of putrefaction ceaſes, and leaves a kind of fat fœtid earthy matter. All the gaſes certainly known to be produced by putrefaction, are carbonic acid, carburetted hydrogen, ſulphuretted and phoſphuretted hydrogen, and ammonia; but either theſe, or ſome of theſe, muſt be conſiderably changed by the ſolution of the animal matter; or ſome compound not yet examined, muſt be produced in that ſtate of putrefaction, when the gas evolved occaſions ſuch dreadful effects upon thoſe that have the misfortune to fall in the way of it, even when diluted conſiderably with common air. This is ſaid to be the caſe when the abdomen of a large animal is firſt burſt, after ſome days or perhaps weeks of putrefaction; the gas from which cauſes inſtant fainting, and ſometimes death, and even when the perſon expoſed to it receives the firſt ſhock, it leaves exceſſive debility and other alarming ſymptoms for a conſiderable time. The moſt deleterious gas that is known is, perhaps, carburetted hydrogen, but the effects of this, as obtained by chemical means, are far ſhort of thoſe above-mentioned, when equally diluted. The generation of ammonia has been ſatisfactorily accounted for, ſince the diſcovery of the conſtituent parts of the volatile alkali, by the new combination formed between the azote of the animal matter, and the hydrogen, of which latter there are many ſources, and particularly that of the decompoſition of water. As ammonia is always produced during putrefaction, it ſeems rational to ſuppoſe, that one important purpoſe of the moiſture neceſſary to the proceſs, is to afford, by its decompoſition, the hydrogen of the volatile alkali. The nitrous acid is alſo an undoubted product of putrefaction; but farther experiments and facts are neceſſary for explaining the reaſon, why in ſome caſes the azote tends to unite with oxygen to form this acid, and in others with hydrogen to form ammonia. For an account of the peculiar changes which animal fleſh undergoes, by which it is converted into a ſpermaceti-like ſubſtance, inſtead of paſſing through the uſual proceſs of putrid decompoſition, we refer to the article Adipocire.

Sir John Pringle has obſerved, that, as all the humours of all animal bodies become thinner by putrefaction, ſo the ſolid or fibrous parts are thereby relaxed, and rendered more tender: and hence the extraordinary bulk of the heart, liver, and ſpleen, incident to perſons labouring under putrid diſeaſes, may be accounted for. It is remarkable, that in diſſections of perſons who die of the plague, the heart is almoſt always found of an uncommon magnitude; and as to the ſcurvy, the liver and ſpleen are ſometimes enlarged to ſuch a degree, that the tumour may be ſeen outwardly.

From matters completely putrefied may be obtained by diſtillation volatile alkali, ſome liquid and ſome ſolid; a pungent fœtid oil, which at firſt is thin, and afterwards becomes more thick; and a reſiduum of coal, not eaſily reducible to aſhes. Some writers on this ſubject have apprehended, that putrid ſubſtances are not to be regarded as alkaline. Sir John Pringle, finding from the experiments which he made in the year 1750, that ſyrup of violets was not changed into a green colour by the ſerum of putrid blood; that this ſerum did not make any efferveſcence, when ſpirit of vitriol was poured upon it; that water, in which corrupted fleſh had been for ſome time infuſed, neither efferveſced nor changed the colour of the ſyrup; and that alkaline ſalts, both fixed and volatile, powerfully oppoſe putrefaction; was led to adopt this opinion. But when he became acquainted with the experiments made by M. J. Bapt. Gaber of Turin (Acta Taurinenſ. vol. i. p. 78, &c.) he embraced with the liberality of a true philoſopher, the firſt opportunity of acknowledging his miſtake. M. Gaber, having poured a drop or two of aqua fortis upon bile, taken out of the gall-bladder of a perſon who had died of an inveterate jaundice without a fever, and whoſe body had lain about twenty-four hours in a cold place in winter, found, that the mixture immediately efferveſced, became ſenſibly warm, and that ſeveral air-bubbles roſe to the ſurface. He alſo expoſed the remainder of this bile in three open glaſſes

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to the thirty-fifth, twenty-fifth, and tenth degrees of heat, indicated by Reaumur's thermometer, and at the end of twenty-four hours mixed them with acids; and he found, that the bile which had been placed in a degree of heat anſwering to thirty-five, was moſt dilated, and gave very ſlight indications of effervefcence; that which had ſtood in twenty-five was alſo dilated, and the acid produced a more ſenſible effervefcence, but ſtill very ſlight; and the bile which had been expoſed only to the temperament of the air, varying from ſeven to ten, preſerved its tenacity, and fermented as much as that in his firſt experiment. Having mixed ſome blood, taken out of a vein of the dead body at the ſame time, and which appeared to be of the yellowiſh-red, with ſpirit of nitre, the mixture effervefced, but in a much leſs degree than the bile: this mixture, being left to digeſt for ſome hours, a yellow ſerum ſeparated from the blood, and covered its whole ſurface; and the blood, being ſubjected to the ſame heat as the bile, and for the ſame time, appeared more diſpoſed to effervefce than the bile, though this diſpoſition afterwards gradually diminiſhed. From theſe experiments the ingenious writer infers, that in diſeaſed bodies the humours may become ſo alkaleſcent as to effervefce with acids: that a very ſlight degree of putrefaction and fœtor, which is not ſufficient to produce alkaleſcence out of the body, will produce it in the body; that alkali formed in the body, and contained in the bile, is extremely volatile, ſince the heat of twenty-five degrees made a great part of it evaporate; and that the ſame alkali contained in the blood, being a little more entangled with other elements, is conſequently leſs volatile, ſince the ſame degree of heat continued for the ſame time, diſſipated but a very inconſiderable part of it: and, therefore, that the different phenomena taken notice of by thoſe who have proſecuted experiments of this kind, ſome of whom affirm that they have ſeen undoubted proofs of the preſence of an alkali, and others that they have ſcarcely diſcovered any ſuch indications at all, are the effects of different degrees of heat, the ſtaleneſs of the ſubſtance expoſed to the heat, or the different volatility of the alkali ariſing from its coheſion with other principles. Having made ſimilar experiments upon healthy bile, blood, and ſerum, and ſubmitted them to the action of mineral acids, he found the bile moſt diſpoſed to effervefce; that human bile was more diſpoſed to effervefce than the bile of an ox; that corrupt blood ferments with acids ſtill ſlower; and that ſerum ferments ſlower than blood. He alſo obſerved, that putreſcent humours not only effervefce with mineral acids, but with very weak diſtilled vinegar: and that thoſe humours that have been expoſed to artificial heat, become fœtid and effervefce ſooneſt, and ſooneſt arrive at the laſt ſtage of fermentation; in which caſe the fermentation ceaſes, though the heat is continued; and the ſmell, which till then is intolerably fœtid, becomes herbaceous, and is not diſagreeable. The fœtor, he ſays, manifeſts itſelf ſooner and laſts longer than the alkaleſcence.

M. Gaber farther obſerves, in relation to the experiments of ſir John Pringle, that at the degree of heat to which he expoſed putreſcent ſubſtances, and which was equal to the hundredth degree of Fahrenheit, correſponding nearly to the thirtieth degree of Reaumur, animal humours very ſoon become putrid; but that they as ſoon loſe the alkaleſcence which they derive from putrefaction, if this degree of heat is continued: ſo that as the corrupting humours manifeſt their alkaleſcent quality only for a very ſhort time, it might eaſily happen that no ſign of alkaleſcence appeared in his experiment, if it was not made in the critical moment, *i. e.* if he examined the putreſcent humours a little before the alkali was formed, or a little after it had evaporated. And he, therefore, apprehends, that if ſir John Pringle's experiments were made with a degree of heat juſt equal to his own, the reſult, *cæteris paribus*, muſt have been the ſame.

From other experiments this writer infers, that blood received from the arm, agitated and left to putrefy, does not putrefy ſo ſoon, nor ſo ſoon manifeſt ſigns of alkaleſcence, as the red part ſeparated from the ſerum, becauſe the ſerum putrefies more ſlowly than any other animal humour; and that the alkali, which evaporates with a degree of heat from twenty-five to twenty-eight of Reaumur, being collected in a receiver, will effervefce, and that the reſiduum is a maſs extremely fœtid, wholly deſtitute of alkali, and, conſequently, that no effervefcence is to be expected by pouring acids upon it. Having kept ſome blood in a glaſs veſſel cloſe ſtopped, he found that it retained its alkaleſcence a long time, though expoſed to a degree of heat equal to twenty-five; but upon unſtopping the veſſel, it flew off with great violence, in an extremely fœtid vapour. Theſe exploſions he attributes to the expanſion of the air, in conſequence of the putrefaction; and hence he deduces the reaſon, why the humours that are contained in the veſſels of a human body become alkaleſcent while they are yet ſcarcely fœtid, although when drawn from the body, and kept in open veſſels, they become fœtid, before they give ſigns of alkaleſcence. As ſoon as they begin to form alkali in the veſſels, the alkali is retained; but as it exhales from veſſels expoſed to the air, a greater quantity muſt be formed than exhales before it can become ſenſible. Having collected the diſtilled liquor of blood in ſuch a ſtate of putreſcence as to effervefce with acids, and expoſed it to the action of various acids, a violent effervefcence enſued; and when poured upon ſyrup of violets, it produced as fine a green as ſpirits of hartſhorn; and this tincture, having been changed into a red by the effuſion of a few drops of aqua fortis, became again blue, upon pouring into it ſome more of the diſtilled liquor; whence he concludes, that putreſcent humours form a true alkali, which exhales with a very ſlight heat. From other experiments he infers, that the alkali of putreſcent ſubſtances is not the productive cauſe of their fœtor, becauſe the latter remains when the former is departed. But as both appear in the ſame degree of heat, when long continued, it appears, he ſays, that this fœtor is produced by the effluvia of parts extremely volatile, but different from volatile alkali, which, though ſooner produced, are more ſlowly diſſipated. Alkaleſcence, however, may be ſometimes connected with a ſlight fœtor; and, on the contrary, extreme fœtor may ſubſiſt without alkaleſcence. And this fact confirms the obſervation of ſir John Pringle, who found a difference between the fœtid and alkaline particles; ſince the exhalations of freſh urine are not pernicious, though they contain more alkali than any ſubſtance in a ſtate of putrefaction, the odour of which is pernicious in the higheſt degree; and, therefore, putrid effluvia are of a different nature from alkaline ſalts. M. Gaber farther adds, by way of inference from this fact, that a volatile alkali is not a neceſſary product of putrefaction, and that the degree of alkaleſcence is not equal to that of putrefaction. Dr. Crell, profeſſor of chemiſtry at Brunſwick, has objected to this doctrine, as not conformable to the phenomena (Phil. Tranſ. vol. lxi. part i. art. 39.); for he ſuppoſes, that as all ſmell depends on a ſaline matter joined with phlogiſton, and the ſaline matter producing the putrid ſtench was very probably not an acid, it muſt be a volatile alkali, which, involved in phlogiſtic matter, might fly off before the alkali was developed. From ſome experiments made with a view of aſcertaining this fact, he infers that the volatile alkali is preſent as long, at leaſt, as the putrid ſmell continues, and that this volatile alkali is the baſis of it; becauſe, as this was diftilled over in his experiments, the refidue, being ftill in inteftine motion, required only the herbaceous fmell. The reafon why the volatile alkali has been diftinctly obferved at a certain period of putrefaction, and not in the other, he apprehends to be this: the volatile alkali has, it feems, a tendency to difentangle itfelf, by inteftine motion, of all fuch matter as it is involved with; but if it is not combined with fuch fixed matter as retains it till it has gone through all its evolutions, it is, being itfelf volatile, carried off by the ftill more volatile phlogiftic matter with which it is commonly joined. For this reafon, he fuppofes the putrefying matter fhews in its beginning no figns of volatile alkali, becaufe its fmell depends only on thofe particles which have been on the furface, without any ftrong cohefion with the fubftance. In the farther progrefs of putrefaction, the matter involving the alkali, or forming it, is intermixed, and in cohefion with the folid particles of the fubftance, and is by thefe means retained till the alkali is come to its purer ftate. Towards the end of putrefaction, the cohefion of the particles being almoft entirely taken off, the volatile alkali is carried off before it can go through all its ftates.

Dr. Macbride made feveral experiments with putrid blood and putrid bile, which afcertain the fact, that as foon as an animal fubftance begins to putrefy, it begins to difcover an alkaline quality; and this volatile matter, now produced in it, may be feparated by diftillation in a very gentle warmth; but he obferves, that the volatile alkali obtained from putrid fubftances is not exactly fimilar to that obtained by violent heat from animal fubftances not putrid. It differs remarkably in the flavour, which is naufeous and difagreeable, is not fo pungent, and is much weaker than the common volatile alkali; and this latter is capable of difpoffeffing the putrid alkali, and of driving it off from any body to which it has been united. But to return from this digreffion. As to the caufe and procefs of putrefaction, it has been generally believed, that the contact of atmofpherical air is neceffary for this purpofe, and that bodies become putrid, becaufe air communicates fomewhat to them: accordingly it has been alleged, that bodies buried deep under the earth, or in water, out of the reach of any air, have remained entire for ages; which, when expofed to the open air, have foon rotted and mouldered away. It is alfo well known, that bodies are preferved from putrefaction by covering them with wax, fuet, &c.; and Mr. Boyle relates, that he has preferved lemons, oranges, and other fruits, from putrefaction, during feveral years, by including them in an exhaufted receiver. Experiments of the fame kind have been lately made by M. Eller of Berlin, which fhew that fubftances, even of the moft putrefcent nature (fuch as blood) may be kept found *in vacuo* for many years. But Dr. Macbride has urged a variety of facts and confiderations to prove, that putrefaction enfues in confequence of the lofs of fome principle, which cemented the conftituent particles of bodies, and that, when this is difengaged from them, they feparate, and are difunited. This principle he difcovered to be air, which, in putrefaction and fermentation, is extricated and thrown off, from a fixed and non-elaftic ftate, into one that is volatile and elaftic; but which immediately, upon meeting with a proper recipient, returns again to its former nature. Thus he found, that cauftic alkali and quicklime may be rendered mild by abforbing this air, extricated from putrefying and fermenting fubftances; that without the extrication of this air no putrefaction can happen; and that even by abforption of it, putrefied fubftances may be corrected and rendered fweet. To the fame purpofe Dr. Alexander has endeavoured to prove, that putrid matter will preferve other fubftances from putrefaction; which is not improbable, becaufe, being already faturated with the putrid effluvium, they cannot readily take any more. Dr. Macbride, having expofed putrid matters to the vapours arifing from fermenting mixtures, or from alkaline fubftances effervefcing with acids, found that the putrid quality was deftroyed; and hence he confiders the fixed air as powerfully antifeptic. And it appears alfo from the experiments of Dr. Prieftley, that fixed air corrects and renders wholefome air tainted with refpiration or putrefaction. Hence he infers, that lime-kilns, which difcharge great quantities of this air, may be wholefome in the neighbourhood of populous towns, the atmofphere of which muft abound with putrid effluvia. Sir William Lee, in a hot feafon, contrived, by impregnating water with fixed air, in the manner defcribed under PYRMONT *water*, and wafhing meat with it two or three times a-day, not only to preferve it as perfectly fweet and good to the extent of ten days, as at the firft killing, but alfo to recover fome meat that had begun to change. And it is farther well known, that fixed air, or carbonic acid, has been lately introduced into the materia medica, and adminiftered with fuccefs in a variety of putrid cafes. Dr. Macbride has alfo proved, that putrefaction is accelerated by taking off the preffure of the atmofphere; and from fome experiments he was led to conclude, that it will take place fooner in vacuo than in the open air; but making a more complete vacuum by means of two brafs hemifpheres joined together, he found that the obfervation of Mr. Boyle and others was agreeable to fact. It appeared alfo, by inclofing flefh in condenfed air, that increafing the preffure of the furrounded air, retarded putrefaction; and hence he deduces, what he deems to be a demonftrative proof, that bodies do not putrefy, becaufe the air adds fomewhat to them; for if they did, then a piece of flefh which lay in condenfed air ought to have putrefied the fooneft, becaufe it had the greateft quantity of air applied to its furface. But the reafon why, according to his fyftem, condenfed air prevents putrefaction is, that the preffure of every fide muft force the conftituent particles clofer together, thus increafe their cohefion, and prevent the inteftine motion; and without inteftine motion there can be no change of combination. However, it is obferved by fir John Pringle, that the putrefaction of meat and other fubftances, advances quicker in a confined than free air; for as the moft putrid parts are alfo the moft fugitive, they inceffantly iffue from a corruptible fubftance, and difperfe with the wind; but in a ftagnation of air they remain about the body, and in the nature of a ferment excite its corruption.

It has been long obferved, that putrefaction generates air. Hence, though flefh, as well as blood, be fpecifically heavier than water, yet dead bodies are found to float, after lying fome time at the bottom, from air generated in the bowels by putrefaction. And fince it has been found by experiments, that the blood and other animal fubftances begin to emit air before they are fo far corrupted, as they frequently are in putrid difeafes, it is probable that feveral of the fymptoms in deep furfeits may be owing to the action of the confined air. As dead bodies become putrid from the lofs of their fixed air, according to Dr. Macbride's theory, he fuggefts, that the immediate caufe of putrefaction in living bodies may be the detachment of too large a proportion of their fixed air. This fact he endeavours to evince by an enumeration of the fymptoms that occur in the fcurvy, and other highly putrid difeafes, which fhew that the air is actually detached from the blood in fuch cafes; as well as from an examination of the principal and prevailing caufes of fuch diforders. And fince the air tainted with animal or vegetable putrefaction is the fame with air rendered noxious by animal refpiration; fince both equally extinguifh flame, are equally noxious to animals, are equally and in the fame way offenfive to the fmell, equally precipitate lime in lime water, and are reftored by the fame means, Dr. Prieftley fuggefts, that one ufe of the lungs is to carry off the putrid effluvia, without which, perhaps, a living body might putrefy as foon as a dead one. See BLOOD and RESPIRATION.

We fhall here obferve, that putrefying and fermenting fubftances have been found, by the experiments of Mr. Cavendifh, Dr. Prieftley, &c. to yield not only *fixed* but *inflammable* air. From an experiment of Dr. Prieftley, intended to determine the proportion of each of the kinds of air in the different ftages of the putrefactive procefs, it appears that a piece of mutton weighing four penny-weights fix grains, yielded in all $2\frac{11}{14}$ meafures of air, of which $2\frac{15}{56}$ was fixed, and the reft inflammable; and that all the inflammable part was exhaufted a confiderable time before the fixed air. The fame ingenious writer has obferved, that the diminution of common air, by means of putrefaction, amounts to a complete fourth part of the whole, notwithftanding the production of fome permanent air from the putrefying fubftance, and has, in all refpects, the appearance of being produced folely by the precipitation of fixed air. It muft occur to every reader, in any way acquainted with this fubject, if the phlogiftic theory be admitted, (which indeed is now generally difcarded,) that if inflammable air be the fame with phlogifton, as Dr. Prieftley feemed to have difcovered, many of the phenomena of putrefaction, depending on this principle, fuch as the fmell, colour, light, &c. will probably from hence admit of an eafy explication.

We fhall here fubjoin fome obfervations with refpect to the decompofition of animal bodies that are interred in burying-grounds. In this fituation, the decompofition is four times as flow as when the putrefying animal is expofed to the air. It is not perfectly ended, according to Mr. Petit, till three years after the body has been interred, at the depth of four feet; and it is flower in proportion as the body is buried at a greater depth. Thefe facts agree with the principles which we have already eftablifhed for bodies buried in the earth, and fubjected to laws of decompofition very different from thofe which take place in bodies expofed to the open air. In this cafe, the decompofition is favoured by the waters which filter through the earth, and diffolve and carry with them the animal juices. It is alfo favoured by the earth, which abforbs the juices with more or lefs facility. Meffrs. Lemery, Geoffroy, and Hunaud, have proved that argillaceous earths exert a very flow action upon bodies; but when the earths are porous and light, the bodies then dry very fpeedily. The feveral principles of bodies abforbed by the earth, or carried by the vapours, are difperfed through a great fpace, imbibed by the roots of vegetables, and gradually decompofed. This is what paffes in burying-grounds in the open air; but it is very far from being applicable to the fepulchres which are made in churches and covered places. Here is neither water nor vegetation; and confequently no caufe which can carry away, diffolve, or change the nature of the animal fluids: and we cannot but applaud the wifdom of government, which has prohibited the burying in churches; a practice which was once a fubject of horror and infection.

The accidents which have happened at the opening of graves and vaults are but too numerous, to render any apology neceffary for our fpeaking a few words refpecting the method of preventing them.

The decompofition of a body in the bowels of the earth can never be dangerous, provided it be buried at a fufficient depth, and that the grave be not opened before its entire and complete decompofition. The depth of the grave ought to be fuch that the external air cannot penetrate it; that the juices, with which the earth is impregnated, may be conveyed to its furface; and that the exhalations, vapours, or gafes, which are developed or formed by decompofition, fhould not be capable of forcing the earthy covering which detains them. The nature of the earth in which the grave is dug, influences all its effects. If the ftratum which covers the body be argillaceous, the depth of the grave may be lefs, as this earth difficultly affords a paffage to gas and vapour; but in general it is admitted to be neceffary that bodies fhould be buried at the depth of five feet, to prevent all thefe unhappy accidents. It is likewife neceffary to attend to the circumftance, that a grave ought not to be opened before the complete decompofition of the body. This decompofition, according to Mr. Petit, is not perfect until the expiration of three years, in graves of four feet depth; or four years, when they are fix feet deep. This term affords many varieties, according to the nature of the earth, and the conftitution of the fubjects buried in it; but we may confider it as a medium. The pernicious cuftom, which allows a fingle grave to families more or lefs numerous, ought therefore to be fuppreffed; for in this cafe, the fame grave may be opened before the time prefcribed. Thefe are abufes which ought to occupy the attention of government; and it is time that the vanity of individuals fhould be facrificed to the public fafety. It is likewife neceffary to prohibit burying in vaults, and even in coffins. In the firft cafe, the principles of the bodies are fpread into the air, and infect it; in the fecond, their decompofition is flower and lefs perfect.

If thefe precautions be neglected; if the dead bodies be heaped together in too confined a fpace; if the earth be not proper to abforb the juices, and decompofe them; if the grave be opened before the entire decompofition of the body;—unhappy accidents will no doubt be produced; and thefe accidents are but too common in great towns, where every wife precaution is neglected. An inftance of this happened, when the ground of the church of St. Benoit at Paris was dug up a few years ago: a naufeous vapour was emitted, and feveral of the neighbours were affected by it. The earth which was taken out of this grave was unctuous, vifcid, and emitted an infectious fmell. Meffrs. Maret and Navier have left us feveral fimilar obfervations. Chaptal's Elem. of Chem. vol. iii.

Putrefaction is one of the inftruments in nature by which many great changes are brought about. In the procefs of vegetable putrefaction, if we throw together any of the tender, green, and fucculent parts of recent vegetables, whether acid or alkaline, in a large heap, in the warm open air, and prefs them down with an additional weight, if their own be inconfiderable; the middle part of the heap will, in a little time, fpontaneoufly conceive a fmall degree of heat, and pafs fucceffively through the other degrees, till it arrive at a ftate of ebullition, and be perfectly putrefied.

In the fpace of three days, from the firft putting them together, they will yield a heat, perceivable by the hand, equal to that of a human body in a healthy ftate; by the fifth, the heat will be too great for the hand to bear without pain; and, laftly, by the fixth, feventh, or eighth day, the juices will generally appear ready to boil; and fometimes the matter will even flame, and burn away.

By this fpontaneous operation, the vegetable acquires an abominably putrid, ftercoraceous, or cadaverous, tafte and odour; and turns entirely into one foft, fimilar, pulpy mafs, or craffamentum, greatly refembling fœtid human excrements in the fcent, and putrefied flefh in the tafte.

If

If now this fœtid matter, thus obtained, be directly, whilst it remains in its fœtid state, committed to a glass retort, and distilled with proper degrees of fire, there will come over, 1. A water impregnated with an urinous spirit, perfectly like that obtainable from animal subjects, and separable by a fresh distillation slowly made in a tall glass, into elementary water, and a large quantity of pure, white, volatile, dry, alkaline salt, not to be distinguished from animal salts. 2. A volatile, alkaline, oily salt, that shoots into globes. 3. An exceedingly volatile and thick fœtid oil, both which are entirely like those of animals. And, lastly, the remainder, being calcined in an open fire, affords not the least particle of fixed salt; just as if the subject had really been of the animal, and not of the vegetable kingdom.

This process is truly universal, and holds equally in all kinds of vegetables, though ever so different in their nature and virtue.

Experiments have been made in the coldest and most succulent, or watery, plants; such as purslane, sorrel, &c. as well as with the hottest or most acrimonious, such as the spurges, &c. and it was always found to succeed; but that the sooner, as the vegetable employed contained the greater quantity of oil; though with the same phenomena.

It will likewise succeed with dry vegetables, provided they be moistened with water before they are thrown into heaps; and thus we sometimes see, that stacks of hay will spontaneously take fire, and burn away; especially if the hay was not well dried in the making.

The conditions necessary for the putrefaction of vegetables are similar to those required in the putrefaction of animal substances. It is necessary that the organization be impregnated with water; the contact of air is necessary, as is also a certain degree of heat; and for the due effect of this kind of decomposition, the vegetables should be heaped together, and their juices be abundant. In these circumstances, the phenomena of decomposition are as follow: the colour of the vegetable is changed; the green leaves become yellow, the texture becomes lax, and the parts less coherent; the colour of the vegetable itself changes to black or brown; the mass rises, and perceptibly swells up; the heat becomes more intense, and is perceived on approaching the heap; and the fumes which arise have already a smell, which sometimes is not disagreeable; at the same time bubbles arise, and break at the surface of the liquid, when the vegetables are reduced to a magma. This gas is a mixture of nitrogene, hydrogene, and carbonic acid. At this epocha, likewise, an ammoniacal gas is emitted, which is formed in these circumstances: and, in proportion as these appearances diminish, the strong and offensive odour is succeeded by another which is fainter and milder, and the mass becomes dry. The internal part still exhibits the vegetable structure, when the stem is solid, and the fibrous matter has been the predominating principle; and it then constitutes manure or soil. Hence it arises that the herbaceous plants of a loose texture, and abounding in juices, are not capable of forming manure by their decomposition, but are reduced into a brown mass of little consistence, in which neither fibre nor texture are observed; and this is what, for the most part, forms vegetable mould.

Vegetable mould usually constitutes the first covering or stratum of our globe; and in such cases wherein it is discovered at a depth in the earth, there is no doubt but it has been buried by some revolution.

When a vegetable is converted into earth by this tumultuous fermentation, it still retains the remains of the vegetable, mixed and confounded with the other solid earths and metallic products; and by distillation it affords oil, nitrogene gas, and often hydrogene. It may, therefore, be considered as an intermediate substance between crude and organic bodies, which participates of the inertia of the one, and the activity of the other; and which in this state is still subject to an insensible fermentation, that changes its nature still more, and deprives it of all its organic contents. These remains of vegetables, still contained in vegetable earth, serve as food for other plants that may grow in it. The insensible progress of fermentation, and the suction of vegetables, impoverish the vegetable earth, deprive it of all its organic matter, and there remain only the earths and metallic residue which form the stiff poor soils, and ochres when the ferruginous principle is very abundant.

As this muddy earth is a mixture of all the primitive earths, and some of the metals which are the product of vegetation, as well as the oils, the salts, and other products we meet with in it; we may consider it as the residue of vegetable decomposition, as the great agent and means by which nature repairs the continual losses the mineral kingdom undergoes. In this mixture of all the principles the materials of all compounds exist; and these materials are so much the more disposed to enter into combinations, as they are in a more divided and disengaged state. It is in these earths that we find diamonds, quartz-crystals, spars, gypsum, &c. It is in this matrix that the bog ores, or ochreous ores of iron, are formed; and it appears that nature has reserved the impoverished residue of vegetables for the reproduction or reparation of the earthy and metallic substances of the globe, while the organic remains are made to serve as nourishment for the growth of other succeeding vegetables.

Some have taken occasion to apply the process of putrefaction to that of digestion, or the change which the aliment suffers in the human body. (See Digestion.) For the change our vegetable foods undergo in the body, being such as brings them to be of the same nature, and to afford the same principles, with the change induced by putrefaction, is a presumption, that digestion is nothing else. Besides, as we know that neither animal nor vegetable substances can become aliment, without undergoing some degree of putrefaction, many distempers must proceed from a deficiency of this action: the crisis of fevers seems to depend upon it; and even animal heat, according to Dr. Stevenson, does the same.

Now, that the concoction of the humours is nothing else but putrefaction, seems probable from hence, that whenever they are in that state, they are always more fluid, and fitter to pass through the smaller vessels, where they stagnated before. Again, the offensiveness of the sweats, or other excretions consequent on a crisis, is likewise a sure sign of a high degree of corruption. The time of resolution or putrefaction depends on the degree of heat, the habit of the patient, and on the part obstructed. Resolution is the putrefaction of the impacted humour only, but suppuration implies a corruption of the vessels also. This manner of speaking, indeed, has been disused, from the prejudice that nothing was putrid but what was offensively so; whereas, in fact, every fibre becoming more tender, and humour thinner, may be considered as putrid in some degree, whether the change tends to the better health, or to the destruction of the person, or whether it becomes grateful or offensive to the senses.

Mr. Boyle has used the words *fermentation* and *putrefaction* of the blood promiscuously, in his Treatise on the Human Blood. Stahl and other celebrated chemists likewise use the term putrid *ferment*; which see.

It

It is, therefore, juſtly obſerved by lord Bacon (Nat. Hiſt. cent. iv.) that an enquiry into the means of preventing or ſtaying putrefaction is of excellent uſe in phyſic. Sir John Pringle has made many curious experiments with a view of determining the power of certain ſubſtances to promote or to prevent putrefaction, together with remarks on this ſubject, which are publiſhed in the Phil. Tranſ. vol. xlvi. p. 480. 525. 550, and by way of appendix to his Obſervations on the Diſeaſes of the Army. From the experiments of this learned and judicious phyſician, it appears, that ſalts of every kind, whether acid, alkaline, or neutral, fixed or volatile, as well as the aſtringent and gummy-reſinous part of vegetables, all of them reſiſt and moſt of them correct putrefaction; and he purſued this branch of enquiry ſo far as to enable him to form a table ſhewing the comparative antiſeptic power of the ſeveral ſubſtances, that of ſea-ſalt being the ſtandard. See this table under the article ANTISEPTIC.

Of all reſinous ſubſtances, he found that camphor reſiſted putrefaction moſt powerfully; its antiſeptic power being three hundred times greater than that of ſea-ſalt. Decoctions of wheat, barley, and other farinaceous grains, checked putrefaction, by becoming ſour. He alſo made experiments to diſcover the effects of mixing vegetable with animal matters.

Two drams of raw beef, as much bread, and an ounce of water, being beat to the conſiſtence of pap, and expoſed to 90° of heat, according to Fahrenheit's thermometer, began to ferment in a few hours, and continued in a fermentation two days. When it began to ferment and ſwell, the putrefaction had begun; and in a few hours afterwards the ſmell was offenſive. Next day the putrid ſmell ceaſed, and an acid taſte and ſmell ſucceeded. Freſh alimentary vegetables, as ſpinach, aſparagus, ſcurvy-graſs, produced ſimilar effects as bread on fleſh, but in a weaker degree. From ſeveral other experiments, he found that animal ſubſtances excite the fermentation of vegetable ſubſtances; and that the latter ſubſtances correct the putreſcency of the former.

By adding ſaliva to a ſimilar mixture of fleſh, bread, and water, the fermentation was retarded, moderated, but rendered of twice the uſual duration, and the acid produced at laſt was weaker than when no ſaliva was uſed.

By adding an oily ſubſtance to the common mixture of fleſh, bread, and water, a ſtronger fermentation was produced, which could not be moderated by the quantity of ſaliva uſed in the former experiment, till ſome fixed alkaline ſalt was added, which ſalt was found, without ſaliva, to ſtop ſuddenly very high fermentations.

He did not find that ſmall quantities of the following ſalts, ſal ammoniac, nitre, vitriolated tartar, ſal diureticus, ſalt of hartſhorn, ſalt of wormwood, were ſeptic, as ſmall quantities of ſea-ſalt were.

Sugar was found to reſiſt putrefaction at firſt, as other ſalts do, and alſo to check the putrefaction after it had begun by its own fermentative quality, like bread and other fermentative vegetables.

Lime-water made ſome ſmall reſiſtance to putrefaction.

Port-wine, ſmall beer, infuſions of bitter vegetables, of bark, and the juice of antiſcorbutic plants, retarded the fermentation of mixtures of fleſh and bread. But an unſtrained decoction of bark conſiderably increaſed that fermentation.

Lime-water neither retarded nor haſtened the fermentation of ſuch a mixture; but when the fermentation ceaſed, the liquor was neither putrid nor acid, but ſmelt agreeably.

Fleſh pounded in a mortar was found to ferment ſooner than that which had not been bruiſed.

The tough inflammatory cruſt of blood was found to be moſt putreſcent, next to which the craſſamentum, or red coagulated maſs, and laſtly the ſerum.

Charcoal is a powerful antiſeptic: hence all ſorts of glaſs-veſſels and other utenſils may be purified from long retained ſmells of every kind, in the eaſieſt and moſt perfect manner, by rinſing them out well with charcoal powder, after the groſſer impurities have been ſcowered off with ſand and potaſh. Rubbing the teeth and waſhing out the mouth with fine charcoal powder will render the teeth beautifully white, and the breath perfectly ſweet, when an offenſive breath has been owing to a ſcorbutic diſpoſition of the gums. (Crell's Journal, vol. ii.) Meat alſo, which is a little tainted with putridity, may at once be made ſweet by charcoal; and it has been ſaid, that common raw ſpirits agitated with charcoal will be deprived of their bad flavour, but they are apt to reſume their old flavour, if kept in the caſk only a few weeks.

The experiments of the author of the "Eſſai pour ſervir à l'Hiſtoire de la Putrefaction," ſhew that metallic ſalts, reſinous powders, extracts of bark and opium, are very powerfully antiſeptic, and that ſalts with earthy baſes are leſs antiſeptic than any other ſalts.

The ſame ingenious phyſician made ſome attempts towards the ſweetening of corrupted fleſh by means of mild ſubſtances. For this purpoſe he put a piece of putrid fleſh into an infuſion of chamomile flowers, which was renewed twice or thrice in as many days, and its ſweetneſs and firm texture were recovered. Several pieces of putrid fleſh were alſo ſweetened by repeated affuſions of a ſtrong decoction of the bark; and he conſtantly obſerved, that not only the corrupted ſmell was removed, but a firmneſs reſtored to the fibres. The corrupt yolk of an egg, diluted with water, was ſweetened by mixing it with a ſtrong infuſion of chamomile flowers. He found alſo that decoctions of wormwood, of the bark, and infuſions of chamomile flowers, and of ſnake-root, preſerved yolks of eggs for a longer time than water, even with the addition of a conſiderable quantity of ſea-ſalt; and that they were preſerved better by ſalt of hartſhorn than by four times the weight of ſea-ſalt. Ox-gall was kept for ſome time from putrefaction by ſmall quantities of ley of tartar, ſpirit of hartſhorn, crude ſal ammoniac, and the ſaline mixture; and ſtill longer by a decoction of wormwood, infuſion of chamomile flowers and of ſnake-root, and by ſolutions of myrrh, camphor, and ſalt of amber. The ſerum of human blood was preſerved by a decoction of the bark, and an infuſion of ſnake-root, as effectually as fleſh. See ANTISEPTIC.

For an account of ſir John Pringle's experiments and obſervations with reſpect to thoſe ſubjects that haſten or promote putrefaction, ſee SEPTICS.

Dr. Macbride's experiments confirm many of thoſe above related, eſpecially thoſe which ſhew that the fermentation of vegetable ſubſtances is increaſed by a mixture of animal or putreſcent matter, that the putreſcency of the latter is corrected by the fermentative quality of the former; and that the putrefaction and fermentation of mixtures of animal and vegetable ſubſtances were accelerated by additions of abſorbent earths and of Peruvian bark. He alſo found, that although unburnt calcareous earths were ſeptic, quicklime and lime-water prevented putrefaction, but that they deſtroyed or diſſolved the texture of fleſh.

From his experiments we learn alſo, that acids, even when greatly lowered, have a ſtrong degree of power to reſiſt putrefaction, and alſo to correct it; but that they deſtroy the texture of the ſubſtance whoſe ſoundneſs they were ſuppoſed to reſtore; that ſalts in general, by a property which is common to them all as ſalts, have the ſame power,

power, but that they exceed the acids in their efficacy for correcting putrefaction; that fermenting and effervescent mixtures are the most powerful of all known antiseptics; and, in general, that whatsoever hath a power to restrain the escape of the fixed air, or hinder the intestine motion, must of course prevent putrefaction; and that fixed air, when transferred from a sound body to one that is putrid, appears to restore to that body the principle which has been destroyed or lost.

Dr. Macbride objects against the administration of acids in putrid diseases, for the following reasons; because, if they came unchanged to the absorbent vessels, they would not admit of them, and if they did, they would be dangerous, and they are quite changed before they leave the primæ viæ. Dr. Crell (Phil. Trans. vol. lxi. part i. p. 340.) has replied to this reasoning, and proposed experiments to prove, that acids, though changed in the alimentary canal so far as not to effervesce with alkalis, may, notwithstanding, check putrefaction, and, therefore, that their use is of great consequence, and ought not to be omitted in putrid diseases.

With regard to the exhibition of alkalis, Dr. Macbride observes, that the point is not yet satisfactorily settled. There can be no doubt of their power to resist and correct putrefaction in dead bodies; but whether, upon the presumption of this virtue, they can be given with propriety as antiseptics, he adds, is not so clear. Dr. Crell affirms, that they can never be used in living bodies as antiseptics; for, laying aside their stimulating quality, which must prevent their use in most of the putrid diseases, they would, he apprehends, increase the morbific matter, by being intimately mixed by circulation with phlogistic matter, which they find abundantly in such bodies. Astringents, says Dr. Macbride, prevent putrefaction very powerfully, but they have not the least degree of efficacy in correcting it; and as antiseptics, they can be of importance only in those cases where, from extreme relaxation and resolution of the solids, the dissolved fluids are suffered to transude, and either form spots of different hues, or run off by actual hæmorhage; and he apprehends, that acids act in those cases where they have been administered with success, merely as astringents. The antiseptic virtue of the gummy-resinous vegetables, judging of their effect by that of the bark, appears to depend on their fermenting in the body, and parting with fixed air in the course of their fermentation, and throwing a great quantity of it into the blood; and attending to the things that prevent putrefaction in living bodies, we shall find that the dependence is on the quantity of air. Thus, vegetable food prevents the putrefactive diathesis; and to the frequent use of fresh vegetables and sugar, in the diet of the European nations, it is owing that putrid diseases or plagues are now so uncommon. And what proves almost to a demonstration the antiseptic power of the fermentable substances, is the cure of the sea-scurvy.

Dr. Crell disagrees with the opinion of Dr. Macbride, that putrid diseases may be cured with fermentable substances only; nor is he convinced that putrefaction depends only on the loss of fixed air. This, he apprehends, is an effect rather than the cause of putrefaction. We shall here only add, that Dr. Macbride recommends, in the putrid yellow fever of the West Indies, to give the patient repeated doses of the alkaline salts, in fresh lime-juice, or the like, and to let it be swallowed during the effervescence; and to order the patient's drink to be somewhat of the highly fermentable kind; such as the juice of the green sugar-cane, diluted and acidulated with some of the recent sour juices. The natives on the coast of Africa give in fevers of this kind, with good success, a drink prepared by macerating in water a fruit of the plum kind, that grows there in great plenty. He adds, that by throwing in such a quantity of antiseptic vapour as would be furnished from this kind of materials, the putrefactive acrimony, which at first seems chiefly to affect the biliary system, might be corrected and saturated. See on the subject of this article Dr. Macbride's Essays, 1776, passim.

Putrefaction, in *Physiology*, the spontaneous changes which animal substances undergo, when deprived of life. See Death.

Putrefaction, in *Agriculture*. It is by means of putrefaction, as stated under its appropriate article, that various substances and bodies are decomposed, reduced, and brought into the state proper for being applied to lands for the support of crops; but this is more fully explained, in speaking of the nature of the different materials that are capable of being made use of in ameliorating land for the growth of crops. See Manure.

Putrefaction *of Water*. It is said to be the peculiar quality of the Thames water, that it will stink and yet be wholesome; and after this will recover itself again. Many sailors have been obliged to drink it stinking, so that they held their noses while they poured it down their throats, yet no sickness ensued from it. It generates a sort of spirit also in this stinking state, which will take fire at the approach of a lighted candle, as if spirit of wine were touched by the same.

It appears from the article Putrefaction, that though a volatile alkali may be obtained from putrid substances by distillation, such substances must not be suffered to remain too long before they are distilled, unless they are kept in close vessels; because the volatile alkali, which is the offspring of putrefaction, is dissipated as fast as it is generated, insomuch that, at length, nothing is left behind but an insipid water, or a solid matter, being an earth similar to common mould. It is in this way, says Dr. Macbride, that stinking water, after some time, becomes sweet: the volatile alkali, generated by the putrefaction of the animal and vegetable substances at first contained in the water, being, after a while, entirely dissipated, leaves the remainder without any disagreeable smell.

Putrid water is immediately deprived of its offensive smell by charcoal. If putrid water be agitated with a small quantity of magnesia, it will lose its bad taste and smell in a few minutes. See Crell's Journal, and Proust, Journal de Physique.

A method of preserving water free from putrefaction was some years since proposed by Dr. Alston. It consisted in adding a quantity of lime to every cask of water; and as lime is known to have a strong antiseptic property, water, as long as it retains the impregnation of lime, never putrefies.

In order to free the water, at the time of using it, from the lime, Dr. Alston proposes the precipitation of the latter by throwing a quantity of magnesia alba, on this principle, that as lime-stone is rendered soluble in water by the deprivation of its fixed air, and has a greater affinity with that air than magnesia has, the particles of quicklime dissolved in the water would attract the air from the magnesia, and thereby becoming no longer soluble, would fall to the bottom, and leave the water tasteless and fit for economical uses. See Lime-*water* and Magnesia.

The expence, however, attending this process prevented the execution of the proposal. Mr. Henry has not long ago suggested a cheap and easily practicable method of precipitating the lime, and thus of restoring the water to its original taste. The following is a short sketch of the author's process. To preserve

preserve the water from putrefaction, two pounds of good quicklime are directed to be added to each cask of water of a hundred and twenty gallons. To free the water afterwards from the lime with which it has been impregnated, it is to be drawn off into a strong cask, containing about sixty gallons, with an aperture at one end large enough to admit a vessel, which is to be let down into it by means of strings, and which contains a proper quantity of effervescent materials, that is, of marble or chalk, and vitriolic acid. Eight ounces of mild calcareous earth, and six ounces of strong vitriolic acid, will be sufficient for sixty gallons of lime-water. The mouth of this last vessel is to be stopped with a tubulated stopper, through which the fixed air, let loose from the marble, passes up through the body of the water. The lime is thus rendered insoluble, and is soon precipitated in the form of an impalpable powder of chalk; the water being thus restored to the same state of purity as when it was first shipped on board; or, as Mr. Henry believes, to a state of still greater purity; several hard waters having, in consequence of this process, been rendered as soft as rain water, and freed from different impregnation. For farther particulars, and the description and drawing of an apparatus for this operation, see Henry's Account of a Method of preserving Water at Sea, &c. p. 10, &c. 1781.

PUTRESCENT Matters, in *Agriculture*, such substances as are in a state of putridity. Various materials of this kind are capable of being made use of by the farmer. It has been lately suggested by Dr. Hunter, of York, in a paper in the third volume of the Farmer's Magazine, that different materials of this nature may form a substitute for the folding of sheep.

The trouble and expence of keeping a flock of sheep for the purpose of folding, may probably be avoided by forming large ponds, so constructed as to receive and hold water. Into these ponds let drains from the stables, cow-houses, ox-stalls, pigeon and wash-houses be directed; and, in order to enrich the water, let all kinds of vegetable and animal substances be thrown in, particularly the contents of the necessaries and slaughter-house. It is presumed, that this putrid water, when put upon the land by means of water-carts, will prove as beneficial as a flock of sheep kept for the express purpose of folding; and where no sheep are kept for that purpose, such will prove an excellent manure for meadow land. A pond of sixty feet diameter, by six feet deep, which will contain upwards of 700 hogsheads of water and putrescent bodies, may be equal in its effects to a considerable fold of sheep. The putrescency of the water may be greatly increased, by occasionally supplying the ponds with the refuse of fish, and sea-weed, where they can be conveniently procured; and in all places within a reasonable distance of sea-ports, where ships are employed in the Greenland fishery, the farmer will find a seasonable supply of putrescent matter by the purchase of the whale blubber, after the oil has been taken from it. Such is the strength of the last named substance, that it is well worth the farmer's while to be at the expence of carrying it in casks to a considerable distance, for the purpose of giving vigour to his compost dunghills. The ancients were scrupulously nice in the formation of their dunghills; and it is a reproach to the present race of farmers, that so material a branch of their business should, at this day, be so imperfectly known or attended to. And in many large cities, and especially Edinburgh, it would be a great improvement, if a well-constructed reservoir was made to receive the excrementitious matter, the bason being occasionally replenished with earth and small rubbish. In this manner, many thousands of loads of rich manure might be saved from the sea, to which place the excrementitious matters are upon their passage.

PUTRID, Putridus, something rotten, or putrefied. See Putrefaction.

Thus we say, putrid flesh; a putrid humour: putrid limbs, *i. e.* mortified ones, are to be cut off.

Putrid *Diseases*. See Putrid *Fever*, &c.

Putrid *Ferment*. See Ferment.

Putrid *Fever*, *&c.* in *Medicine*, an epithet originating in the chemical school of physic, in which the true operations and phenomena of *life* were mistaken for the fermentations and decompositions of the laboratory. This mistake was probably the result of the offensive smell, and actual putrefactive odour of some of the discharges from the living body, in the last stages of severe fevers; but farther observation has demonstrated that, however the excretions may undergo the process of putrefaction after they are thrown out of the living system, no degree of putrefaction can exist for a moment in the circulating blood, without occasioning instant death.

The symptoms which were formerly ascribed to putrefaction, but which are now believed to originate from a great deficiency of the vital or nervous power derived from the brain and nervous system, are such as occur in typhus gravior, the hospital and gaol fever, and in the worst cases of dysentery, and small-pox; among which are a black tongue and mouth, extreme prostration of strength, fœtid evacuations from the stomach, bowels, and bladder, hæmorrhages, petechiæ, and purple blotches, &c. See Fever, and Typhus.

Putrid *Ulcer*. See Ulcer.

PUTRINE, in *Geography*, a town of Prussia, in Oberland; six miles W. of Passenheim.

PUTT, in *Rural Economy*, a provincial word, applied commonly in some districts to the mole-hill. Also, sometimes to animals which put or thrust with their horns.

Putt, or *Pitne*, in *Geography*, a town of Anterior Pomerania; eight miles S.W. of Stralsund.

PUTTAN-SUMNAUT, a town of Hindoostan, in Guzerat; near which was a famous pagoda, much venerated and frequented by devotees from all parts of the country. In the year 1002 this town and temple were taken by Mahmood, king of Ghizni, and plundered of their great wealth. In the temple was found a statue, in which, on being broken, was found a vast quantity of precious stones. The Hindoos believed that the souls of deceased persons came to this place to be transferred to other bodies; 80 miles S. of Noanagur. N. lat. 21° 1'. E. long. 69° 40'.

PUTTEN, Vander, Henry, in *Biography*, was born at Vandloo in 1574: after studying at the universities of the Low Countries, he visited Italy, and for a considerable time was professor of rhetoric at Milan, where he took the degree of doctor of laws. He was nominated historiographer to his Catholic majesty, and received the honour of citizenship at Rome. In 1606 he was invited to the chair of Lipsius, who had been his tutor. He was also made a counsellor to the archduke Albert, and entrusted with the government of the citadel of Louvain. When a truce was negotiating between the Dutch and the king of Spain, in 1633, he published a work, entitled "Statera Belli et Pacis," in which he shewed how important a peace would be to the Spanish Netherlands. This work gave great offence, and the author had nearly experienced the usual fate of those who counsel pacific measures, at a time when passion, prejudice, and interest, urge the continuance of war. He died at Louvain in 1646, age 72. Besides his "Statera," mentioned above, he published "Historia Insubrica;" "Orchestra

"Orcheftra Burgundica;" "Theatrum Hiftoricum Imperatorum;" "Comus, feu de Luxu;" "De ufu Bibliothecæ," with a catalogue of the Ambrofian library; befides feveral tracts relative to claffical antiquities, printed among the collections of Grævius and Gronovius. Moreri. Bayle.

Putten, in *Geography*, a fmall ifland of Holland, in the Meufe, E. of Voorn.

PUTTERAHEE, a town of Hindooftan, in the circar of Gohud; 27 miles E.N.E. of Gohud.

PUTTOCKS, or Puttock-*Shrouds*, otherwife called *futtock* or *foot-hook fhrouds*, in a *Ship*, are fmall fhrouds which go from the fhrouds of the main-maft, fore-maft, and mizen-maft, to the top-maft fhrouds; and if there be any top-gallant maft, there are puttocks to go from the top-maft fhrouds into thefe. Thefe puttocks are at the bottom feized to a ftaff, or to fome rope which is feized to a plate of iron, or to a dead-man's eye, to which the laniards of the fore-maft fhrouds come. See Shrouds.

PUTTY fometimes denotes a white powder of lead and tin calcined together, in the proportion of two parts of lead to one of tin; ufed in polifhing, and giving the laft glofs to works of iron, fteel, ftone, and glafs. This is alfo the bafis of white enamels, and glazings for earthen-ware.

Putty is alfo ufed to denote fpodium.

Putty, in its popular fenfe, denotes a kind of pafte, compounded of whiting, with or without a little white lead, and linfeed oil, beaten together to the confiftence of a tough dough; ufed by glaziers for faftening the fquares of glafs in fafh-windows, &c. and by painters, to ftop up the crevices and clefts in timber and wainfcot, to prevent the wet from getting in, and ruining the work.

PUTTYRAM, in *Geography*, a town of Hindooftan, in Bengal; 18 miles E.S.E. of Dinagepour.

PUTUAY, a fmall ifland on the coaft of Bengal. N. lat. 22° 41′. E. long. 89° 28′.

PUTUMAYO, a river of South America, which rifes about 80 miles S. of Popayan, purfues an eaftern courfe, inclining to the fouth, about 300 miles, and after being joined by a branch of the Caquet, takes the name of Ica, and running S.E. about 200 miles, joins the river of the Amazons in S. lat. 3° 30′. W. long. 50° 40′.—Alfo, a town of South America, in the government of Popayan, on a river of the fame name; 50 miles E. of Pafto.

PUTURA, a cuftom claimed by the keepers of forefts, and fometimes by bailiffs of hundreds, to take man's meat, horfe's meat, and dog's meat, of the tenants and inhabitants, gratis, within the perambulation of the foreft, hundred, &c.

"Johannes clamat unam puturam in prioratu de Penevoftham, qui eft quædam cella abbatiæ de Evefham, pro fe & miniftris, equis, & garcionibus fuis, per unum diem & duas noctes, de tribus feptimanis, in tres feptimanas, *viz.* de victualibus, ut & efculentis & potulentis, ad collas prioratus prædicti indebite." Placit. apud Præfton. 17 Edw. III.

This cuftom, within the liberty of Knarefburg, was long fince turned into the payment of four-pence, *pro putura*.

The land fubject to this fervice is called *terra puturata*. The learned Somner has erred in his expofition of this word.

PUTYAJURY, in *Geography*, a town of Bengal; 30 miles S.S.W. of Silhet.

PUTZIG. See Pauzk.

PUVIGLIO, a town of the duchy of Parma; nine miles N.E. of Parma.

PUWAKHAGA, in *Botany*, the name by which fome authors call the faufel-tree, of whofe fruit the expreffed juice called terra Japonica, or Japan earth, is made.

PUXUANAIRO, in *Geography*, a town of Mexico, in the province of Mechoacan; 25 miles N.W. of Mechoacan.

PUY, Peter du, in *Biography*, the third fon of Claude du Puy, a magiftrate in the parliament of Paris, was born in that city in 1582, and was educated with great care under his father. While a youth, he made extraordinary proficiency in literature, and ftill further improved himfelf by a journey to Holland, whither he accompanied the French ambaffador. After his return he laboured with great affiduity in afcertaining the rights of the crown of France over fome of the neighbouring diftricts, and for that purpofe was indefatigable in his examination o. ancient charters, and thereby acquired a profound knowledge of French hiftory. The reward of this, and other labours of the fame fort, were the places of king's counfellor, and keeper of the royal library, in both of which he was diftinguifhed by his patriotifm and love of letters. His works were numerous and valuable. In almoft all of them he aims at repreffing the ecclefiaftical authority, and the claims of the fee of Rome; hence they were not well received at the papal court. They are, however, faid to contain a rich treafure of facts relative to all the matters on which he treats. He died at Paris in 1651, at the age of 69, and his life was written by his intimate friend Nicholas Rigault. Some of his writings are as follow: "Preuves des Libertès de l'Eglife Gallicane;" "Hiftoire Veritable de la Condemnation de l'Ordre des Templiers;" "Traité de la Loi Salique;" "Du Concordât de Bologne entre le Pape Léon X., et le Roi Francis I;" "Apologie de l'Hiftoire de M. le Préfident de Thou." He had a brother, James, prior of St. Sauveur, who became keeper of the king's library after the death of Peter, whom he affifted in all his works, of the greater part of which he was the publifher. He died in 1656, leaving behind him a high character for learning and probity. Another brother, Chriftopher du Puy, was prothonotary to the cardinal de Joyeufe, and by his remonftrances he prevented the congregation of the Index from putting the firft of De Thou's hiftory in the lift of heretical books. He was king's almoner, and, while attached to cardinal du Perron, he made a collection entitled "Perroniana." He became a Carthufian, and died at Rome in 1554, proctor-general of his order.

Puy, Louis du, a man of letters, was born at Clarey, in Bugey, in 1709; he ftudied in the college of Lyons, and came to Paris in 1732. He was for a confiderable time principal editor of the Journal des Sçavans, and during thirty years enriched this collection with a great number of critical differtations. He was well verfed in the learned languages, and in the mathematics, and acquired an extenfive knowledge of hiftory and antiquities. The prince of Soubife entrufted him with the management of his library, and by his care it was rendered one of the moft valuable in the metropolis. In 1753 he was nominated fecretary to the Academy of Infcriptions, in which fituation he pronounced the eulogies of twelve of his affociates, and edited from the 36th to the 41ft vols. of its memoirs. He died in 1795. He was author of "Obfervations on infinitely fmall Quantities, and the metaphyfical Principles of Geometry," inferted in the Journal des Sçavans for 1759; "A Tranflation of four Tragedies of Sophocles," 1762; "A Tranflation of the Greek Fragments of Anthemius on mechanical Paradoxes, with Notes;" fome memoirs on the Roman coin, the filver denier of Charlemagne, and other antiquarian and literary fubjects. Du Puy was highly efteemed for ftrict probity,

 fincerity,

ſincerity, and an obliging diſpoſition, which diſplayed itſelf in uſeful advice and information to thoſe who conſulted him on literary topics.

Puy, *Mademoiſelle du*, a celebrated performer on the harp, who had acquired a conſiderable fortune by the exerciſe of her talents in different parts of Europe. She died at Paris in 1777, and made a will that ſeemed dictated by inſanity. Among other articles, ſhe ordered that no blind, lame, or deformed perſon ſhould attend her funeral. She ordered that her houſe ſhould be let to none but nobility. She left a large piece of ground to be formed into a public garden, upon condition that no ſtunted trees ſhould be allowed a place in it. And laſtly, ſhe bequeathed an annuity for the maintenance of cats, of which ſhe was fond, and for a perſon to take care of them. But the annuity depended wholly on the life of the cats. The harp upon which ſhe had acquired her poſſeſſions, was left to a blind harper in the Hoſpital des Quinze Vingts, who played tolerably well on many different inſtruments. Great pains were taken to ſet this will aſide, but without effect. It was declared valid by law, and obliged to be executed. Laborde.

Puy, *Le*, in *Geography*, a town of France, and principal place of a diſtrict, in the department of the Upper Loire, and capital of the department, ſituated on a ſmall river near the Loire; before the revolution, the ſee of a biſhop; a place of conſiderable trade, eſpecially in lace; 38 miles S.W. of Lyons. The place contains 15,915 inhabitants, in two cantons, the one containing 13,396, and the other 14,100, on an extent of 185 kiliometres, in 16 communes. N. lat. 45° 2′. E. long. 3° 57′.

Puy-*Laurens*, a town of France, in the department of the Tarn, and chief place of a canton, in the diſtrict of Lavaur; 12 miles S.E. of Lavaur. This place contains 5648, and the canton 9817 inhabitants, on a territory of 125 kiliometres, in 9 communes.

Puy-*l'Evêque*, a town of France, in the department of the Lot, and chief place of a canton, in the diſtrict of Cahors; 14 miles W. of Cahors. The place contains 2082, and the canton 12,127 inhabitants, on a territory of 285 kiliometres, in 11 communes.

Puy-*Mirol*, a town of France, in the department of the Lot and Garonne, and chief place of a canton, in the diſtrict of Agen. The place contains 1263, and the canton 8072 inhabitants, on a territory of 125 kiliometres, in 11 communes.

Puy *de Belliard*, a town of France, in the department of La Vendée; 18 miles N.W. of Fontenay le Comte.

Puy *Caſquier*, a town of France, in the department of the Gers; nine miles N.E. of Auch.

Puy *de Dome*, a mountain of France, near Clermont en Ferrand, 810 toiſes in height.

Puy *de Dome* is alſo the name of one of the nine departments of the central region of France, ſo called from the mountain that is ſituated in it; it is bounded on the N. by the department of the Allier, on the E. by that of the Rhône and Loire, on the S. by the departments of the Cantal and Upper Loire, and on the W. by thoſe of the Correze and Creuſe; formerly Lower Auvergne, in N. lat. 45° 40′, containing 8450 kiliometres, or about 35 French leagues in length, and 22 in breadth, or 447 ſquare leagues, and 508,444 inhabitants; divided into five diſtricts, *viz.* Riom, including 126,640; Thiers, 61,530; Ambert, 73,535; Clermont, 158,449; and Iſſoire, 88,290 inhabitants; 50 cantons, and 438 communes. The circles, according to Haſſenfratz, are 8, the cantons 71, and the population 516,593. Its capital is Clermont. The general total of its contributions in the 11th year of the new French era, was eſtimated at 3,656,547 francs; and its expences for adminiſtration, juſticiary, and for public inſtruction, at 374,681 francs, 37 cents. The ſoil of this department, diverſified with hills and plains, is remarkably fertile, producing abundantly grain, wine, fruits, hemp, and paſtures. It has mines of ſilver and lead, mineral ſprings, &c.

Puy *le Garde*, a town of France, in the department of the Lot; 15 miles N.E. of Montauban.

Puy *Guillaume*, a town of France, in the department of the Puy de Dome; eight miles N.E. of Lezoux.

Puy *Laurens*, a town of France, in the department of the Aude; ſeven miles S.E. of Quillan.

Puy *Marin*, a town of France, in the department of the Upper Garonne; 17 miles N. of St. Gaudens.

Puy *Mirlan*, a town of France, in the department of the Lot and Garonne; ſix miles E. of Marmande.

Puy *Moiſſon*, a town of France, in the department of the Lower Alps; 15 miles S. of Digne.

Puy *Notre Dame*, or *Puy en Anjou*, a town of France, in the department of the Mayne and Loire; 10 miles S.W. of Saumur.

Puy *de la Poix*, a town of France, in the department of the Puy de Dome; 18 miles E. of Clermont.

Puy *la Roque*, a town of France, in the department of the Lot; 17 miles N.E. of Montauban.

Puy *St. Martin*, a town of France, in the department of the Drôme; 11 miles N.E. of Montelimart.

Puy *Val d'Or*, a town of France, in the department of the Eaſtern Pyrenées; 10 miles N.W. of Montlouis.

PUYA, in *Botany*, the vulgar name, in Chili, of a plant, which is figured in Feuillée, v. 3. 59. t. 39, and adopted as a genus, after Molina, in Juſſieu's Genera 447, under the above barbarous appellation, with the following character.

"Calyx in ſix deep ſegments; the three innermoſt largeſt, and vaulted. Stamens ſix, inſerted into the lower part of the calyx; their filaments formed like a ſcale at the baſe, and bearing honey. Germen ſuperior, triangular; (ſtyle and ſtigma unknown). Capſule of three cells, with numerous minute ſeeds, (doubtful whether furniſhed with down.")

Feuillée's deſcription is to the following effect. The roots are fibrous, throwing up ſeveral ſtems, about nine feet high, as thick as a man's body at the bottom, where they are clothed with the ſcaly imbricated veſtiges of old leaves, above which ſtand the numerous leaves of the preſent year. Theſe are three or four feet long, and about two inches wide, reſembling the foliage of the Pine-apple, their margins being fringed with very ſharp hooked prickles, five lines long, and about an inch and a half aſunder; the ſurface of the leaves is ſmooth, ſhining, of a fine bright green. The Indians make uſe of theſe prickles as fiſh-hooks. The part of the ſtem above the leaves is round, two inches or more in thickneſs; of a blueiſh-green externally; white and watery within, clothed with very ſhort, alternate, claſping leaves, or ſcales. The ſummit conſiſts of a large pyramid of flowering branches, or ſpikes, the lowermoſt a foot long; all clothed with ſimilar ſcales, or bracteas, each of which is accompanied by a ſeſſile axillary flower. Each flower is compoſed of ſix leaves, three large and three ſmall, in a double row. The latter are three quarters of an inch long, (Feuillée ſays, apparently by miſtake, three inches,) and three lines and a half broad, covered with minute white down: the three larger are of a greeniſh-yellow, two inches and a half long, and nine lines broad, terminating like a Gothic arcade. The flowers roll up ſpirally as they fade. Six ſtamens ſpring from the bottom of each flower, ſurrounding a triangular piſtil, which extends beyond them, and becomes

a fruit

a fruit of three cells, filled with an infinite number of seeds. Feuillée met with several specimens of this plant in the kingdom of Chili. He refers it to his genus of *Renealmia*, the *Tillandsia* of Linnæus. Jussieu justly suspects its being the same genus with l'Heritier's PITCAIRNIA, see that article; of which therefore the plant in question may be presumed to constitute an additional species to the four we have described; agreeing most with *P. bracteata* in habit, size and colour, but differing in having more spinous leaves, as well as a more compound inflorescence.

The reader will observe that Jussieu, according to the principles he had assumed, calls the whole integument of the flower a calyx, while we follow other writers in taking the three inner parts for petals; a measure justified, if we mistake not, by their habit, and mode of withering. The little differences respecting the scales or nectaries may easily be reconciled.

PUYCERDA, in *Geography*, a town of Spain, in Catalonia, and capital of the county of Cerdagne, surrounded with walls and bastions, and defended by a castle; 19 miles E.N.E. of Urgel. N. lat. 42° 30′. E. long. 1° 48′.

PUYO, a town of France, in the department of the Landes; nine miles S.W. of Aire.

PUYS, a term used for the poles with which the keels on the Tyne river are stowed along.

PUYSEGUR, JAMES DE CHASTENET, *Lord of*, in *Biography*, lieutenant-general under Lewis XIII. and XIV., was born in 1600. He entered the army at the age of seventeen, and served, without intermission, during forty-three years. He was present at above thirty battles, and one hundred and twenty sieges, without ever having been sick or received a wound, but he had not the good fortune to rise in his profession, being more zealous for the king's service, than complaisant to the ministers. He drew up "Memoirs," comprising the period from 1617 to 1658, in which are contained various remarkable particulars relative to the campaigns in which he served, with useful military instructions. They were printed at Paris and Amsterdam in 1690, 2 vols. 12mo. under the inspection of Du Chesne, historiographer of France, and they have the character of narrating with freedom and fidelity. He died at his country seat in 1682. Moreri.

PUYSEGUR, JAMES DE CHATELET, *Marquis de*, was son of the preceding, born at Paris in 1655, and entered into the army under his father, and gradually rose to the post of commander-in-chief in the French Netherlands, and finally, to the still more important one of a marshal of France in 1734. He died at Paris in the year 1743, at the age of 88. He was author of a work "On the Art-Military," published by his only son the marquis of Puysegur. Moreri.

PUZZALO, in *Geography*, a town of the island of Sicily, in the valley of Noto, near the S. coast of the island; 12 miles S.W. of Noto.

PUZZLING BAY, a bay in the straits of Magellan, on the coast of Patagonia. N. lat. 53° 35′. W. long. 74° 28′.

PUZZOLANA. See POZZOLANA, and *Calcareous* CEMENT.

PUZZUOLI, in *Geography*. See POZZUOLI.

PWLLHELI, a borough, market, and sea-port town in the parish of Denio, cwmmwd of Cannologion, cantref of Lleyn, now called the hundred of Gyfflogion, county of Caernarvon, South Wales, is situated on the south side of the promontory of Lleyn, in St. George's Channel, at the distance of 27 miles S.S.W. from Caernarvon, and 243½ miles W.N.W. from London. This town consists chiefly of a single street, running parallel to the shore. It was constituted a free borough by Edward the Black Prince, at the request of Nigel de Lohareyn, and had its privileges confirmed by king Edward III. The government is vested in a mayor, recorder, and two bailiffs, who have the powers of justices. The market days here are Wednesday and Saturday, weekly; and there are besides six annual fairs. This port has a considerable trade; and upwards of eighty ships, of different burthens, belong to it. Along the coast to Bardsea island, an extensive and valuable herring fishery has been lately established. The harbour is good, and well sheltered from the winds; and the bay, to which the town gives name, affords excellent anchorage ground. Pwllheli is one of the contributary boroughs with Caernarvon, in returning one member to parliament, and is likewise the seat of the petty sessions for the district of Lleyn, which extends about twenty-two miles in length, and from three to ten in breadth, projecting into the sea in a manner similar to the county of Cornwall. According to the parliamentary returns of 1811, the parish contains 312 houses, and 1383 inhabitants, of which number, above one-half are resident in the town of Pwllheli.

At the distance of five miles from this town is Carn-Madryn, a strong fortress, which formerly belonged to the sons of Owen Gwynedd. The bottom, sides, and top are filled with cells, varying in size and shape, many of which are still nearly entire. Close to the sea-coast is an entrenchment, called Dinas Dinlle, which constitutes an object of great attraction from the road to Caernarvon by Clynnog Fawr, a neat romantic village, boasting one of the largest and handsomest churches in Wales. Near it is the valley called Nant-y-Gwrtheyrn, or the valley of Vortigern, where that prince is said to have concealed himself, to avoid the persecution of his subjects. It is bounded on two sides by stony steps, only productive of heath and stunted gorse, and on a third by a tremendous precipice. The only opening to this secluded spot is towards the sea, "a northern aspect, where chilling winds exert all their fury, and half freeze, during winter, its few inhabitants." Nicholson's Cambrian Traveller's Guide, 1813. Carlisle's Topographical Dictionary of Wales, 1811, 4to.

PYANEPSIA, Πυανεψια, in *Antiquity*, a feast celebrated by the Athenians in the month Pyanepsion; which, according to the generality of the critics, corresponded to our September.

Plutarch refers the institution of this feast to Theseus; who, at his arrival from Crete, made a kind of sacrifice to Apollo of all the provisions remaining in his vessel; putting them all into a kettle, boiling them together, and eating them with his six companions; which custom was afterwards continued. The scholiast of Aristophanes says, this was done to acquit himself of a vow he made to Apollo in a tempest.

M. Baudelot writes the word *Puanepsia*, and takes it to be a feast instituted in memory of Theseus's return after killing the Minotaur.

The Greeks vary as to the origin and signification of the word Pyanepsion, whence the feast is denominated. Harpocration calls it *Pæanoptia*; he adds, that others call it *Panopsia*, because then the fruits all appear to the eye. Hesychius writes *Pyanepsia*; and derives it from πυανον, *bean*, and εψω, *coquo*; because in this feast the Athenians gathered their beans, and made a kind of broth of them.

PYANEPSION, Πυανεψιων, in the Athenian *Chronology*, a month of thirty days, in which the festival Pyanepsia was celebrated, and called by the Bæotians Damatrius.

PYAPOUR, in *Geography*, a town of Hindoostan, in Bahar; 13 miles E. of Bahar.

PYBOLOWO, a town of Lithuania; 25 miles E. of Minfk.

PYCIELT, in *Botany*, a name given by Hernandez, and fome other authors, to a peculiar fpecies of tobacco, diftinguifhed by Mr. Tournefort by the name of nicotiana major lato et rotundo folio, the broad roundifh-leaved great tobacco.

PYCNANTHEMUM, a name contrived by Michaux, from πυκνος, *denfe*, and ανθος, *a flower*, to exprefs the denfe inflorefcence.—Michaux Boreali-Amer. v. 2. 7. Ait. Hort. Kew. v. 3. 376. Purfh v. 2. 409. (Brachyftemum; Michaux Boreali-Amer. v. 2. 5.)—Clafs and order, *Didynamia Gymnofpermia*. Nat. Ord. *Verticillatæ*, Linn. *Labiatæ*, Juff.

Gen. Ch. *Cal.* Perianth of one leaf, inferior, tubular, ftriated, erect, permanent, with five awl-fhaped, acute, nearly equal teeth; the mouth naked. *Cor.* of one petal, ringent; tube cylindrical, the length of the calyx; upper lip nearly erect, oblong, flightly convex, rounded, fcarcely notched; lower lip much the largeft, widely fpreading, channelled, three-lobed; the lateral lobes femi-elliptical; the middle one longeft. *Stam.* Filaments four, awl-fhaped, diftant, various in length; two of them fhorter than the reft; anthers with two parallel cells. *Pift.* Germen fuperior, four-cleft; ftyle briftle-fhaped, rather fhorter than the corolla; ftigmas two, fpreading, acute. *Peric.* none, except the permanent calyx. *Seeds* four, roundifh.

Eff. Ch. Calyx five-cleft. Middle fegment of the lower lip of the corolla longer than the reft. Stamens diftant. Anthers with parallel cells.

Obf. This genus feems to differ from *Satureja* principally in the form of its corolla. The fpecies, as far as we know, are all American.

Sect. 1. *Stamens prominent. Pycnanthemum* of Michaux.

1. P. *incanum.* Hoary Tufted Savory. Michaux v. 2. 7. Purfh n. 1. Ait. n. 1. (Clinopodium incanum; Linn. Sp. Pl. 822. Willd. Sp. Pl. v. 3. 132. C. menthæ folio, incanum et odoratum; Dill. Elth. 87. t. 74. C. Serpentaria dictum, &c.; Pluk. Mant. 51. t. 344. f. 1.)—Leaves oblong-ovate, acute, flightly ferrated, downy. Heads compound; the lateral ones ftalked. Bracteas fetaceous.—Found in low fields and copfes, from Virginia to Carolina; flowering from July to October. It was cultivated in Sherard's garden at Eltham before the year 1732, but has fcarcely been attended to by recent amateurs. The *root* is perennial. *Stem* three feet high, erect, fomewhat branched, leafy, bluntly quadrangular. *Leaves* about two inches long, on fhort ftalks; their under fide moft hoary or downy. *Flowers* white, tinged with red, in denfe ftalked hoary whorls, with a terminal head; their inner *bracteas* briftle-fhaped. The whole herb is clothed with fine foft pubefcence; the *leaves* marked with pellucid dots; their fcent aromatic, partaking of the common, as well as fweet, Marjoram.

2. P. *ariftatum.* Briftly Tufted Savory. Michaux v. 2. 8. t. 33. Purfh n. 2. Ait. n. 2. (Nepeta virginica; Linn. Sp. Pl. 799. Willd. Sp. Pl. v. 3. 56. Clinopodium amaraci folio, flore albo; Pluk. Phyt. t. 85. f. 2.)—Leaves ovato-lanceolate, fomewhat hoary, flightly ferrated. Heads feffile. Bracteas and calyx awned.—Native of dry woods, on a limeftone foil, from Maryland to Carolina, flowering in July and Auguft. Miller appears to have cultivated this fpecies in 1752. It is perennial, with altogether the herbage and afpect of an *Origanum.* The *leaves* are not an inch long, nearly feffile, dotted, veiny, thick-edged, very minutely, and fcarcely perceptibly, hoary. *Flowers* white, fmall, in numerous, denfe, terminal, hoary, compound heads. *Bracteas* lanceolate, entire, with long, rigid, awn-like points.

3. P. *montanum.* Mountain Tufted Savory. Michaux v. 2. 8. Purfh n. 3.—"Leaves oval-lanceolate, ferrated. Head feffile. Calyxes crowded, erect, with fhort teeth."—Native of high mountains in Carolina, according to Michaux, the only perfon who appears to have gathered this plant. The *ftem*, and part of the reft of the herb, are ufually tinged with purple. We have feen neither fpecimen nor figure.

4. P. *Monardella.* Monarda Tufted Savory. Michaux v. 2. 8. t. 34. Purfh n. 4. (Origanum incanum; Walter Carolin. 165.)—Somewhat hairy. Leaves ovate, taper-pointed, ferrated. Outer bracteas ovate, coloured, longer than the flowers; inner lanceolate, fringed. Calyx bearded.—Found on the mountains of Virginia and Carolina, but as yet a ftranger to our gardens. It flowers from June to Auguft, and is perennial. The habit of the plant, and its coloured *bracteas*, refemble *Monarda fiftulofa.* The *flowers* are fmall, and pale red, according to Mr. Purfh, on whom we depend for the fynonym of Walter.

5. P. *linifolium.* Flax-leaved Tufted Savory. Purfh n. 5. Ait. n. 3. (Brachyftemum virginicum; Michaux v. 2. 6. B. linifolium; Willd. Enum. 623. Thymus virginicus; Linn. Syft. Veg. ed. 13. 453. Willd. Sp. Pl. v. 3. 145. Satureja virginiana; Linn. Sp. Pl. 793. Herm. Parad. 218. t. 218. Pulegium virginianum anguftifolium, &c.; Pluk. Phyt. t. 54. f. 2.)—Stem erect, much branched, corymbofe, roughifh. Leaves lanceolate, entire. Heads crowded, nearly globular. Bracteas ovate, fringed.—Found in rather dry and mountainous meadows of North America, from New England to Carolina, flowering in July and Auguft. Miller had it in cultivation in the year 1739, and it is ftill preferved in curious gardens, being a tolerably hardy, fomewhat fhrubby, perennial, of a bufhy corymbofe habit, about eighteen inches or two feet high. The whole plant fmells ftrongly of Penny-royal. The *ftem* is fquare, pale, downy chiefly at the angles; its upper branches rifing all nearly to a level, and forming a *corymbus* of numerous, globofe or hemifpherical, downy heads, of fmall white *flowers.* The *bracteas* are numerous, all ovate; the outer ones large, the inner very downy. Such is the plant intended by Linnæus under the above fynonyms, and which is perhaps rather the *P. lanceolatum* of Purfh, than his *linifolium.* In the latter the *ftamens* are longer than the *corolla;* in the former they are fhorter; but this is evidently, as in Mints, a variable circumftance; and therefore the *Pycnanthemum* and *Brachyftemum* of Michaux, are certainly one and the fame genus. We are confident alfo that there is no fpecific difference between Purfh's and Willdenow's *linifolium* and *lanceolatum.*

Sect. 2. *Stamens within the tube. Brachyftemum* of Michaux.

6. P. *muticum.* Pointlefs Tufted Savory. Purfh n. 7. (Brachyftemum muticum; Michaux v. 2. 6. t. 32.)—Leaves ovate, pointed, fmoothifh, fomewhat ferrated. Heads terminal, feffile, folitary. Bracteas lanceolate, acute, awnlefs.—Gathered by Michaux in Upper Carolina. Mr. Purfh never found this fpecies. The former writer is incorrect in his definition of the *leaves*, which are by no means "lanceolate-oval," nor are they "dentate," but truly ferrated, at leaft in his plate. The *heads* bear fome refemblance to thofe of our fifth fpecies, but are lefs globofe.

7. P. *verticillatum.* Whorled Tufted Savory. Purfh n. 8. (Brachyftemum verticillatum; Michaux v. 2. 6. t. 31. Origanum clinopodioides; Walt. Carol. 165.)—Leaves ovate, pointed, entire. Flowers capitate and whorled. Bracteas lanceolate, pointed.—Native of mountains in North America, from Pennfylvania to Carolina, flowering in

in July and August. *Pursh.* This, like the rest, is perennial. It nearly resembles the last, but differs in having entire *leaves*, and one or two dense axillary whorls of *flowers*, besides the solitary terminal heads. The *bracteas* are also said to be more pointed.

PYCNI, πυκνοὶ, in the *Ancient Music*, was used for such sounds or chords of a tetrachord as might enter the spissum, or πυκνον.

These were the hypatæ, the parypatæ, and the lichani, of the several tetrachords. The hypatæ were called *barypycni*, βαρυπυκνοι; the parypatæ, *mesopycni*, μεσοπυκνοι; and the lichani, *oxypycni*; οξυπυκνοι; because the first were the lowest notes; the second, the middle notes; and the third, the highest of the spissum. Such chords as could never enter the spissum were called *apycni*, απυκνοι, υπατοειδεις, παρυπατοειδεις, λιχανοειδεις.

Hence, in the Greek scale or diagram, containing eighteen chords, there were five barypycni, as many mesopycni, and an equal number of oxypycni, together with three apycni. The apycni and barypycni were stabiles or fixed chords; but the mesopycni and oxypycni were moveable, or mobiles.

PYCNITE, in *Mineralogy*, is the mineral called schulite by Klaproth, leucolite by Daubenton, and schorlous beryl by Werner, who first classed it as a subspecies of beryl. It is now arranged with the topaz, to which its constituent parts bear a nearer resemblance. It is remarkable for containing, like the topaz, a portion of fluoric acid. Pycnite is generally found crystallized in long six-sided prisms imbedded in granite rocks. Small four-sided prisms may be obtained by a careful mechanical division from the large crystals; the bases of these are rhombs with angles of 120° and 60°. Bucholz considers this to be the primitive form of pycnite. The colour of this mineral is either various shades of white, passing on one side from greyish and yellowish-white to straw-yellow, or from reddish-white to a peach blossom and crimson red. Some specimens are marked with spots of violet blue. The crystals are translucent. The cross fracture is imperfectly foliated, the longitudinal imperfectly small conchoidal. It is harder than quartz, which it scratches, but is easily broken in a direction perpendicular to the axis of the crystals. Its specific gravity is 3.61. By the analysis of Vauquelin, pycnite contains

Alumine	- -	60
Silex	- -	30
Fluoric acid	-	6
Lime	- -	2
Water	- -	1
Loss 1.	- -	99

Bucholz makes the proportion of fluoric acid 17 *per cent.* There is no less difference in the proportion of fluoric acid in different specimens of the topaz, as given by Klaproth and Vauquelin. See TOPAZ. B.

PYCNON, πυκνον. See SPISSUM.

PYCNOSTYLE, πυκνοστυλο, formed from πυκνος, *close*, and στυλο, *column*, in the *Ancient Architecture*, a building where the columns stand very close to one another; one diameter and a half of the column being allowed for the intercolumnation.

The pycnostyle is the smallest of all the intercolumnations mentioned by Vitruvius. Some make it the same with *systyle*; others distinguish the latter by its allowing half a module more in the Corinthian intercolumnation.

The pycnostyle, Mr. Evelyn observes, chiefly belonged to the Composite order, and was used before the most magnificent buildings; as, at present, in the perystyle of St. Peter's at Rome, consisting of near three hundred columns; and such as yet remain of the ancients among the late discovered ruins of Palmyra.

PYCNOTICS, INCRASSANTS, or medicines of an aqueous nature, which have the faculty of cooling and condensing, or thickening, the humours.

The word, in its original Greek, πυκνωτικον, signifies something that has the power of thickening.

Purslane, the nenuphar or water-lily, solanum, &c. are ranked among pycnotics.

PYDNA, in *Ancient Geography*, a town of Macedonia, in Pieria, on the coast of the Thermæan gulf, some miles N. of the river Aliacmon. It was near this town that the Romans gained over Perseus the battle which terminated the kingdom of Macedon. Steph. Byz. calls it Cydna.—Also, a town of the Rhodians.—Also, a mountain of the island of Crete.—Also, a town of Asia, in Phrygia, in the vicinity of mount Ida.

PYE, in English *Antiquity*. See PICA.

PYE, in *Mechanics*. See CRAB.

PYE, in *Ornithology*. See PICÆ.

PYE, *Sea*. See PICA *Marina*.

PYE's *Islands*, in *Geography*, a cluster of small islands in the North Pacific ocean, near the W. coast of North America. The southernmost forms, in various appearances of it, a very conspicuous peak; its S. extremity is situated in N. lat. 59° 19′. E. long. 210° 21′.

PYGAIA, in the *Materia Medica*, a name by which some authors have called the ipecacuanha, or vomiting Indian root.

PYGARGA, in *Zoology*, a species of *Antelope;* which see.

PYGARGITES, in *Natural History*, a name given by Pliny and some other of the old writers to the eagle-stone, when it was variegated with white, in the manner of the tail of the eagle, called *pygargus*.

PYGARGUS, in *Ornithology*, a species of eagle, called also by some authors *albicilla*, and *hirundinaria*. Linnæus has classed this bird among the vultures, calling it the *vultur albicilla*, because its bill is rather straighter than is usual in the eagle; but Mr. Pennant observes, that it can have no claim to be ranked with that genus, because the pygargus is wholly feathered; whereas the characteristic mark of the vulture is, that the head and neck are either quite bare, or only covered with down.

It is a large and fierce bird, of the size of the common turkey; its beak is yellow, and covered with a yellow membrane at its base; it has large hazel-coloured eyes; its feet are yellow, and its claws extremely strong and sharp; the head is white, and there are no feathers, but some fine hairs between the eyes and nostrils; the upper part of the neck is of a reddish-brown, and the rump black; all the body besides this is of an obscure rust colour, and its wings are partly black, partly grey; its tail is long, and the upper half of it is white, and the rest black. It is from this white part that it has its name *albicilla*. The male is of a darker colour than the female. This bird inhabits Scotland and the Orkneys, and feeds on fish as well as on land animals.

Authors who have written on this subject seem not at all agreed to call the same bird by this name. The pygargus of Aldrovand seems different from this, and the pygargus prior of Bellonius seems no other than the male of that kind of hawk, called in English the *hen-harrier*.

Mr. Willughby imagines his first pygargus, p. 61, to be only a variety of the white-tailed eagle, having the same charac-

characteriftic mark, and differing only in the pale colour of the head.

Pygargus *Accipiter*, a name by which many authors have called the fubbuteo, a bird of the hawk kind; the male of which is called in Englifh the hen-harrier, and the female fuppofed by fome to be the ring-tail. See Falco.

PYGELA, in *Ancient Geography*, a town of Afia Minor, in Ionia, where was a temple of Venus Munychian, according to Strabo and Steph. Byz.

PYGME, πυγμη, the length, or extent, between the elbow, and extremity of the hand, the fift being fhut; called alfo a cubit.

PYGMY, Pygmæus, πυγμαιος, formed of πυγμη, *cubit*, a dwarf, or perfon of exceeding fmall ftature, not exceeding a cubit in height. See Dwarf.

The appellation is given among the ancients to a fabulous nation, faid to have inhabited Thrace; who generated and brought forth young at five years of age, and were old at eight; famous for the bloody war they waged with the cranes.

Pygmy *Ape*, in *Zoology*. See Simia *Sylvanus*.

PYHA, in *Geography*, a large lake of Sweden, in the province of Savolax, N.E. of lake Saima, and communicating with it.—Alfo, a river of Sweden, which runs into the gulf of Bothnia, at Braheftad.

PYHAJARVI, a town of Sweden, in the province of Nyland; 34 miles N.W. of Helfingfors.

PYHAJOCKI, a town of Sweden, in Eaft Bothnia, near the fea coaft; 10 miles S.S.W. of Braheftad.

PYHAMAA, a fmall ifland in the gulf of Bothnia, on a peninfula of the coaft of Finland. N. lat. 69° 59′. E. long. 21° 12′.

PYKEHAUS, a town of Bengal; 52 miles S.E. of Pucculoe.

PYKER, or Pycar, in our *Writers*, a fmall fhip or herring boat.

PYLA, in *Geography*, a town of the duchy of Warfaw; 48 miles N. of Pofen.—Alfo, a river of England, in Monmouthfhire, which runs into the Olwy; 2 miles N.E. of Ufk.

PYLADES, in *Biography*. See Bathyllus, Hylas, Mime, and Pantomime.

PYLÆ Persides, in *Ancient Geography*, a famous ftrait in Afia, between the Perfide and Sufiana, according to Diodorus Siculus. This ftrait is named Portæ Perficæ by Strabo, and Pylæ Sufiades by Arrian.

Pylæ *Sarmaticæ*. Sarmatia is bounded on the S. by mount Caucafus, which feparates it from the neighbouring countries. Ptolemy fpeaks of two ftraits or paffages in this famous mountain; one called Portæ Caucafiæ, which affords entrance into Siberia; the other named Pylæ Albaniæ, and gives entrance into Albania.

PYLÆA, a town of Macedonia, in Trachinia, fituated at the foot of mount Oëta, according to Philoftratus. This gave name to the Pylaic gulf, mentioned by Strabo.

Pylæa, πυλαια, in *Antiquity*, a name given to the affembly of the Amphictyons, as well when they met at Delphi as at Thermopylæ. The concourfe of people at thefe affemblies was fo great, that the term pylæa came to be ufed for any very numerous affembly, or crowd of people. Mem. Acad. Infcr. vol. iv. p. 287. 290.

PYLAGORÆ, Πυλαγορες, a name given to the Amphictyons, becaufe they affembled at Thermopylæ, or Pylæ.

PYLAU, in *Geography*, a town of Pruffia; 18 miles S. of Konigfberg.

PYLE, Thomas, in *Biography*, was born at Stodey, near Holt, in Norfolk, in the year 1674. He received his academical education at Caius college, Cambridge, where he took his degrees, and became an excellent fcholar. When inducted to the church, he difcharged all the duties attaching to his fituation as curate with the moft confcientious integrity. His great aim was to amend and improve his hearers, and his difcourfes and urgent manner gained him the attention for which he was anxious. In early life he took part in the Bangorian controverfy, and acquitted himfelf fo much to the fatisfaction of bifhop Hoadly, that his lordfhip prefented him with a prebend, and procured for him a refidentiaryfhip in the cathedral church of Salifbury, and likewife made his two fons prebendaries of Winchefter. He died in his 84th year. He was greatly admired as a preacher, and no lefs fo as a faithful friend, an agreeable companion, a man of the moft liberal fentiments, and fo free from all pride and conceit of his own abilities, that he was apt to pay a deference to the opinions of many perfons much inferior to himfelf. Archbifhop Herring fpeaks of him as a worthy man, but who had not at all times the proper government of his own temper. He was author of feveral works: as "A Paraphrafe, with Notes, on the Acts of the Apoftles, and Epiftles," being a fupplement to Dr. Clarke's Paraphrafe on the Four Gofpels: "The Scripture Prefervative againft Popery; being a Paraphrafe, with Notes, on the Revelation of St. John." He publifhed alfo, between the years 1715 and 1725, "A Paraphrafe, with fhort and ufeful Notes, on the Books of the Old Teftament." In 1773, his friends publifhed two vols. of pofthumous fermons, to which, in 1783, a third was added. Though thefe fermons want the care and polifh of finifhed compofitions, they are reckoned interefting and highly ufeful family difcourfes.

PYLE-RUDBAR, in *Geography*, a town of Perfia, in the province of Ghilan; 32 miles S. of Refhd.

PYLING *the Ground for Foundations*. See Foundation, and Pallification.

PYLORIC *Artery* and *Vein*, in *Anatomy*, are blood veffels belonging to the ftomach. See Stomach.

PYLORUS, the circular ring by which the ftomach communicates with the fmall inteftine. See Stomach.

PYLSTART, in *Geography*, an ifland in the South Pacific ocean, about fix miles in circumference, difcovered by Tafman in 1643. It prefents to view two lofty hills, which feem feparated from each other by a low valley: it is called by Maurelle "La Sola." S. lat. 22° 22′. W. long. 175° 59′.

PYLUS *Meffeniæ*, now *Navarin*, in *Ancient Geography*, was fituated on the weftern coaft of Meffenia, over-againft the ifland of Afina.

Pylus (*Zonchio*), or *Avarino Veccio*, a town of Meffenia, upon the fea-coaft, S.E. of Platamodes.

Pylus *Ælianus*, a town of Triphylia, N.W. of Onus, upon the Ladon.

PYMATUNING, in *Geography*, a town of America, in Mercer county, Pennfylvania; 23 miles W.S.W. of Fort Franklin. It contains 376 inhabitants.

PYNAKER, Adam, in *Biography*, a landfcape painter, was born at the village of Pynaker, near Delft, in 1621. Whether his real name was that by which he is known or not, is not now to be afcertained. By an earneft ftudy of the art, firft in his native land, and afterwards at Rome, he acquired very confiderable fkill and celebrity. He generally exhibits brilliant effects of funfhine, in fubjects not always happily felected, but executed with great frefhnefs, purity, and tafte. In his pictures we frequently fee ruins of elegant and antique buildings, and figures well adapted to the fcenery.

fcenery. In general his pictures are of a fmall fize, and are rather fcarce. He died in 1673, at the age of 52.

PYNANG, in *Botany*, a name by which fome authors call the faufel, or areca-tree; a kind of palm, from the expreffed juice of which the drug commonly, but improperly, called Japan-earth is made.

PYNY, in *Geography*, a town of Hindooftan, in Coimbetore; 18 miles S. of Daraporum.

PYONY WATER. See WATER.

PYRACANTHA, in *Botany*, a name given by fome authors to the lycium, or box-thorn.

PYRÆIA, or PYRETHEA, among the *Eaftern Nations of Antiquity*, were great inclofures uncovered, and dedicated to the fun, in which a perpetual fire was kept up in honour of this luminary, which was worfhipped by moft of them. See CHAMANIM.

PYRALIS, the *fire-fly*, a name given by authors to a fuppofed infect, which they fay is produced in the violent fires of the glafs and metal furnaces. Plin. lib. ii. c. xxxvi. See LAMPYRIS.

PYRAMID, πυραμις, in *Geometry*, a folid ftanding on a fquare, triangular, or polygonal bafis, and terminating at top in a point; or a body whofe bafe is a regular rectilinear figure, and whofe fides are plain triangles; their feveral vertices meeting together in one point.

Euclid defines it a folid figure, confifting of feveral triangles whofe bafes are all in the fame plane, and have one common vertex.

Wolfius defines it a folid, bounded by as many triangles, A D C, D C B, and A D B, terminating in one point D, as the bafe A B C has fides. *Plate* XI. *Geometry*, *fig.* 18.

The pyramid is faid to be *triangular*, *quadrangular*, *quinquangular*, &c. according as the bafe is triangular, quadrangular, &c. The pyramid may be called a fquare, triangular, &c. cone; or the cone a round pyramid.

PYRAMID, *Properties of the*. 1. All pyramids and cones ftanding on the fame bafe, and having the fame altitude, are demonftrated to be equal.

2. A triangular pyramid is the third part of a prifm, ftanding on the fame bafe, and of the fame altitude.

3. Hence, fince every multangular may be divided into triangulars, every pyramid is the third part of a prifm, ftanding on the fame bafis, and of the fame altitude.

4. If a pyramid be cut by a plane, *a b c*, parallel to its bafe, A B C, the former plane, or bafe, will be fimilar to the latter.

5. All pyramids, prifms, cylinders, &c. are in a ratio compounded of their bafes and altitudes: the bafes, therefore, being equal, they are in proportion to their altitudes; and the altitudes being equal, they are in proportion to their bafes.

6. Similar pyramids, prifms, cylinders, cones, &c. are in a triplicate ratio of their homologous fides.

7. Equal pyramids, &c. reciprocate their bafes and altitudes; *i. e.* the altitude of the one is to that of the other, as the bafe of this to the bafe of that.

8. A fphere is equal to a pyramid, whofe bafe is equal to the furface, and its height to the radius of the fphere.

PYRAMID, *to meafure the furface and folidity of a*. Find the folidity of a prifm that has the fame bafe and height with the given pyramid. And divide this by three; the quotient will be the folidity of the pyramid. Or, multiply the bafe by the perpendicular height; and one-third of the product will be the content.

Suppofe, *v. gr.* the folidity of the prifm be found 67010328, the folidity of the pyramid will be thus found 22336776.

The furface of a pyramid is had, by finding the areas, both of a bafe, A B C, and of the lateral triangles, A C D, C B D, D B A. (See TRIANGLES.) The fum of thefe is the area of the pyramid.

The external furface of a right pyramid, ftanding on a regular polygonal bafe, is equal to the altitude of one of the triangles which compofe it, multiplied by the whole circumference of the bafe of the pyramid.

PYRAMID *on a plane, to defcribe a*. 1. Draw the bafe, *v. gr.* the triangle A B C (if the pyramid required be triangular); fo as that the fide A B, fuppofed to be turned behind, be not expreffed. 2. On A C and C B, conftruct the triangles A D C and C D B, meeting in any affumed or determined point, *v. gr.* D; and draw A D, C D, B D; then will A D B C be a triangular pyramid.

PYRAMID *of pafteboard*, &c. *to conftruct a*. Suppofe, *v. gr.* a triangular pyramid required. 1. With the radius A B defcribe an arc B E (*fig.* 19.); and to this arc apply three equal chords, B C, C D, and D E. 2. On C D conftruct an equilateral triangle, D F C, and draw the right lines A D and A C. This pafteboard, &c. being cut off by the contour of the figure, what remains within will turn up into a pyramid.

PYRAMID, *Truncated*. See TRUNCATED.

PYRAMID, *Fruftum of a*. See FRUSTUM.

PYRAMID, in *Architecture*, denotes a folid, maffive edifice; which, from a fquare, triangular, or other bafe, rifes diminifhing to a point, or vertex.

Some derive the word from πυρος, *wheat*, and αμαω, *colligo*; pretending that the firft pyramids were built by the patriarch Jofeph, for granaries. But Villalpandus, with much better reafon, derives the word from πυρ, *fire*; becaufe of their ending in a point like flame.

Wilkins, converfant with the Coptic tongue, fuggefts (Diff. de Ling. Copt.) another derivation from that language, in which *pouro* fignifies a king, and *mifi*, a race or generation; and he fays, the pyramids were thus called, becaufe they were erected to preferve the memories of the Egyptian kings and their families; and that thofe who defcended from them had recourfe to thefe pillars in order to prove their pedigree.

When they are very narrow at bottom, *i. e.* their bafe very fmall, they are called *obelifks*, and *needles*.

Pyramids are fometimes erected to preferve the memory of fingular events, and, fometimes, to tranfmit to pofterity the glory and magnificence of princes; but, as they are the fymbols of immortality, they are more commonly ufed as funeral monuments

Such is that of Ceftius at Rome, the maufoleum of this diftinguifhed Roman, who was one of the feven officers called *Epulones*, and is faid to have lived under Auguftus, repaired in 1673, by Alexander VII. and thofe other celebrated ones of Egypt, as famous for their fize as their antiquity; and reckoned by the ancients among the wonders of the world.

Thefe laft are all fquare in their bafes; and it is a thing that has been frequently propofed, to eftablifh a fixed meafure from them, to be thereby tranfmitted to pofterity. See their defcriptions, meafures, &c. in Thevenot, Pietro della Valle, Greaves, Pococke, Shaw, Perry, Maillet, Savary, &c. The pyramids of Egypt, comprehending the great and fmall, are very numerous; of thefe there are about twenty of the largeft fize. The moft remarkable are the three pyramids of Memphis, or, as they are now called, of Gheifa, Geeza, or Gizé. The dimenfions of the greateft of thefe have been differently ftated both by ancient and modern

modern writers. Herodotus (lib. ii.) makes the bafe of it to be 800 Grecian feet long; Diodorus (lib. i.) 700; Strabo (lib. xvii.) lefs than 600; and Pliny (lib. xxxvi. c. 12.) 883 feet. Among the moderns, Sandys found it to be 300 paces; Bellonius 324; Greaves 693 Englifh feet; Le Bruyn 704 French feet, or 750 Englifh feet; Profper Alpinus 750 French feet; Thevenot 682; Niebuhr 710; Chazelles 704.80 Englifh feet. In order to reconcile thefe differences, Dr. Shaw obferves, that none of the fides of this pyramid are exactly upon a level; fo that it is difficult to find a true horizontal bafe; befides, it is impoffible to fay how much the drifts of fand, to which it is expofed, may have been accumulated above the foundation of it; and, therefore, all calculations depending upon the time and circumftances of the fituation, when they were made, muft be exceedingly precarious. The perpendicular altitude of it, according to Greaves, is 499 feet; but its oblique height is equal to the breadth of the bafe, or 693 feet. The whole area of the bafe contains 480,249 fquare feet, or $11\frac{1089}{43560}$ Englifh acres. The height, according to Herodotus, is 800 French feet; according to Strabo 625; according to Diodorus Siculus 600 and a fraction; as ftated by Le Bruyn 616; by Profper Alpinus 625; by Thevenot 520; by Niebuhr 440. The afcent to the top of the pyramid is by fteps, the lowermoft being near four feet high and three broad; the fecond of the fame dimenfions, but retiring inward from the firft near three feet; and in the fame manner the third row is placed upon the fecond, and the reft in the fame order to the top, which terminates in a fmall flat or fquare; and they are fo difpofed, that a line ftretched from the bottom to the top would touch the angle of every ftep. Thefe fteps are called by Herodotus little altars, on account of their form; and their number has been varioufly affigned; Greaves ftates them at 207; Maillet at 208; Pococke at 212; Belon at 250; Thevenot at 208, and Chazelles at 498.222 Englifh feet. For a defcription of the infide of this pyramid, we muft refer to Greaves, Savary, &c. *ubi infra.*

This pyramid, being that already defcribed, is fituated on a rocky hill, in the fandy defert of Libya, about a quarter of a mile from the plains of Egypt, above which the rock rifes 100 feet or more, with a gentle and eafy afcent. Upon this advantageous elevation, and folid bafis, the pyramid is erected: the height of the fituation adding to the beauty of the work, and the folidity of the work affording it a ftable fupport.

We may here obferve, that the fides of this pyramid ftand exactly facing the four quarters of the world, and confequently mark the true meridian of the place: which precife pofition could not have been well owing to chance, but was, probably, the effect of defign and art; and this is faid to be confirmed by the pofition of the tomb itfelf, which lies within it. We may hence infer that the Egyptians had made an early progrefs in aftronomy.

The fecond pyramid ftands at about a bow-fhot from the firft, towards the fouth of this. Herodotus fays, after having meafured both, that it falls fhort of the other in magnitude; that it has no fubterraneous chambers, and that the Nile is not conveyed into it by a channel, as into the former, but that it is of an equal altitude. Diodorus informs us, that it refembles the firft in its architecture, but is inferior to it in magnitude; each fide of the bafe containing a ftadium, or 600 Grecian feet in length, fo that by his computation each fide is lefs than that of the former in length by 100 feet. Pliny makes the difference to be greater by 46 feet. Thevenot makes it but 631 feet fquare. Strabo fuppofes thefe pyramids to be equal, and Greaves affures us, that the bafes of both are alike, and that the height is not inferior to that of the firft. This pyramid has no entrance like the other, and is built of white ftones, not near fo large as thofe of the firft: the fides do not rife with gradations, but are fmooth and equal, and the whole fabric, except on the fouth fide, is quite entire. On the N. and W. fides of this fecond pyramid are two very ftately and elaborate pieces of architecture, about 30 feet in depth, and about 1400 in length, cut out of the rock in a perpendicular direction and fquared by a chiffel; fuppofed to be defigned for the lodgings of the Egyptian priefts.

The third pyramid ftands at about the diftance of a furlong from the fecond, on an advantageous rifing of the rock, fo that at a diftance it appears equal to the former, though it be much lefs and lower. Herodotus fays that it is 300 feet on every fide, and to the middle, built of Ethiopic marble. Diodorus gives the fame dimenfions of its bafe, and adds that the walls were raifed fifteen flories with black ftone, like Thebaic marble, and the reft finifhed with fuch materials as the other pyramids are built with; that this piece of work, though it be exceeded by the two former in magnitude, yet far excels them in refpect to the ftructure, art, and magnificence of the marble; and that on the fide towards the north, the name of Mycerinus, the founder, is engraved; but this infcription has been defaced by time. Pliny writes to the fame effect, except that he makes this pyramid 363 feet between the angles.

Dr. Shaw apprehends, that neither of thefe pyramids was ever finifhed, fuppofing that the fteps already mentioned fhould have been filled up with prifmatical ftones, fo that each fide of the pyramid might be fmooth and level, like that of Ceftius at Rome.

But from the defcription of Maillet and Savary, the firft pyramid appears to have been covered with a coating of marble, and thus finifhed on the outfide, but clofed; and that it has been fince forcibly opened, and the ftones which fhut the paffage and were of an enormous fize have been removed. This paffage was compofed of marble, and the ftones which form its four fides are of the fineft white and hardeft marble. For other particulars we refer to Greaves, Maillet, and Savary.

The ancients inform us, that the ftones of the pyramids were brought from the mountains of Arabia, and Herodotus (lib. ii. c. 124.) has defcribed the manner in which they were conveyed; but Dr. Shaw imagines, that they were taken from the fpot where they were employed; and he obferves, that the greateft of them, efpecially, is not an entire heap of hewn ftones, becaufe that portion of it, which lies below the horizontal fection of the entrance, may probably be no more than an incruftation of the natural rock on which it is founded. Dr. Bryant conjectures, that, like the fphynx, which ftands directly in the front of the fecond pyramid, they were immenfe rocks which ftood upon the brow of the mountain; that the Egyptians cafed them over with large ftones, and brought them by thefe means to a degree of fymmetry and proportion. At the fame time they filled up the unneceffary interftices with rubbifh and mortar, and made chambers and apartments, as the intervals in the rock allowed, being obliged to humour the indirect turns and openings in the original mafs to execute what they propofed. This he infers from the narrownefs and unneceffary floping of the paffages, which are often very clofe and fteep, and alfo from the fewnefs of the rooms in a work of fo immenfe a ftructure. That the pyramids were built upon a rock in the place where they now ſtand, was ſuggeſted by Mr. Hooke. See Birch's Hiſt. Royal Society, vol. iv. p. 245.

It is very ſurpriſing that the pyramids, which have been reckon d among the wonders of the world, ſhould not have preſerved a more certain era, and tradition of the names of their founders. Pliny reckons a number of authors who have wrote concerning them; and all, he informs us, diſagree in their accounts of thoſe who built them. Some modern writers maintain, that they were erected by the Iſraelites, under the tyranny of the Pharoahs, and allege to this purpoſe the teſtimony of Joſephus, Antiq. lib. i. cap. 5.

According to the relations of Herodotus (lib. ii.), and Diodorus (lib. i.), the firſt pyramid was erected by Cheops, or Chemmis, a king of Egypt, who is ſaid to have employed three hundred and ſixty thouſand men for twenty years in the ſtructure. Cephren, brother and ſucceſſor to the former king, is ſaid to be the founder of the ſecond pyramid; and the third is ſaid to have been built by Mycerinus, the ſon of Chemmis, according to Diodorus, but according to Herodotus, of Cheops. However, Herodotus ſays, that ſome aſcribed the laſt to Rhodope, a courtezan, and the other two to the ſhepherd Philittion. The learned Greaves places the three kings who erected theſe pyramids in the twentieth dynaſty; Cheops having begun his reign in the year 3448 of the Julian period, 490 years before the firſt olympiad, and 1266 years before the Chriſtian era. He reigned fifty years, ſays Herodotus, and built this pyramid, as Diodorus obſerves, 1000 years before his time, or in the 180th olympiad; whereas, he might have ſaid 1207. Cephren, the builder of the ſecond, reigned fifty-ſix years; and Mycerinus, the builder of the third, ſeven years.

Dr. Bryant gives a different account of the origin of theſe pyramids: he aſcribes the ſtructure of them to the Cuthites (ſee Dispersion *of Mankind*), or Arabian ſhepherds, who built Heliopolis, and who were the giants and Titans of the firſt ages. Theſe ſons of Chus, according to this writer, ſeem to have come into Egypt immediately after their diſperſion from Babel.

Many have conſidered theſe ancient ſtructures with contempt, as being vaſt piles without any great ſymmetry, and have thought the labour idle, and the expence unneceſſary. Thus Pliny (lib. xxxvi. cap. 12.) calls them *regum pecuniæ otioſa ac ſtulta oſtentatio, &c.* built for oſtentation, to keep an idle people employed, and to prevent commotion and rebellion. Ariſtotle (Polit. lib. iii.) calls them the work of tyranny.

The general opinion with regard to their intention and uſe is, that they were ſepulchres and monuments of the dead, particularly of kings. This is expreſsly affirmed by Diodorus (lib. i.), and Strabo (lib. xvii.), and the opinion is confirmed by the writings of the Arabians. And the reaſon, ſays Greaves, of their erecting theſe magnificent ſtructures is founded in the theology of the Egyptians, who, as Servius ſhews in his comment upon Virgil (Æneid, lib. iii.), where he deſcribes the funeral of Polydorus—*Animamque ſepulchro condimus*—believed, that as long as the body endured, ſo long the ſoul continued with it; and this was alſo the opinion of the Stoics. Upon this principle, that the bodies might neither be reduced to duſt by putrefaction, nor converted into aſhes by fire, they embalmed them, and laid them up in theſe ſtately repoſitories, where they might continue free from the injury of time and of men. The reaſon of their building their ſepulchres in the form of pyramids, was either from a notion that this was the moſt permanent form of ſtructure, or becauſe they hereby intended to repreſent ſome of their gods: particularly, as Greaves conjectures, Oſiris, or the ſun with many rays; for, under this form, the ſtatues of the gods were frequently exhibited, and the gods themſelves worſhipped.

Among the Egyptians, the pyramid is ſaid to have been a ſymbol of human life; the beginning of which is repreſented by the baſe, and the end by the apex; on which account it was that they uſed to erect them on ſepulchres. Herodotus.

Some, however, have objected to this deſign of the Egyptian pyramids, and are of opinion that they were originally intended for ſome nobler purpoſe. If Cheops, or any other perſon, ſays Dr. Shaw, who was the founder of the great pyramid, intended it only for his ſepulchre, what occaſion was there for ſuch a narrow crooked entrance into it; for the well, as it is called, at the end of the entrance; for the lower chamber, with a large nitch or hole in the eaſtern wall of it; for the long narrow cavities in the walls of the upper room; or, for the two antichambers and the lofty gallery, with benches on each ſide that introduce us into it.

As the whole of the Egyptian theology was clothed in myſterious emblems and figures, it ſeems reaſonable to ſuppoſe, ſays this writer, that all theſe turnings, apartments, and ſecrets in architecture were deſigned for ſome purpoſe of religion, and that the Deity, which was typified in the outward form of this pile, was to be worſhipped within. The ſquare cheſt of granite marble, which is placed in the upper chamber of the great pyramid, may be ſuppoſed to have been rather intended for ſome religious uſe than for the coffin of Cheops. It might have ſerved for one of their ſacred cheſts, in which either the images of their deities, or their ſacred veſtments or utenſils were kept, or it might have been a *ſaviſſa* or ciſtern, ſuch as contained the holy water uſed in their ceremonies. Its length favours the opinion of its having been deſigned for a coffin, but its height and breadth far exceed the dimenſions that were adhered to on ſuch occaſions; the Egyptian ſtone coffins were made of a different form, and inſcribed with hieroglyphics. Nor is this cheſt placed according to the manner in which the Egyptians depoſit their dead; for their mummies always ſtand upright, whereas this cheſt lieth flat upon the floor. If, therefore, this cheſt was not intended for a coffin, it is inferred that the pyramid itſelf could not have taken the name of a ſepulchre from it. Cheops, indeed, and others might have been buried within the precinct of this or any other of the pyramids, and this was no more than was practiſed in other temples, and therefore could not deſtroy the principal uſe and deſign for which they were erected. Upon the whole, Dr. Shaw concludes, from the outward figure of theſe piles, the ſtructure and contrivance of the ſeveral apartments in the inſide of the greateſt, together with the ample proviſion that was made on each ſide of it for the reception, as may be ſuppoſed, of the prieſts, that the Egyptians intended the latter for one of the places, as all of them were to be the objects, at leaſt, of their worſhip and devotion.

Dr. Bryant has lately maintained, with conſiderable force of argument, this opinion, that the pyramids were deſigned for high altars and temples, and were conſtructed in honour of the Deity. If the chief pyramid were deſigned for a place of burial, what occaſion, ſays he, was there for a well, and for paſſages of communication, which led to other buildings? The apartments near the pyramids he ſuppoſes to be deſigned for the reception of prieſts, and to be appendages not to a tomb, but to a temple of the Deity.

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The ftone coffin, he apprehends, was a trough or refervoir for water, which, by means of the well, they drew from the Nile. The priefts of Egypt delighted in obfcurity, and they probably came by the fubterraneous paffages of the building to the dark chambers within; where they performed their luftrations, and other nocturnal rites. Many, he adds, of the ancient temples in this country were caverns in the rock, enlarged by art, and cut out into numberlefs dreary apartments; for no nation upon the earth was fo addicted to gloom and melancholy as the Egyptians. From the top of the pyramids they obferved the heavens, and marked the conftellations; and upon the fame eminence it is probable that they offered up vows and oblations. See on this article Greaves's Works, vol. i. p. 1, &c. Shaw's Travels, fol. p. 413, &c. Pococke's Defcript. of the Eaft, vol. i. p. 41, &c. Perry's View of the Levant, p. 413, &c. Bryant's Anal. of Ancient Myth. vol. iii. p. 523, &c. Farmer's Worfhip of Human Spirits, &c. p. 379, &c. Savary's Letters, vol. i.

The tomb of Porfenna, king of Etruria, at Clufium in Italy, is an ancient monument of fquare ftone, each fide of which is three hundred feet broad, and fifty feet high. Within the fquare bafe there is an inextricable labyrinth; upon this fquare there ftand five pyramids, four in the angles and one in the middle, feventy-five feet broad at the bottom, and a hundred and fifty feet high, and terminating in a point; at top they are covered with a brafs circle, from which are fufpended bells, which are put in motion by the wind, fo as that their found may be heard at a great diftance. Upon this circle there are four other pyramids, each a hundred feet high, above which, upon one plane, there are five other pyramids. Such is the account which Pliny gives from Varro, lib. xxxvi. cap. 13.

Pyramid, *Scenography of a.* See Scenography.

Pyramid, *Optic.* See Optic *Pyramid.*

PYRAMIDAL Fountain. See Fountain.

Pyramidal *Mirrors.* See Mirror.

Pyramidal *Numbers* are the fums of polygonal numbers, collected after the fame manner as the polygonal numbers themfelves are extracted from arithmetical progreffion. See Numbers.

Thefe are particularly called *firft* pyramidals. The fums of firft pyramidals are called *fecond* pyramidals. And the fums of thofe *third* pyramidals; and fo on, *ad infinitum.* Particularly, thofe arifing from triangular numbers are called *prime triangular* pyramidals; thofe arifing from pentagonal numbers are called *prime pentagonal* pyramidals, &c. The numbers 1, 4, 10, 20, 35, &c. formed by the addition of the triangular numbers 1, 3, 6, 10, &c. are ufually called by the fimple name of pyramidals; and the general formula for finding them is $n \times \frac{n-1}{2} \times \frac{n-2}{3}$; *i. e.* the fourth pyramidal may be found by fubftituting 4 for n; the fifth, by fubftituting 5 for n, &c.

PYRAMIDALIA Corpora, in *Anatomy*, two prominences in the medulla oblongata. See Brain, and Nervous *Syftem.*

PYRAMIDALIS Abdominis, one of the abdominal mufcles. See Obliquus.

Pyramidalis *Nafi*, a name given by fome anatomifts to that portion of mufcular fibres which defcends from the fronto-occipitalis along the fide of the nofe. See Epicranius.

PYRAMIDOID, called alfo *parabolic fpindle*, a folid figure, formed by the revolution of a femiparabola round one of its ordinates.

According to the method of indivifibles, this may be conceived to confift of an infinite feries of circles, whofe diameters are all parallel to the axis of the revolving parabola.

The parabolic fpindle is equal to $\frac{8}{15}$ths of its circumfcribing cylinder. See Spindle.

Pyramidoid, *Parabolic.* See Parabolic *Pyramidoid.*

PYRAMIDS, in *Geography*, rocks in the Eaft Indian fea, near the E. coaft of the ifland of Myfol. S. lat. 1° 55′. E. long. 130° 59′.

PYRAMUS, Gihon, in *Ancient Geography*, a river of Afia, rifing in the country of Cataonia, where it begins to be navigable, and traverfing mount Taurus through the rocks, it enters the plain of Cilicia, paffes by the foot of the mountain of Anazarbus, and leaving it to the right, throws itfelf into Mopfuete, and at length lofes itfelf in the Mediterranean, at the point where was formerly fituated the town of Megarfus.

PYRBAUM, in *Geography*, a town of Bavaria, and capital of a lordfhip united to Salzburg; 13 miles S.E. of Nuremberg.

PYRENÆUM Promontorium, *Cape de Creus*, in *Ancient Geography*, a promontory of Hifpania Citerior; which terminates the Pyrenées eaftwards, and projects into the fea.

PYRENÆUS Saltus, a name given by Cornelius Nepos and Livy to that part of the Pyrenæan mountains which Hannibal traverfed in his way to Italy, paffing from Spain to Gaul.

PYRENE, a town of Gallia Celtica, near the place where the Danube rifes, according to Herodotus.

Pyrene, in *Natural Hiftory*, the name of a ftone found always in the fhape of the ftone of an olive. It is of the lapis Judaicus kind, being no other than the petrified fpine of fome fpecies of echinites.

PYRENE'ES, in *Geography*, a chain of mountains, celebrated fince the time of Herodotus, forming the boundaries between France and Spain, and extending from the Mediterranean to the Atlantic, about 200 miles in length, and in its greateft breadth 100 miles. Its various branches are diftinguifhed by different names, and may be confidered as belonging either to France or Spain. The higheft fummits of thefe mountains, which are in the centre of the chain, have prefented to the refearch of the naturalift not only calcareous appearances, but even fhells. The higheft elevation of the Pyrenées is *Mont* Perdu, for an account of which, we refer to that article. The Canigou was formerly reckoned the higheft fummit, though it does not exceed 8544 Englifh feet. Other noted heights are Tuccarroy, Marboré, the pic de Midi, 9300 feet high, the pic de los Reyes, 7620 feet high, the pic d'Offano 11,700 feet in height, the pic d'Arni, the Niege Veille, the Vigne Mali, La Breche de Roland, &c. At a diftance the Pyrenæan chain appears like a fhaggy ridge, prefenting the fegment of a circle fronting France, and defcending at each extremity till it difappears in the ocean and Mediterranean. Thus, at St. Jean de Luz, only high hills appear, and in like manner on the eaft beyond the fummit Canigou, the elevations gradually diminifh. The higheft fummits are covered with perpetual fnow. Blocks of granite are interfperfed with vertical bands, argillaceous and calcareous, the latter primitive or fecondary, and fupplying the marbles of Campan and Antin, of beautiful red fpotted with white, though the general mountain mafs be grey. To the S. and W. the Pyrenées prefent nothing but dreadful fterility, but on the N. and E. the defcent is more gradual, and affords frequent woods and paftures. Befides the dreadful fall of

 rocks,

rocks, undermined by the waters, they are expofed to Lavanges, or the impetuous defcent of vaft maffes of fnow, called Avalanches in Switzerland, and have their glaciers and other terrific features of the Alps.

The opinion of Ramond, that the fummit of mont Perdu (which fee) muft have been covered by the fea, is confirmed by Lapeyroufe, (Journ. des Mines, N° 46.) A fingular feature of the Pyrenées confifts of *houles*, as they are called, or walls difpofed in a circular form. Near the fummit of mont Perdu is a confiderable lake, more than 9000 feet above the level of the fea, which throws its waters to the E. into the Spanifh valley of Beouffa; and which the travellers allege as a proof that mont Perdu really belongs to Spain, and that Tuccarroy forms the boundary. Lapeyroufe fuggefts it as probable that the fole accefs to the fummit of mont Perdu will be found on the fide of Spain; there being three fummits called by the Spaniards "Las Tres Sorrellas," or the Three Sifters; the higheft being to the N., and the loweft on the S., but feparated by large glaciers. Hence he infers the exiftence of chains of mountains, in which bands of granite, porphyry, trap, hornblende, and petrofilex, alternate vertically with primitive limeftone, and are fo intermingled as to prove a common origin. But in the Pyrenées thefe bands are furmounted by fecondary lime-ftone, replete with marine fpoils, and containing even fkeletons of animals, fo that he concludes that the higheft mountains of the chain muft have yielded to the fury of the ocean, and that the fecondary parts only now exift. Mr. Townfend (Spain, i. 89.) obferves, that the lime-ftone and fchiftus feed the vegetation on the N. of the Pyrenées, while the S. is barren, and confifts of granite; while, in fact, mountains are generally barren and precipitous on the S. and W., becaufe the moft violent rains and tempefts come from thofe regions. Pinkerton's Geog. vol. i.

The paffages over thefe mountains from one country to another are five; the three principal of which are from St. Sebaftian to St. Jean de Luz; from Pamplona to St. Jean de Luz; and from Jonqueira to Perpignan. Thefe mountains afford quantities of timber for fhipping, which are conveyed, by means of the Ebro and other ftreams to the fea, with abundance of pitch and tar. The Pyrenées give name to three of the French departments.

PYRENÉES, *Eaftern*, one of the nine departments of the fouthern region of France, in N. lat. 42° 40′, formerly Rouffillon, bounded on the N. by the departments of the Arriere and the Aude, on the E. by the Mediterranean, on the S. and W. by Spain; about 58 miles from E. to W., and from 18 to 25 from N. to S., or 28 Fr. leagues in length, and 15 in breadth, containing 4337½ kiliometres or 212 fquare leagues, and 117,764 inhabitants; it is divided into 3 diftricts, 17 cantons, and 249 communes. The three diftricts are Perpignan, including 51,961 inhabitants, Ceret, 24,750, and Prades, 41,053. According to Haffenfratz, the number of circles is 3, of cantons 25, and of inhabitants 114,158. The contributions in the 11th year of the French era amounted to 1,010,520 fr., and the expences for adminiftration, education, &c. to 181,961 fr. 85 cents. The capital is Perpignan. This department is fertile in corn, wine, oil, flax, hemp, fruits, and paftures. On the hills there is little wood, but variety of medicinal plants and herbs. There are feveral lofty mountains on the S. and W. boundaries, as Maffane, Canigou, &c.

PYRENÉES, *Lower*, a department of France, in the S.W., or Garonne region, compofed of Bearn, Navarre, Bafque-François, with a part of Chaloffa and of Landes, in N. lat. 43° 10′, and bounded on the N. by the departments of the Landes and Gers, on the E. by the department of the Upper Pyrenées, on the S. by Spain, and on the W. by the fea; 70 miles in length, and from 15 to 45 in breadth, or 16 Fr. leagues in length and 10 in breadth. It contains 8072½ kiliometres, or 388 fquare leagues, and 384,030 inhabitants. It is divided into 5 diftricts, 40 cantons, and 660 communes. The diftricts or circles are, Pau, including 99,486 inhabitants, Oleron, 69,484, Mauleon, 65,447, Bayonne, 69,486, and Orthés, 80,127. According to Haffenfratz, its circles are 6, its cantons 44, and the number of its inhabitants 138,339. Its capital is Pau. Its contributions in the 11th year of the French era amounted to 1,523,760 fr. and its expences for adminiftration, &c. to 290,740 fr. 66 cents. This department, bounded on one fide by the Pyrenées, and on the other by the ocean, prefents a great variety of foil and diverfity of profpect. The mountains are crowned with woods; the hills are covered with vines; the vallies are rich and populous; the heaths are wild and uncultivated. The plains yield wheat, rye, barley, oats, millet, flax, fruits, and paftures. It has mines of filver, copper, iron, quarries of marble, granite, flate, and mineral fprings.

PYRENÉES, *Upper*, a department of France, in the Garonne region, formerly Bigore, in N. lat. 43°, bounded on the N. by the department of the Gers, on the E. by that of the Upper Garonne, on the S. by Spain, and on the W. by the department of Lower Pyrenées; 20 Fr. leagues long and 16 broad, or 53 Englifh miles in length, and from 25 to 38 in breadth; a fmall diftrict towards the N. being fcarcely more than feven miles in breadth. It contains 4937½ kiliometres, or about 235 fquare leagues, and 206,680 inhabitants. It is divided into 3 diftricts, 26 cantons, and 501 communes. Its diftricts or circles are Tarbes, including 87,005 inhabitants, Bagnéres, 78,099, and Argelés, 41,376. According to Haffenfratz, its circles are 5, and cantons 30, and the number of its inhabitants 188,690. Its capital is Tarbes. Its contributions in the 11th year of the French era amounted to 893,637 fr. and its expences for adminiftration, &c. to 173,759 fr. 12 cents. The plains in this department yield little wheat, but abundant crops of rye, barley, and millet, excellent wine, flax, and paftures. The hills produce confiderable forefts, with mines of iron and lead, quarries of marble, flate, and mineral fprings.

PYRENOIDES PROCESSUS, in *Anatomy*, a procefs of the fecond vertebra of the neck; called alfo *odontoides*, and *dentiformis*, or the tooth-like procefs.

The word πυρηνοειδής, is formed of πυρην, *nucleus*, *kernel*, or *berry*, and ειδος, *figure*.

PYRETHRUM, in *Botany*, an ancient Greek name, adopted by Haller, Gærtner, and the writer of the prefent article, who are followed by Willdenow and Aiton, for the genus in queftion, on account of its refemblance to the πυρεθρον of Diofcorides. The latter is, however, the *Anthemis Pyrethrum* of modern writers, or Pellitory of Spain; owing its Greek appellation to the fiery or pungent flavour of the root; whence alfo it obtained the Latin name of *Salivaria*, becaufe it caufes fo remarkable a flow of faliva. Our prefent *Pyrethrum* is made up of feveral Linnæan fpecies of *Chryfanthemum* and *Matricaria*, with fome new ones.—Haller Helvet. v. 1. 40. Sm. Fl. Brit. 900. Willd. Sp. Pl. v. 3. 2150. Ait. Hort. Kew. v. 5. 97. Purfh v. 2. 527. Gærtn. t. 169.—Clafs and order, *Syngenefia Polygamia-fuperflua*. Nat. Ord. *Compofitæ difcoideæ*, Linn. *Corymbiferæ*, Juff.

Gen. Ch. *Common Calyx* hemifpherical, imbricated; the fcales clofe-preffed, rather acute, membranous at the edges. *Cor.* compound, radiated. Florets of the difk perfect, numerous,

numerous, tubular, funnel-shaped, with five spreading segments; those of the radius more than 12, female, ligulate, elliptic-oblong, three-toothed. *Stam.* in the perfect florets. Filaments five, capillary, very short; anthers united into a cylinder, hardly so long as the corolla. *Pist.* Germen, in all the florets, obovate; style thread-shaped, longer than the stamens; stigmas two, divaricated, abrupt. *Peric.* none, the calyx remaining unaltered. *Seeds* nearly alike in all the florets, oblong, quadrangular, each crowned with an erect, membranous, more or less lobed border. *Recept.* naked, dotted, convex.

Eff. Ch. Receptacle naked. Seeds crowned with a membranous margin. Calyx hemispherical, imbricated with sharpish scales, bordered with a membrane.

Section 1. *Radius white; rarely reddish.*

1. P. *frutescens.* Shrubby Feverfew. Willd. n. 1. Ait. n. 1. (Chrysanthemum frutescens; Linn. Sp. Pl. 1251. Leucanthemum canariense, sapore pyrethri; Walth. Hort. 31. t. 24. Buphthalmum canariense leucanthemum; Pluk. Almag. 73. Phyt. t. 272. f. 6.)—Stem shrubby. Leaves fleshy, pinnatifid, linear, toothed; three-cleft at the extremities.—Native of the Canary islands, from whence it was brought very early; flowering in the green-house most part of the year. The woody *stem* is much branched. The *leaves* are crowded about the ends of the branches, and in their fleshy texture, as well as linear forked figure, resemble those of a *Crithmum*, or *Artemisia.* The *flowers* are terminal, solitary, on long naked stalks, and resemble a white daisy.

2. P. *simplicifolium.* Simple-leaved West Indian Feverfew. Willd. n. 2. (Matricaria? prostrata; Swartz Ind. Occ. v. 3. 1366.)—Leaves obovate; toothed at the extremity. Stalks axillary, single-flowered. Branches prostrate. Gathered by Von Rohr in Curaçao and the neighbouring islands. It has never been brought alive to Europe. *Stem* herbaceous, branched, decumbent, round, downy, especially the ends of the branches. *Leaves* alternate, nearly sessile, wedge-shaped, obovate, or roundish, half an inch long, downy, ribbed, notched or serrated; mostly accompanied by two minute leaves at the base. *Stalks* opposite to the leaves, thickish, an inch long, erect, downy, each bearing a yellowish-white, nearly globose, *flower*, whose disk is entirely yellow. *Seeds* crowned with a quadrangular minute border. *Swartz.*

3. P. *ptarmicifolium.* Goose-tongue Feverfew. Willd. n. 3. Ait. n. 2.—Leaves linear, finely serrated. Flowers corymbose.—Native of mount Caucasus. Sir Joseph Banks sent it to Kew in 1803. Willdenow describes this as perennial, with the habit of *Achillea Ptarmica*, only the *flowers* are twice as large. The *stem* is branched, either erect or decumbent. *Leaves* an inch long, very finely and sharply serrated. *Corymbs* terminal, simple, the stalks single-flowered. Radiant *florets* ovate. *Crown* half the length of the seed.

4. P. *serotinum.* Creeping-rooted Feverfew. Willd. n. 4. Ait. n. 3. Pursh n. 1. (Chrysanthemum serotinum; Linn. Sp. Pl. 1251. Jacq. Obs. fasc. 4. 8. t. 90. Bellis americana, procerior, serotina, ramosa, flore amplissimo; Pluk. Almag. 65. Phyt. t. 17. f. 2.)—Leaves lanceolate; the lower ones strongly serrated; the upper entire. Branches corymbose.—Supposed to be a native of North America; but Michaux has it not, and Pursh merely saw a specimen in Mr. Lambert's herbarium, probably, like that of Linnæus, from a garden. The plant was cultivated by Miller, and is a hardy perennial, flowering in October or later. Its *stem* is herbaceous, two or three feet high, much branched, leafy, furrowed and angular. *Leaves* alternate, sessile, two or three inches long, and half an inch wide, entire or sparingly serrated in the upper parts of the stem, but mostly furnished, in our specimen, with a sharp tooth on each side at the base, which we do not find mentioned by authors. The *flowers* are terminal, solitary, much like our common *Chrysanthemum Leucanthemum*, but rather smaller.

5. P. *uliginosum.* Bog Feverfew. Willd. n. 5. Waldst. et Kitaib. Hungar.—"Leaves lanceolate, all deeply serrated. Stem erect, branched at the top."—Native of wet ground in Hungary and Spain. Perennial. Very nearly akin to the last, but different in having all the *leaves* deeply serrated throughout, and the *stem* branched at the top only. *Willd.*

6. P. *Halleri.* Hallerian Feverfew. Willd. n. 6. (P. n. 97; Hall. Helvet. v. 1. 41. Leucanthemum alpinum tenuifolium; Barrel. Ic. t. 458. f. 3?)—Stem-leaves lanceolate, deeply toothed; radical ones pinnatifid, on long stalks. Stem single-flowered.—Native of the Swiss alps, in stony places. The *roots* are creeping, black, long and slender, with very long fibres. *Stems* solitary, simple, leafy, ascending, three or four inches high. *Leaves* smooth; the lowermost short, wedge-shaped, deeply pinnatifid, on long stalks; the uppermost sessile, deeply and sharply toothed, an inch or more in length. *Flowers* solitary, stalked, terminal, large; the calyx-scales bordered with black; the radiant florets broad and elliptical. The above figure of Barrelier seems to accord better with our Swiss specimens than fig. 2. cited by Haller and his copyists, except that the upper leaves in fig. 3. are too narrow.

7. P. *alpinum.* Alpine Feverfew. Willd. n. 7. Ait. n. 4. (Chrysanthemum alpinum; Linn. Sp. Pl. 1253. Leucanthemum alpinum; Clus. Hist. v. 1. 335.)—Lower leaves wedge-shaped, pinnatifid; uppermost linear and entire. Stem single-flowered.—Native of the German, Swiss and Italian alps. The creeping *roots* throw out many short tufted leafy *stems*, each bearing one long simple *flower-stalk*, downy in its upper part, and furnished below with one, two, or more, alternate, simple, linear, entire floral leaves. The rest of the *foliage* is stalked, pinnatifid, somewhat pectinate; the segments elliptical, entire, smooth, rather fleshy; each *leaf*, with its flat stalk, an inch or more in length. The *flower* is large, much like the last.

8. P. *Balsamita.* Costmary-leaved Feverfew. Willd. n. 8. Ait. n. 5. (Chrysanthemum Balsamita; Linn. Sp. Pl. 1252. Jacq. Obs. fasc. 4. 8. t. 89. Leucanthemum orientale, costi hortensis folio; Tourn. Cor. 37.)—Leaves ovate-oblong, serrated, auricled. Flowers corymbose.—Native of the Levant; rare in our gardens. Mr. Blackburne is said to have cultivated it in his celebrated collection at Orford about 35 years ago. The habit of this species is so much like Common Costmary, *Tanacetum Balsamita* of Linnæus, that one cannot help suspecting they are mere varieties of each other. The presence of a radius, in the plant before us, is known, by the examples of *Bidens* and *Coreopsis*, to be no infallible distinction. There is indeed the membranous crown of the *seed*, as Willdenow remarks, which makes this a *Pyrethrum*, not a *Chrysanthemum*; but such belongs to *Tanacetum*, and confirms our suspicion, or rather our belief, that the present is but a radiated variety of the Costmary. The *radius* is about twice the length of the *calyx*, white, not yellow, as Linnæus seems to describe it.

9. P. *palustre.* Marsh Feverfew. Willd. n. 9. (Leucanthemum orientale, chrysanthemi folio, tanaceti odore; Tourn. Cor. 37.)—"Leaves smooth, sessile, lyrato-pinnatifid. Stalks single-flowered, corymbose."—Native of marshy places in Armenia. *Tournefort.*—*Stem* erect, furrowed, smooth, two feet high. *Leaves* an inch or inch and

and half long; their fegments lanceolate, toothed at the outer margin, the lower ones deep, the upper gradually confluent into a large cut terminal lobe, and entire. *Stalks* fingle-flowered, leafy, alternate, five or fix at the top of the ftem, compofing a *corymbus*. *Flowers* the fize of *Chryfanthemum Leucanthemum*. *Willd.*

10. P. *pinnatifidum*. Pinnatifid Feverfew. Willd. n. 10. —" Leaves downy, glaucous, nearly feffile, lyrato-pinnatifid, unequally toothed. Flowers corymbofe." — Willdenow defcribed this from living fpecimens, but did not know their native country. The *ftem* is faid to be erect, two feet high, branched, furrowed, flightly downy. *Leaves* downy on both fides; pinnate at the bafe; pinnatifid in the middle; cut at the end; their length two or three inches; their fegments lanceolate, unequally toothed. *Corymbs* fimple, at the tops of the ftem and branches. *Flowers* almoft like the common *P. Parthenium*.

11. P. *macrophyllum*. Large-leaved Feverfew. Willd. n. 11. Ait. n. 6. (Chryfanthemum macrophyllum; Waldft. et Kitaib. Hung. v. 1. 97. t. 94.)—Leaves hairy, nearly feffile, pinnatifid, toothed, obtufe. Corymb terminal, compound.—Native of the woods and mountains of Hungary. Sir J. Banks introduced it, in 1803, to the Kew garden, where it is a hardy perennial, flowering in July and Auguft. This plant refembles *Achillea macrophylla*, for which fome botanifts have miftaken it, but is much larger. We have feen no fpecimen.

12. P. *rofeum*. Rofe-coloured Feverfew. Ait. n. 7. Willd. Enum. 905. (Chryfanthemum coccineum; Willd. Sp. Pl. v. 3. 2144. Sims in Curt. Mag. t. 1080. Buphthalmum orientale, tanaceti folio ampliore, flore magno coccineo; Tourn. Cor. 37. Buxb. Cent. 2. 25. t. 20.)—Leaves fmooth, pinnate; leaflets once or twice pinnatifid, ferrated, acute, fpreading. Stem erect, fingle-flowered. Gathered by Tournefort in Iberia. It is found alfo on mount Caucafus, from whence that diftinguifhed cultivator Mr. Loddiges received feeds of this elegant fpecies in 1803. The plant proves perennial and hardy, flowering in Auguft or September. The *ftem* is 12 or 18 inches high, more or lefs leafy, bearing one large handfome *flower*, whofe difk is yellow, and the radius of a rich rofe colour, or crimfon, on its upper fide; fometimes varying to white. The *leaves* are from two to four inches long, ftalked, rigid, paler beneath, pinnate, varioufly ferrated, cut or pinnatifid, all the points and ferratures very acute. Tournefort gathered plenty of this plant, and his original fpecimens are difperfed through many collections.

13. P. *corymbofum*. Mountain Feverfew. Willd. n. 12. Ait. n. 8. (Chryfanthemum corymbofum; Jacq. Auftr. t. 379. Ch. corymbiferum; Linn. Sp. Pl. 1251. Tanacetum non odorum; Ger. Em. 650.)—Leaves pinnate; leaflets lanceolate, pinnatifid, fharply ferrated; the upper ones confluent. Flower-ftalks corymbofe. — Native of mountainous woods in Siberia, and many parts of Germany. Gerarde appears, by the catalogue of his garden, to have cultivated it in 1596. The *root* is perennial, woody, with long fibres. *Stems* erect, two or three feet high. *Leaves* fomewhat like Tanfy, but without fcent or tafte, except that after a while, according to Jacquin, they caufe a heat or pungency in the mouth. The numerous large white *flowers*, each with a bright yellow difk, form an ample terminal corymb.

14. P. *Parthenium*. Common Feverfew. Sm. Fl. Brit. n. 1. Engl. Bot. t. 1231. Willd. n. 13. Ait. n. 9. (Matricaria Parthenium; Linn. Sp. Pl. 1255. Woodv. Suppl. t. 249. Fl. Dan. t. 674. Matricaria; Ger. Em. 652.)—Leaves pinnate; leaflets oblong, obtufe, pinnatifid and cut. Stem branched. Flowers corymbofe. Radius about twice the length of the calyx. Seed-crown toothed. —Native of cultivated or wafte ground throughout Europe, fpringing up abundantly with us in neglected gardens or court-yards, flowering all fummer long. The *root* appears to be rather biennial than perennial. The whole *herb* is bitter and aromatic, hoary or downy. *Stem* bufhy. *Leaves* ftalked, flat and dilated. *Flowers* numerous, each about the fize of a common daify, but with a large yellowifh difk, and fhort white radius. Sometimes the latter is wanting; and more frequently the flowers are double, the difk becoming white and ligulate, like the radius, but each *floret* of a fmaller proportion. The *receptacle* is flat.

15. P. *parthenifolium*. Narrow Hoary Feverfew. Willd. n. 14.—" Leaves pinnate; leaflets oblong, obtufe, pinnatifid, toothed. Stem wand-like. Flowers corymbofe. Radius thrice the length of the calyx. Seed-crown entire."—Willdenow defcribed this from a garden, without knowing whence it came. He fays it is very like the laft, but has a taller wand-like *ftem*, narrower *leaves*, a *difk* but half fo large, though the *radius* is larger, and an entire, not toothed, margin to the *feed*. A plant, now become a weed in Kew garden, and faid to have been imported from China, anfwers precifely to this defcription in every point, except that its *ftem* is fcarcely lefs bufhy than in *P. Parthenium*. We are perfuaded, neverthelefs, that it is what Willdenow meant. Its *leaves* are confpicuoufly hoary, with narrower divifions than thofe of the laft, and the *flowers*, on account of their long and brilliant-white *radius*, are more ftriking. We have had no opportunity of inveftigating the crown of the *feed*.

16. P. *caucaficum*. Caucafian Feverfew. Willd. n. 15. Ait. n. 10.—" Leaves doubly pinnate; leaflets linear-awl-fhaped. Stem fingle-flowered." — Native of mount Caucafus. Sent to Kew in 1804, by the late Mr. G. Don. " *Root* woody, horizontal. *Stem* a fpan high, fimple, ftriated, fmooth. *Leaves* half an inch long, feffile, doubly pinnate; their leaflets linear-awl-fhaped, entire. *Flower* folitary, the fize of *P. alpinum*, or rather larger. *Seed-crown* membranous, two-lobed." *Willd.*

17. P. *fufcatum*. Dingy Feverfew. Willd. n. 16. Sm. Prodr. Fl. Græc. Sibth. n. 2095. (Chryfanthemum fufcatum; Desfont. Atlant. v. 2. 283. t. 237.) — Leaves downy, pinnate; leaflets with a few deep linear oblong fegments. Stem branched from the bafe, diffufe.—Gathered by Desfontaines in uncultivated fields near Tunis. Sibthorp found it in Greece. The *root* appears to be perennial, bearing many widely-fpreading or procumbent *ftems*, a fpan long, which are leafy, and flightly branched. The *leaves* are rather fucculent. *Flowers* terminal, folitary, large, with a blackifh *calyx*, pale yellowifh difk, becoming brown in decay, and broad white elliptical radiant florets. It bloffoms in winter.

18. P. *inodorum*. Corn Feverfew, or Scentlefs Mayweed. Sm. Fl. Brit. n. 2. Engl. Bot. t. 676. Willd. n. 17. Ait. n. 11. (Chryfanthemum inodorum; Linn. Sp. Pl. 1253. Fl. Dan. t. 696.) — Leaves pinnate, in many capillary fegments. Stem branched, fpreading. Seed-crown entire. — Found in fields and wafte ground throughout moft parts of Europe, efpecially where the foil is gravelly, flowering in autumn. *Root* tapering, annual. *Herb* almoft without any peculiar fcent, by which it is readily known, in every ftate of growth, from *Anthemis Cotula*. The *ftem* is a foot or more in height, widely fpreading, clothed with pale-green fmooth *leaves*, whofe leaflets are deeply and varioufly divided into linear, almoft capillary, pointed fegments. More fimple fegments are numeroufly

numeroufly crowded about the bottom of each *leaf*, rendering it, in a manner, lyrate, and furrounding the ftem or branch. *Branches* fomewhat corymbofe, each terminated by a rather large *flower*, with long white rays, and a prominent yellow difk. The late Mr. Crowe once found in Norfolk a partly double-flowered variety.

19. P. *maritimum*. Sea Feverfew. Sm. Fl. Brit. n. 3. Engl. Bot. t. 979. Willd. n. 18. Ait. n. 12. (Matricaria maritima; Linn. Sp. Pl. 1256. Chamæmelum maritimum perenne humilius, foliis brevibus craffis obfcure virentibus; Dill. in Raii Syn. 186. t. 7. f. 1.)—Leaves doubly pinnate; fegments linear, pointlefs, flefhy; convex above; keeled beneath. Stem diffufe. Seed-crown lobed.—Native of the fea-coaft in the north of Europe. Found in feveral parts of Scotland, as well as on the fouth coaft of England, and in Lancafhire and Durham, flowering in July and Auguft. The *root* is perennial. *Stems* numerous, proftrate, fpreading circularly to the extent of two or three feet. The *leaves* are more flefhy than in the foregoing; the difk of the *flower* broader, in proportion to the length of the rays; and the crown of the *feed* divided into three or four lobes. The whole herb is flightly aromatic, and of a darker more fhining green than *inodorum*.

20. P. *parviflorum*. Small-flowered Feverfew. Willd. n. 19.—"Leaves doubly pinnate; leaflets linear-thread-fhaped, in two or three deep divifions. Stem erect, branched. Seed-crown two-lobed."—Defcribed by Willdenow from living fpecimens, but the native country of this fpecies is unknown. It is faid to be annual, greatly refembling *P. inodorum*, but having a taller and upright *ftem*; a fhorter *radius*; and a green two-lobed crown to the *feed*.

Section 2. *Radius yellow*.

21. P. *multicaule*. Many-ftalked yellow Feverfew. Willd. n. 20. (Chryfanthemum multicaule; Desfont. Atlant. v. 2. 282. t. 236.)—Leaves fimple, fmooth, fpatulate; the lower ones toothed. Stem erect, much branched from the bottom.—Native of fandy hills near Mafcar, in Barbary. *Root* fibrous, apparently annual. *Stem* branched from the bafe principally, bufhy; the branches naked above, each bearing a folitary *flower*, about as big as a French Marygold, whofe radiant *florets* are yellow, and of a very broad elliptical form, about eight or nine or number.

22. P. *trifurcatum*. Three-forked Yellow Feverfew. Willd. n. 21. (Chryfanthemum trifurcatum; Desfont. Atlant. v. 2. 281. t. 235. f. 2.)—Leaves flefhy, fmooth, linear, acute; the lowermoft pinnate; the uppermoft undivided. Stem afcending, fingle-flowered.—Native of fields near Kerwan in Barbary, flowering in winter. The *ftem* is fimple, a foot high; leafy below; naked above; terminated by a very large *flower*, with numerous yellow radiant florets. Some *leaves* are partly bipinnate; others three-cleft; the uppermoft fimple; all linear, wavy, acute, and of equal breadth.

23. P. *Bocconi*. Dwarf Pale-yellow Feverfew. Willd. n. 22. (Chryfanthemum aragonenfe; Affo Synopf. n. 845. t. 9. f. 1. *Willd.* Bellis incana, chryfanthemi cretici folio; Bocc. Muf. 136. t. 98.)—Leaves hoary, ftalked, pinnate; leaflets linear-awl-fhaped: upper ones linear, undivided, and entire. Stems fingle-flowered.—Native of Spain and Sicily. Willdenow defcribes it thus from dried fpecimens. "*Root* many-headed, woody. *Stems* feveral, fimple, a fpan high, fingle-flowered. *Leaves* hoary; the radical ones ftalked, oblong, fading when arrived at maturity, and altogether wanting when the *flowers* open; lower ftem-leaves ftalked, pinnate at the extremity, with three or four pair of very fhort linear-awl-fhaped leaflets, and a membranous linear *footftalk*; the upper ones linear, feffile, and entire. Rays of the *corolla* pale yellow. It refembles *Chryfanthemum pectinatum*, but differs abundantly in the *calyx* not being membranous, and in having a crown to the *feed*."

We know nothing of Affo's plant. Willdenow cites an additional fynonym, Barrelier's t. 1153. f. 1, which feems to have no affinity to the figure of Boccone, and much more refembles *Cineraria minuta*, Cavan. Ic. t. 33. f. 3, under which indeed Willdenow likewife quotes it, Sp. Pl. v. 3. 2086.

24. P. *orientale*. Oriental Yellow Feverfew. Willd. n. 23.—"Leaves doubly pinnate; leaflets linear. Stems afcending, fingle-flowered."—Native of Georgia. *Stems* fix inches high, naked above. Lower *leaves* an inch long; the upper ones half as long, and only fimply pinnate. Scales of the *calyx* withered at the edge. *Flowers* deep yellow, the fize of *Chryfanthemum fegetum*. *Willd.*

25. P. *millefoliatum*. Milfoil-leaved Yellow Feverfew. Willd. n. 24. Ait. n. 13. (P. n. 174; Gmel. Sib. v. 2. 207. t. 86. f. 1, 2. Chryfanthemum millefoliatum; Linn. Syft. Veg. ed. 13. 643. Anthemis millefolia; Linn. Sp. Pl. 1263. Achillea foliis pinnatis, &c.; Mill. Ic. t. 9.)—Leaves doubly pinnatifid, linear, bluntifh. Stem corymbofe. Rays half as long as the diameter of the difk.—Native of Siberia. A hardy perennial, flowering throughout the fummer. The *ftem* is twelve or eighteen inches high, leafy, branched and corymbofe, bearing eight or more long-ftalked yellow *flowers*, whofe difk is about half an inch in diameter, and their radiant florets of a fhort roundifh figure, hardly extending a quarter of an inch from the difk. *Seed-crown* toothed. *Leaves* doubly and interruptedly pinnatifid, with linear, bluntifh fegments, each tipped with a minute point; their furfaces both downy, or fomewhat filky. The *leaves*, as well as *flowers* and *feeds*, are very diftinct from *Chryfanthemum italicum*, to which Linnæus compares this fpecies.

26. P. *bipinnatum*. Wing-leaved Yellow Feverfew. Willd. n. 25. Ait. n. 14. (P. n. 172; Gmel. Sib. v. 2. 205. t. 85. f. 1. Chryfanthemum bipinnatum; Linn. Sp. Pl. 1255.)—Leaves doubly or triply pinnatifid; their fegments dilated upwards, minutely pointed. Stem nearly fimple. Rays wedge-fhaped, not a quarter fo long as the diameter of the difk.—Native of Siberia, flowering in June. Introduced at Kew by Mr. Bufh, in 1796. This differs from the laft in having more compound *leaves*, whofe ultimate fegments are almoft elliptical, and all their points diftinctly awned. But the *flowers* efpecially differ in being fewer, from one to three on each *ftem*, and furnifhed with a difk near an inch wide, while their radiant marginal florets are fhort, broad, and wedge-fhaped, with broad fpreading teeth. The *calyx*, as well as all the herbage, is fhaggy with foft hairs.

27. P. *indicum*. Eaft Indian Yellow Feverfew. Sims in Curt. Mag. t. 1521. Ait. n. 15.—Leaves pinnatifid; their fegments dilated upwards, lobed. Stem branched. Flowers on long ftalks, nearly globular. Radiant florets few, very fhort.—Sent by Dr. Roxburgh, from the Eaft Indies, to A. B. Lambert, efq. It proves a hardy annual in our gardens, flowering moft part of the fummer. The *ftem* is much branched, but the pinnatifid, though more fimple and broader, *leaves*, betray an affinity to the two laft fpecies, which is confirmed by the fhort yellow radiant *florets*. Thefe however are, according to Dr. Sims, moft generally wanting. The *flowers* are folitary, on long fwelling furrowed *ftalks*, terminating each branch; their difk nearly an inch wide, and finally convex. The *herbage* appears to be fmooth.

28. P.

28. P. *Myconi.* Tongue-leaved Yellow Feverfew. (Chryfanthemum Myconi; Dalech. Hift. 873. Linn. Sp. Pl. 1254. Willd. Sp. Pl. v. 3. 2148. Ait. Hort. Kew. v. 5. 96. Jacq. Obf. fafc. 4. 10. t. 94.)—Leaves tongue-fhaped, obtufe, toothed, clafping the much-branched ftem. Radiant florets numerous, roundifh.—Native of fields in the fouth of Europe; a hardy annual with us, but preferved for the fake of variety, rather than ornament, the flowers being inferior in fize and fplendour to our wild *Chryfanthemum fegetum*, while the leaves refemble thofe of *C. Leucanthemum.* The plant however is very different from both thofe, and a true *Pyrethrum*, akin to the laft defcribed, the *feed* having a very evident membranous crown, as Willdenow, copying Linnæus, mentions; yet he ftill left this fpecies where he found it. Our predeceffor, the excellent Mr. Wood, has corrected this error. (See CHRYSANTHEMUM, at the end.) We venture likewife to correct the fpecific name, which authors have copied incorrectly from Dalechamp. He calls the plant *Myconi*, after its difcoverer Myconus. The *ftem* is very much branched. *Leaves* fimple, an inch and a half or two inches long, fmooth. *Flowers* on long folitary ftalks, at the ends of the branches, bright yellow, an inch wide; their radiant florets numerous, crowded, fhort, of a roundifh or oblong fhape. *Seed-crown* large, jagged, and fringed.

PYRETICS, formed from πυρετος, *fever*, of πυρ, *fire*, medicines good againft fevers.

PYREXIA, in *Medicine*, from πυρετος, *fever*, a term ufed by Dr. Cullen to fignify feverifh action generally, whether idiopathic or fympathic. The fame writer alfo ufed the term as the denomination of his firft clafs of difeafes, including fevers and inflammations. See his Nofol. Method. clafs 1, *Pyrexiæ.*

PYRGI, or PYRGOS, in *Ancient Geography*, a town of Italy, upon the coaft of Etruria; placed by Ptolemy between Caftrum Novum and Alfium, and faid by Livy to have been a Roman colony.—Alfo, a town of the Peloponnefus, in Meffenia.

PYRGO, in *Geography*, a fea-port town on the S.E. coaft of the ifland of Santoria. N. lat. 36° 26′. E. long. 25° 38′.

PYRGUS, among the Romans, a dice-box of the fhape of a modius, open above, and having a great many fhelves or partitions within it; fo that when the dice were thrown into it out of the fritillum, they were thereby overturned many times before they could reach the bottom, in which there was an opening for them to fall through upon the table.

PYRGUS, in *Botany*, a genus of Loureiro's, Fl. Cochinch. 120, which Mr. Brown, Prodr. Nov. Holl. v. 1. 533, reduces to ARDISIA, fee that article. The name is taken from πυργος, *a turret*, alluding to the conical fhape affumed by the converging ftamens.

PYRHOPOECILOS, in the *Natural Hiftory of the Ancients*, a ftone fo called from its having a great many fpots of the colour of fire.

PYRIATERION, a word ufed by the ancients to exprefs a fweating room.

PYRIATOS, a word ufed by fome authors to exprefs a brick when heated, in order to be applied to the body wrapped up in a cloth by way of a dry fomentation.

PYRICAUSTUM, a word ufed by medical writers to exprefs a burn or fcald.

PYRICUBIUM, in *Natural Hiftory*, the name of a genus of foffile bodies, ufually comprehended, with many others of very different figure and ftructure, under the general name *pyrites.*

The diftinguifhing characters of the pyricubia are thefe; they are compound, inflammable metallic bodies, of a cubic figure, or refembling a die, being compofed of fix fides. Of this genus there are only two known fpecies. Hill.

PYRIFORMIS, in *Anatomy*, a mufcle of the thigh, flattened and triangular in its figure, fituated at the back of the pelvis, and extending from the facrum to the great trochanter. The pofterior furface is covered by the gluteus magnus, and partly by the medius. The anterior is partly in the pelvis, partly on the outfide of the cavity. Within the pelvis it correfponds to the rectum, the fciatic plexus, and the hypogaftric veffels: externally to the cavity it covers the gluteus minimus, the os innominatum, and the capfule of the hip. The upper edge correfponds to the fciatic notch, and the gluteal artery; it then lies clofe to the gluteus medius. The inferior edge correfponds to the leffer facro-fciatic ligament, and then is parallel to the geminus fuperior: it is at firft feparated from the latter mufcle by the great fciatic nerve, and afterwards approaches to, and is united with it.

The bafis of the pyriformis is attached to the fide of the anterior furface of the facrum, in the intervals of the facral foramina, to thefe foramina at their outer parts, to the anterior furface of the great facro-fciatic ligament, and to the pofterior and upper part of the os innominatum. The mufcle proceeds from within outwards, and rather downwards, paffes out of the pelvis at the great facro-fciatic foramen, gradually diminifhes, and terminates in a fmall tendon, fixed to the upper part of the internal furface of the great trochanter.

The attachment of this mufcle to the great trochanter is by means of a tendon, the lower edge of which is connected to that of the fuperior geminus. This tendon expands into an aponeurofis, which, after extending on the front of the mufcle, enters into its fubftance. The flefhy fibres arife from the parts mentioned above; and are fixed in all directions to the tendon. Sometimes a portion of the fciatic nerve paffes through a flit in the mufcle.

When the thigh is extended, the pyriformis will rotate it outwards; but when it is bent, it will act as an abductor. If the thigh is fixed, it will move the pelvis in an oppofite direction.

PYRIPHLEGES, a word ufed by the old writers in medicine to exprefs a perfon labouring under an extreme degree of a febrile heat.

PYRIPLACIS, in *Natural Hiftory*, the name of a genus of pyritæ, the characters of which are thefe: they are compound, inflammable, metallic bodies, found in loofe detached maffes of a fimple and uniform, not ftriated internal ftructure, and are covered with an inveftient coat or cruft.

Of this genus of foffils there are three known fpecies. Hill.

PYRIPOLYGONIUM, the name of a genus of foffils, the characters of which are, that they are compound metallic bodies, of a regular figure, confifting of twelve planes.

There is only one known fpecies of this genus, though fubject to great varieties in its appearance; and this has been by authors hitherto confounded with many other bodies of a very different nature and figure, under the general name *pyrites.*

It is not unfrequent in Cornwall and Devonfhire; but is much more common in Germany. Hill.

PYRITES, *Sulfure metallique*, in *Mineralogy* and *Chemiftry*, a name given to certain ores which contain a large quantity of fulphur, and have a metallic luftre. The Greek word

word πυρίτης, formed of πυρ, *fire*, denotes fire-ftone; a denomination given to this fubftance on account of its inflammability. For the mineralogical characters of copper pyrites, and iron pyrites, fee COPPER *Ore*, and IRON *Ore*.

Befides thefe there are arfenical pyrites, auriferous pyrites, and tin pyrites. Combinations of fulphur with the metals are called by chemifts fulphurets; and the different kinds of pyrites are properly metallic fulphurets. Sulphur has a great affinity for iron, and in combination with this metal, under the form of pyrites, exifts in extenfive beds in primary mountains, or is diffeminated through the fecondary rocks and ftrata, in veins and maffes, or varioufly cryftallized: it occurs alfo in beds of coal and bituminous clay. Iron pyrites may be confidered, after the earths, as one of the moft abundant fubftances in the mineral kingdom, forming a conftituent part of the globe, and by its decompofition giving rife to many important fubterranean phenomena.

The proportions of iron and fulphur in the different fubfpecies of iron pyrites enumerated by mineralogifts are,

52 to 54 Sulphur
48 to 56 Iron.

Magnetic pyrites differs from common pyrites: its conftituent parts, according to Mr. Hatchett, are,

36.50 Sulphur
63.50 Iron.

By the application of heat common pyrites becomes fufceptible of attraction by the magnet; the excefs of fulphur being expelled. Iron pyrites is not worked as an ore of iron, but is principally valued for the green vitriol or fulphate of iron, which it affords when expofed to air and moifture. Sulphur may alfo be obtained from pyrites when heated with charcoal.

The decompofition of pyrites is effected fpontaneoufly by the abforption of oxygen from water and the atmofphere, which converts the fulphur into fulphuric acid, and the iron into an oxyd. Thefe fubftances unite during the procefs, and form the fulphate of iron, or green vitriol.

Some kinds of pyrites are rapidly decompofed, others require to have part of the fulphur expelled by heat. The pyrites, or pyritous fubftance intended to form vitriol, is collected in extenfive heaps, fpreading the furface as much as can be conveniently done. The ground on which thefe heaps are fpread fhould be impervious to water, and inclined, in order that the faline matter which efflorefces may be wafhed off, and conveyed into refervoirs to cryftallize. As the decompofition proceeds the mafs becomes heated, and is occafionally moiftened, particularly when the air is dry and warm. Thefe beds continue productive for many years, and if the pyrites be pure, but little refiduum is left. An excefs of fulphuric acid is formed during the procefs, on which account a quantity of old iron is added to the folution, to faturate it, and obtain the falt in a cryftallized ftate. During the decompofition of pyrites much heat is evolved, and a confiderable abforption of oxygen from the atmofphere takes place. The fact was firft obferved by Henckel, who affirmed, in his "Pyritologia," that air was neceffary to the procefs of vitriolization, and that it enters into combination with pyrites and remains fixed in it: "non ut inftrumentum tranfiens fed immanens." This may be confidered as a happy anticipation of one of the moft important doctrines of modern chemiftry. Some geologifts have fuppofed that fubterranean fires, and the temperature of hot fprings, are occafioned by the fpontaneous decompofition of immenfe beds of pyrites in the interior of the earth, and an experiment made by Lemery gives fome plaufibility to this opinion. He found that a mixture of iron filings and fulphur, moiftened with a fmall quantity of water, becomes hot in a few hours, the mafs fwells, and the parts adhere together: it then breaks with a perceptible noife and crackling, and emits aqueous vapour, and a fetid odour like that of fulpurated hydrogen gas. If the mixture be made in a large quantity, it takes fire in twenty-four or thirty hours. As foon as the emiffion of aqueous vapour has ceafed, the heat becomes greater and greater, is fucceeded by inflammation, the fmell is then much ftronger, and appears to arife from the hydrogen produced by the decompofition of water. Beaumé, who obferved this phenomenon from a mixture of one hundred pounds of iron filings, with an equal quantity of fulphur in powder, ftates that the flames rofe to a foot in height, but did not continue longer than two or three minutes; the mafs, however, remained red-hot for forty hours. Lemery the elder gave to this experiment the name of the artificial volcano.

Dr. Watfon, in his Chemical Effays, vol. i. p. 187, fays that he has repeated this experiment more than once. When made in the open air the flame is of fhort duration, and the whole mafs, after the extinction of the flame, continues at intervals to throw out fparks. A ladle full of the ignited mafs being dropped down from a confiderable height, defcended like a fhower of red-hot afhes. The fuccefs of this experiment depends on a due proportion of water. Half a pound of flower of fulphur, with half a pound of clean iron filings, mixed with fourteen ounces of water, and worked into a pafte, will acquire heat enough to make the mafs take fire.

Some dark-coloured carbonaceous and bituminous earths contain pyrites in minute grains, and decompofe with great rapidity when expofed to moifture. In the month of Auguft 1751, the cliffs near Charmouth, in Dorfetfhire, containing a fimilar kind of pyritous earth, took fire in confequence of a heavy fall of rain after a hot dry feafon, and continued at intervals to emit flame for feveral years. Almoft all kinds of pit-coal in England contain more or lefs pyrites: in fome the quantity is very inconfiderable, in other kinds it abounds fo much as to render them unfit for domeftic purpofes, and totally inapplicable for forges or iron works, on account of the fulphur which they emit when burned. This pyritous coal may be diftinguifhed by its greater fpecific gravity, and the brafs-like metallic appearance of the pyrites with which it is intermixed. Pyritous coal and coal fhale, or bituminous clay, containing pyrites, frequently take fire fpontaneoufly in coal mines, or when expofed in heaps out of the pits, and continue burning many years. Inftances of this kind now exift in the north of England; and fo intenfe is the heat produced by the ignition of thefe maffes, that the coal fhale is fometimes fufed. We have feen fpecimens from thefe heaps which have all the characters of cellular volcanic lava. In the vicinity of Leeds there is a large heap of coal fhale which has been on fire near half a century; it is covered in parts with vegetation, and prefents no appearance of ignition during the day; but if a dry ftick be thruft into it the furface is changed in a few minutes. In fome of the coal mines in Leicefterfhire, near Afhby de la Zouch, the ftratum of indurated clay over the main bed of coal contains fo much pyritous matter, and is fo fubject to fpontaneous inflammation when it falls down and is intermixed with fmall coal and moifture, that the miners are obliged to clofe up the fpace with brick-clay where the coal has been worked, to prevent the accefs of air to the combuftible matter. In this ftate, excluded from the air, the pyritous earth fometimes becomes ignited, as is evident by the heat communicated to the neighbouring parts of the mine; but the fire is prevented from fpreading among the coal,

coal, by the precautionary meaſure of cloſing the cavities with clay.

The great heat evolved during the decompoſition of pyrites, may proceed in part from the combination of oxygen with the ſulphur and iron, and may be increaſed by the different capacity of the new compound for heat. Whenever chemical changes take place rapidly, they produce a change in the temperature of ſubſtances, as in the well-known inſtances of lime and water, nitric acid and vegetable oils, &c.

The phenomena accompanying the mud volcanoes in various parts of the world, preſent many appearances which give probability to the opinion, that they proceed from the decompoſition of pyritic ſtrata. See Volcano.

The formation of alum is alſo effected naturally, in many ſituations, by the decompoſition of pyrites, the ſulphuric acid combining with the alumine of pyritous clay. This is not unfrequently the caſe in excavations of coal mines that have been long worked out.

At Hartlet, near Glaſgow, in the excavations of an old coal mine that has been worked ſome centuries, there is a very extenſive formation of alum, from the decompoſition of the roof of the pit. It is a pyritous clay ten inches thick. In the old workings of the mine which are dry the air circulates ſlowly, and the roof gradually decompoſes and exfoliates, and falls upon the floor, in which ſituation the decompoſition proceeds, and the ſubſtance aſſumes the appearance of a ſpicular effloreſcence. In time the whole ſpace to the roof is filled; it is then removed. The maſs conſiſts of earth richly impregnated with ſulphate of alumine, ſulphate of iron, and in ſome inſtances with ſulphate of magneſia. The coal in this mine, contrary to the uſual practice, is worked to the dip, ſo that the old workings are always dry. To this circumſtance may principally be attributed the great accumulation of alum in this mine. In many of the mines in England a ſimilar formation of alum would take place, but they contain too much water to permit the ſaline ſubſtances to remain. In general, alum rock or alum ſhale require to be expoſed in heaps, and burned in the open air, to expel the ſulphur, and combine it with the oxygen from the atmoſphere. The ſulphuric acid thus formed unites with a requiſite portion of the clay during the proceſs.

The gypſum, or the ſulphate of lime which occurs in beds, among ſecondary ſtrata of red ſand-ſtone and beds of marle, probably may owe its preſent ſtate to maſſes of pyrites, which have exiſted over common lime-ſtone, and been decompoſed naturally. The ſulphuric acid thus produced would unite with the lime, and form gypſum. The great quantity of the red oxyd of iron which is in the ſtone and marle that accompany this kind of gypſum, gives much probability to this opinion. The cryſtals of gypſum or ſelenite found detached in beds of clay had probably a ſimilar origin.

Sulphuret of iron may be formed by heating together iron filings and ſulphur. From the experiments of Vauquelin it is proved that there are four ſulphurets of iron, according to the degree of heat and other circumſtances under which the combination may be formed. The firſt ſulphuret conſiſts of

$$\left.\begin{array}{l}78 \text{ Iron} \\ 22 \text{ Sulphur}\end{array}\right\} \text{Artificial.}$$

The ſecond ſulphuret, of

$$\left.\begin{array}{l}64 \text{ Iron} \\ 36 \text{ Sulphur}\end{array}\right\} \text{Natural magnetic pyrites.}$$

The third ſulphuret, of

$$\left.\begin{array}{l}54.16 \text{ Iron} \\ 45.84 \text{ Sulphur}\end{array}\right\} \text{Artificial.}$$

The fourth ſulphuret, of

$$\left.\begin{array}{l}47 \text{ Iron} \\ 33 \text{ Sulphur}\end{array}\right\} \text{Natural common pyrites.}$$

When the quantity of ſulphur does not exceed 40 *per cent.* pyrites is ſoluble in muriatic acid, and may be rendered permanently magnetic. The ſpecific gravity of common pyrites is from 4.60 to 4.83. Of magnetic pyrites 4.51.

Arſenical pyrites, called marcaſite, is diſtinguiſhed from iron pyrites by its colour, which is a ſilver white, and by yielding a ſmell like garlic when rubbed or expoſed to heat. See Arsenic *Ores*.

Auriferous pyrites, or iron pyrites, with a ſmall alloy of gold: the richeſt ſpecimens of this ore in Europe are found in Tranſylvania, containing from 0.02 to 0.03 of gld. Theſe ores are diſtinguiſhed from iron and copper pyrites by their colour, malleability, and ſpecific gravity.

Tin pyrites. See Tin *Ore*.

The pyritæ, in ſubſtance, are never uſed medicinally; nevertheleſs, in their products they are very important. From theſe common ſulphur is extracted, in Sweden and Saxony; the native vitriols are produced in caverns of the earth, or on its ſurface; the greateſt quantities of artificial vitriol are prepared; and the mineral waters, vitriolic, aluminous, ſulphureous, hot or cold, are ſuppoſed to receive their impregnation.

When the matter of the pyrites is mixed with the lead ores, the method of ſeparating the metal by aſſaying is this: roaſt two centners of the ore, as in the uſual method, and keep a ſtronger fire than when the ore is pure. The pyrites, eſpecially when it is merely iron, hinders ore from eaſily growing clammy or turning into large lumps, or entirely melting. When the ore is ſufficiently waſhed, let it cool, beat it to powder, and repeat the roaſting to a third fire, till when it is red-hot in the fire, there is no ſmell of ſulphur; then mix the ore with ſix centners of the black flux, and two of ſandiver, and finiſh the work in the common way, only making the fire greater, and continuing it longer, toward the end of the operation. Cramer's Art of Aſſaying, p. 292. See Lead *Ore*.

Pyrites is applied by ſome authors to the marcaſite ores of all metals; the names of which are varied according to the metals they partake of.

Thus *chryſitis* is that of gold; *argyritis* that of ſilver; *ſideritis* that of iron; *chalcitis* that of copper; and *molybditis* that of lead, &c.

PYRITICUM Liquamen. See Liquamen *Pyriticum*.

PYRITRICHIPHYLLUM, in *Natural Hiſtory*, the name of a genus of foſſils of the claſs of the pyrites, the characters of which are theſe: they are compound, inflammable, metallic bodies, found in looſe maſſes not of any regularly angular figure, and of a ſtriated texture, with foliaceous ends to the ſtriæ, appearing on the ſurface, or within the maſs.

Of this genus there are only two known ſpecies: one having the foliaceous ends of the ſtriæ on the outer ſurface of the maſs; and the other having a ſmooth external ſurface, and the foliaceous ends of the ſtriæ covering the ſides of internal hollows.

The firſt of theſe is found in many of the Engliſh and German mines; the other has been yet only found in the mines on Mendip hills in Somerſetſhire, but there in conſiderable plenty. Hill.

PYRITRICHUM, the name of a genus of pyrites, the characters of which are theſe: they are compound, inflammable, metallic foſſils, always found in detached maſſes of no regularly angular figure, and of a fimply ftriated internal ftructure.

Of this genus of pyritæ there are three known fpecies. All the three fpecies are found plentifully in different parts of the kingdom: the firft in all forts of ftrata, and often loofe on the ground; the fecond principally in the chalk-pits of Kent and Suffex; and the laft in Effex and Hampfhire, and very frequently in the German mines. Hill.

PYRITZ, in *Geography*. See PIRITZ.

PYRMONT, a town of Germany, and capital of the country fo named; its citadel is fortified with a broad ditch, high ramparts, and fubterraneous paffages and vaults; 12 miles S.W. of Hamala. N. lat. 51° 57'. E. long. 9° 17'.— Alfo, a county and principality of Germany, bounded on the N. by the principality of Calenberg, on the E. by Wolfenbuttle and Calenberg, on the S. by Wolfenbuttle, and on the W. by the county of Lippe; about nine miles long, and three broad. The revenues are eftimated at 30,000 rix-dollars, principally arifing from the fprings and falt-works.

PYRMONT *Water*, in *Phyfiology* and *Medicine*, a very brifk, fpirituous chalybeate, abounding in fixed air, and which, when taken up from the fountain at Pyrmont, in Germany, whence its name, fparkles like the brifkeft Champaign wine. It has a pleafant, vinous tafte, and fomewhat fulphureous fmell. It is perfectly clear, and bears carriage better than the Spa water.

The hiftory of thefe waters is accurately given by Hoffmann in his obfervations on them, both in their natural ftate, and in mixture with other bodies.

He firft obferves, that they contain a volatile and fubtile principle, much more penetrating and ftrong, as well as in larger quantity, than any other mineral water; but that this is not to be expected in them any where but upon the fpot, for thofe who tranfport them to other places are conftrained to let a part of this fly off, to preferve the reft. If either glafs or earthen veffels be filled at the fpring, and immediately corked and faftened down, the confequence is, that they will burft on the firft motion, or heat of the weather. They are, therefore, forced to fill them only in part at firft, and let them ftand awhile for this fubtile fpirit to exhale; and then awhile after the filling them up, to cork and fit them for carriage.

2. If they are drank upon the fpot in a morning, on an empty ftomach, they affect the nofe with a pungent tingling, and difturb the head for many hours afterwards.

3. If they are taken at the fpring, they purge but very little; but if taken in another place, after tranfportation, they purge confiderably more, and render the ftools black. It is obfervable alfo, that if they are left in an open veffel a few days, their virtue wholly exhales, and they no longer purge nor render the ftools black.

4. If tea-leaves, baulaftine-flowers, or galls, are put into this water, they firft change it to a blue, from that to a purple, and finally to a black. This is a ready proof that black is only a deep purple, and purple only a deep blue: a little fpirit of vitriol added to this liquor deftroys all the colour, and renders it limpid as before.

5. If any acid be mixed with Pyrmont water, there is raifed an effervefcence, and bubbles of air are carried up in great quantity; and this whether the ftronger acids, fuch as fpirit of vitriol, or aqua fortis, be ufed; or the weaker, as vinegar, lemon juice, or Rhenifh wine.

6. If an alkaline liquor be added, whether it be volatile, as the fpirit of fal ammoniac, or fixed, as the oil of tartar, there is no ebullition raifed, but the liquor becomes turbid and milky. If fpirit of vitriol be afterwards added to this, to faturate the additional alkali, the liquor becomes limpid again.

7. Cow's milk mixed in equal quantity with Pyrmont water does not coagulate, but, on the contrary, becomes thinner than before, and is preferved from turning four fo foon as it otherwife would in hot weather. This is a proof that there is no predominating acid in thefe waters.

8. If fyrup of violets be added to Pyrmont water, it turns it to a beautiful green. This is a proof of the alkaline nature of thefe waters; and it is further proved, by adding fpirit of vitriol, or any other acid, to this green liquor, which on that becomes limpid again.

9. Four pints of this water evaporated over a gentle fire, yield no more than two fcruples of a dry refiduum. Oil of vitriol being poured on this, an acid effervefcence arifes, and with it an acrid and pungent vapour, like that produced by mixing oil of vitriol and common falt. If fpirit of vitriol be ufed inftead of the oil, the effervefcence is in a lefs degree, and the falt is in part changed to a bitter faline mafs, the remainder feparated from which proves to be a calcareous earth, no longer fermenting with the fpirit of vitriol.

10. If a quantity of Pyrmont water be expofed twenty-four hours to the open air in a bafon, it will at the end be found to have loft all its virtues, tafting wholly infipid, and being turbid, inftead of the fine clearnefs it had before, and a yellow ochreous earth is precipitated to the bottom: after this the liquor will no longer fhew any of thofe qualities, which were before its diftinguifhing characters; it will no longer ferment with acids, nor turn black with galls, nor green with fyrup of violets.

It appears from the whole, that the Pyrmont waters poffefs a pure, extremely penetrating, and elaftic mineral fpirit, and that in a very large proportion; and to this their virtues are principally to be attributed. This mineral fpirit, while it remains engaged in a calcareous earth, imitates the properties of an alkaline fubftance; and when joined with a fubtile martial earth, it emulates the properties of vitriol, giving the ftools a black colour, and turning a tincture of galls into ink: and while this remains in the water in thefe forms of an alkaline or vitriolic principle of fo great fubtilty, it cannot but give them very great virtues in ftrengthening the tone of the vifcera, opening obftructions, and ftimulating in a proper manner the excretory ducts, fo as to make them duly perform their office; but as foon as by the ftanding of the water open, or by any other accident, this fubtile element is evaporated, all the virtues of the water muft be gone with it.

The great quantity of this powerful fpirit contained in the waters, makes them more fit for the robuft and ftrong conftitutions, when depraved by illnefs, than for the weak and tender ones; but even the tendereft people may take them, only obferving to take but a fmall dofe, or to dilute them with an equal quantity of common water immediately before the taking them.

Hoffmann alfo recommends the Pyrmont water mixed with equal quantities of milk, on his own experience, in fcorbutic and gouty cafes. Hoffm. Oper. tom. v. p. 143, feq.

We have already obferved, under the articles ACIDULÆ and CARBONIC *Acid*, that Pyrmont water, and other mineral waters of a fimilar nature, owe their acidulous tafte and peculiar virtues to the fixed AIR (carbonic acid) which they contain; and to thofe articles the reader is referred for a brief hiftory of of this important difcovery. We fhall here add fome farther remarks on the effects and medical ufes of this water.

Perfons who drink it at the well are affected with a kind of giddinefs or intoxication, which is probably owing to the great quantity of carbonic acid with which the water abounds. The common operation of this water is by urine; but it is alfo a gentle fudorific; and if taken in large quantity, proves laxative. However, in order to this effect, it is ufual to mix fome falts with the firft glaffes. It is drank by glafsfuls in the morning, to the quantity of from one to five or fix pints, according to circumftances; thofe who drink it walking about between each glafs. This water is recommended in cafes where the conftitution is relaxed; in want of appetite and digeftion; weaknefs of the ftomach, and heartburn; the green ficknefs; female obftructions and barrennefs; the fcurvy, and cutaneous difeafes; and in the gout, efpecially, as Hoffmann obferves, when mixed with milk; in colics; bloody fluxes; diforders of the breaft and lungs; in which cafe it is beft taken lukewarm: in nervous, hyfteric, and hypochondriacal diforders; in apoplexies and palfies; in the gravel and urinary obftructions; in foulnefs of the blood; and in obftructions of the finer veffels. It amends the lax tenure of the blood; exhilarates the fpirits without inflaming, as vinous liquors are apt to do; and is reckoned among the beft reftoratives in decayed and broken conftitutions. It is faid to poffefs the general virtues of the Spa water, and at the fountain it is more fpirituous, as well as a ftronger chalybeate. Elliot's Medicinal Virtues, &c. of Mineral Waters, 1781, p. 181.

Near the famous well at Pyrmont is a ftone quarry under ground, from fome parts in which a fulphureous fteam comes out, which commonly rifes to a fmall height. Animals held in this fteam are foon fuffocated, but recover, if quickly taken out. When a man ftands in this fteam, but with his head over it, it proves an excellent fudorific. Dr. Seip propofes to perform cures in feveral difeafes with it. See Phil. Tranf. N° 448, fect. 4, and Mifc. Berolin. tom. v. part 2. fect. 4. See Grotta *del Serpi.*

Pyrmont *Water, Imitation of.* This medicinal water may be imitated very nicely by art in the following manner: take a quart of the pureft and lighteft water, add to it thirty drops of a ftrong folution of iron made in fpirit of falt, a drachm of oil of tartar per deliquium, and thirty drops of fpirit of vitriol, or a little more or lefs, as is found neceffary, not to let the alkali of the oil of tartar prevail too ftrongly, though it muft prevail a little. Shake all brifkly together, and on tafting it will be found extremely to refemble the true Pyrmont water.

The bafis on which this is founded is the analyfis and trial of the true Pyrmont water, by which it is found to contain a fubtile aqueous fluid, a volatile iron, and a predominant alkali, all joined together into one brifk pungent fpirituous water. The artificial Pyrmont thus made, if the proportions are carefully minded, will extremely refemble the natural, and will have the fame effect as a medicine. Shaw's Lectures, p. 90.

But the beft method of forming artificial Pyrmont water is by impregnating it with fixed air, or carbonic acid, for which we are indebted to Dr. Prieftley. The firft perfon, we believe, who actually compounded an artificial acidulous or fpirituous water, like that of Seltzer or Pyrmont, was M. Venel; though he was ignorant of the real nature of the ingredient to which it owed thefe qualities, and which he erroneoufly fuppofed to be common air. For this purpofe he diffolved in a pint of water two drachms of foffile alkali, to which he added an equal quantity of marine acid: in the procefs he made ufe of a veffel with a narrow neck, and to prevent the efcape of the air, he difpofed the ingredients in fuch a manner, that they could not communicate with each other till after the bottle was corked. In this cafe the fixed air diflodged from the alkaline falt, in a phial nearly full and clofely corked, being confined, fuffers a degree of compreffion that greatly promotes its combination with the water. See Memoires prefentés par les Sçavans Etrangers, tom. ii. containing two Memoirs of M. Venel, read before the Royal Academy of Sciences in 1750; and Laviofier's Effays, &c. by Henry, p. 34, &c. However, Dr. Prieftley was undoubtedly the firft who fo far improved upon the difcoveries made by himfelf and others in relation to the principle then denominated fixed air, as to contrive an eafy method of impregnating water with it. The firft idea of this kind occurred to him in 1767, when, having placed fhallow veffels of water within the region of fixed air on the furface of the fermenting veffels of a brewery, and left them all night in that fituation, he found that the water had acquired a very fenfible and pleafant impregnation. He proceeded to accelerate the impregnation by pouring the water from one veffel into another, while they were both held within the fphere of the fixed air. The method of effecting this by air diflodged from chalk and other calcareous fubftances, did not occur to him till the year 1772, when he publifhed his directions for this purpofe, together with a drawing of the neceffary apparatus, which he had before communicated to the Board of Admiralty. This apparatus, reprefented in *Plate* XV. *Pneumatics*, *fig.* 1, confifts of a glafs veffel, *a*, with a narrow neck, and fo formed, that it will ftand upright, with its mouth downwards: this veffel, when filled with water, and covered with a flip of paper or thin pafteboard, preffed clofe to it, to prevent the admiffion of common air, is inverted in another veffel, *b*, with a little water in it, fo that the flip of paper or pafteboard may be withdrawn, and the end of the pipe, *c*, introduced into it. This pipe is flexible and air-tight, and beft made of leather, fewed with a fhoemaker's waxed thread. It is kept open at both ends by a piece of a quill, while one of them is introduced into the veffel of water, and the other into the bladder *d*; the oppofite end of which is tied round a perforated cork, kept open by a quill, and the cork is made to fit a phial, *e*, two-thirds of which fhould be filled with chalk juft covered with water. Dr. Prieftley has fince found it moft convenient to ufe a glafs tube; and to preferve the advantage which he had of agitating the veffel *e*, he makes ufe of two bladders, communicating by a perforated cork, to which they are both tied. He alfo obferves, that the flexible pipe is not neceffary; but inftead of this a bent tube of glafs muft be ready to be inferted into the hole made in the cork, when the bladder containing the fixed air is feparated from the phial in which it was generated. The extremity of this tube being put under the veffel of water, and the bladder being compreffed, the air will be conveyed into it, as in the other cafe. Inftead of the bladder, a fmall phial may be interpofed between the phial containing the chalk, &c. and the veffel of water: for thus the chalk and water that may be thrown up the tube communicating with this phial will lodge at the bottom of the other, while nothing but the air will get into the pipe communicating with the water. The apparatus being thus prepared, let the phial containing the chalk and water be detached from the bladder, and the pipe alfo from the veffel of water; pour a little oil of vitriol upon the chalk and water; and having carefully preffed all the common air out of the bladder, put the cork into the bottle prefently after the effervefcence has begun. Alfo prefs the bladder once more after a little of the newly-generated air has got into it, in order the more effectually to clear it of all the remains of the common air; and then introduce

troduce the end of the pipe into the mouth of the veſſel of water, as in the drawing, and begin to agitate the chalk and water briſkly. This will preſently produce a conſiderable quantity of fixed air, which will diſtend the bladder; and this being preſſed, the air will force its way through the pipe, and aſcend into the veſſel of water, the water at the ſame time deſcending, and coming into the baſon.

When about one-half of the water is forced out, let the operator lay his hand upon the uppermoſt part of the veſſel, and ſhake it as briſkly as he can, not to throw the water out of the baſon; and in a few minutes the water will abſorb the air, and taking its place, will nearly fill the veſſel as at the firſt. Then ſhake the phial containing the chalk and water again, and force more air into the veſſel, till, upon the whole, about an equal bulk of air has been thrown into it. Alſo ſhake the water as before, till no more of the air can be imbibed. As ſoon as this is perceived to be the caſe, the water is ready for uſe; and if it be not uſed immediately, ſhould be put into a bottle as ſoon as poſſible, well corked, and cemented. It will keep, however, very well, if the bottle be only well corked, and kept with the mouth downwards.

It may be proper to obſerve on this proceſs, that the phial, *c*, ſhould always be placed conſiderably lower than the veſſel *a*; that the water to which the chalk is put ſhould be changed after every operation; that with a veſſel of water holding three pints, and a phial containing the chalk and water of ten ounces, a little more than a tea-ſpoonful of oil of vitriol will produce air enough to impregnate ſuch a quantity of water, that the whole proceſs does not take up more than a quarter of an hour, and the agitation not five minutes; and that in this method the water is eaſily made to imbibe an equal bulk of air; whereas Dr. Brownrigg found that Pyrmont water at the ſpring-head did not contain ſo much as one-half. This apparatus has received conſiderable improvements, which we ſhall briefly recite; but in juſtice to the merit of the original inventor, his method deſerves to be recorded; and beſides, it requires leſs time, and is much leſs expenſive than thoſe that are now generally uſed.

The apparatus contrived by Dr. Nooth, and improved by Mr. Parker, is repreſented in *fig.* 2. It is made of glaſs, and ſtands on a wooden veſſel, *d d*, reſembling a tea-board; the middle veſſel B has a neck, which is inſerted into the mouth of the veſſel A, to which it is ground air-tight. This lower neck of the veſſel B has a glaſs ſtopple S, compoſed of two parts, both having holes ſufficient to let a good quantity of air paſs through them. Between theſe two parts is left a ſmall ſpace, containing a plano-convex lens, which acts like a valve, in letting the air paſs from below upwards, and hindering its return into the veſſel A. The upper veſſel C terminates below in a tube *r t*, which, being crooked, hinders the immediate aſcent to the bubbles of fixed air into that veſſel, before they reach the ſurface of the water in the veſſel B. The veſſel C is alſo ground air-tight to the upper neck of the middle veſſel B, and has a ſtopple, *p*, fitted to its upper mouth, which has a hole through its middle. The upper veſſel B holds juſt half as much as the middle one B; and the end, *t*, of the crooked tube goes no lower than the middle of the veſſel B.

For the uſe of this apparatus, fill the middle veſſel B with ſpring or any other wholeſome water, and join to it the veſſel C. Pour water into the veſſel A (by the opening *m*, or otherwiſe) ſo as to cover the riſing part of its bottom: about three-fourths of a pint will be ſufficient. Fill an ounce phial with oil of vitriol, and add it to the water, ſhaking the veſſel ſo as to mix them well together. As heat is generated, it will be beſt to add the oil by a little at a time, otherwiſe the veſſel may be broke. Put to this, through a wide glaſs or paper funnel, about an ounce of powdered raw chalk, or marble. White marble being firſt granulated, or pounded like coarſe ſand, is better for the purpoſe than pounded chalk, becauſe it is harder; and, therefore, the action of the diluted acid upon it is ſlower, and laſts a conſiderable time. On this account the ſupply of fixed air from it is more regular than with the chalk: and beſides, when no more air is produced, the water may be decanted from the veſſel A, and the white ſediment waſhed off, and the remaining granulated marble may be employed again, by adding to it freſh water and a new quantity of oil of vitriol. The funnel in this proceſs is made uſe of in order to prevent the powder from touching the inſide of the veſſel's mouth: for if that happens, it will ſtick ſo ſtrongly to the neck of the veſſel B, as not to admit of their being ſeparated without breaking. Place immediately the two veſſels B and C (faſtened to each other) into the mouth of the veſſel A, as in the figure, and all the fixed air which is diſengaged from the chalk or marble by the oil of vitriol, will paſs up through the valve in S into this veſſel B. When this fixed air comes to the top of the veſſel B, it will diſlodge from thence as much water as is equal to its bulk: which water will be forced up through the crooked tube into the upper veſſel C.

Care muſt be taken not to ſhake the veſſel A when the powdered chalk is put in; otherwiſe a great and ſudden efferveſcence will enſue, which will perhaps expel part of the contents. In ſuch caſe it may be neceſſary to open a little the ſtopple *p*, in order to give vent, otherwiſe the veſſel A may burſt. It will be proper alſo to throw away the contents, and waſh the veſſel; for the matter will ſtick between the necks of the veſſels, and cement them together. The operation muſt then be begun afreſh. But if the chalk be thrown in without ſhaking the machine, or if marble be uſed, the efferveſcence will not be violent. If the chalk be put into the veſſel looſely wrapt up in paper, this accident will be ſtill better guarded againſt. When the efferveſcence goes on well, the veſſel C will ſoon be filled with water, and the veſſel B half filled with air; which will eaſily be known to be the caſe, by the air going up in large bubbles through the crooked tube *r t*.

When this is obſerved, take off the two veſſels B and C together as they are, and ſhake them ſo that the water and air within them may be much agitated. A great part of the fixed air will be abſorbed into the water; as will appear by the end of the crooked tube being conſiderably under the ſurface of the water in the veſſel. The ſhaking them for two or three minutes will be ſufficient for this purpoſe. Theſe veſſels muſt not be ſhook while joined to the under one A, otherwiſe too great an efferveſcence will be occaſioned in the latter; together with the ill conſequences above-mentioned. After the water and air have been ſufficiently agitated, looſen the upper veſſel C, ſo that the remaining water may fall down into B, and the unabſorbed air paſs out. Put theſe veſſels together, and replace them into the mouth of A, in order that B may be again half filled with fixed air. Shake the veſſels B and C, and let out the unabſorbed air as before. By repeating the operation three or four times, the water will be ſufficiently impregnated.

Whenever the efferveſcence nearly ceaſes in the veſſel A, it may be renewed by giving it a gentle ſhake, ſo that the powdered chalk or marble at the bottom may be mixed with the oil of vitriol and water above it; for then a greater quantity of fixed air will be diſengaged.

When the efferveſcence can be no longer renewed by ſhaking the veſſel A, either more chalk muſt be put in, or more

more oil of vitriol; or more water, if neither of these produce the desired effects.

The ingenious Mr. Magellan has still farther improved the contrivance of Dr. Nooth and Mr. Parker; he has two sets of the vessels B and C. While he is shaking the air and water contained in one of these sets, the other may be receiving fixed air from the vessel A. By this means twice the quantity of water may be impregnated in the same time. He has a wooden stand K (*fig.* 3.) to fix the vessels B, C on, when taken off from A, which is very convenient. He has a small tin trough for measuring the quantity of chalk or marble requisite for one operation, and a wide glass funnel for putting it through into the vessel A, to prevent its sticking to the sides, as mentioned before.

He has also contrived a stopple without a hole, to be used occasionally, instead of the perforated one *p*. It has a kind of bason at the top, to hold an additional weight when necessary. (See *fig.* 4.) The stopple must be of a conical figure, and very loose; but so exactly and smoothly ground as to be air-tight merely by its pressure, which may be increased by additional weights put into its bason. Its use is to compress the fixed air on the water, and thereby increase the impregnation: for by keeping the air on the water in this compressed state, the latter may be made to sparkle like Champaign. And if the vessels are strong, there will be no danger of their bursting in the operation.

If the vessels be suffered to stand six or eight hours, the water will be sufficiently impregnated even without agitation. But by employing the means above described, it may be done in as many minutes.

The water thus impregnated may be drawn out at the opening *k*. But if it is not wanted immediately, it will be better to let it remain in the machine, where it has no communication with the external air. Otherwise the fixed air flies off by degrees, and the water becomes vapid and flat; as also happens to other acidulous waters. But it may be kept a long time in bottles well stopped, especially if they are placed with their mouths downwards.

Mr. Blades of Ludgate-Hill has still farther improved this apparatus, by changing the stopple at *k* for a glass cock, which is more convenient. He has likewise altered the middle vessel B into a form more advantageous for the impregnation. See *fig.* 5.

For Dr. Hulme's method of impregnating water with fixed air, we refer to his "Safe and easy Remedy for the Stone," &c. 1778: observing, that he merely mixes the solution of fixed alkaline salt and water, containing as much vitriolic acid as he finds necessary, *á priori*, for neutralizing the alkali, and expelling from it all its fixed air.

Dr. Withering, of Birmingham, has lately contrived a new apparatus for impregnating water with fixed air, which, he says, is preferable to that in common use, because it can be made at less expence, and is more easily prepared; because the whole quantity of fixable air produced is converted to use, without any waste of the vitriolic acid; because it impregnates three times the quantity of water at one time, more completely and with less trouble; and the impregnated water will always retain its virtue, if the joints and cocks of the machine are made perfectly air-tight; for which purpose they should once a year be supplied with a small quantity of unsalted lard. This apparatus is exhibited in *fig.* 6, and consists of a glass vessel A, about ten inches high in the cylindrical part, and six inches and a half in diameter; another glass vessel B, about twelve inches high in the conical part, one inch and a half in the neck, and five inches in diameter at the bottom; a copper pipe C passing through the stopper of the vessel B, and tied fast in the flexible tube D, made of strong leather, air-tight, and kept hollow by means of a spiral wire passing through its whole length; a conical brass pipe E, with a stop-cock fastened to the tube D; another conical pipe F, with a stop-cock G, into which the end of the tube E is accurately ground, so as to be air-tight, and cutting off all communication with the atmosphere when the pipe E is removed; two large hog's bladders H, H, each of which ought to hold two quarts; a stop-cock I, to prevent the water rising into the bladders, when the vessel A is agitated; a bladder K, tied to the crooked tube with the stop-cock L, which occasionally opens or shuts the communication with the vessel B; a glass funnel M, accurately fitted with the glass stopper N; an aperture O, fitted with a glass stopper or a silver cock, from which the impregnated water is to be drawn for use; and, lastly, the tube P opening into the vessel A. When this apparatus is used, let the vessel A be filled with pure water, and any other ingredients that are required, in a proper proportion; into the vessel B put as much marble or whiting, in small lumps, as will cover its bottom to the height of about two inches, and pour in water to the height represented by the dotted line; let the mouth of the vessel A be well fitted with a cork, and through a hole in the cork pass the tube P, putting upon the cork melted sealing-wax of the softest kind, or modelling-wax, so as to make the whole air-tight. The modelling-wax may be procured at the engravers, or it may be prepared by adding to half a pound of melted bees-wax, two ounces of tallow, and one ounce of Venice turpentine: to this mass add a sufficient quantity of red lead, or Spanish brown, to give it a colour, and let the mixture be stirred till it is cold: let the mouth of the vessel B be stopped with a piece of mahogany, turned into a conical figure in a lathe, and of a size somewhat larger than the mouth of the glass will admit; put this piece of wood into melted bees-wax, and heat the wax till the wood begins to grow black: when cool, turn it again till it fits the mouth of the vessel: the tubes C, L, and M, are fitted into holes bored through the wooden stopper, previous to its being immersed in the wax: push these tubes through the holes, and press the stopper into the orifice of the vessel B, and cement the whole with sealing or modelling-wax: shut the stop-cocks I and L, having previously pressed the air out of the bladder K; open the stop-cocks G and E; then squeeze the air out of the bladders H, H, and afterwards press the conical pipe E into the pipe F: pour about a large spoonful of oil of vitriol through the funnel M, and stop it with its stopper N. The fixable air let loose by the effervescence in the vessel B, rising through the tube C, passes into the bladders H, H, and distends them. In this case open the stop-cock I, and from the aperture O draw out about a quart of water; and the space before occupied by the water will be filled with fixable air, which soon begins to be absorbed by the remaining water, and is still supplied from the bladders H, H, and from the effervescing mixture in the vessel B. When the bladders are considerably collapsed, more vitriolic acid must be added through the funnel M, so that they may be always kept pretty fully distended. When an impregnation is speedily required, turn the stop-cocks at G and E, and open that at L; then separate the pipe E from the tube F, and agitate the vessel A; the fixable air will pass into the bladder K, and may be pressed into the two other bladders, when the parts of the apparatus are united. During the agitation, the stop-cock at I should be closed, and open only occasionally to supply out of the bladders H, H, the fixable air absorbed by the water. If a strong impregnation be required, this process should be carried on in a room, the heat of which does not exceed forty-eight degrees of Fahrenheit's thermometer. Dr. Withering observes, obferves, that the impregnated water receives no tafte from the bladders: and that if the veffel A with its impregnated water be feparated from the veffel B, at the conical parting E F, it may be inclofed in a pyramidal mahogany cafe, out of the lower part of which the filver cock at O projects; and thus ferve for an ornamental as well as a luxurious and falubrious addition to the fide-board, particularly in the fummer and autumnal feafons.

Mr. Henry has defcribed a method of impregnating water in large quantities with fixed air, fo as to give it the properties of mineral water, for the ufe of the fick on board of fhips, and in hofpitals. He has given the following account of his apparatus and procefs for this purpofe. Cut off the two extremities of a calf's or pig's bladder *f*, (*fig.* 7.) and having previoufly moiftened them, into one end infert the top of the tubular ftopper *e*, round the neck of which it is to be clofely faftened with ftrong thread. Into the upper end introduce the part *g* of the long bent tube *h*, and tie them round in the fame manner. The pipe *h* muft be paffed through a hole formed by a hot iron borer, in a large cork adapted to the orifice *i* in the cafk B B, holding about ten or twelve gallons, to which it muft be cemented: and the length of the pipe from this point muft be fuch as to reach within a few inches of the bottom of the cafk B B, which is to be completely filled with frefh water, or fuch as has been recovered from lime. See PUTREFACTION *of Water*.

To a quantity of mild calcareous earth and water, placed in the air-veffel C, add a fmall portion of ftrong vitriolic acid, and by the time moft of the common air may be fuppofed to be expelled by the fixed air arifing from the mild calcareous earth, add a larger quantity of acid, and putting the tubulated ftopper *e* in its place, the bladder *f* will become inflated. Prefs it gently till its fides collapfe; and then introducing the pipe *h h*, with its cork, into the orifice *i* of the cafk B B, again prefs the air forward, as it diftends the bladder into the water cafk, where, bubbling up through the water, it will rife to the furface, and by its preffure, force the water to afcend into the funnel *k*, which is to be cemented into the head of the cafk at *l*. In proportion as the water in the cafk becomes impregnated with fixed air, that in the funnel will return into its place; but if, at any time, the latter fhould rife fo high as to be in danger of overflowing, a quantity of air may be let out of the water cafk, by means of the fmall plug at *m*. And this is neceffary to be done, occafionally, to difcharge the refiduum of the fixed air, which is not foluble in water.

If the operation be required to be performed more expeditioufly, it may be quickened by agitating the water cafk. To do this, the tubular ftopper *e* muft be withdrawn from the air-veffel, and fupported, together with the bladder, by an affiftant, while the cafk B B is fhaken. During this time another tubular ftopper muft be put into the air-veffel, and it may be immerfed into a quantity of lime-water to prevent wafte. When the agitation has been continued for fome minutes, in proportion to the falling of the water in the funnel, replace the ftopper attached to the bladder *f* in the air-veffel when taken out of the lime-water, and proceed as before, repeating the agitation occafionally.

During the procefs, additional quantities of vitriolic acid may be introduced into the air-veffel through the opening at *d*, which is to be, at all other times, carefully fecured with its ftopper.

By this procefs, fixed air may be imparted to wine, beer, and almoft any liquor whatever. And when beer is become flat or dead, it will be revived by this means; but the delicate agreeable flavour, or acidulous tafte communicated by the fixed air, and which is manifeft in water, will hardly be perceived in wine, or other liquors, which have much tafte of their own.

The artificial mineral waters thus made, are more pleafant to the tafte than the natural Pyrmont or Seltzer waters; which, befides their fixed air, contain faline particles of a difagreeable tafte, which are known to contribute little or nothing to their medicinal virtues, and may, in fome cafes, be hurtful. They are likewife confiderably ftronger. According to fir John Pringle, thefe waters may be made more nearly to refemble genuine Pyrmont water, by adding to each pint of them from eight to ten drops of tinctura martis cum fpiritu falis. Or this may be done, by adding to the water in the middle veffel B (*fig.* 2.) in the proportion of about thirty grains of Epfom falt, ten grains of common falt, a fcruple of magnefia alba, and a drachm of iron filings, or iron wire, clean and free from ruft, to one gallon of fpring water, and impregnating the whole with fixed air in the manner already defcribed. Let them remain till the other ingredients, and as much of the iron as is neceffary, are diffolved, which will be in two or three days; or the magnefia may be omitted, and then the operation will be finifhed in lefs than half that time. Thefe waters may be rendered ferruginous or chalybeate very eafily, by putting in the middle veffel two or more flender phials, filled with cuttings of fine iron-binding wire, or with fmall iron nails; becaufe the impregnated water will diffolve the iron fo faft, as to become well faturated with it in a few hours, according to the experiments of Mr. Lane. But the method of rendering thefe artificial waters chalybeate, ufed by Dr. Hulme, is to add one grain of falt of fteel to each pint (fixteen ounces) of water already impregnated with fixed air.

The difcovery of an eafy method of impregnating water with fixed air is of great importance; as it is now well known that fuch water is a very powerful antifeptic, or that it both refifts and corrects putrefaction. It is, therefore, given with great fuccefs in putrid fevers, in the fea-fcurvy, in dyfenteries, in mortifications, and in other diforders arifing from a putrid caufe, or attended with putrefaction, a draught of it being taken now and then, or even by way of common drink. But the ingenious Mr. Bewly has invented a ftill better method of exhibiting fixed air as a medicine. He directs a fcruple of alkaline falt to be diffolved in a fufficient quantity (a quarter of a pint, or lefs) of water, which is to be impregnated with as much fixed air as it can imbibe; this is to be drank for one dofe. Mr. Bewly directs it to be prepared in larger quantities at a time, and calls it his mephitic julep. If immediately after it a fpoonful of lemon juice, mixed with two or three fpoonfuls of water, and fweetened with fugar, be drank, the fixed air will be extricated in the ftomach; and thus a much greater quantity of it may be given than the fame quantity of water alone can be made to imbibe. Fixed air acts as a corroborant; and, therefore, may be given with fuccefs in weaknefs of the ftomach, and in vomitings arifing from that caufe. It has alfo been given with fuccefs in the ftone, and in nephritic complaints. When the lungs are purulent, fixed air, mixed with the air drawn into the lungs, has repeatedly been found to perform a cure. The bark alfo may be given with advantage in water impregnated with fixed air, as they both coincide in the fame intention. Fixed air may be applied by means of a fyringe, funnel, or otherwife, to inflamed breafts, putrid ulcers, mortified parts, ulcerated fore throats, and has been found in fuch and fimilar cafes to have very remarkable efficacy. It may alfo be given internally at the fame time. In putrid dyfenteries, and in putrid ftools, fixed air may be given by way of clyfter.

Ferment-

Fermenting cataplaſms are of ſervice chiefly as they ſupply fixed air to the part. In caſes of putridity, fixed air has been ſucceſsfully applied to the ſurface of the body, expoſed to ſtreams of it. It is alſo found an excellent cooling as well as ſtrengthening beverage in hot relaxing weather, and has the advantage of being pleaſant to the taſte. See on the ſubject of this article Prieſtley's Exp. and Obſ. on Air, vol. ii. p. 263, &c. 298, &c. Phil. Tranſ. vol. lxv. part i. p. 59, &c. Magellan's Deſcription of a Glaſs Apparatus for making Mineral Waters, &c. p. 1, &c. Prieſtley's Exp. and Obſ. vol. v. Appendix, p. 389, &c. Elliot's Account of the Nature and medicinal Virtues of the principal Mineral Waters, &c. 1781. Henry's Account of a Method of preſerving Water at Sea, &c. 1781. p. 19, &c.

PYROBOLOGY, or the art of miſſile fires, is derived from the Greek πυρ, *fire*, and βαλλειν, *to throw*. See PYROTECHNY.

PYROBOLUS, in *Natural Hiſtory*, a name given by many authors to the ſtone more generally called *pyrites*; others have called it *ſiderites*, *pyrobalanus*, *pyropus*, and *othonna*, and the Greeks *mylias*.

PYROCHROA, in *Entomology*. See LAMPYRIS.

PYROCTOGONIUM, in *Natural Hiſtory*, the name given by Dr. Hill to a genus of foſſils uſually comprehended by authors, with many other bodies of a different figure and ſtructure, under the general name *pyrites*.

The characters of the pyroctogonium are theſe: it is a compound, inflammable, metallic body, of a regular octohedral figure, or compoſed of eight planes.

There is only one known ſpecies of this genus, which is a very ſingular and elegant foſſil, being compoſed of eight triangular planes; theſe being the ſides of two quadrilateral pyramids, with broad baſes, which being joined baſe to baſe, conſtitute the pyroctogonium.

It is found very frequently in Cornwall, Devonſhire, and moſt other of our counties where there are mines. It is ſometimes met with looſe in the earth, ſometimes lodged in the bodies of marcaſites, or in the ſolid foſſils, and varies ſometimes from its iron colour to a duſky yellow. It is ſometimes alſo found with many ſpecimens connected into a maſs; theſe are ſeldom uniform in ſize, and cohere in various directions, often greatly injuring one another's figure. Sometimes alſo, as in the caſe of the cryſtals, they form a large maſs, of which the outer ſurface only is concreted into or covered with regular figures, the whole inner part being a confuſed ſubſtance.

Maſſes of this kind are not unfrequently found of a regular orbicular figure, and beſet all over with regularly figured pyroctogonia of various ſizes. Hill.

PYRODMALITE, in *Mineralogy*, a mineral diſcovered ſome years ago in the mine of Bjelke, in Vermeland, a province of Sweden, ſituated on the N. ſide of the lake Venner, which was obſerved to have the property of giving out the odour of muriatic acid when heated, and hence diſtinguiſhed by the name of pyrodmalite. J. G. Gahn of Fáhlun has given the following deſcription of it. Its colour is commonly yellowiſh-brown, paſſing into greeniſh: internally, it is light greeniſh-yellow. It occurs cryſtallized in regular ſix-ſided priſms, without any terminating pyramids. It is compoſed of plates lying on each other in a direction perpendicular to the axis of the priſm; principal fracture, reſplendent; croſs fracture, uneven and without luſtre; opaque; ſemi-hard; ſcratched by ſteel; the cryſtals are often ſeveral inches long; ſpecific gravity 3.081. Before the blowpipe it becomes dark reddiſh-brown, and emits the odour of muriatic acid. It then melts into a black ſlag, and at laſt a ſmall bead is obtained, more or leſs attracted by the magnet. It diſſolves readily, and in conſiderable quantity in glaſs of borax, and gives a colour indicating the preſence of mangancſe and iron:—in phoſphate of ammonia and ſoda it diſſolves with great difficulty. Its conſtituents are ſilica, lime, iron, manganeſe, and muriatic acid. In the mine of Bjelke it occurs mixed with iron ore, calcareous ſpar, and black cryſtallized malacolite. Pyrodmalite was lately analyſed by Mr. Hiſinger, who found its conſtituents to be as follow:

Silica - - -	35.4
Oxyd of iron -	32.6
Oxyd of manganeſe	23.1
Alumina - -	0.6
Muriatic acid -	6.5
Loſs - - -	1.8
	100.0

The eſcape of the acid by heat ſeems to indicate the preſence of a portion of water amounting to about two-thirds of the loſs ſtated as ſuſtained in the analyſis. Annals of Philoſophy, N° 12.

PYROENUS, formed of πυρ, *fire*, and οινος, *wine*, is a term ſometimes uſed for rectified ſpirit of wine; thus called becauſe made by fire, or rather becauſe rendered of a fiery nature.

PYROET, PYROUET, or rather *Pirouette*, in the *Manege*. See PIROUETTE.

PYROLA, in *Botany*, a name adopted by Linnæus from the old authors, but not one of their beſt. It is a diminutive of *Pyrus*, and alludes to the reſemblance of the leaves, in this pretty genus, to thoſe of a pear-tree.—Linn. Gen. 221. Schreb. 297. Willd. Sp. Pl. v. 2. 621. Mart. Mill. Dict. v. 3. Ait. Hort. Kew. v. 3. 58. Purſh 299. Sm. Fl. Brit. 443. Prodr. Fl. Græc. Sibth. v. 1. 274. Juſſ. 161. Tourn. t. 132. Lamarck Illuſtr. t. 367. Gærtn. t. 63. (Chimaphila; Purſh 300.)—Claſs and order, *Decandria Monogynia*. Nat. Ord. *Bicornes*, Linn. *Ericæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, ſmall, in five deep ſegments, permanent. *Cor.* Petals five, roundiſh, concave, ſpreading. *Stam.* Filaments ten, awl-ſhaped, ſhorter than the corolla; anthers drooping, large, with two horns at the baſe, each diſcharging the pollen by a terminal orifice. *Piſt.* Germen ſuperior, roundiſh, angular; ſtyle cylindrical, permanent, various in length and direction, ſometimes ſcarcely any; ſtigma thickiſh, variouſly ſhaped. *Peric.* Capſule roundiſh, depreſſed, five-ſided, of five cells, burſting at the angles. *Seeds* numerous, chaffy.

Eſſ. Ch. Calyx in five deep ſegments. Petals five. Capſule ſuperior, with five cells, burſting at the angles, and many ſeeds. Anthers with two pores.

Obſ. In ſome ſpecies the ſtamens and ſtyle are erect; in others inclined to one ſide or the other; in ſome the former ſpread every way. The form of the ſtigma is different in different ſpecies. In two American ones the ſtigma is nearly, or quite, ſeſſile; on which mark Mr. Purſh's genus *Chimaphila* is founded, its name being nearly ſynonimous with Winter-green, the Engliſh appellation of *Pyrola*.

Section 1. *Style elongated.* *Pyrola* of Purſh.

1. P. *rotundifolia.* Round-leaved Winter-green. Linn. Sp. Pl. 567. Willd. n. 1. Ait. n. 1. Purſh n. 1. Engl. Bot. 213. (Pyrola; Ger. Em. 408. Camer. Epit. 723. Rivin. Pentap. Irr. t. 136. f. 2. P. vulgatior; Cluſ. Hiſt. v. 2. 116. Limonium; Fuchſ. Hiſt. 467. L. ſylveſtre; Trag. Hiſt. 707.)—Stamens aſcending. Style twice as long, deflexed and recurved. Cluſter many-flowered. Calyx as long as the ſtamens.—Native of thickets, for the moſt

part in mountainous ſituations, in the more northern parts of Europe, alſo in North America, flowering in July. We have gathered it on the plain of mount Cenis, and in moiſt parts of the ſandy downs of Holland; oppoſite to which, on the Norfolk coaſt, this plant has likewiſe been found by the accurate Mr. Lily Wigg, growing among buſhes, on Bradwell common, not far from Yarmouth; where we likewiſe have ſeen it. There is more difficulty in aſcertaining an indubitable ſtation of this ſpecies in the northern or mountainous parts of Britain, becauſe of the *media* having been ſo much confounded with it, nor have we any ſpecimen from thoſe countries. The *roots* are perennial, long, creeping, thread-ſhaped, ſcaly. *Stems* very ſhort and ſimple, leafy, ſolitary at the end of each ſhoot of the root. *Leaves* four or five; on bordered ſmooth *footſtalks* of various lengths, (from one to two inches); roundiſh or elliptical, obtuſe, an inch or inch and a half long, very obſcurely crenate, ſmooth, ſhining, reticulated with numerous veins; paler beneath. *Flower-ſtalk* terminal, ſolitary, about a ſpan long, angular, ſlightly twiſted, ſmooth, bearing a few ſcattered lanceolate membranous *bracteas*, and terminating in a long, rather looſe, *cluſter*, of from four to eight or ten large, handſome, white, drooping, but not quite pendulous, fragrant *flowers*, each having a ſimilar *bractea* to the reſt, at the baſe of the partial ſtalk, and fully equal to it in length. Segments of the *calyx* lanceolate, acute, full half the length of the *petals*, which, though uſually rounded and blunt, have ſometimes a pointed appearance. *Stamens* about the length of the calyx, all turned upward, and crowded together; their anthers deflexed, yellow, with orange horns. *Germen* ſhort, five-lobed. *Style* twice as long as the ſtamens, ſlender and quite pendulous in its lower part, gradually ſwelling towards the extremity, which is recurved. *Stigma* dilated, annular, with five ſmall central points. *Capſule* the ſize of a pea, depreſſed, five-lobed, crowned with the permanent ſtyle and ſtigma.

2. P. *chlorantha*. Greeniſh-flowered Winter-green.—Swartz in Stockh. Tranſ. for 1810. 190. t. 5. (P. folio obtuſo, flore viridiuſculo; Rivin. Pentap. Irr. t. 138. f. 1.)—Stamens ſlightly aſcending. Style twice as long, club-ſhaped, deflexed and recurved. Cluſter many-flowered. Calyx ſhorter than the ſtamens.—Native of Sweden, and probably, by the ſynonym of Rivinus, of Germany, flowering about the middle of July. Profeſſor Swartz diſtinguiſhes it from the foregoing, by the ſmaller, often abrupt, *leaves; ſtalk* almoſt deſtitute of *bracteas* below; *petals* of a whitiſh, or yellowiſh, green hue; and *ſtamens* leſs curved upwards. We gather alſo, from his figure and deſcription, that the *bracteas* which accompany each *flower* are much ſhorter than the partial ſtalks, and that the *calyx* alſo is ſhorter, and more cloſe-preſſed, than in *P. rotundifolia*. In the poſture and form of the *ſtyle* we find no difference. The common *flower-ſtalk* is remarkably ſpiral. Poſſibly the P. folio rotundo of Rivinus, t. 137, may repreſent this ſpecies in fruit; as the poſture of the permanent *ſtyles* agrees better with it than with the following.

3. P. *media*. Intermediate Winter-green. Swartz in Stockh. Tranſ. for 1804 (not 1784), 257. t. 7. f. 1. Engl. Bot. t. 1945. Winch Guide, v. 2. 19. (P. rotundifolia; Fl. Dan. t. 110.)—Stamens regularly inflexed. Style twice as long, deflexed perpendicularly. Cluſter of many pendulous flowers. Calyx ſhorter than the ſtamens.—Native of buſhy ſhady places in Sweden, and various parts of the north of England, flowering towards the end of June. We ſuſpect alſo that this is the Oxfordſhire ſpecies, commonly miſtaken for *minor*, and that it has often in Scotland, from whence we have ſpecimens, been taken for *rotundifolia*. The *leaves* moſt agree with the laſt-named, but the *flowers* differ eſſentially in being ſmaller, more pendulous, and of a leſs pure white. The *ſtamens* are nearly twice the length of the calyx, all regularly and equally inflexed, not at all turned upward. *Style* bent in a curve downward, its extremity furrowed, ſlightly thickened, vertical, not recurved. The *ſtalk* is ſpiral, as in the laſt, with about two diſtant *bracteas* in its lower part, the *bracteas* which accompany each flower being nearly as long as the partial ſtalks. Even Linnæus may perhaps have confounded this with his true *minor*.

4. P. *minor*. Leſſer Winter-green. Linn. Sp. Pl. 567. Willd. n. 2. Ait. n. 2. Engl. Bot. t. 158. Fl. Dan. t. 55. Rivin. Pentap. Irr. t. 136. f. 1. (P. roſea; Engl. Bot. t. 2543.)—Stamens regularly inflexed. Style the ſame length, ſtraight, ſtigma lobed, pointleſs. Cluſter of many drooping flowers. Stalk ſtraight.—Native of woods and thickets on the mountains of Europe; occurring in ſeveral parts of Scotland and the county of Durham, and flowering in July. This is ſmaller in general than any of the foregoing; the *leaves* more elliptical; *ſtalk* ſtraight, not ſpiral, with three principal angles and a ſmaller one, bearing a few broad *bracteas* near the baſe, but ſcarcely any other, except the ſmall awl-ſhaped ones at each partial ſtalk. The *flowers* are very numerous, but ſmall, drooping or even pendulous, white with more or leſs of a pink tinge. *Stamens* regularly incurved. Pores of the *anthers* dilated, not tubular. *Style* ſtraight, of a much ſhorter proportion than any of thoſe we have hitherto mentioned; the *ſtigma* large, five-lobed; depreſſed, and deſtitute of points, in the centre. We can no longer doubt that t. 158 and t. 2543 of Engliſh Botany repreſent one and the ſame ſpecies, which we poſſeſs alſo from mount Cenis, Savoy, and Switzerland, as well as in the Linnæan herbarium. *P. media*, having been confounded by botaniſts in general with this, has cauſed all our perplexity expreſſed in Engl. Bot. 2543. The plant which Mr. Lightfoot introduced at Bulſtrode, we judge from memory to have been *media;* ſee Engl. Bot. 158.

5. P. *aſarifolia*. Aſarabacca-leaved Winter-green. Michaux Boreal-Amer. v. 1. 251. Purſh n. 2.—"Leaves kidney-ſhaped. Stalk with a few ſheathing, convoluted, diſtant ſcales. Flowers turned every way. Style declining." *Michaux*.—Found by Michaux in Canada; by Purſh in beech woods on the mountains of Pennſylvania, flowering in July. The *flowers* are yellowiſh-green. If it were not for the "ſheathing ſcales," we ſhould ſuſpect this might be the ſame as our *chlorantha*, n. 2, whoſe *leaves* are often, it ſeems, ſhort and abrupt; but we have ſeen no ſpecimens anſwerable to either.

6. P. *dentata*. Toothed Winter-green.—Leaves elliptic-obovate, obtuſe, toothed. Stalk ſtraight, obſcurely angular, nearly naked. Stamens aſcending. Style deflexed, ſtrongly recurved. Stigma with a cylindrical point. Gathered by Mr. Menzies, on the weſt coaſt of North America. This ſpecies is readily diſtinguiſhed from all others, hitherto diſcovered, by its *leaves*, which are obovate, or ſomewhat elliptical, one and a half or two inches long, half or three quarters of an inch broad; their margin beſet with very remarkable diſtinct, ſmall, blunt teeth, uſually near a quarter of an inch aſunder; their ſurface not reticulated, but furniſhed with one ſeries of connected arching veins, on each ſide the midrib. *Footſtalks* triangular, about as long as the leaves. *Flower-ſtalk* ſix inches long, nearly naked, round, very ſlightly angular, bearing a long looſe *cluſter* of *flowers*, much reſembling thoſe of the firſt ſpecies in ſize and ſtructure, as well as in the poſition of their *ſtamens;* but their *ſtyle* is ſtill more remarkably recurved, ſo as to form a ſemicircle; and the point of the *ſtigma* much more prominent, of a cylindrical ſhape, five-cleft at the ſummit.

7. P. *aphylla*. Leafleſs Winter-green.—Stem and ſtalk ſcaly,

fcaly, without leaves. Anthers beaked. Style deflexed and recurved. Stigma with a cylindrical point.—Gathered on the weft coaft of North America, by Mr. Menzies, who affures us the plant is always quite deftitute of *leaves*, inftead of which the angular *ftem* bears numerous lanceolate, membranous, pointed *fcales*, about half an inch in length, a few fimilar but more remote ones being fcattered along the *ftalk*, which is angular. The *flowers* are nearly as large as the laft, but our dried fpecimen will not allow us to determine the pofture of the *ftamens*. The *anthers* are long and narrow, with a fmall acute point at the contrary end to the pores. *Style* deflexed, its end fomewhat recurved. *Stigma* with a long cylindrical point, like the laft.

8. P. *picta*. Variegated Winter-green.—Leaves ovate, fomewhat ferrated. Flowers drooping all one way. Pores of the anthers contracted, tubular. Style curved. Stigma abrupt, with five fmall points.—This alfo was found by Mr. Menzies on the weft coaft of North America. In fome points it agrees with the two laft, as well as with the *rotundifolia* and its allies; in others it refembles the following, but is a totally diftinct fpecies. The *leaves* are near an inch and half long, and almoft an inch wide, ovate, bluntifh, with fhallow, more or lefs diftant, ferratures, rather flefhy, marked with large branching veins, and variegated with white or yellowifh blotches. *Footftalks* nearly as long as the leaves. *Flower-ftalk* fix inches long, obliquely afcending, quadrangular, twifted, bearing two or three fhort, ovate, pointed fcales. *Flowers* numerous, as big as thofe of the *rotundifolia*, all, as far as we can judge from the dried fpecimen, drooping toward one fide. *Calyx* fhort, broad, and fpreading. *Stamens* all, as far as can be difcerned, alike difpofed round the germen; their *anthers* fhort, ovate, minutely pointed, the pores prominent in the form of two fhort narrow tubes, contracted at the orifice. *Style* curved, but we cannot tell in what direction. *Stigma* fcarcely at all thicker than the ftyle, abrupt, with an acute edge, and apparently five minute fharp central points.

9. P. *fecunda*. Serrated Winter-green. Linn. Sp. Pl. 567. Willd. n. 3. Ait. n. 3. Purfh n. 4. Fl. Dan. t. 402. Engl. Bot. t. 517. (P. fecunda tenerior; Cluf. Hift. v. 2. 117. Ger. Em. 408. P. folio mucronato; Rivin. Pentap. Irr. t. 138. f. 2.)—Leaves ovate, acute, ferrated. Flowers drooping all one way. Pores of the anthers dilated. Style ftraight. Stigma dilated, five-lobed.—Native of moffy alpine woods in various parts of Europe, from Lapland to Greece, as well as of fandy barren woods in North America, from Canada to New Jerfey, flowering in July. It occurs in fir or birch woods, in feveral parts of the highlands of Scotland; as alfo near Moffat in the lowlands; and according to Ray in Yorkfhire. The *ftems* are long and trailing. *Leaves* fcattered or crowded, an inch or more in length, with numerous fine fhallow ferratures, and abundance of reticulated veins. *Footftalks* half the length of the leaves. *Flower-ftalk* from three to fix inches long, erect, ftraight; round below; angular above; with two or three green ovate fcales. *Clufter* of many crowded greenifh-white *flowers*, not half the fize of the foregoing, nor fo much expanded. *Stamens* regularly placed round the germen, at firft curved, then ftraight. *Anthers* whitifh, fhort, pointlefs; their pores fomewhat oblique, but not tubular, foon becoming dilated and jagged. *Style* ftraight, twice the length of the flower. *Stigma* much dilated, annular, but thin-edged, terminating in a large five-lobed umbilicated fummit.

10. P. *uniflora*. Single-flowered Winter-green. Linn. Sp. Pl. 568. Willd. n. 6. Ait. n. 6. Purfh n. 5. Fl. Dan. t. 8. Engl. Bot. t. 146. (P. quarta minima; Cluf. Hift. v. 2. 118. Ger. Em. 408. P. flore fingulari; Rivin. Pentap. Irr. t. 139. f. 1.)—Stalk bearing a folitary flower. Pores of the anthers contracted, tubular. Stigma with five rays.—Native of alpine forefts, among moffy rills, in various parts of Europe and North America. It was firft difcovered, in the Britifh dominions, by Mr. James Hoggan, who gathered wild fpecimens, now before us, in the weftern iflands of Harris and Bernera, in 1783. Mr. James Hoy, and Mr. Brodie of Brodie, have alfo gathered this moft elegant and curious plant in fir woods of the county of Moray. It is, like the reft, perennial and evergreen, bloffoming in July. The *leaves* vary greatly in fhape and acutenefs, but are generally roundifh, about an inch long, more or lefs ftrongly ferrated, and reticulated with many veins. *Footftalks* half as long. *Flower-ftalk* folitary, fimple, erect, three inches high, with one concave *bractea*, and a large, terminal, white, or flightly reddifh, *flower*, an inch in diameter, and fmelling like lily of the valley. *Stamens* fpreading equally, half the length of the corolla, three of them lying on one of the petals, one only on another, and two on each of the three remaining. *Anthers* fhort, ovate, pointlefs; their pores tubular, confiderably elongated. *Style* erect, ftraight, the length of the germen. *Stigma* large, of five thick, fpreading, acute, ray-like lobes. The wild fpecimen delineated in Englifh Botany, having travelled from fo great a diftance, was in too imperfect a condition to allow of that figure being fo good as ufual.

Section 2. *Stigma nearly feffile*. *Chimaphila* of Purfh.

11. P. *umbellata*. Umbelled Winter-green. Linn. Sp. Pl. 567. Willd. n. 4. Ait. n. 4. Curt. Mag. t. 778. (P. tertia fruticans; Cluf. Hift. v. 2. 117. Ger. Em. 408. P. folio arbuti; Rivin. Pentap. Irr. t. 139. f. 2. Chimaphila corymbofa; Purfh n. 2.)—Leaves obovate, ferrated. Flowers fomewhat umbellate. Stigma nearly feffile. Stamens fmooth.—Native of woods in the northern parts of Europe, Afia and America, but not found wild in Britain. Mr. Menzies gathered it on the weft coaft of North America, and Mr. Purfh found it frequent in dry woods, from Canada to Virginia. Linnæus, Gmelin, Pollich, Roth, &c. give it in their Floras. Dr. Sims, who received this fpecies in flower in June, from Mr. Loddiges, juftly afferts it to be the moft beautiful of all the genus. The *ftem* is woody, a fpan high, fomewhat branched, angular, and roughifh. *Leaves* crowded together into fomething like whorls, ftalked, narrow-obovate, bluntifh, ftrongly ferrated; dark green and veiny above; paler beneath; about an inch and a half long. *Flower-ftalks* terminal, folitary, three inches long, reddifh, bearing about five, imperfectly umbellate, fimple, partial ftalks, each an inch long, fpreading, rough with glandular pubefcence, and fometimes furnifhed with a little lanceolate *bractea*. *Flowers* fmaller than that of *P. uniflora*, but larger than any other of the foregoing, drooping. *Petals* orbicular, concave, cream-coloured; crimfon at the bafe. *Stamens* fhort, red, all regularly inflexed. *Anthers* fhort, purple, with white tubular pores, dilated and lobed at the orifice. *Germen* globofe, green. *Style* thick and very fhort, but certainly prefent. *Stigma* orbicular, convex, with five flight notches. The American fpecimens are ufually lefs umbellate, and more racemofe, than the European.

12. P. *maculata*. Holly-leaved Winter-green. Linn. Sp. Pl. 567. Willd. n. 5. Ait. n. 5. Curt. Mag. t. 897. (P. mariana, arbuti foliis anguftioribus, &c.; Pluk. Mant. 157. Phyt. t. 349. f. 4. Chimaphila maculata; Purfh n. 1.)—Leaves ovato-lanceolate, with tooth-like ferratures. Stalks two or three-flowered. Stigma nearly feffile. Stamens woolly.—This is exclufively an American fpecies. Mr. Purfh obferved it in fhady gravelly or fandy woods, from Canada to Carolina, and Mr. Menzies brought fpeci-

mens from the north-weſt coaſt. It is now and then met with in our more curious gardens, requiring bog earth, with ſhade and moiſture, and flowering in June and July. Its ſhrubby habit is like the laſt, but of more humble growth. *Leaves* more pointed, with ſharper tooth-like ſerratures; their upper ſurface marked, along the rib and veins, with a pale ſtripe. Partial *flower-ſtalks* uſually two, rarely three, drooping. *Flowers* the ſize of the laſt, but white. *Stamens* denſely fringed in their lower part. *Anthers* with tubular jagged-mouthed pores. *Style* very ſhort and thick. *Stigma* hemiſpherical, nearly entire, green. Mr. Purſh ſays this plant is in high eſteem among the natives of North America for its medicinal qualities, and is called *Sip-ſiſewa*. He witneſſed a ſucceſsful cure of ſevere hyſterics by a decoction of this *Pyrola*.—We can by no means aſſent to the eſtabliſhment of that able writer's genus *Chimaphila*, hinted at by Michaux; there being ſurely no diverſity of habit to ſupport it; nor any character, but a difference of length in the ſtyle; which the other ſpecies of *Pyrola* ſhew to afford admirable ſpecific, but no generic, diſtinctions.

PYROLAMPIS, in *Zoology*. See GLOW-*worm*, and LAMPYRIS.

PYROLIGNEOUS ACID, or *Empyreumatic acid of wood*, in *Chemiſtry*, a ſpecies of empyreumatic ACETOUS *Acid* (which ſee), procured by diſtilling in a glaſs or earthen retort a quantity of ſhavings of any kind of wood, ſuch as box, guaiacum wood, or beech; in which caſe an extremely ſtrong-ſmelling dark-coloured empyreumatic acid liquor is obtained, nearly one-third of the weight of the wood. This acid is ſourer, and alſo much blacker and more empyreumatic, than either the *pyromucous* or *pyrotartareous* acid, probably as requiring a ſtronger heat for its production. The acid of wood is obtained in a large quantity near London, from the preparation of charcoal for gunpowder, by diſtilling wood in caſt-iron cylinders. It ſtains the hands deeply, and wood indelibly. This acid is procured in ſuch a quantity as to be an object of manufacture. At the beſt it is only an inferior acetous acid, and the difficulty of purifying it will prevent the profitable uſe of it in many of the arts to which vinegar is applied. However, as the proceſs for procuring radical vinegar at the ſame time purifies this empyreumatic acid, it may probably be uſed for this purpoſe. It may be added, that much of the acid from the diſtilled charcoal for gunpowder, near London, is employed by calico-printers in forming the acetated iron, uſed as a mordant, as in this caſe the colour and ſmell of the acid are not at all detrimental. Some time ago Vauquelin announced, as a *new* diſcovery, that pyroligneous acid is identically the ſame as the acetous; but this was known to Glauber near 200 years ago. In the folio edition of his works, p. 188, may be ſeen directions for its diſtillation, with a copper-plate of the apparatus which he employed. He there calls it the vinegar of wood. Parker's Chem. Catech. p. 195, note.

PYROMACHUS, a name given by ſome to antimony, when reduced to a ſtony hardneſs; and by others to copper, when fuſed with ſulphur, and thus rendered leſs ductile.

PYROMANCY, πυρομαντεια, a kind of divination, performed by means of fire.

The ancients imagined they could fortell futurity by inſpecting fire and flame: to this end they conſidered its direction, or which way it turned. Sometimes they added other matter to the fire, *e. gr.* a veſſel full of urine, with its neck bound about with wool, watching narrowly on which ſide it would burſt, and thence taking their augury.

Sometimes they threw pitch on it, and if it took fire immediately, they eſteemed it a good augury.

PYROMETER, formed of πυρ, *fire*, and μετρεω, *I meaſure*, in *Phyſics*, the name of a machine contrived to meaſure the alteration of the dimenſions of metals, and other ſolid bodies, ariſing from heat.

Theſe inſtruments have been conſtructed of various forms; but as their object is to render the ſmall expanſions of ſolids apparent to the obſerver, they have conſiſted of a machine adapted to this purpoſe, and of an apparatus fit for heating the bodies under examination to a determined degree.

The moſt uſual, and, indeed, the moſt eligible mode of heating the bodies, is to place them in water, in which a thermometer is placed, and to heat the water by means of lamps. The ſmall expanſions of the heated ſolids have been rendered viſible, *firſt*, by multiplying-wheels, or by levers, or by fine ſcrews, which render a ſmall motion communicated to one end of the mechaniſm productive of a great movement at the other end; and, *ſecondly*, by magnifying the ſmall expanſion through microſcopes; which ſeems, upon the whole, to be the method that is both moſt certain and moſt manageable; for with wheels and pinions, and even with levers or ſcrews, there is always ſome equivocal motion, ariſing from the looſe connection of teeth and pinions, or from the ſtreſs and bending of other parts.

Muſchenbroek, who was the original inventor of this machine, has given a table of the expanſion of the different metals, in the ſame degree of heat. Having prepared cylindric rods of iron, ſteel, copper, braſs, tin, and lead, he expoſed them firſt to a pyrometer with one flame in the middle; then with two flames; and ſucceſſively to one with three, four, and five flames. But previous to this trial, he took care to cool them equally, by expoſing them ſome time upon the ſame ſtone, when it began to freeze, and Fahrenheit's thermometer was at thirty-two degrees. The effects of which experiment are digeſted in the following table, where the degrees of expanſion are marked in parts equal to the $\frac{1}{12500}$dth part of an inch.

Number of Flames.	Expanſion of					
	Iron.	Steel.	Copper.	Braſs.	Tin.	Lead.
By one flame - -	80	85	89	110	153	155
By two flames placed cloſe together	117	123	115	220		274
By two flames $2\frac{1}{2}$ inches diſtant	109	94	92	141	219	263
By three flames placed cloſe together	142	168	193	275		
By four flames placed cloſe together	211	270	270	361		
By five flames - -	230	310	310	377		

It

It is to be obferved of tin, that it will eafily melt when heated by two flames placed together. Lead commonly melts with three flames placed together, efpecially if they burn long.

From thefe experiments it appears, at firft view, that iron is the leaft rarefied of any of thefe metals, whether it be heated by one or more flames; and therefore is moft proper for making machines, or inftruments, which we would have free from any alterations by heat or cold, as the rods of pendulums for clocks, &c. So likewife the meafures of yards or feet fhould be made of iron, that their length may be as nearly as poffible the fame, fummer and winter.

The expanfion of lead and tin, by only one flame, is nearly the fame; that is, almoft double of the expanfion of iron. It is likewife obfervable, that the flames, placed together, caufe a greater rarefaction than when they have a fenfible interval between them; iron, in the former cafe, being expanded 117 degrees, and only 109 in the latter; the reafon of which difference is obvious. By comparing the expanfion of the fame metal, produced by one, two, three, or more flames, it appears, that two flames do not caufe double the expanfion of one; nor three flames three times that expanfion, but always lefs; and thefe expanfions differ fo much the more from the ratio of the number of flames, as there are more flames acting at the fame time.

It is alfo obfervable, that metals are not expanded equally at the time of their melting, but fome more, fome lefs. Thus, tin began to run, when rarefied 219 degrees; whereas brafs was expanded 377 degrees, and yet was far from melting.

As to the conftruction of M. Mufchenbroeck's pyrometer, together with Defaguliers's alterations and improvements, the curious may confult Defagul. Experim. Philof. vol. i. p. 421, &c. See alfo Mufchenbroeck's tranflation of the experiments of the Academy del Cimento, printed at Leyden in 1731. And for a pyrometer of a new conftruction, by which the dilatations of metals in boiling fluids may be examined and compared with Fahrenheit's thermometer, fee Mufchenb. Introd. ad Philofophiam Nat. 4to. 1762, vol. ii. p. 610.

But it has been obferved, that M. Mufchenbroeck's pyrometer was liable to fome objections; and a contrivance was made, with a view of removing thefe, by Mr. Ellicott, who has given a defcription of his improved pyrometer in the Philofophical Tranfactions, N° 443. This may alfo be feen in Dr. Martyn's Abridgment, vol. viii. p. 464.

This inftrument is formed with a flat piece of brafs A A, (*Plate* XXIII. *Mifcellany*, *fig.* 4.) which is fcrewed down to a thick piece of mahogany. Upon this plate are fcrewed three pieces of brafs, two of which, B, B, ferve to fupport the flat iron bar C, called the ftandard bar. The upper part of the third piece of brafs is a circle D, about three inches in diameter, divided into three hundred and fixty equal parts, or degrees: within this circle is a moveable plate *d*, divided likewife into three hundred and fixty parts, and a fmall fteel index. The bar of metal E, upon which the experiment is to be made, is laid on the ftandard bar. F is a lever two inches and a half long, faftened to an axis, which turns in two pieces of brafs, fcrewed to one of the fupports B. To the end of this lever is faftened a chain, or filk-line, which, after being wound round a fmall cylinder, to which the index in the brafs circle, D, is faftened, paffes over a pulley, with a weight hung to the end of it. Upon the axis, to which the lever is fixed, is a pulley, a quarter of an inch in diameter, to which a piece of watch-chain is faftened, the other end of which is hooked to a ftrong fpring G, which bears againft one end of the metal E. H is a lever, exactly of the fame form and dimenfions with the other; but the chain faftened to the pulley on its axis is hooked to the ftandard bar. The line faftened to the end of this lever, after being wound round a cylinder, to which the moveable plate is fixed, paffes over a fmall pulley, and has a weight hung to the end of it; or rather the fame line, paffing under a pulley to which the weight is hung, has its other end faftened to the lever F; fo that one weight ferves for both levers. From this defcription it is plain, that whenever the bar E is lengthened, it gives liberty to the weight to draw the lever F upwards by its action to the fpring G; and the index will, at the fame time, by means of the filk line, be carried forward in the circle; and as the bar fhortens, it will return back again: the fame motion will be communicated to the ftandard bar. When the bar is lengthened the 20th part of an inch, the index will be carried once round the brafs circle, which is divided into three hundred and fixty degrees; and, therefore, if the metal lengthens the 7200dth part of an inch, the index will move one degree. In order to make an experiment with this inftrument, lay a bar of any kind of metal, as E, on the ftandard bar; then heat this bar to any degree of heat with a lamp, and mark the degree of its expanfion, as indicated by the moveable plate; obferve alfo the degree of expanfion of the metal E, by the heat communicated to it from the ftandard bar, as marked on the brafs circle by the index: let the inftrument ftand, till the whole is thoroughly cold; then removing the bar E, lay any others fucceffively in its place, and proceed exactly as before; and thus the degrees of expanfion of different metals, by the fame degree of heat, may be eftimated.

By the help of this inftrument Mr. Ellicott found, upon a medium, that the expanfion of bars of different metals, as nearly of the fame dimenfions as poffible, by the fame degree of heat, were as follow:

Gold,	Silver,	Brafs,	Copper,	Iron,	Steel,	Lead,
73	103	95	89	60	56	149

The great difference between the expanfions of iron and brafs, has been applied with good fuccefs to remedy the irregularities in pendulums arifing from heat. Phil. Tranf. vol. xlvii. p. 485. See PENDULUM.

Mr. Graham ufed to meafure the minute alterations, in length, of metal bars, by advancing the point of a micrometer-fcrew, till it fenfibly ftopped againft the end of the bar to be meafured. This fcrew, being fmall and very lightly hung, was capable of agreement within the three or four thoufandth part of an inch. On this general principle Mr. Smeaton contrived his pyrometer, in which the meafures are determined by the contact of a piece of metal with the point of a micrometer-fcrew. A B C D (*fig.* 5.) reprefents the main bar or bafis of this inftrument; E F is the bar to be meafured, lying in two notches, one fixed to the upright ftandard A B, the other to the principal lever H I; the end E of the bar E F bears againft the point of G, a fcrew which is of ufe in examining the micrometer-fcrew; the other end of the bar F bears againft a fmall fpherically protuberant bit of hard metal, fixed at the fame height as G, in the principal lever H I; K is an arbor fixed in the bafis, which receives at each end the points of the fcrews, H, L, upon which the lever H I turns and ferves as a fulcrum to it; O is a flender fpring, to keep the lever in a bearing ftate againft the bar; and P is a check, to prevent the lever from falling forward, when the bar is taken out; N is the feeler, fomewhat in the fhape of a T, fufpended, and moveable up and down upon the points of the fcrews,

I, M,

I, M, which, as well as L, H, are fo adjufted as to leave the motion free, but without fhake; Q R is the handle of the feeler, moveable upon a loofe joint at R, fo that laying hold of it at Q, the feeler is moved up and down, without being affected by the irregular preffure of the hand; the extremity, S, of the feeler is alfo furnifhed with a bit of protuberant hard metal, to render its contact with the point of the micrometer-fcrew more perfect; T is the micrometer-fcrew; V the divided index-plate; and W a knob for the handle; the micrometer-fcrew paffes through two folid fcrewed holes at D and Y; the piece Y Z is made a little fpringy, and endeavours to pull the fcrew backwards from the hole at D, and confequently keeps the micrometer-fcrew conftantly bearing againft its threads the fame way, and thereby renders the motion thereof perfectly fteady and gentle; X is the index, having divifions upon it, anfwering to the turns of the fcrew. This piece points out the divifions of the plate, as the face of the plate points out the divifors upon the index. When the inftrument is ufed, lay hold of the knob at Q with one hand, and, moving the feeler up and down, with the other move forward the fcrew T, till its point comes in contact with the feeler; then will the plate and index, V and X, fhew the turns and parts. The bafis of this inftrument, as well as the other parts of it, is brafs: one end of which is continued of the fame piece at right angles, to the height of three inches and a half; and the other end acts upon the middle of a lever of the fecond kind, whofe fulcrum is in the bafis; and, therefore, the motion of the extremity of the lever is double the difference between the expanfion of the bar and the bafis. Hence, having the length of the lever from its fulcrum to the point of fufpenfion of the feeler, the diftance between the fulcrum and the point of contact with the bar, the inches and parts that correfpond to a certain number of threads of the micrometer, and the number of divifions in the circumference of the index-plate; the fraction of an inch expreffed by one divifion of the plate may be deduced. Thofe meafures are as follow: from the fulcrum of the lever to the feeler, 5.875 inches; from the fulcrum to the point of contact, 2.895 inches; length of feventy threads of the fcrew, 2.455 inches; and the divifions in the circumference of the index-plate, 100. Hence the value of one divifion will be the $\frac{10}{57863}$d part of an inch: but if the fcrew be altered one-fourth of one of thefe divifions, when the contact between the fcrew and feeler is well adjufted, the difference of contact will be very perceivable to the flighteft obferver; and, confequently, $\frac{1}{23145}$th part of an inch is perceivable in this inftrument. When the inftrument is made ufe of, it is immerged, together with the bar to be meafured, in a ciftern of water; which water, by means of lamps underneath, is made to receive any intended degree of heat not greater than that of boiling, and thereby communicates the fame degree of heat to the inftrument, the bar, and to a mercurial thermometer immerged therein, for the purpofe of afcertaining that degree. See *fig*. 6, in which A B is the ciftern, C the cover, which, when the inftrument (*fig*. 5.) is raifed upon blocks, goes on between the bar E F and the bafis B C; D a handle to take off the cover, when hot; E the mercurial thermometer; F the cock, to let out the water; and G H a hollow piece of tin, which fupports feven fpirit lamps, which are raifed higher or lower by the fcrews I and K, in order to give the water in the ciftern a proper degree of heat. With this pyrometer Mr. Smeaton performed feveral experiments, which are arranged in a table; and their refult agrees very well, he obferves, with the proportions of expanfions of feveral metals given by Mr. Ellicott. The following table fhews how much a foot in length of each metal grows longer, by an increafe of heat correfponding to 180° of Fahrenheit's thermometer, or to the difference between freezing and boiling water, expreffed in fuch parts of which the unit is equal to the 10,000dth part of an inch.

1.	White-glafs barometer-tube	100.
2.	Martial regulus of antimony	130.
3.	Bliftered fteel	138.
4.	Hard fteel	147.
5.	Iron	151.
6.	Bifmuth	167.
7.	Copper hammered	204.
8.	Copper eight parts, mixed with tin one	218.
9.	Caft brafs	225.
10.	Brafs fixteen parts, with tin one	229.
11.	Brafs wire	232.
12.	Speculum metal	232.
13.	Spelter folder, *viz*. brafs two parts, zinc one	247.
14.	Fine pewter	274.
15.	Grain tin	298.
16.	Soft folder, *viz*. lead two, tin one	301.
17.	Zinc eight parts, with tin one, a little hammered	323.
18.	Lead	344.
19.	Zinc or fpelter	353.
20.	Zinc hammered half an inch *per* foot	373.

For a farther account of this inftrument, with its ufe, fee Phil. Tranf. vol. xlviii. art. 79. p. 598, &c.

Mr. Fergufon has conftructed and defcribed a pyrometer, which makes the expanfion of metals by heat vifible to the 45,000dth part of an inch. The upper furface of this machine is reprefented by *fig*. 7. Its frame, A B C D, is made of mahogany, on which is a circle divided into three hundred and fixty equal parts; and within that circle is another, divided into eight equal parts. If the fhort bar E be pufhed one inch forward (or toward the centre of the circle,) the index *e* will be turned 125 times round the circle of 360 parts or degrees. As 125 times 360 is 45,000, it is evident, that if the bar E be moved only the 45,000dth part of an inch, the index will move one degree of the circle. But, as in this pyrometer the circle is nine inches in diameter, the motion of the index is vifible to half a degree, which anfwers to the 90,000dth part of an inch in the motion or pufhing of the fhort bar E.

One end of a long bar of metal F is laid into a hollow place in a piece of iron G, which is fixed to the frame of the machine; and the other end of this bar is laid againft the end of the fhort bar E, over the fupporting crofs-bar H I: and, as the end, *f*, of the long bar is placed clofe againft the end of the fhort bar, it is plain that if F expands, it will pufh E forward, and turn the index *e*.

The machine ftands upon four fhort pillars, high enough from a table, to let a fpirit lamp be put on the table under the bar F; and, when that is done, the heat of the flame of the lamp expands the bar, and turns the index.

There are bars of different metals, as filver, brafs, and iron; all of the fame length as the bar F, for trying experiments on the different expanfion of different metals, by equal degrees of heat applied to them for equal lengths of time; which may be meafured by a pendulum that fwings feconds. Thus,

Put on the brafs bar F, and fet the index to the 360th degree: then put the lighted lamp under the bar, and count the number of feconds in which the index goes round the plate, from 360 to 360 again; and then blow out the lamp, and take away the bar.

This done, put on an iron bar F where the brafs one was

was before, and then set the index to the 360th degree again. Light the lamp, and put it under the iron bar, and let it remain just as many seconds as it did under the brass one; and then blow it out, and you will see how many degrees the index has moved in the circle: and by that means you will know in what proportion the expansion of iron is to the expansion of brass; which will be found to be as 210 is to 360, or as 7 to 12. By this method, the relative expansion of different metals may be found.

The bars ought to be exactly of equal size, and to have them so, they should be drawn, like wire, through a hole.

When the lamp is blown out, you will see the index turn backward; which shews that the metal contracts as it cools.

The inside of this pyrometer is constructed as follows.

In *fig.* 8. A *a* is the short bar, which moves between rollers; and, on the side *a*, it has fifteen teeth in an inch, which take into the leaves of a pinion B (twelve in number), on whose axis is the wheel C of one hundred teeth, which take into the ten leaves of the pinion D, on whose axis is the wheel E of one hundred teeth, which take into the ten leaves of the pinion F, on the top of whose axis is the index above-mentioned.

Now, as the wheels C and E have one hundred teeth each, and the pinions D and F have ten leaves each, it is plain, that if the wheel C turns once round, the pinion F, and the index on its axis, will turn one hundred times round. But, as the first pinion B has only twelve leaves, and the bar A *a* that turns it has fifteen teeth in an inch, which is twelve and a fourth part more; one inch motion of the bar will cause the last pinion F to turn one hundred times round, and a fourth part of one hundred over and above, which is twenty-five. So that if A *a* be pushed one inch, F will be turned one hundred and twenty-five times round.

A silk thread *b* is tied to the axis of the pinion D, and wound several times round it; and the other end of the thread is tied to a piece of slender watch spring G, which is fixed in the stud H. So that as the bar *f* expands, and pushes the bar A *a* forward, the thread winds round the axle, and draws out the spring; and as the bar contracts, the spring pulls back the thread, and turns the work the contrary way, which pushes back the short bar A *a* against the long bar *f*. This spring always keeps the teeth of the wheels in contact with the leaves of the pinions, and so prevents any shake in the teeth.

In *fig.* 7. the eight divisions of the inner circle are so many thousandth parts of an inch in the expansion or contraction of the bars; which is just one thousandth part of an inch for each division moved over by the index. Ferguson's Lectures on Mechanics, Supplem. p. 7, &c. 4to.

Another pyrometer was invented by M. De Luc, in consequence of a hint suggested to him by Mr. Ramsden. The basis of this instrument is a rectangular piece of deal board two feet and a half long, fifteen inches broad, and one inch and a half thick, and to this all the other parts are fixed. This is mounted in the manner of a table, with four deal legs, each a foot long, and an inch and a half square, well fitted near its four angles, and kept together at the other ends by four firm cross-pieces. This small table is suspended by a hook to a stand; the board being in a vertical situation in the direction of its grain, and bearing its legs forward in such a manner as that the cross-pieces which join them may form a frame, placed vertically facing the observer. This frame sustains a microscope, which is firmly fixed in another frame that moves in the former by means of grooves, but with a very considerable degree of tightness; the friction of which may be increased by the pressure of four screws. The inner sliding frame, which is likewise of deal, keeps the tube of the microscope in a horizontal position, and in great part without the frame, insomuch that the end which carries the lens is but little within the space between the frame and the board. This microscope is constructed in such a manner as that the object observed may be an inch distant from the lens; and it has a wire which is situated in the focus of the glasses, in which the objects appear reversed. At the top of the apparatus there is a piece of deal, an inch and a half thick, and two inches broad, laid in a horizontal direction from the board to the top of the frame. To this piece the rods of different substances, whose expansion by heat is to be measured, are suspended: one end of it slides into a socket, which is cut in the thickness of the board, and the other end, which rests upon the frame, meets there with a screw, which makes the piece move backwards and forwards, to bring the objects to the focus of the microscope. There is a cork very strongly driven through a hole bored vertically through this piece; and in another vertical hole, made through the cork, the rods are fixed at the top; so that they hang only, and their dilatation is not counteracted by any pressure. In order to heat the rods, a cylindrical bottle of thin glass, about twenty-one inches high, and four inches in diameter, is placed in the inside of the machine, upon a stand independent of the rest of the apparatus. In this bottle the rods are suspended at a little less than an inch distance from one of the sides, in order to have them near the microscope. Into this bottle is poured water of different degrees of heat, which must be stirred about by moving upwards and downwards, at one of the sides of the bottle, a little piece of wood fastened horizontally at the end of a stick: in this water is hung a thermometer, the ball of which reaches to the middle of the height of the rods. During these operations the water rises to the cork, which thus determines the length of the heated part; the bottle is covered to prevent the water from cooling too rapidly at the surface; and a thin case of brass prevents the vapour from fixing upon the piece of deal to which the rods are fixed. This pyrometer is represented in *fig.* 9, in which *a a* is the stand to which it is suspended; *b* the hook from which it hangs; *c c c* the deal-board, which is the basis of the whole apparatus; *d, d, d, d,* four arms, to which is fixed the frame *e e e e*: the other frame which carries the microscope is *s s s s*: *g, g,* are two cross-pieces, through which passes the tube of the microscope, and which support it near both ends; *h h* is the microscope; *i* its micrometer; *k* the cork, through which passes the glass rod *l l*, and by which it is kept suspended; *m* a rod of metal, or any other substance less dilatable than glass; *n* the point of union, obtained by means of two connected rings, in which both rods are fastened by screws: above these is another pair of rings, in one of which the metal rod is free, and which rod it supports; *o p* the piece to which the glass rod is suspended; *q* a square piece fixed to the frame by four screws, behind which is a box, in which, as well as in a groove cut in the basis in *p*, the piece *o p* slides; *r* a screw, which passes through the square piece *q*, whose use is to move backwards or forwards the piece *q*, in order to bring the surface of the metal rod to the focus of the microscope: *s, s, s, s,* four screws, with round metal plates behind their heads, which serve to press the frame of the microscope against the frame *e e e e*; the longitudinal openings, through which the screws pass, permit the free motion of the first frame, when one strikes gently with a hammer to the bottom or the top of one of the sides. If the microscope is wanted higher or lower than the grooves permit, the screws may be removed

moved to other holes made on purpose in the side pieces or the frame *eeee*: *tttt* is the cylindrical bottle, in which hang the rods in order to be heated at different degrees by water of various temperatures; *u, u*, are the supporters of the bottle; *x* the thermometer suspended in the water; *yy* a rod, to the lower end of which is fixed a small plate, to stir the water, by moving it up and down; *zz* a syphon, one branch of which is within, and the other without, the bottle, the latter being furnished with a cock, which serves to draw off the quantity of water that is necessary for changing the temperature in the bottle. For a farther account of this instrument, together with the principle of its construction and use, both in the comparative measure of the expansions of bodies by heat, and the measure of their absolute expansion, and the experiments made with it, we must refer to an elaborate essay of M. De Luc on Pyrometry, &c. in the Phil. Transf. vol. lxviii. part i. art. 20. p. 419—546.

All the contrivances above described must be considered as inferior to that constructed by Mr. Ramsden, of which general Roy has given an accurate and minute account in the Phil. Transf. vol. lxxv. p. 462. We shall here give such an account as our limits will allow of this instrument, the construction of which is so accurate, says major-general Roy, that it seems not easy to improve it; and refer for a fuller account illustrated by appropriate drawings. This pyrometer, named the *microscopic*, because by means of two microscopes attached to it, the expansion is measured, consists of a strong deal frame, 5 feet long, nearly 28 inches broad, and about 42 inches in height. The metallic bar, whose expansion is to be measured, and which may be even five feet long, is placed in a copper trough little longer than five feet; and this is placed over 12 spirit lamps, the flames of which heat the water of that trough fully to the boiling point, and of course heat the bar which is plunged into it. Two other wooden troughs, also full of water, are placed parallel to, and at a little distance from, the copper one. Each of these contains a cast-iron prismatic bar. To the ends of one of these bars two microscopes are fastened in an horizontal situation, perpendicularly to the bars. One of these microscopes is furnished with a micrometer, or mechanism, to measure the magnified image of an object; the other microscope has a simple mark. The parts of the microscopes, as well as the proper marks for measurement, are so separated and disposed, partly upon the ends of the cast-iron rods, and partly upon the ends of the rod under examination, that if any of them be lengthened or shortened, that alteration is clearly perceived through the microscopes, and may be measured by means of the micrometer. It follows, that if the temperature of the cast-iron prismatic bars be kept unaltered, whilst that of the bar under examination is increased, then the increase of length, which is measured by the micrometer, must be attributed to that bar only, and by these means the expansions of seven substances were ascertained. For further particulars relating to the construction and use of this instrument, we refer to the Transactions (ubi supra), and to the article Expansion in this Cyclopædia. For an account of Wedgwood's pyrometer, see Thermometer. Also, for a description of Mr. Troughton's pyrometer, we are under the necessity of referring to the same article.

PYROMUCOUS Acid, or *Empyreumatic acid of sugar*, or *Syrupous acid*, is different from the acid of sugar, or Oxalic *Acid*, (which see,) and denotes that pungent acid vapour of sugar, or any saccharine matter strongly heated, which is familiar to every person who has ever entered a sugar baking-house. It is prepared by chemists in the following manner: Put into a very large glass retort any quantity of pulverized sugar of any kind, so as to fill only ⅛th of it, as the matter very much swells in the process: adapt to it a large receiver, not closely luted, and heat it gradually on a sand-bath. A great quantity of gas arises when the sugar begins to be scorched, which is mostly carbonic acid mixed with an inflammable gas, probably the gaseous oxyd of carbon. In the receiver is condensed a weak acidulous liquor, coloured by an oily matter, and also apparently fouled by a portion of fuliginous matter volatilized during the distillation. The quantity of acid, obtainable in this process, varies according to the regulation of the fire, which should at least be pushed so as to make the retort red-hot, and to reduce the sugar to a perfect charcoal; but in general about ⅘ths of the weight of sugar may be obtained of the distilled acid. Gum mucilage, manna, honey, starch, and other mucous or mucoso-saccharine substances, yield, by distillation, the same acid as sugar. Aikin, Dict. Min.

PYRONOMIA, a term used by the chemical writers to express the art of regulating fire, so as to make it subservient to all their processes in a determinate degree.

PYROPE, in *Mineralogy*, a precious stone, formerly called the Bohemian garnet. (See Garnet.) The colour is a dark blood red: when held between the eye and the light, the red colour inclines to a yellow. The pyrope is never found crystallized, but occurs in small round or angular fragments imbedded in serpentine rock, or scattered in the sands on the sea-shore, and in alluvial ground. It scratches quartz. The specific gravity is stated by Klaproth 3.718. On account of its lustre, transparency, colour, and hardness, it is much prized by jewellers. The small grains, when powdered, are applied to cut softer stones. According to Klaproth, the constituent parts of pyrope are

Silex	40.0
Alumine	28.50
Magnesia	10.00
Lime	3.50
Oxyd of iron	16.50
Oxyd of manganese	0.25
Loss	1.25

B.

PYROPHAGI. See Fire-*Eaters*.

PYROPHANES, in *Mineralogy*, a variety of the semi-opal; so called because, being heated in a spoon, it becomes transparent, but returns to its opaque state when cold, as Mr. Landriani has discovered. M. Saussure, junior, renders common hydrophanes transparent, and of a topaz colour, when heated by digesting them in melted wax. It is said that some pyrophanes are found in Armenia, which are transparent while exposed to the sun, and opaque at night. See Gem.

PYROPHORUS, formed of πυρ, *fire*, and φερω, *I bear*, in *Chemistry*, the name usually given to that substance called by some *black phosphorus*; a chemical preparation possessing the singular property of kindling spontaneously when exposed to the air.

This substance was accidentally discovered by M. Homberg, who prepared it of alum and human fæces. (See Phosphorus *Fæcalis*.) See also M. Le Fevre's preparation, described under Phosphorus *of Sulphur*.

It was apprehended for a considerable time after the discovery, that human fæces were essential to the operation, till the youngest son of the great Lemery found, that honey, sugar, flour, and, indeed, any animal or vegetable matter, might be substituted instead of the human fæces; and since that time, M. de Suvigny has shewn that moist vitriolic salts may be substituted for the alum; having added to the alu-

 minous

minous pyrophorus of Homberg two other claſſes of ſubſtances of this kind, *viz.* the metallic, or thoſe made with the three vitriols of iron, copper, and zinc; and the neutral, or thoſe compoſed of vitriolated tartar and Glauber's ſalt.

The aluminous pyrophorus may be made in the following manner. Take four or five parts of alum, and one part of wheat flour, or any animal or vegetable ſubſtance; calcine theſe together to a brown or blackiſh maſs: powder the maſs, and put it into a phial; ſtop it looſely with paper, and ſet it in a ſand heat, ſo as to make it continue glowing-hot for ſome time; after this remove the whole from the fire, ſet it to cool gradually, and finally ſtop the bottle very cloſe down.

The following proceſs is recommended by Macquer for this preparation. Let three parts of alum and one part of coarſe brown ſugar be mixed together. This mixture muſt be dried in an iron ladle or ſhovel over a moderate fire, till it be almoſt reduced to a blackiſh powder or coal; during which operation it muſt be ſtirred with an iron ſpatula. Any large maſſes muſt be bruiſed into powder, and then it muſt be put into a glaſs matraſs, the mouth of which is rather ſtraight than wide, and its length ſeven or eight inches. This matraſs is to be placed in a crucible, or rather earthen veſſel, large enough to contain the belly of the matraſs, with about a ſpace equal to the thickneſs of a finger all round it. The ſpace is to be filled with ſand, ſo that the matraſs ſhall not touch the earthen veſſel: the apparatus is then to be put in a furnace, and the whole to be made red-hot; the fire muſt be gradually applied, that any oily or fuliginous matter may be expelled. After which, when the matraſs is made red-hot, ſulphureous vapours exhale: this degree of heat is be continued till a truly ſulphureous flame, which appears at the end of the operation, has continued nearly a quarter of an hour: the fire is then to be extinguiſhed, and the matraſs to cool without taking it out of the crucible; and when it ceaſes to be red-hot, it muſt be ſtopped with a cork. Before the matraſs is perfectly cold, it muſt be taken out of the crucible; and the powder it contains muſt be poured into a very dry glaſs phial, which muſt be well cloſed with a glaſs ſtopper. If we would preſerve this pyrophorus a long time, the bottle containing it muſt be opened as ſeldom as poſſible. Sometimes it kindles while it is poured into the glaſs phial, but it may be then extinguiſhed by cloſing the phial expeditiouſly.

Another excellent method of preparing pyrophorus, cited by Aikin from Higgins's Minutes, is the following. Mix together three parts of Roman alum, and one of flour, and heat the mixture to dryneſs in an iron pot, as already deſcribed: the black calcined maſs thus produced is to be put into ounce phials of green glaſs, coated without and within with clay. The phials thus charged are to be lightly ſtopped with balls of tempered clay, and then ſet up to their necks in ſand in an iron pot; charcoal powder is then to be ſtrewed on to the depth of half an inch, over which is to be placed an earthen cover, luted to the pot. The whole apparatus is now to be placed in a furnace, and kept at a red heat for an hour and a half; at the expiration of which period, being taken out of the furnace and cooled quickly, it is to be unpacked, and the phials containing the pyrophorus are to be placed with their mouths inverted in mercury, in which ſituation the pyrophorus may be kept for many years without injury.

When half a drachm of this pyrophorus is put on a piece of paper and expoſed to air, it quickly kindles, becomes red like burning coals, emits a ſtrongly ſulphureous vapour, and burns the paper or other combuſtible body which ſupports it: and nothing is left but the white earthy baſe of the alum. When no ſenſible change takes place in the pyrophorus, either from a defect in the preparation, or from ſome air remaining in the phial that contains it, the combuſtion may be effected by breathing on the powder, and thus ſupplying it with the moiſture which ſeems to be the primary agent in this phenomenon. The pyrophorus that is made in the laſt method we have recited is ſo highly inflammable as to take fire while it is falling from the mouth of the phial. If it be poured into a jar of pure oxygen gas, it forms a brilliant fiery ſhower: the oxygen is for the moſt part conſumed, and there remain in the jar ſulphureous acid and carbonic acid gaſes: the pyrophorus alſo being conſumed with the exception of its aluminous baſe.

The ſpontaneous accenſion of the aluminous pyrophorus, on its being expoſed to the air, has been a ſubject of conſiderable diſcuſſion among chemiſts and philoſophers; ſeveral of whom have adopted the hypotheſis propoſed by M. de Suvigny, in the Memoires de Mathematique et de Phyſique, tom. iii. To explain this curious appearance, M. de Suvigny obſerves, that the vitriolic acid in the alum, during the calcination in the phial, leaves its earthy baſis, and unites with the phlogiſton in the coal. By its union with this inflammable matter, a part of it is undoubtedly rendered volatile, and exhales partly under the form of volatile vitriolic acid, and partly in that of a blue ſulphureous flame; while another part of it combines likewiſe with the phlogiſton forming a real ſulphur, or an earthy hepar ſulphuris; in which the ſulphur is protected from the fire by the earth with which it is combined, and the particles of which remain every where intermixed with thoſe of the powder. Thus far (ſays Mr. Bewly, an excellent chemiſt and philoſopher) M. de Suvigny is ſupported by the appearances, and by a juſt chemical analyſis of the powder: but he proceeds farther, and ſuppoſes that, at the end of the proceſs, a part of the vitriolic acid is left in a diſengaged, or uncombined ſtate, and highly concentrated. In this ſtate it is well known that this acid attracts moiſture, and at the ſame time generates a conſiderable degree of heat. When the pyrophorus, therefore, is expoſed to the air, he again ſuppoſes that this diſengaged and concentrated acid ſuddenly attracts the watery particles floating in the atmoſphere, and by the heat thus generated, ſets fire to the ſulphur and other inflammable matter contained in the powder. This hypotheſis he has endeavoured to eſtabliſh by the following obſervations; that the pyrophorus, as he apprehends, can be made only with ſubſtances fit for producing ſulphur, or with ſulphur itſelf:—that no pyrophorus will be produced, if the mixture be calcined by too long or too violent a fire; becauſe then the whole vitriolic acid can be combined into perfect ſulphur, and conſequently is engaged, and not in a proper ſtate to attract the moiſture of the air; or elſe if it does not combine into ſulphur, being half diſengaged from its baſis, it is driven off by the violence or long continuance of the fire; and, conſequently, after this complete calcination, no acid remains partly diſengaged, as it ought to be, that it might unite with the water with ſufficient activity:—that when the pyrophorus is very ſlowly moiſtened, as when it is kept in a bottle not well cloſed, it does not kindle, becauſe ſufficient heat is not produced by this ſlow and gradual attraction of water; it is alſo ſpoiled and rendered incapable of kindling, when expoſed to the open air; becauſe its acid becomes then ſaturated, or nearly ſaturated with moiſture, and cannot, therefore, unite with that of the air with ſufficient activity:—that a pyrophorus, thus ſpoiled by expoſure to moiſture, may be reſtored to its peculiar properties by making it again red-hot in a matraſs; ſince by this calcination its partly-difengaged acid is again concentrated, and refumes all its force of combining with water ;—and, laftly, that the inflammation of the pyrophorus is accelerated by placing it upon a paper a little wetted, or by breathing upon it ; becaufe the acid then attracts the moifture more haftily, and confequently with more heat.

M. de Suvigny extends the fame reafoning to the feveral other pyrophori which he difcovered, fimilar to that of alum ; particularly to thofe which are made by fubftituting vitriolated tartar, Glauber's falt, and other vitriolic falts with metallic, earthy, or alkaline bafes, in the room of alum. Mr. Bewly has examined this hypothefis with his ufual acutenefs and accuracy ; and from numerous well-conducted experiments he is led to conclude, that pyrophori of all the above-mentioned claffes may be prepared, differing from them in no other particular, except that they contain no vitriolic acid, and which neverthelefs kindle as readily, on being expofed to the air, as thofe which have been impregnated with that principle. In order to fhew that the prefence of vitriolic acid is not neceffary to conftitute the pyrophorus made with vitriolated tartar, he added to a quantity of this tartar more than an equal weight of powdered charcoal, and calcined the mixture a long time, in a red heat, in an open crucible ; frequently ftirring the powder, in order to expel from it as much of the vitriolic acid as poffible ; the calcination was alfo fometimes repeated with frefh charcoal : and yet on heating the falt, thus deprived of a confiderable part of its acid, with charcoal, in a crucible or tobacco-pipe, in the manner which we fhall here fubjoin, he obferved no diminution in its quality of producing a pyrophorus.

Mr. Bewly, in feveral of his experiments, made ufe of the bowl of a tobacco-pipe, in which he combined the materials, which he wifhed to examine in fmall quantities, and in an expeditious manner ; preffing them down flightly, fo as to fill half or three-fourths of the bowl, and filling the remainder of it with fine fand. This is kept in a red heat twenty minutes, or half an hour ; or it may continue there two hours longer, if the operator pleafes, without any injury to the pyrophorus. The pipe being taken out of the fire, the matter is knocked out of it as foon as it becomes cool, and generally, pretty foon afterwards, takes fire fpontaneoufly. Thus he formed his pyrophorus with a mixture confifting of two parts of alum, previoufly calcined in a red heat ; and of powdered charcoal and falt of tartar each one part.

In another experiment, having added fucceffively various and increafing quantities of fixed alkali to the falt heated as above, till the vitriolic acid contained in the mixture might be confidered nearly as an evanefcent quantity, a pyrophorus was ftill produced on calcining it with charcoal as before. He alfo mixed equal parts of falt of tartar, and vegetable or animal coal, or fometimes three parts of the former with two of the latter, and calcined them in the ufual manner ; and this compofition, on being expofed to the air, generally kindled in half a minute or a minute ; though, as it contained no fulphur, it did not burn with fo much vivacity as the vitriolic pyrophori. This, which Mr. Bewly calls the alkaline pyrophorus, differs in no circumftance from M. de Suvigny's neutral pyrophori, except in its not containing that principle to which he afcribes their accenfion. However, left it might be fufpected that the falt of tartar which he employed might accidentally contain vitriolated tartar, or vitriolic acid, he repeated the experiment with tartar calcined by himfelf, as well as with nitre fixed or alkalifed by deflagration with charcoal, and with iron filings ; and in all thefe cafes with the fame refult. By diverfifying in a like manner M. de Suvigny's experiments on the metallic pyrophori, Mr. Bewly found that none of the three vitriols, heated with charcoal alone, in his ufual method, could produce a pyrophorus. And thus he found that the addition of an alkaline falt to the compofition, which was a part of M. de Suvigny's procefs, was effential to its fuccefs.

Treating in the ufual manner equal parts of calcined green vitriol and charcoal, the powder which contained no fulphur nor hepar fulphuris, did not acquire any of the properties of a pyrophorus. The vitriolic acid feemed to have been entirely diffipated ; having no bafe to detain it, when diflodged from the metallic earth. The charcoal and calx of iron, left in this procefs, were calcined again, together with fome falt of tartar ; and a pyrophorus was produced, which exhibited indications of its containing a fcarcely perceptible portion of hepar fulphuris. Thirty grains of crocus martis aftringens were calcined with fifteen grains of charcoal, and the fame quantity of falt of tartar ; and the mixture burnt fpontaneoufly, though it contained no hepar fulphuris, or vitriolic acid. Having by thefe experiments evinced that metallic pyrophori may be prepared without vitriolic acid, Mr. Bewly proceeded to form an aluminous pyrophorus of the fame kind. For this purpofe, he procured the earth of alum by a long and violent calcination ; and examining a part of it, he found, by the ufual tefts, that it neither contained any fulphur, hepar fulphuris, nor alum undecompounded. This he confidered as perfectly pure, though he afterwards found that it contained a fmall quantity of vitriolated tartar : and yet it repeatedly furnifhed a pyrophorus as active as when alum itfelf is employed. From thefe and fimilar experiments he infers, that the feveral kinds of pyrophori are not kindled by moifture attracted by the vitriolic acid, as M. de Suvigny has maintained : and his conclufion is farther confirmed by fome experiments of Dr. Prieftley, from which it appears, that they are kindled in dry, nitrous, and dephlogifticated air.

M. Prouft, cited by Mr. Bewly, defcribes a variety of new pyrophori, which neither contain vitriolic acid, nor feem likely to owe their accenfion to the attraction of humidity from the air. Thefe principally confift of a coaly matter fimply divided by metallic or other earths ; fuch are the fediment left on the filter in preparing Goulard's extract, various combinations of tartar, or its acid, or the acetous acid, with metals, calcareous earth, &c.

Mr. Bewly, having evinced the infufficiency of M. de Suvigny's theory, and difcovered that the pyrophori are not kindled by moifture, attracted (merely) by the vitriolic acid, directed his attention to the nitrous acid, which Dr. Prieftley has fhewn to be a conftituent part of atmofpherical air, as the probable agent in the production of this phenomenon. The ftrong affinity which this acid has with phlogifton, and the heat, and even flame, which it is known to produce with certain inflammable matters, manifefted that it was equal to the effect ; and having excluded the vitriolic acid from having any effential concern in this operation, he fuggefts, either that the pyrophorus is kindled by moifture attracted by fome of the other ingredients which compofe it ; or that it has the power of decompounding atmofpherical air, by fuddenly attracting its nitrous acid, and thereby generating a heat fufficient to kindle the phlogiftic matter contained in it. This idea appeared plaufible, when he farther confidered that Dr. Prieftley produced the pureft refpirable air with this fame acid combined with other principles ; and that this as well as common air is diminifhed, and probably in part decompounded, in a variety of phlogiftic proceffes. This ingenious writer concludes, upon the whole, from the experiments he hath made, that the pyrophorus feems to owe its fingular

lar property to its being a combination of earth or alkali with phlogiston; the vitriolic acid, when present, only occasionally increasing or diminishing the effect, according to circumstances. In the process of calcination, the earth or alkaline principle is not merely mixed, but actually, though loosely, combined with the phlogistic principle of the coal; so that the pyrophorus, considering it in its most simple state, is only a perfectly dry phlogisticated alkali or earth. On these data, the phenomena may be explained in the two following methods; with respect particularly to the influence of moisture and heat upon the pyrophorus. Supposing either the alkaline or earthy principles to have a greater affinity to water than to the phlogiston with which either of them is united, they may, on being exposed to a moist atmosphere, attract the humidity, and therefore set the phlogistic principle at liberty; which may, in its turn, attract and be ignited by, the supposed aerial acid, its strong affinity to which is well known:—or, if this hypothesis be rejected, the inflammable matter may be kindled, merely in consequence of the heat produced by the combination of the alkali, &c. with moisture. This reasoning, however, supposes the existence of phlogiston, which modern chemists have generally exploded.

The chemical changes that take place during the formation and decomposition of pyrophorus, as they are stated by Aikin, appear to be the following: 1. By being heated below redness in the open air, the ingredients enter into fusion, and thus mix accurately with each other; then the water of crystallization is driven off from the alum, and of the sugar or flour, little else than the charcoal escapes volatilization. 2. The red heat to which it is exposed in the phial causes the sulphuric acid of the alum and charcoal of the sugar to re-act on each other, by which part of the charcoal is driven off in the form of carbonic acid, and part of the sulphuric acid escapes as sulphureous acid. The blue flame that characterizes the latter part of this process is probably caused by the volatilization and combustion of a portion of sulphur, more than is requisite to saturate the potash of the alum. Thus the pyrophorus, when prepared, consists of alumine, charcoal, and sulphuret of potash in intimate mixture. 3. When this powder is exposed to the air, a rapid decomposition of the air itself, and of the moisture which it contains, takes place, the oxygen of each being absorbed by the sulphuret, while a sufficient quantity of heat is disengaged, to bring the charcoal and remainder of the sulphur to a state of actual inflammation. See on the subject of this article, Macquer's Chemical Dict. art. Pyrophorus; and Priestley's Obs. on Air, vol. iii. Appendix, p. 386, &c. vol. iv. Appendix, p. 479, &c. Aikin's Dictionary.

PYROPHYLACIA, a term used by Kircher and some others, to express those magazines of fire which are placed in the cavities of mountains and other hollows of the earth, and serve to supply the several volcanoes in the different parts of the world. See VOLCANO.

PYROPHYSALITE, in *Mineralogy*, is so called from πυρ, *fire*, and φυσαλις, *a bubble*, because this mineral emits bubbles when exposed to the flame of the blowpipe. It is found at Finbo, near Fahlun, in Sweden, imbedded in a granitic rock. The colour of pyrophysalite is white, inclining to green, and occasionally small spots of blue fluor spar are seen on its surface. It commonly occurs in oblong pieces, some of which approach to an irregular rhomboid. It differs from felspar, to which it has the most resemblance, in having but one determinate direction in which it can be split; its specific gravity is also greater, and it fuses more easily. The fragments scratch glass, but are less hard than quartz. The powder of the finest fragments emit a phosphorescent light when heated. Its specific gravity is 3.45, and the constituent parts, according to Hesinger and Berzelius, are

Alumine	-	53.5
Silex	-	32.88
Lime	-	.88
Oxyd of iron		.88
Volatile matter		.75
Loss	-	11.26

The substance lost during the process is suspected to be fluoric acid. Haüy classes this mineral with the topaz. See TOPAZ. B.

PYROPŒCILOS, in the *Natural History of the Ancients*, the name by which they call the granite of Arabia, commonly known to this day under the name of the Oriental granite.

The name is derived from the Greek, πυρ, *fire*, or *fire-coloured*, and ποικιλος, *spotted*; and the ancients having used the epithet fiery to yellow, as well as red, some have imagined the granite must be a yellow stone; but it is evident that red is the colour meant by it here.

PYROSCOPE, an instrument invented by professor Leslie for measuring the intensity of fire. This is merely the *differential* THERMOMETER (which see), with one of its balls covered with silver leaf, while the other is naked. The fire heats the naked ball, but not the silvered ball. Hence the liquid in the tube rises or falls, according to the intensity of the fire, and of course marks that intensity.

PYROSCOPIA, formed of πυρ, *fire*, and σκοπεω, *I consider*, among the Greeks, a kind of divination, being the same with pyromancy and ignispicium.

PYROSIS, in *Medicine*, called in Scotland the *water-brash*, is a disorder of the stomach, which is characterized by a sudden and violent attack of pain in that organ, followed by a copious discharge of a colourless, insipid, and generally cold fluid, resembling saliva, from the œsophagus, mouth, and throat.

The first description of this disease was given by Linnæus, as a common affection of the Laplanders, under the appropriate appellation of *Cardialgia sputatoria*; whence Sauvages gave it the denomination of pyrosis *Suecica*. (Nosol. Meth. class vii. gen. 18.) Dr. Cullen adopted the generic term pyrosis, and deems it an idiopathic disease. It seems to occur, however, in conjunction with other forms of indigestion, and might have been arranged as one of the symptoms of dyspepsia.

The fits of pyrosis usually come on in the morning and forenoon, when the stomach is empty. The first symptom is a pain at the pit of the stomach, with a sense of constriction, as if the stomach were drawn towards the back: the pain is increased by raising the body into an erect posture, and therefore the patient bends himself forward. This pain is often extremely severe, with a sense of burning; and after continuing for some time, it brings on an eructation of a thin watery fluid in considerable quantity. This fluid has sometimes an acid taste; but most commonly it is described as being absolutely insipid. It continues to be brought up for some time, and does not immediately give relief to the pain which preceded it; but at length it terminates the pain, and the fit ceases.

These paroxysms come on without any evident cause, nor is the origin of the disease always to be imputed to any particular sort of diet. It seldom, if ever, attacks those people who use fresh animal food daily; but appears to be most common among those who live almost entirely upon tea, milk, potatoes, and farinaceous substances. It is much more common in women than in men; sometimes it attacks pregnant women, and often those who labour under leucorrhœa. It seldom occurs in any one before the age of puberty, or in those who are considerably advanced in life: when it has once taken place, it is very prone to recur occasionally for a long time afterwards. It is more common in Scotland than in this country, and chiefly affects the lower classes of the people.

While the same diet is continued, it is not always easy to cure the disease. The paroxysm is most effectually relieved by anodynes, especially opium; hyoscyamus, conium, &c. answer a similar purpose; and with less certainty; other stimulants and antispasmodics, as sulphuric æther, ammonia, the tincture of guaiacum, &c. alleviate the fit. These remedies, however, do not materially contribute to prevent the recurrence of the paroxysms; and bitters, aromatics, and the whole of remedies against indigestion, have been often employed in vain. A combination of aromatic laxatives, with strong alkalies and narcotics, have appeared to the writer of this article to be on the whole the most effectual remedies. See Cullen, First Lines, vol. iv. p. 1.

Pyrosis is also a word used to express an intense heat and redness in the face, such as that of persons who travel in extremely hot weather, and the like.

PYROSTRIA, in *Botany*, so called by Commerson, from the pear-shaped striated fruit.—Juss. 206. Willd. Sp. Pl. v. 1. 614. Lamarck Illustr. t. 68.—Class and order, *Tetrandria Monogynia*. Nat. Ord. *Rubiaceæ*, Juss.

Gen. Ch. *Cal.* Perianth superior, short, in four deep, acute, broad segments, deciduous. *Cor.* of one petal, somewhat bell-shaped; tube thrice as long as the calyx, swelling gradually upwards; limb of the same length, in four acute, equal, spreading segments; throat downy. *Stam.* Filaments four, short, inserted into the tube of the corolla, alternate with the segments of the limb; anthers oblong, erect, pointed, shorter than the limb. *Pist.* Germen turbinate, inferior; style short, cylindrical; stigma capitate. *Peric.* Berry small, dry, pear-shaped, with eight furrows, and eight cells, destitute of any crown. *Seeds* solitary in each cell.

Ess. Ch. Calyx four-toothed. Corolla bell-shaped, four-cleft, downy in the throat. Berry inferior, obovate, with eight furrows and eight seeds.

Obs. Jussieu, by an error which seems typographical, attributes five segments to the corolla, which Willdenow copies. There are, however, but four, as the analogy of the other parts, in this case, necessarily requires.

1. P. *salicifolia*. Willow-leaved Streak-berry. Willd. n. 1. (Pyrostria olæoides; Lamarck Illustr. v. 1. 289. t. 68. f. 2, (not f. 4.)—Gathered by Commerson, in the isle of Bourbon; not, as Willdenow has it, the Mauritius. A *shrub*, with round, smooth, greyish, leafy *branches*. *Leaves* opposite, on short stalks, rather crowded, two or three inches long, elliptic-lanceolate, sharpish, entire, coriaceous, smooth, with one rib, and several lateral incurved veins, occasionally accompanied by an axillary gland-like tubercle, that seems accidental; paler beneath. *Stipulas* between the footstalks, and of the same length, awl-shaped, erect, dilated at the base, deciduous. *Flower-stalks* axillary, solitary, somewhat umbellate, bearing one or more simple, single-flowered, partial stalks, with a pair of oblong tapering *bracteas* at the base of the latter. *Flowers* hardly a quarter of an inch long, erect, apparently white. *Fruit*, according to Lamarck, near an inch in length, pear-shaped, umbilicated, with eight deep longitudinal furrows. When cut transversely, it shews the eight seeds, compressed, and radiating from the centre.

PYROTARTAREOUS Acid, or *Empyreumatic acid of tartar*, a species of empyreumatic acetous acid, very different from Tartareous *acid*; which see. To procure this acid, distil any quantity of cream of tartar in a glass or earthen retort, as in the process for Pyromucous *Acid:* the retort being half full of the tartar, on raising the fire very slowly, the first produce is a limpid, acidulous, somewhat bitterish water, after which, as the heat increases, a most prodigious volume of the inflammable gas is given out, together with a stronger acid, and more empyreumatic liquid, and at last a black oil, and some volatile alkali.

The whole quantity of liquid acid procured from tartar in this method, is generally not more than about a quarter of the weight of the tartar, and is not quite so brown, nor so highly empyreumatic as the *pyromucous*. This acid, and also the pyroligneous and pyromucous acids, are capable of very considerable purification by easy methods, so that they lose their empyreuma, their peculiar taste and smell, in which consist their characteristic differences, till at last, when brought into the most concentrated state by some of the modes in which vinegar is dephlegmated, they exhibit the characters of acetous acid so unequivocally, that no doubt can be entertained of their identity. Simple rectification, or redistillation in a very gentle heat, and stopping the process when the liquor at last comes over much coloured, will purify, to a very great degree, the pyromucous and pyroligneous acids: the latter, by this process, from being of a dark coffee colour, assumes the hue of very pale clear brandy. But on long exposure to light, it again becomes brown, for it retains its empyreumatic character more than any other. Charcoal, newly burnt and powdered, contributes very much to the purification of all these acids; they may be either gently distilled off it, or even merely filtered through a stratum of it. But the most effectual method of purification is by uniting these acids with lime, or a fixed alkali, evaporating to dryness, and then expelling the acid by means of the sulphuric acid, in the same manner as the concentrated vinegar is prepared. The acid vapour that rises in this process has now lost its empyreuma almost entirely; has both the strength and the powerful odour of radical vinegar; when again united to potash, forms acetated potash, which may be obtained white by repeated crystallization, or by charcoal powder, and in short is perfect acetous acid. Aikin.

PYROTECHNY, derived from the Greek words πυρ, *fire*, and τεχνη, *art*, is a term applied to the art or science which teaches the management and application of fire in certain operations. Although this term has been used in a very extensive sense by some writers, and applied to the use and structure of fire-arms and artillery employed in the art of warfare, yet it is commonly confined, as it will be in this work, to those articles and instruments made use of for amusement, and for grand public occasions, as the celebration of victories, the demonstrations of public joy on account of peace, after long continued war, &c.

Of the origin of artificial fire-works there is nothing certain recorded. In Europe the invention of them is of recent date, and is given to the Italians. The use of fire-works in China was very general long before they were known in European countries: and from an account given of some recent exhibitions at Pekin, it should seem that they have attained to a degree of perfection not surpassed even by the artists of England, France, or Italy. "The fire-works, in some particulars," says Mr. Barrow in his Travels in China, "exceeded any thing of the kind I had ever seen. In grandeur, magnificence, and variety, they were, I own, inferior to the Chinese fire-works we had seen at Batavia, but infinitely superior in point of novelty, neatness, neatnefs, and ingenuity of contrivance. One piece of machinery I greatly admired; a cheft five feet fquare was hoifted up by a pulley to the height of fifty or fixty feet from the ground: the bottom was fo conftructed as then fuddenly to fall out, and make way for twenty or thirty ftrings of lanterns enclofed in a box to defcend from it, unfolding themfelves from one another by degrees, fo as at laft to form a collection of full 500, each having a light of a beautifully coloured flame burning brightly within it. This devolution and developement of lanterns were feveral times repeated, and, at every time, exhibited a difference of colour and figure. On each fide was a correfpondence of fmaller boxes, which opened in like manner as the others, and let down an immenfe net-work of fire, with divifions and compartments of various forms and dimenfions, round and fquare, hexagons, octagons, &c. which fhone like the brighteft burnifhed copper, and flafhed like prifmatic lightning with every impulfe of the wind. The diverfity of colours with which the Chinefe have the fecret of clothing fire feems one of the chief merits of their pyrotechny. The whole concluded with a volcano, or general explofion and difcharge of funs and ftars, fquibs, crackers, rockets, and granadoes, which involved the gardens for above an hour in a cloud of intolerable fmoke."

The apparatus ufed in making fire-works confifts of folid wooden cylinders, called formers, for rolling the cafes on; fimilar cylinders, either of wood or metal, for ramming down the compofition; moulds for holding the cafes while filling; a machine for contracting the cavity of the cafes; another for grinding the materials; and a particular apparatus for boring fome cafes after they are filled.

Conftruction of the Cartridges for Rockets.--A rocket is a cartridge, or cafe made of ftiff paper, which, being filled in part with gunpowder, faltpetre, and charcoal, rifes of itfelf into the air when fire is applied to it. There are feveral kinds and fizes of rockets, but the three following are the principal: *viz.* 1. Small ones, the calibre of which is not larger than that of a bullet of a pound weight. 2. Rockets, the calibre of which is equal to the fize of a ball of from one to three pounds weight. 3. Large rockets, equal to a ball of from three pounds to a hundred weight.

To give the cartridges the fame length and thicknefs, they are put into a hollow cylinder of metal, or ftrong wood. This mould is not to be confounded with another piece of wood, called the former or roller, around which is rolled the thick paper employed to make the cartridge. The rule for the fize of the mould and roller is this: if the calibre of the mould be divided into eight equal parts, the diameter of the roller muft be equal to five of thefe parts; of courfe the vacuity between the roller and the interior furface of the mould is equal to $\frac{3}{8}$ths of the calibre of the mould, which will be exactly filled by the cartridge.

The fize of the mould is meafured by its calibre; but the length of the moulds for different rockets does not always bear the fame proportion to the calibre, the length being diminifhed as the calibre is increafed. In fmall rockets, the length of the mould ought to be fix times the diameter of the calibre; but in the larger fized rockets, it need not be more than between four and five times the calibre of the mould.

Large ftiff paper of a peculiar kind is employed in making cartridges, and hence it has obtained the name of *cartridge-paper*. This paper is wrapped round the roller, and then cemented by means of common pafte. When the cartridge is formed, the roller is drawn almoft out, by turning it round, until it is diftant from the edge of the cartridge the length of its diameter. A piece of cord is then made to pafs twice round the cartridge at the extremity of the roller; and into the vacuity left in the cartridge another roller is introduced, fo as to leave a fpace between the two. By means of the cord, the cartridge muft be pinched till there remains only an aperture capable of admitting an inftrument called a piercer: then the cord is removed, and its place is fupplied by a piece of packthread.

Befides the roller, a rod is employed to load the cartridge, which muft be fomewhat fmaller than the roller, that it may be eafily introduced into the cartridge. This rod is pierced lengthwife to a fufficient depth to receive the piercer, which muft enter into the mould, and unite with it exactly at the lower part. The piercer, which decreafes in fize, is introduced into the cartridge through the part where it has been choaked, and ferves to preferve a cavity within it.

After the cartridge is placed in the mould, the prepared compofition is to be poured gradually in, and rammed down with great accuracy. When the cartridge is about half filled, feparate, with a bodkin, half of the folds of the paper which remains, and having turned them back on the compofition, prefs them down, and pierce three or four holes in the folded paper, by means of a piercer, which muft be made to penetrate to the compofition of the rocket. Thefe holes ferve to form a communication between the body of the rocket and the vacuity at the extremity of the carriage, as it is called, or that part which has been left empty. In fmall rockets this vacuity is filled with granulated powder, and covered over, which ferves to let them off: in thofe that are larger, the pot, containing ftars, ferpents, and running rockets, is adapted to it.

It now remains to affix the rocket to its rod, which is thus done. When it has been conftructed, in the way juft defcribed, it is to be faftened to a rod of light fmooth wood. Its length and weight muft be proportioned to the fize of the rocket; that is, it ought to be as long as to remain in equilibrium with it, when fufpended on the finger, or other fulcrum, within an inch, or an inch and a half of the neck. Before it is fired, place it with the neck downwards, and let it reft on two nails, in a direction perpendicular to the horizon: and to make it afcend to a greater height, adapt to its fummit a pointed cap made of ftiff paper, which will ferve to facilitate its paffage through the air. To thefe rockets may be added feveral other things, as a petard, which is a box of tin plate filled with fine gunpowder, placed on the fummit. The petard is placed on the compofition, at the end where it has been filled, and the remaining paper of the cartridge is folded down over it, to keep it firm. The petard produces its effect when the rocket is in the air, and the compofition is confumed. A reprefentation of a rocket completely fitted up is given in *Plate Pyrotechny, fig.* 2.

Stars, ferpents, &c. may be added to them, which is done by adjufting to the head of the rocket an empty pot or cartridge, larger than the rocket, in order that it may contain the things intended to render the exhibition the more beautiful. The following tables are neceffary to thofe who would manufacture rockets for themfelves. The firft fhews the fize of the calibre of the mould for rockets of a pound weight and below; and the fecond points out the fize required for the calibre of moulds of from 1lb. to 50lbs. It muft be obferved, that a pound rocket is that which is juft capable of admitting a leaden bullet of a pound weight, and fo of the reft.

Table I.—Size of the Calibre of Moulds of a Pound Weight and below, to One Ounce.

Weight of Rockets in Ounces.	Diameters in Lines.
16	$19\frac{1}{2}$
12	17
8	15
7	$14\frac{3}{4}$
6	$14\frac{1}{4}$
5	13
4	$12\frac{1}{3}$
3	$11\frac{1}{2}$
2	$9\frac{1}{8}$
1	$6\frac{1}{2}$

Here it is evident, that the mould of a rocket of twelve ounces in weight ought to be feventeen lines in diameter ; one of five ounces will require a mould of thirteen lines in diameter. Hence we derive an eafy method of finding the fize when the weights are given : and if the diameter of the rocket be given, it will be equally eafy to find the weight of the ball correfponding to that calibre. Thus, if the diameter be fifteen lines, it will, by the table, be feen that it correfponds to a ball of eight ounces.

Table II.—Size of the Calibre of Moulds, of from 1 to a 50lb. Ball.

Pounds.	Calibre.	Pounds.	Calibre.	Pounds.	Calibre.	Pounds.	Calibre.
1	100	14	241	27	300	40	341
2	126	15	247	28	304	41	344
3	144	16	252	29	307	42	347
4	158	17	257	30	310	43	350
5	171	18	262	31	314	44	353
6	181	19	267	32	317	45	355
7	191	20	271	33	320	46	358
8	200	21	275	34	323	47	361
9	208	22	286	35	326	48	363
10	215	23	284	36	338	49	366
11	222	24	288	37	333	50	368
12	228	25	292	38	336		
13	235	26	296	39	339		

By this fecond table, if the weight of the ball be given the fize of the mould may be found : fuppofe it be 18 pounds, oppofite to it is the number 262. Then we fay by the rule of proportion (as $19\frac{1}{2}$, fee table I. is fuppofed to be divided into 100 parts), 100 : $19\frac{1}{2}$ :: 262 to the fourth term fought, *viz.* 51.09 ; therefore the required calibre is 52 lines nearly, or four inches and four lines, or $4\frac{1}{3}$ inches. But if the calibre be given in lines, the weight of the ball may be found : fuppofe the given calibre be 36 lines, then as $19\frac{1}{2}$: 100 :: 36 : 184. The neareft number in the table to this is 181, which fhews that the weight of the ball will be rather more than 6lbs., or, in other words, that a rocket, the diameter or calibre of which is 36 lines, is a rocket of a 6lb. ball.

The compofition of the powder for rockets muft be different, according to the different fizes, it being completely afcertained that what is proper for fmall rockets would be too ftrong for the larger ones.

For rockets of one or two ounces, the compofition fhould be one pound of gunpowder, and two ounces of finely ground foft charcoal.

For rockets of fomewhat larger fize, the compofition may be ten ounces of gunpowder, three and a half of faltpetre, and three ounces of charcoal.

If the rockets be of five or fix ounces weight, then to two pounds five ounces of gunpowder, add eight ounces of faltpetre, two ounces of fulphur, fix ounces of charcoal, and two ounces of iron filings.

If the rockets be from ten to twelve ounces, you may add to feventeen ounces of gunpowder, four ounces of faltpetre, three and a half of fulphur, and one of charcoal.

For rockets of a pound weight : to one pound of gunpowder add an ounce of fulphur, and three ounces of charcoal.

For rockets of from four to feven pounds : to thirty-one pounds of faltpetre, add four pounds and a half of fulphur, and ten of charcoal : and for thofe that are ftill larger, we may add to eight pounds of faltpetre, one pound four ounces of fulphur, and two pounds twelve ounces of charcoal. In all cafes the ingredients are to be pounded feparately, and finely fifted before they are ufed. Gunpowder, thus reduced from the corns in which it is manufactured, is called meal-powder.

Matches.—The matches to let off rockets are thus made. Take linen, hemp, or cotton thread, and double it eight or ten times, if intended for large rockets, or only four or five times, if to be employed for ftars. When the match is thus made, dip it in pure water, and being foaked, it is to be fqueezed as dry as poffible. Mix fome gunpowder with a little water, fo as to reduce it to a kind of pafte, and immerfe the match in it, turning and twifting it till it has imbibed a fufficient quantity of gunpowder ; then fprinkle it over with dry powder, and when it is dry, it is fit for ufe.

In anfwer to the inquiry what caufes rockets to afcend in the air, we may obferve, that it is nearly the fame as that which produces a recoil in fire-arms. Thus, when powder is inflamed in the chamber of a mufket or cannon, it exerts its power againft the breech of the piece, and againft the bullet or wadding. But the refiftance oppofed by the bullet being much lefs than that oppofed by the mafs of the barrel or cannon, the bullet is forced out with great velocity. The caufe of the afcent of a rocket is nearly the fame. At the moment when the powder begins to inflame, its expanfion produces a torrent of elaftic fluid, which acts in every direction, that is, againft the air which oppofes its efcape from the cartridge, and againft the upper part of the rocket ; but the refiftance of the air is more confiderable than the weight of the rocket ; therefore the rocket afcends by the excefs of the one of thefe forces over the other. This, however, would not be the cafe unlefs the rockets were pierced to a certain depth.

Brilliant Fire and Chinefe Fire.—As iron-filings, when thrown into the fire, enflame and emit a ftrong light, this gave rife to the idea of rendering the fire of rockets much more brilliant, than when gunpowder, or the fubftances of which it is compofed, are alone employed. But the Chinefe have long been in poffeffion of a method of rendering this fire much more brilliant and variegated in its colours. It confifts in the ufe of a very fimple ingredient, namely, caft iron reduced to a powder more or lefs fine : the Chinefe give it a name that anfwers to *iron-fand* in our language. It is prepared from old iron pots pulverized, till the grains are not larger than radifh feed. Thefe, however, are paffed through fieves of different degrees of finenefs; thofe that pafs through the clofeft fieve, are called fand of the firft order ;

order; thoſe which paſs through the next ſieve in ſize, ſand of the ſecond order, and ſo on. This ſand, when it inflames, emits an exceedingly vivid light, forming almoſt inſtantaneouſly luminous flowers and ſtars of various apparent magnitudes. It ſhould be obſerved that rockets, into the compoſition of which iron-filings and iron-ſand enter, cannot be long preſerved, owing to their readineſs in attracting the moiſture which the ſaltpetre gives out. The following tables exhibit the proportions of the different ingredients for rockets of this kind of from 12 to 33 lbs.

For Red Chineſe Fire.

Calibres.	Saltpetre.	Sulphur.	Charcoal.	Sand of the 1ſt Order.
Pounds.	Pounds.	Ounces.	Ounces.	oz. dr.
12 to 15	1	3	4	7 0
81 — 21	1	3	5	7 8
24 — 36	1	4	6	8 0

For White Chineſe Fire.

Calibres.	Saltpetre.	Mealed Gunpowder.	Charcoal.	Sand of the 2d Order.
Pounds.	Pounds.	Ounces.	oz. dr.	oz. dr.
12 to 15	1	12	7 8	11 0
18 — 21	1	11	8 0	11 8
24 — 36	1	11	8 8	12 0

When theſe materials have been accurately weighed, the ſaltpetre and charcoal muſt be three times ſifted through a hair ſieve, in order to their being well mixed: the iron-ſand is then to be moiſtened with brandy to make the ſulphur adhere, and then they are to be thoroughly incorporated.

The upper part of rockets is generally furniſhed with ſome compoſition, which takes fire when it has reached to its greateſt height, emits a conſiderable blaze, or produces a loud report and whizzing noiſe. Of this kind are sauciſſons, maroons, ſtars, ſhowers of fire, &c. To make room for an artifice of this kind, the rocket is crowned with what is called a pot, which is larger than the rocket. (See *fig.* 3.) The following is the method of making this pot, and connecting it with the body of the rocket.

The mould for forming the pot, though of one piece, muſt conſiſt of two cylindric parts of different diameters. That on which the pot is rolled up muſt be three diameters of the rocket in length, and its diameter muſt be three fourths that of the rocket; the length of the other ought to be equal to two of theſe diameters, and its diameter to $\frac{7}{8}$ths that of the rocket. Having rolled the thick paper, intended for making the pot, twice round the cylinder, a portion of it muſt be pinched in that part of the cylinder which has the leaſt diameter: this part muſt be pared in ſuch a manner, as to leave only what is neceſſary for making the pot faſt to the top of the rocket, and the ligature muſt be covered with paper.

To charge ſuch a pot, attached to a rocket. Having pierced three or four holes in the double paper which covers the vacuity of the rocket, pour over it a ſmall quantity of the compoſition with which the rocket is filled, and by ſhaking it, make a part enter theſe holes; then arrange, in the pot, the compoſition with which it is to be charged, taking care not to introduce into it a quantity heavier than the body of the rocket. The whole muſt be ſecured by means of a few ſmall balls of paper, to keep every thing in its place, and the pot muſt be covered with paper cemented to its edges: if a pointed ſummit be added to it, the rocket is fit for uſe.

Serpents.—Theſe are ſmall flying rockets, without rods, which, inſtead of riſing in a perpendicular direction, mount obliquely, and deſcend in a zigzag form, without aſcending to a great height. The compoſition of theſe is nearly the ſame as that of rockets, and the conſtruction is as follows. The length, A C, (*fig.* 4.) of the cartridge is about four inches; it muſt be rolled on a ſtick ſomewhat larger than a gooſe-quill, and after being choaked at one of its ends, it is filled beyond the middle, as to B, with the compoſition; then it is to be pinched ſo as to leave a ſmall aperture. The remainder, B C, muſt be filled with grained powder, which will occaſion a report when it burſts. Laſtly, choak the cartridge entirely towards the extremity C; and at the other extremity, A, place a train of moiſt powder, to which, if fire be applied, it will be communicated to the compoſition in the part A B, and cauſe the whole to riſe in the air. The ſerpent, as it falls, will make ſeveral turns in a zigzag direction, till the fire is communicated to the grained powder in the part B C; on which the ſerpent will burſt with a loud report before it falls to the ground. The ſerpent cartridges are generally made of playing cards. Theſe are rolled round a rod of iron or hard wood, and to confine the card a piece of ſtrong paper is cemented over it. Larger ſerpents may be made by cementing two playing cards together, firſt moiſtened with water.

Maroons are ſmall cubical boxes, filled with a compoſition proper for making them burſt. To conſtruct theſe, cut a piece of paſteboard according to the method taught in geometry to form the cube (ſee *fig.* 5.); join theſe ſquares at the edges, leaving one only to be cemented, and fill the cavity of the cube with grained powder; then cement ſtrong paper in various directions over the body, and wrap round it two rows of packthread, dipped in ſtrong glue: then make a hole in one of the corners, and introduce into it a match. If the maroons are to be luminous, that is, which are to give out a brilliant light before they burſt, they muſt be covered with a paſte, the compoſition of which will be noticed below under *Stars*, and then rolled in meal powder to ſerve as a match or communication.

Sauciſſons differ from maroons only in form. The cartridges of the latter are round, and muſt be only four times their exterior diameter in length. They are choaked at one end in the ſame manner as a rocket, and a pellet of paper is driven into the aperture which has been left, in order to fill it up. They are then charged with corn powder, above which is placed a ball of paper, gently preſſed down to prevent the powder from being bruiſed; the ſecond end of the sauciſſon being now choaked, the edges are to be pared on both ſides, and the whole is covered with ſeveral turns of packthread, dipped in ſtrong glue, and then left to dry.

Stars are ſmall globes which emit a moſt brilliant light, ſo that, momentarily, they may be compared to the light of the ſtars in the heavens. Theſe balls are not larger than a muſket-ball, and when put into rockets they muſt be wrapped up in tow, prepared for the purpoſe. The compoſition of theſe ſtars is as follows: To a pound of fine mealed gunpowder, add four pounds of ſaltpetre, and two pounds of ſulphur. When theſe ingredients are thoroughly mixed, take a piece as large as a ſmall nutmeg, and having

wrapped

wrapped it in a linen rag, or paper, form it into a ball; then tie it clofely round with packthread, and pierce a hole through the middle of it, large enough to receive a piece of prepared tow, which is to ferve as a match. This, when lighted, will exhibit a moft beautiful appearance; becaufe the fire as it iffues from the two ends of the hole in the middle will extend to a great diftance, and will make it feem very much larger than it actually is.

There are other compofitions for ftars; *viz.* with three ounces of faltpetre, mix one ounce of fulphur, and two drachms of mealed gunpowder; or with eight ounces of mealed powder, mix four ounces of fulphur, and the fame quantity of faltpetre. When thefe materials have been well fifted, and fprinkled over with brandy, in which a fmall quantity of gum has been diffolved, the ftar is made in the following manner. Take a rocket mould eight or nine lines in diameter, and introduce into it a nipple, the piercer of which is of an uniform fize throughout, and equal in length to the height of the mould. Put into this mould a cartridge, and by means of a pierced rod load it with one of the preceding compofitions; when loaded, take it from the mould, without removing the nipple, the piercer of which paffes through the compofition, and then cut the cartridge quite round into pieces of the thicknefs of three or four lines. The cartridge being thus cut, draw out the piercer gently, and the pieces which refemble the men employed for playing at drafts, pierced through the middle, will be ftars, which muft be filed on a match thread, that may be covered with tow. To give more brilliancy to ftars of this kind, a cartridge thicker than that already defcribed, and thinner than that of a flying rocket of the fame fize, may be employed; but before it is cut in pieces, five or fix holes muft be pierced in the circumference of each piece to be cut. When the cartridge is cut, and the pieces have been filed, cement over the compofition fmall bits of a card, each having a hole in the middle, fo that thefe holes may correfpond to the place where the compofition is pierced.

Etoiles à Pet are made in the fame way nearly as fauciffons already defcribed, only that it will not be neceffary to cover them with packthread: it will be fufficient if they are pierced at one end, in order that ftars may be faftened to them, conftructed according to the firft method, the compofition of which is dry; for if the compofition be in the form of pafte, there will be no need to tie it. In this cafe, a little more of the paper muft be left hollow at the end of the fauciffon which has been pierced for the purpofe of introducing the compofition, and to place in the vacuity, towards the neck of the fauciffon, fome grained powder, which will communicate fire to the fauciffon when the compofition is confumed.

Shower of Fire.—To form this fort of fire-work, mould fmall paper cartridges on an iron-rod two lines and a half in diameter, and make them two inches and a half in length. They muft not be choaked, it being fufficient to twift the end of the cartridge, and having put the rod into it to beat it, in order to make it affume its proper form. When the cartridges are filled, which is done by immerfing them in the compofition, fold down the other end, and then apply a match. This will fill the furrounding air with an undulating fire. The following compofitions are given as proper for ftars of this kind.

Chinefe Fire.—Mealed gunpowder one pound, fulphur two ounces, iron-fand of the firft order five ounces.

Ancient Fire.—Mealed gunpowder one pound, charcoal two ounces.

Brilliant Fire.—Mealed gunpowder one pound, iron-filings four ounces. The firft of thefe compofitions is thought to be the moft beautiful.

Sparks differ from ftars only in their fize and duration, for they are made fmaller than ftars, and are confumed fooner. They are thus prepared. Having put into an earthen veffel an ounce of mealed gunpowder, two ounces of pulverized faltpetre, one ounce of liquid faltpetre, and four ounces of camphor reduced to powder, pour over this mixture fome gum-water, or brandy in which gum has been diffolved, till the compofition becomes of the confiftence of thick foup. Then take fome lint which has been foaked in brandy, or in vinegar, or even in a folution of faltpetre, and being dried and unravelled, throw into the mixture fuch a quantity of it as is fufficient to abforb it entirely, taking care to ftir it well. This compofition may be formed into fmall balls about the fize of a pea, and being dried in the fhade, and fprinked with mealed powder, they will readily catch fire.

Sparks may be made by the following method: Take faw-duft of fir, poplar, &c. and boil it in water in which faltpetre has been diffolved. When the water has boiled fome time, it is to be poured off, that the faw-duft may remain in the veffel. When nearly dry, it is to be fpread out on a table, and fprinkled with fulphur fifted through a very fine fieve, to which may be added a little mealed powder.

Golden Rain.—Some flying rockets, which, as they fall, make fmall undulations in the air like frizzled hair, are called by the French writers *fusées chevelues*, and by us bearded rockets; they finifh with a kind of fhower of fire, which is called golden rain, and they are conftructed in the following manner. Fill the barrels of fome goofe-quills with the compofition of flying rockets, and place upon the mouth of each a little moift gunpowder, both to keep in the compofition, and to ferve as a match. If a flying rocket be then loaded with thefe quills, they will produce at the end a beautiful fhower of fire, which is denominated golden rain.

Conrantins, or Rockets that fly along a Rope.—A rocket may be made to run along an extended rope, by affixing to the rocket an empty cartridge, and introducing into it the rope which is to carry it along. Place the head of the rocket towards that fide to which you intend it to move; if it be then fet fire to, it will run along the rope without ftopping till the matter it contains is entirely exhaufted. If the rocket is to move in a retrograde direction, firft fill one half of it with the compofition, and cover it with a fmall round piece of wood, to ferve as a partition between it, and that put into the other half; then make a hole below this partition, fo as to correfpond with a fmall canal filled with bruifed powder, and terminating at the other end of the rocket. By thefe means the fire, when it ceafes in the firft half of the rocket, will be communicated through the hole into the fmall canal, which will convey it to the other end; and this end being then kindled, the rocket will move backwards, and return to the place from whence it fet out.

Two rockets of equal fize, bound together by ftrong packthread, and fo arranged that the head of the one fhall be oppofite to the neck of the other, in order that when the fire has confumed the compofition in the one, it may be communicated to that in the other, and oblige both of them to move in a retrograde direction, may likewife be adjufted to the rope by means of a piece of hollow reed. Rockets of this kind are generally employed for fetting fire to various other pieces when large fire-works are exhibited; and to render

render them more ſtriking, they are made in the form of different animals, ſuch as ſerpents, dragons, &c.

To give a rocket a kind of rotatory motion around the rope along which it advances, it will be ſufficient to tie to it another rocket, placed in a tranſverſal direction. But the aperture of the latter, inſtead of being at the bottom, ought to be in the ſide, near one of the ends. If both rockets be fired at the ſame time, the latter will make the other revolve around the rope, while it advances along it.

Rockets which burn in the Water.—In theſe there muſt be a conſiderable variation in the conſtruction of the mould, and alſo in the materials of which they are compoſed. The mould may be eight or nine inches in length, and an inch in diameter: the former, on which the cartridge is rolled up, may be nine lines in thickneſs. The compoſition ſhould conſiſt of three materials mixed together, *viz.* three ounces of mealed powder, one pound of ſaltpetre, and eight ounces of ſulphur. If the rocket is to appear on the water with a beautiful tail, the compoſition muſt conſiſt of eight ounces of gunpowder, one pound of ſaltpetre, eight ounces of pounded and finely ſifted ſulphur, and two ounces of charcoal. When the compoſition has been prepared according to theſe proportions, and the rocket has been filled in the manner above deſcribed, apply a ſauciſſon to the end of it, and having covered the rocket with wax, pitch, &c. attach to it a ſmall rod of white willow, about two feet in length, that the rocket may conveniently float. If it be required that theſe rockets ſhould plunge down, and again riſe up, a certain quantity of mealed gunpowder, without any mixture, muſt be introduced into them, at certain diſtances.

A rocket which is fired in the water, and, after burning there half the time of its duration, mounts into the air with great velocity, may be thus conſtructed. Take a *flying* rocket, furniſhed with a rod, and by means of a little glue attach it to a water-rocket, but only at the middle, A, (*fig.* 6.) in ſuch a manner that the latter ſhall have its neck uppermoſt, and the other its neck downward. Adjuſt to their extremity, B, a ſmall tube, to communicate the fire from the one to the other, and cover both with a coating of pitch, wax, &c. that they may not be damaged by the water. Then attach to the flying rocket, after it has been thus cemented to the aquatic one, a rod, as D, and from F ſuſpend a piece of packthread, to ſupport a muſket bullet E, made faſt to the rod by means of a needle or piece of iron wire. When theſe arrangements have been made, ſet fire to the part C after the rocket is in the water; and when the compoſition is conſumed to B, the fire will be communicated through the ſmall tube to the other rocket; the latter will then riſe and leave the other, which will not be able to follow it, on account of the weight adhering to it.

Globes and Fire-Balls are made in different forms, *viz.* ſpherical, ſpheroidal, or cylindrical. The ſpherical are made in the following manner. Conſtruct a hollow wooden globe of any ſize at pleaſure, and very round both within and without, ſo that its thickneſs, A C or B D, (*fig.* 7.) may be about the ninth part of its diameter A B, and having an aperture, L M or O N, equal to the thickneſs A C or B D, that is, to the ninth part of the diameter A B. It is through this aperture that fire is communicated to the globe, when it has been filled with the proper compoſition, through the lower aperture I K. A petard of metal, loaded with good grained powder, is to be introduced alſo through the lower aperture, and to be placed horizontally. The aperture I K, which is nearly equal to the thickneſs, E F or G H, of the cylinder E F G H, is to be cloſed by means of a wooden tompion dipped in warm pitch; and melt over it ſuch a quantity of lead that its weight may cauſe the globe to ſink in water, till nothing remain above it but the part G H; which will be the caſe if the weight of the lead, with that of the globe and the compoſition, be equal to the weight of an equal volume of water. If the globe be then placed in the water, the lead, by its gravity, will keep the aperture, I K, directly downwards, and the cylinder, E F G H, in a perpendicular direction, to which fire muſt have been previouſly applied. The compoſition with which the globe muſt be filled, is as follows: to a pound of corned powder, add thirty-two pounds of ſaltpetre, eight pounds of ſulphur, one ounce of ſcraped ivory, and eight pounds of ſawduſt previouſly boiled in a ſolution of ſaltpetre, and dried in the open air.

Globes which leap or roll on the Ground.—Having conſtructed a wooden globe A, (*fig.* 8.) with a cylinder C, ſimilar to the one juſt deſcribed, and having loaded it with the ſame compoſition, introduce into it four or even more petards, loaded with good corned powder to their orifices, as is ſhewn at A B, which muſt be well ſtopped with paper or tow. If a globe, prepared in this manner, be fired by means of a match at C, it will leap about as it burns, on a ſmooth horizontal plane, according as the petards are ſet on fire. The petards may be affixed to the exterior ſurface of the globe, as is ſeen in the figure, which they will cauſe to roll and leap as they catch fire.

Aerial Globes, called Bombs.—Theſe globes are called ærials, becauſe they are thrown into the air from a mortar. Though they are of wood, and have a ſuitable thickneſs, yet they are liable to burſt unleſs the charge be nicely proportioned to their ſtrength. The uſual quantity is an ounce of powder for a globe of four pounds weight; two ounces for one of eight, and ſo on. As the chamber of the mortar may be too large to contain the exact quantity of powder ſufficient for the fire-ball, which ought to be placed immediately above the powder, in order that it may be expelled and ſet on fire at the ſame time, another mortar may be conſtructed of wood, or of paſte-board with a wooden bottom, which may be put into the large iron mortar, to be loaded with a quantity of powder proportioned to the weight of the globe. This ſmall mortar muſt be of light wood, or of paper paſted together, and rolled up in the form of a cylinder, but the bottom muſt be of wood. The chamber for the powder muſt be pierced obliquely, ſo that the aperture may correſpond to the aperture of the metal mortar, then the fire applied to the latter may be communicated to the powder which is at the bottom of the chamber, immediately below the globe.

The globe muſt be filled with ſeveral pieces of reed or cane, or common reed equal in length to the interior height of the globe, and charged with a ſlow compoſition, made of three ounces of mealed gunpowder, an ounce of ſulphur moiſtened with a ſmall quantity of petroleum oil, and two ounces of charcoal; and in order that theſe reeds or canes may catch fire the ſooner, and with more facility, they muſt be charged at the lower ends, which reſt on the bottom of the globe, with pulverized gunpowder moiſtened with petroleum oil or brandy, and then dried. The bottom of the globe ought to be covered with gunpowder, partly mealed and partly corned, which, when ſet on fire, will communicate the fire to the lower part of the reed. Inſtead of reeds, the globe may be charged with running rockets, or paper petards, and a quantity of fiery ſtars or ſparks mixed with mealed powder placed above theſe petards, which muſt be choaked at unequal heights, that they may produce their effects at different times.

Jets of Fire are a ſort of fixed rockets, the effect of which is to throw up into the air jets of fire ſimilar to jets of water. They

They ferve alfo to reprefent cafcades, for if a feries of fuch rockets be placed horizontally on the fame line, it may be eafily feen that the fire which they emit will refemble a fheet of water. When arranged in a circular form, like the radii of a circle, they form what is called a fixed fun. To form jets of this kind, the cartridge for brilliant fires muft, in thicknefs, be equal to a fourth part of the diameter, and for Chinefe fire only a fixth part. The cartridge is loaded on a nipple, having a point equal in length to the fame diameter, and in thicknefs to a fourth part of it; but as it generally happens that the mouth of the jet becomes larger than is neceffary for the effect of the fire, the cartridge muft be filled equal to a fourth part of the diameter with clay, which muft be rammed down. This will make the jet afcend much higher. When the charge is completed with the proper compofition, the cartridge muft be clofed with a tompion of wood, above which it muft be choaked. Jets intended for reprefenting fheets of fire ought not to be choaked. They muft be placed in a horizontal pofition, or inclined a little downwards. The following are the principal compofitions for jets of fire.

1. *For Jets of half an Inch or lefs in Diameter.—Chinefe fire:* Saltpetre and mealed powder 1lb. each; fulphur 8 ounces; charcoal 2 ounces.—*White fire:* Saltpetre 1lb.; mealed powder 8 ounces; fulphur 3 ounces; charcoal 2 ounces; iron-fand of the firft order 8 ounces.

2. *For Jets of an Inch or lefs in Diameter.—Brilliant fire:* Mealed powder 1lb., iron-filings 5 ounces.—*White fire:* Saltpetre and mealed powder 1lb. each; fulphur 8 ounces; charcoal 2 ounces.—*Chinefe fire:* Saltpetre 16 ounces; fulphur 5 ounces; charcoal 5 ounces; iron-fand of the third order 12 ounces.

3. *For Jets of* 15 *or* 18 *Lines in Diameter.—Chinefe fire:* Saltpetre 16 ounces; fulphur 7 ounces; charcoal 5 ounces; of the feveral different kinds of iron-fand mixed 12 ounces.

Fires of different Colours.—For *white fire* the gunpowder muft be mixed with iron or rather fteel-filings: for *red fire*, iron-fand of the firft order muft be employed in the fame way. Camphor mixed with the ufual compofition is faid to make the flame appear of a *pale white* colour. Rafpings of ivory give a clear flame of a filver colour.

Pafte for reprefenting Animals, &c. in Fire.—Take fulphur reduced to a very fine powder, and having formed it into a pafte with ftarch, cover it with the figure of the thing to be reprefented, having firft coated it with clay to prevent it from being burnt. After the figure is covered with the pafte, it muft be fprinkled, while moift, with gunpowder; and when the whole is perfectly dry, arrange about it feveral fmall matches, that the fire may be fpeedily communicated to it on all fides. In this way all forts of garlands, feftoons, and other ornaments, may be imitated by fire of different colours.

Suns, fixed and moveable.—For fixed funs, let a round piece of wood be cut, into the circumference of which are to be fcrewed twelve or fifteen pieces in the form of radii, to which are to be attached jets of fire, of the compofition defcribed above; fo that they may appear as radii tending to the fame centre, the mouth of the jet being towards the circumference. Apply a match in fuch a manner that the fire communicated at the centre, may be conveyed at the fame time to the mouth of each of the jets, by which means, each throwing out its fire, there will be produced the appearance of a radiating fun, that is, fuppofing the wheel is placed in a pofition perpendicular to the horizon. The rockets or jets may be fo arranged as to crofs each other in an angular manner, in which cafe, inftead of a fun, you will have a ftar, or a crofs. Some of thefe funs are made alfo with feveral rows of jets, which are called glories. For revolving funs, provide a wooden wheel, and attach to the circumference fire-jets placed in the direction of the circumference: they muft not be choaked at the bottom, and ought to be arranged in fuch a manner, that the mouth of the one fhall be near the bottom of the other, fo that when the fire of the one is ended, it may immediately proceed to another. When the fire is applied to one of thefe jets, the recoil of the rocket will make the wheel turn round, unlefs it be too large and ponderous. For this reafon, when thefe funs are of a confiderable fize, that is, when they confift of perhaps twenty rockets, fire muft be communicated at the fame time to the firft, the fixth, eleventh, and fixteenth, from which it will proceed to the fecond, the feventh, the twelfth, the feventeenth, and fo on. Thefe four rockets will make the wheel turn round with great rapidity. If two fimilar funs be placed one behind the other, and are made to turn in a contrary direction, they will produce a fine effect of crofs-fire.

Making, loading, and firing Pots des Brins.—Thefe are made of pafte-board, and muft be rolled pretty thick; ufually made three or four inches in diameter, and four diameters long, and pinched with a neck at one end, like common cafes. A number of thefe are placed on a plank thus: having fixed on a plank two rows of wooden pegs, cut in the bottom of the plank a groove the whole length under each row of pegs; then, through the centre of each peg, bore a hole down to the groove at bottom, and on every peg fix and glue a pot, whofe mouth muft fit tight on the peg: through all the holes run a quick-match, one end of which muft go into the pot, and the other into the groove, which muft have a match laid in it from end to end, and covered with paper, fo that, when lighted at one end, it may difcharge the whole almoft inftantaneoufly: in all the pots put about one ounce of meal and corn powder; then in fome put ftars, and others rains, fnakes, ferpents, crackers, &c.: when they are all loaded, pafte paper over their mouths. Two or three hundred of thefe pots being fired together, make a very pretty fhow, by affording fo great a variety of fires. *Fig.* 9. is a range of pots des brins, with the leader A, by which they are fired.

Caduceus Rockets, in rifing, form two fpiral lines, or double worm, by reafon of their being placed obliquely, one oppofite the other; and their counterpoife is in their centre, which caufes them to rife in a vertical direction. Rockets for this purpofe muft have their ends choaked clofe, without either head or bounce, for a weight at top would be a great obftruction to their mounting; though they have been known fometimes to be bounced, but then they did not rife fo high as thofe that were not; nor do any caduceus rockets afcend fo high as fingle, becaufe of their ferpentine motion, and likewife the refiftance of air, which is much greater than two rockets of the fame fize would meet with, if fired fingly.

By *fig.* 10. we fee the method of fixing thefe rockets: the fticks for this purpofe muft have all their fides equal, which fides fhould be equal to the breadth of a ftick proper for a fky-rocket of the fame weight as thofe we intend to ufe, and to taper downwards as ufual, long enough to balance them, one length of a rocket, from the crofs ftick, which muft be placed from the large ftick, fix diameters of one of the rockets, and its length feven diameters; fo that each rocket, when tied on, may form with the large ftick an angle of fixty degrees. In tying on the rockets, place their heads on the oppofite fides of the crofs ftick, and their ends on the oppofite fides of the long ftick; then carry a leader from the mouth of one into that of the other. When thefe rockets are to be fired, fufpend them between two hooks or nails,

nails, then burn the leader through the middle, and both will take fire at the fame time. Rockets of one pound are a good fize for this ufe.

Illuminated ſpiral Wheel.—Firſt have a circular horizontal wheel, made two feet in diameter, with a hole quite through the nave; then take three thin pieces of deal, three feet long each, and three quarters of an inch broad each: one end of each of theſe pieces nail to the fell of the wheel, at an equal diſtance from one another, and the other end nail to a block with a hole in its bottom, which muſt be perpendicular with that in the block of the wheel, but not ſo large. The wheel being thus made, take a hoop planed down very thin and flat; then nail one end of it to the fell of the wheel, and wind it round the three ſticks in a ſpiral line, from the wheel to the block at top: on the top of this block fix a caſe of Chineſe fire; on the wheel you may place any number of caſes, which muſt incline downwards, and burn two at a time. If the wheel ſhould conſiſt of ten caſes, you may let the illuminations and Chineſe fire begin with the ſecond caſes. The ſpindle for this wheel muſt be a little longer than the cone, and made very ſmooth at top, on which the upper block is to turn, and the whole weight of the wheel to reſt. See *fig.* 11.

Fruiloni Wheels.—Firſt take a nave, made nine inches long, and three in diameter: near the bottom of this nave fix eight ſpokes, with a hole in the end of each, large enough to receive a two or four-ounce caſe: each of theſe ſpokes may be fourteen inches long from the block. Near the top of this block fix eight more of the ſame ſpokes, exactly over the others, but not ſo long by two inches. As this wheel is to run horizontally, all the caſes in the ſpokes at top muſt play obliquely upwards, and all of them in the ſpokes at bottom obliquely downwards. This being done, take a ſmall horizontal wheel, made with eight ſpokes, each five inches long from the block; on the top of this wheel place a caſe of brilliant fire: all the caſes on this wheel muſt play in an oblique direction downwards, and burn two at a time, and thoſe on the large wheel four at a time; that is, two of thoſe in the top ſet of ſpokes, and two of them in the bottom ſet of ſpokes. The four firſt caſes on the large wheel, and the two firſt on the ſmall, muſt be fired at the ſame time, and the brilliant fire at top, at the beginning of the laſt caſes. The caſes of the wheels may be filled with a grey charge. When theſe wheels are completed, you muſt have a ſtrong iron ſpindle, made four feet ſix inches long, and fixed perpendicular on the top of a ſtand: on this put the large wheel, whoſe nave muſt have a hole quite through, from the bottom to the top. This hole muſt be large enough to turn eaſy round the bottom of the ſpindle, at which place there muſt be a ſhoulder, to keep the wheel from touching the ſtand: at the top of the ſpindle put the ſmall wheel, and join it to a large one with a leader, in order to fire them both together.

Illuminated Globes, with horizontal Wheels.—The hoops for theſe globes may be made of wood, tin, or iron wire, about two feet in diameter. For a ſingle globe take two hoops, and tie them together, one within the other, at right angles; then have a horizontal wheel made, whoſe diameter muſt be a little wider than the globe, and its nave ſix inches long, on the top of which the globe is fixed, ſo as to ſtand three or four inches from the wheel: on this wheel you may put any number of caſes, filled with what charge you like; but let two of them burn at a time: they may be placed horizontally, or to incline downwards, juſt as you chooſe. Now, when the wheel is clothed, fix on the hoops as many illuminations as will ſtand within two inches and a half of each other: theſe you faſten on the hoops with ſmall iron binding wire; and when they are all on, put on your pipes of communication, which muſt be ſo managed as to light them all with the ſecond or third caſe on the wheel. The ſpindle on which the globe is to run muſt go through the block of the wheel, up to the inſide of the top of the globe, where muſt be fixed a bit of braſs or iron, with a hole in it to receive the point of the ſpindle, on which the whole weight of the wheel is to bear, as in *fig.* 12, which repreſents a globe on its ſpindle. By this method may be made a crown, which is done by having the hoops bent in the form of a crown. Sometimes globes and crowns are ordered ſo as to ſtand ſtill, and the wheel only to turn round; but when you would have the globe or crown to ſtand ſtill, and the wheel to run by itſelf, the block of the wheel muſt not be ſo long, nor the ſpindle any longer, than to juſt raiſe the globe a little above the wheel, and the wheel-caſes and illumination muſt begin together.

Dodecahedron, ſo called becauſe it nearly repreſents a twelve-ſided figure, and is made thus. Firſt take a ball, turned out of ſome hard wood, fourteen inches in diameter: when done, divide its ſurface into fourteen equal parts, from which bore holes an inch and a half in diameter perpendicular to the centre, ſo that they may all meet in the middle: then let there be turned in the inſide of each hole a female ſcrew; and to all the holes, but one, muſt be made a round ſpoke, five feet long, with four inches of the ſcrew at one end, to fit the holes; then in the ſcrew end of all the ſpokes bore a hole, five inches up, which muſt be bored ſlanting, ſo as to come out at one ſide, a little above the ſcrew; from which cut a ſmall groove along the ſpoke, within ſix inches of the other end, where you make another hole through to the other ſide of the ſpoke: in this end fix a ſpindle, on which put a ſmall wheel, of three or four ſides, each ſide ſix or ſeven inches long: theſe ſides muſt have grooves cut in them, large enough to receive a two or four-ounce caſe: when theſe wheels are clothed, put them on the ſpindles, and at the end of each ſpindle put a nut, to keep the wheel from falling off: the wheels being thus fixed, carry a pipe from the mouth of the firſt caſe on each wheel, through the hole in the ſide of the ſpoke, and from thence along the groove, and through the other hole, ſo as to hang out at the ſcrew end about an inch. The ſpokes being all prepared in this manner, you muſt have a poſt, on which you intend to fire the work, with an iron ſcrew in the top of it, to fit one of the holes in the ball: on this ſcrew fix the ball; then in the top hole of the ball put a little meal powder, and ſome looſe quick-match; then ſcrew in all the ſpokes, and in one ſide of the ball bore a hole, in which put a leader, and ſecure it at the end; and your work will be ready to be fired. By this leader the powder and match in the centre are fired, which will light the match at the ends of the ſpokes all at once, whereby all the wheels will be lighted at once. There may be an addition to this piece, by fixing a ſmall globe on each wheel, or one on the top wheel only. A grey charge will be proper for the wheel-caſes.

Yew-tree of brilliant Fire, is repreſented by *fig.* 13, as it appears when burning. Firſt, let A be an upright piece of wood, four feet long, two inches broad, and one thick: at top of this piece, on the flat ſide, fix a hoop, fourteen inches in diameter; and round its edge and front place illuminations, and in the centre a five-pointed ſtar; then at E, which is one foot and a half from the edge of the hoop, place two caſes of brilliant fire, one on each ſide: theſe caſes ſhould be one foot long each: below theſe fix two more caſes of the ſame ſize, and at ſuch a diſtance, that their mouths may almoſt meet them at top: then, cloſe to the ends of theſe caſes, fix two more of the ſame caſes; they muſt ſtand parallel to them at E. The caſes being thus fixed, clothe them with leaders, ſo that they, with the illuminations and ſtar at top, may all take fire together.

Illuminated Yew-tree.—Firſt have a tree made of wood, ſuch as is ſhewn by *fig.* 14. The middle piece, or ſtem, on which the branches are fixed, muſt be eight feet ſix inches high: at the bottom of this piece draw a line, at right angles, two feet ſix inches long at each ſide; then from L, which is one foot ſix inches from the bottom, draw a line on each ſide to C and D; theſe lines will give the length of the two firſt branches. Then put on the two top branches parallel to them at bottom: let the length of each of theſe branches be one foot from the ſtem: from the ends of theſe two branches draw a line to C and D; then fix on five more branches at an equal diſtance from each other, and their length will be determined by the lines A C and E D. When the branches are fixed, place illuminating port-fires on the top of each, as many as you chooſe: behind the top of the ſtem faſten a gerbe, or white fountain, which muſt be fired at the beginning of the illuminations on the tree.

Moon and Seven Stars.—Let *fig.* 15. be a ſmooth circular board, ſix feet diameter; out of the middle of it cut a circular piece twelve or fourteen inches diameter, and over the vacancy put white Perſian ſilk, on which paint a moon's face; then let I, I, I, &c. be ſtars each four or five inches in diameter, cut out with five points, and covered with oiled ſilk: on the front of the large circular board draw a ſeven-pointed ſtar, as large as the circle will allow; then on the lines which form this ſtar bore holes, wherein fix pointed ſtars. When this piece is to be fired, it muſt be fixed upon the front of a poſt, on a ſpindle, with a wheel of brilliant fire behind the face of the moon; ſo that while the wheel burns, the moon and ſtars will appear tranſparent, and when the wheel has burnt out, they will diſappear, and the large ſtar in front, which is formed of ſtars, will begin, being lighted by a pipe of communication from the laſt caſe of the vertical wheel, behind the moon: this pipe muſt be managed in the ſame manner as thoſe in regulated pieces.

Pin Wheels.—Firſt roll ſome paper pipes, about fourteen inches long each; theſe pipes muſt not be made thick of paper, two or three rounds of elephant paper being ſufficient. When your pipes are thoroughly dried, you muſt have made a tin tube, twelve inches long, to fit eaſy into the pipes: at one end of this tube fix a ſmall conical cup, which done is called a funnel; then bend one end of one of the pipes, and put the funnel in at the other, as far as it will reach, and fill the cup with compoſition; then draw out the funnel by a little at a time, ſhaking it up and down, and it will fill the pipe as it comes out. Having filled ſome pipes, and made ſome ſmall blocks, about an inch in diameter, and half an inch thick; round one of theſe blocks wind and paſte a pipe, and to the end of this pipe join another; which muſt be done by twiſting the end of one pipe to a point, and putting it into the end of the other, with a little paſte; in this manner join four or five pipes, winding them one upon the other, ſo as to form a ſpiral line. Having wound on your pipes, paſte two ſlips of paper acroſs them, to hold them together: beſides theſe ſlips of paper the pipes muſt be paſted together.

There is another method of making theſe wheels, called the French, which is, by winding on the pipe without paſte, and ſticking them together with ſealing wax, at every half-turn; ſo that, when they are fired, the end will fall looſe every time the fire paſſes the wax; by which means the circle of fire will be conſiderably increaſed. The formers for theſe pipes are made from one-half to four-ſixteenths of an inch diameter, and the compoſition for them as follows; meal powder eight ounces, ſaltpetre two ounces, and ſulphur one: among theſe ingredients may be mixed a little ſteel-filings, or the duſt of caſt-iron: this compoſition ſhould be very dry, and not made too fine, or it will ſtick in the funnel. Theſe wheels may be fired on a large pin, and held in the hand with ſafety.

Placing Fire-works to be exhibited, with the *Order of Firing.* Nothing adds more to the appearance of fire-works, than the placing them properly; though the manner of placing them chiefly depends on the judgment of the maker. We ſhall give ſuch rules here, as have been generally obſerved; for example, whether your works are to be fired on a building, or on ſtands. If they are a double ſet, place one wheel of a ſort on each ſide of the building; and next to each of them, towards the centre, place a fixed piece, then wheels, and ſo on, leaving a ſufficient diſtance between them, for the fire to play from one without burning the other. Having fixed ſome of your works thus in front, place the reſt behind them, in the centre of their intervals: the largeſt piece, which is generally a regulated or tranſparant piece, muſt be placed in the centre of the building, and behind it a ſun, which muſt always ſtand above all the other works: a little before the building, or ſtands, place your large gerbes; and at the back of the works, fix your maroon batteries, pots des aigrettes, pots des brins, pots des ſauciſſons, air-balloons, and flights of rockets: the rocket-ſtands may be fixed behind, or any where elſe, ſo as not to be in the way of the works.

Single collections are fired on ſtands, which ſtands are made in the ſame manner as theodolite ſtands, only the top part muſt be long or ſhort occaſionally: theſe ſtands may be fixed up very ſoon without much trouble. Having given ſufficient inſtructions for placing of fire-works, we ſhall proceed with the manner of firing them.

Order of Firing.

1. Two ſignal } rockets.
2. Six ſky } rockets.
3. Two honorary } rockets.
4. Four caduceus } rockets.
5. } Two { vertical } wheels illuminated.
6. } Two { ſpiral } wheels illuminated.
7. } Two { tranſparent ſtars.
8. A line rocket of five changes.
9. Four tourbillons.
10. } Two { horizontal wheels.
11. } Two { air-balloons illuminated.
12. } Two { Chineſe fountains.
13. } Two { regulating pieces of four mutations each.
14. } Two { pots des aigrettes.
15. Three large gerbes.
16. A flight of rockets.
17. } Two { balloon wheels.
18. } Two { caſcades of brilliant fire.
19. Twelve ſky-rockets.
20. } Two { illuminated yew-trees.
21. } Two { air-balloons of ſerpents, and two compound.
22. Four tourbillons.
23. } Two { Fruiloni wheels.
24. } Two { illuminated globes with horizontal wheels.
25. One pot des ſauciſſons.
26. Two plural wheels.
27. Marron battery.
28. Two chandeliers illuminated.
29. Range of pots des brins.
30. Twelve ſky-rockets.
31. Two yew-trees of fire.

32. Neſt

32. Neſt of ſerpents.
33. Two double cones illuminated.
34. Regulating piece of ſeven mutations, *viz.*
   1. Vertical wheel illuminated.
   2. Golden glory.
   3. Octagon vertical wheel.
   4. Porcupine's quills.
   5. Croſs fires.
   6. Star piece with brilliant rays.
   7. Six vertical wheels.
35. Brilliant ſun.
36. Large flight of rockets.

When water-works are to be exhibited, divide them into ſeveral ſets, and fire one ſet after every fifth or ſixth change of land and air-works. Obſerve this rule in firing a double ſet of works; always to begin with ſky-rockets, then two moveable pieces, then two fixed pieces, and ſo on; ending with a large flight of rockets, or a maroon battery: if a ſingle collection, fire a fixed piece after every wheel or two, and now and then ſome air and water-works. Jones's Fire-works, 8vo. 1776.

PYROTECHNICAL Spunge. See Spunge.

PYROTICS, Πυρωτικα, formed from πυρ, *fire*, in *Medicine*, cauſtics, or remedies, either actually or potentially hot; and which, accordingly, will burn the fleſh, and raiſe an eſchar.

PYROUET. See Pirouette.

PYROXENE, in *Mineralogy*. See Augite and Lava. According to Haüy, the mineral called augite by Werner is the black or greeniſh-black variety of pyroxene found in volcanic countries and in baſalt. The primitive form of the cryſtals of pyroxene is an oblique rhomboidal priſm.

The greyiſh-green tranſparent pyroxene, with the forms of the cryſtals diſtinctly marked, from the department of the Po, is the alalite of Bouvoiſin. Journal des Mines, N° 115.

The greyiſh-green, or whitiſh-grey variety, the primitive cryſtals of which are indiſtinct, from the ſame deparment, were called by Bouvoiſin maſſite. Both theſe varieties have been called by ſome mineralogiſts diopſide.

The greyiſh-green and obſcure green perioctahedral variety of pyroxene, is the ſahlite of Werner, called alſo malocolithe by Haüy. The mineral called coccolite, diſcovered by Dandrada at the iron mines of Sudermannland and Nerika, in Sweden, and Arendahl in Norway, is alſo brought under the ſpecies pyroxene by Haüy. Tableau Comparatif.

By reducing many varieties of minerals under one ſpecies, Haüy may be conſidered as having rendered an additional ſervice to mineralogy, already too much loaded with pedantic or unmeaning terms; but the term pyroxene itſelf may be juſtly objected to, as being founded not on any diſtinct character, but on the hypothetical aſſumption that theſe cryſtals are foreign to the igneous products in which they are imbedded, an aſſumption for which there does not appear ſufficient proof. The conſtituent parts of pyroxene, its ſpecific gravity and hardneſs, ſo nearly agree with thoſe of baſaltic hornblende, that theſe ſubſtances ought perhaps to be claſſed as varieties of the ſame ſpecies, without regarding the ſmall difference of their cryſtalline forms. See Hornblende.

Pyroxene *en Roche*, or *Rock Pyroxene*. In the Journal des Mines, Nov. 1812, a deſcription is given of entire rocks compoſed of pyroxene, diſcovered by J. Charpentier in the Pyrenées. The ſubſtance is homogeneous, of a texture commonly granularly lamellar, which in ſome pieces becomes ſlaty. Its moſt common colour is green of various ſhades, from an olive green to an emerald green, ſometimes cloudy but often clear. From a greeniſh-grey it paſſes to a reddiſh-brown and ochre yellow. It is amorphous. The luſtre is ſplendent. Its fracture is lamellar, and has a two-fold cleavage equally perfect, croſſing at an angle of about 92°. In other directions the fracture is either imperfectly lamellar or conchoidal. It ſcratches glaſs, and gives ſome ſparks with ſteel. It melts with great difficulty by the blowpipe, but with borax it eaſily forms a green glaſs. M. Vogel has analyſed this mineral, and diſcovered chrome in the green ſpecimen. From the detailed deſcription of this rock, it appears nearly allied to ſchiſtoſe, ſpar, and ſerpentine. It is frequently intimately combined with talc, in which ſtate it is not eaſy to diſtinguiſh it from ſerpentine. Rock pyroxene is found in beds in the primitive limeſtone, that forms vaſt mountains ſuperincumbent on granite, extending from the valley of Viedeſſos, in the department of Arriege, to St. Beat, in the valley of Garonne. The maſſes of rock pyroxene are of extraordinary ſize, extending in length 5000 toiſes. Its thickneſs is difficult to determine, but is ſuppoſed to exceed 300 toiſes. Charpentier is diſpoſed to claſs rock pyroxene as an intermediate rock between hornblende and ſerpentine, and ſubordinate to primitive limeſtone. It neither contains foreign beds nor mineral veins, and is leſs liable to decompoſition when pure, than almoſt any other rock. When intermixed with talc it decompoſes rapidly.

PYRRHA, in *Ancient Geography*, a town of the iſle of Leſbos, between the promontory Sigrium and the town of Ereſſus, according to Ptolemy. The town took its name from a ſtrait between Aſia Minor and the iſle of Leſbos, and gave it to a foreſt in the ſame iſle.—Alſo, a town of Macedonia, in Magneſia. Pliny.—Alſo, a town of Aſia Minor, in Lycia. Pliny.—Alſo, a town of Aſia Minor, in Ionia, ſituated at the entrance of the northern part of the Latmic gulf, E.N.E. of the town of Miletus, and S.S.E. of that of Myus. Strabo places it at 100 ſtadia from Heraclea—Alſo, a promontory of Theſſaly, upon the coaſt of the Phthiothide. Strabo ſays, that before this promontory were two iſles; one called Pyrrha, and the other Deucalion.—Alſo, a town of Greece, in the Phocide. Pliny.—Alſo, a town ſituated in the vicinity of the Palus-Mæotis; ſubmerged according to the relation of Pliny.—Alſo, a town of Aſia Minor, in Caria.

PYRRHICHA, Πυῤῥιχη, in *Antiquity*, a kind of exerciſe on horſeback; or a feigned combat, for the exerciſe of the cavalry.

It was thus called from its inventor Pyrrhicus, or Pyrrhus, in Cydonia, who firſt taught the Cretans to march in meaſure and cadence to battle, and to obſerve the pace of the Pyrrhic foot. Others derive the name from Pyrrhus, ſon of Achilles, who inſtituted this exerciſe at the obſequies of his father. Ariſtotle ſays, that it was Achilles himſelf who invented it.

The Romans alſo called it *ludus Trojanus*, the Trojan game; and Aulus Gellius *decurſus*. It is doubtleſs this exerciſe, that we ſee repreſented on medals, by two cavaliers in front, running with lances, and the word *decurſio* in the exergum.

PYRRHICHIUS, Πυῤῥιχιος, in the Greek and Latin *Poetry*, a foot conſiſting of two ſyllables, both ſhort; as *deus*.

Among the ancients this foot is alſo called *periambus*; by others *hegemona*.

PYRRHICUS, in *Ancient Geography*, a town of Laconia, upon the ſtream of Scyrax, S. of Hypſus. Here were two temples, one of Diana Aſtratæa, and another of the Amazonian Apollo. The ſtatues of theſe deities were of wood, and it is ſuppoſed they were placed here by the Amazons themſelves.

PYRRHO. See Pyrrhonians.

PYRRHO-

PYRRHOCORAX, in *Ornithology*, a ſpecies of *Corvus* (which ſee), the Alpine crow of Latham, and the Choucas des Alpes of Buffon.—Alſo, the Monedula, Coracias of Aldrovand, &c., Corniſh chough, red-legged crow of Pennant and Latham, and CORVUS *Graculus*, which ſee.

PYRRHONIANS, PYRRHONEANS, or *Pyrrhoniſts*, a ſect of ancient philoſophers, ſo called from their founder Pyrrho, a Greek philoſopher, born at Elea, in Peloponneſus, who in early life ſtudied painting, but aſpiring to philoſophical purſuits he became a diſciple of Anaxarchus, and accompanied him as far as India. In this journey he followed Alexander the Great; and hence we may know in what time he flouriſhed. In India he converſed with the Brachmans and Gymnoſophiſts, imbibing from their doctrine whatever might ſeem favourable to his natural diſpoſition towards doubting; a diſpoſition which was cheriſhed by his maſter, who had formerly been a diſciple of a ſceptical philoſopher, Metrodorus of Chios. As he was involved in freſh uncertainty by every advance he made in the ſtudy of philoſophy, he left the ſchool of the Dogmatiſts, who profeſſed to be poſſeſſed of certain knowledge, and eſtabliſhed a new ſchool, in which he taught, that every object of human inquiry is involved in uncertainty, ſo that it is impoſſible ever to arrive at the knowledge of truth.

The diſtinguiſhing character of this philoſopher was, that he profeſſed to doubt of every thing, maintaining that men only judge of truth and falſehood from appearances, which deceive. On this principle he kept himſelf in continual ſuſpenſion of mind, never determining on any thing; to avoid the inconveniencies of error and falſe judgments.

He found in all things (ſays Bayle) reaſons to affirm and to deny; and therefore he ſuſpended his aſſent after he had well examined the arguments *pro* and *con*, and reduced all his concluſions to a *non liquet*, let the matter be farther enquired into. Hence it is (ſays he) that he ſought truth as long as he lived, but he ſo contrived the matter, as never to grant that he had found it. Though he is not the inventor of that method of philoſophizing, yet it goes by his name. The art of diſputing about every thing, without doing any thing elſe but ſuſpending one's judgment, is called Pyrrhoniſm, or Scepticiſm.

Some have ſaid, that this philoſopher acted upon his own principles, and carried his ſcepticiſm to an extreme ſo ridiculous, that his friends were obliged to accompany him wherever he went, that he might not be run over by carriages, or fall down precipices. Theſe reports, however, are inconſiſtent with the reſpect that is paid to him by ancient writers, and with the general hiſtory of his life, and are charged, as calumnies, upon the Dogmatiſts, whom he oppoſed. A great part of his life was ſpent in ſolitude; and he always preſerved a ſettled compoſure of countenance, undiſturbed by fear, or joy, or grief. He endured bodily pain with great fortitude; and in the midſt of dangers he manifeſted no ſigns of apprehenſion. As a diſputant, he was celebrated for the ſubtlety of his arguments, and the perſpicuity of his language. So highly was Pyrrho eſteemed by his countrymen, that they honoured him with the office of chief prieſt, and from reſpect to him, paſſed a decree by which all philoſophers were indulged with an exemption from public taxes. Of the poets, and particularly of Homer, he was a great admirer; and frequently repeated paſſages from his poems. He flouriſhed about the 110th olympiad, and died about the 90th year of his age, probably in the 123d olympiad, B.C. 288. After his death, the Athenians honoured his memory with a ſtatue; and a monument, as Laertius informs us, was erected to him in his own country. His ſcepticiſm may in a great meaſure be aſcribed to his early acquaintance with the ſyſtem of Democritus. Having learned from this philoſopher to deny the real exiſtence of all qualities in bodies, except thoſe that are eſſential to primary atoms, and to refer every thing elſe to the perceptions of the mind produced by external objects, that is, to appearance and opinion, he concluded, that all knowledge depended upon the fallacious report of the ſenſes, and conſequently, that there can be no ſuch thing as certainty. In this notion he was encouraged by the general ſpirit of the Eleatic ſchool, in which he was educated, which was unfavourable to ſcience. But his ſcepticiſm was more confirmed by the ſubtleties of the Dialectic ſchool, in which he was inſtructed by Bryſon, the ſon of Stilpo. Regarding mental tranquillity as the great end of all philoſophy, and obſerving that nothing contributed ſo much to diſturb it, as the diſſenſions which agitated the ſchools of the Dogmatiſts, and alſo inferring from their endleſs diſputes the uncertainty of the queſtions which they debated, he had recourſe to the doctrine of univerſal uncertainty; and thus it happened in his caſe, as in that of many others, that controverſy became the parent of ſcepticiſm.

Pyrrho had ſeveral diſciples, but none who merit particular notice except Timon, the Phliaſian, who lived to the age of 90 years, and flouriſhed in the time of Ptolemy Philadelphus. The public ſucceſſion of profeſſors in the Pyrrhonic ſchool terminated with Timon, and in Cicero's time this ſchool was extinct. The diſciples of Timon choſe to ſcreen their ſcepticiſm under the authority of the Academy; and after ſome interval, the ſchool itſelf was revived by Ptolemæus, a Cyrenian, and continued at Alexandria by Œneſidemus, a contemporary with Cicero: the latter wrote a treatiſe "On the Principles of the Pyrrhonian Philoſophy," the heads of which are preſerved by Photius. From his time it was tranſmitted, through a ſeries of preceptors little known, to Sextus Empiricus, who has given a ſummary of the ſceptical doctrine; for an account of which, ſee SCEPTICS. As for Pyrrho and his followers, they rather endeavoured to demoliſh every other philoſophical ſtructure, than to erect one of their own. They aſſerted nothing; but propoſed poſitions merely in the way of enunciation, without attempting to determine on which ſide, in any diſputed queſtion, the truth lay, or even preſuming to aſſert, that one propoſition was more probable than another.

Thoſe now diſtinguiſhed by the name of Pyrrhonians, or Sceptics, are perſons who, from the great number of things that are dark and obſcure, and from the averſion they bear to popular credulity, maintain, that there is nothing certain in the world.

The truth is, Pyrrhoniſm has ſome foundation in nature: we do not judge of things from their real eſſences, but from their relations to ourſelves. Moſt of our ideas we receive by means of our ſenſes; but our ſenſes are not given us to judge of the eſſences, but of the relations of things to themſelves; *i. e.* how they may affect us ſo as to do us good or harm.

Thus, *e. gr.* our eyes do not give us the real magnitudes of objects, but their relative ones only.

The Academics differed from the Pyrrhonians, in that they owned there were ſome things more like or more near akin to truth than others, which the Pyrrhonians peremptorily denied. On account of the ſimilarity of the opinions of this ſect and thoſe of the Platonic ſchool in the Middle and New Academy, it happened, that many of the real followers of Pyrrho choſe to ſcreen themſelves from the reproach of univerſal ſcepticiſm, by calling themſelves *Academics* (which ſee); and hence the appellation of Pyrrhoniſts rhonifts fell into difufe, whilft the doctrine of Pyrrho had many advocates. For the difference between them, fee SCEPTICS.

Le Clerc obferves, that the Pyrrhonians, in affirming that there is nothing certain, were the moft affuming and decifive of all philofophers; fince they muft firft have examined all things, to be able to determine precifely that all things are uncertain.

It may be added, that the very principle of the Pyrrhonians deftroys itfelf; for if there be nothing certain, then muft that dogma itfelf be precarious; and if no one thing be more probable, or liker to truth than another, why fhall the principle of the Pyrrhonians be believed preferably to the oppofite one? fince itfelf is come at in the fame way as our other knowledge. Brucker's Hift. of Philof. by Enfield, vol. i.

PYRRHUM, in *Ancient Geography*, a town of Pannonia, on the route from Pætovio to Sifcia, between Aquaviva and Dautona, according to the Itin. of Antonine.

PYRRHUS, in *Biography*, king of Epirus, one of the moft diftinguifhed warriors of the period in which he flourifhed, fuppofed to be defcended from Pyrrhus, the fon of Achilles, was the fon of Æacides, who was expelled the kingdom by a revolt of his fubjects. When Pyrrhus was only twelve years of age, he was placed on the throne of his anceftors by Glaucias, king of Illyria, who had protected him in his infancy. He reigned in peace till he was about feventeen years of age, when, being abfent from his kingdom, his fubjects feized his treafures, and conferred the crown upon his great uncle, Neoptolemus. Pyrrhus being poffeffed of no force to enable him to recover his authority, repaired to Demetrius Poliorcetes, the fon of Antigonus, who had married his fifter, and under that eminent commander he learned the art of war, in company with many officers and foldiers of Alexander the Great. At the battle of Ipfus, in the year B.C. 301, he greatly diftinguifhed himfelf, and after its lofs by Demetrius, he fecured for him the Greek cities, with the care of which he had been entrufted. When a treaty of peace was concluded between Demetrius and Ptolemy Lagus, king of Egypt, Pyrrhus confented to be one of the hoftages fent into that country for the performance of the conditions. In the Egyptian court he excited general admiration by his amiable and correct behaviour, and his dexterity in martial exercifes; and he obtained from the king his daughter Antigone in marriage. The next ftep was to reftore him to his throne, which was effected by an armament fupplied by Ptolemy, with the aid of which he defeated Neoptolemus. That prince, however, being fupported by his allies, Pyrrhus confented to allot him a fhare of his dominions; but fuch a partnerfhip was not likely to be durable, and Neoptolemus, it was faid, attempted to poifon Pyrrhus, which gave the latter a pretence to order his death. He being fettled on the throne of Epirus, began to execute thofe fchemes of ambition, in which the remainder of his life was fpent. A civil war raging between the two fons of Caffander, in Macedonia, one of them, Alexander, applied to Pyrrhus for affiftance. He gladly took occafion of interfering in the affairs of that kingdom, and being put in poffeffion of all its maritime towns, proceeded to conquer the reft for Alexander. A peace was made, by which Macedonia was divided between the two brothers, and Pyrrhus feems to have withdrawn his troops to his own country. Shortly after, Demetrius made himfelf mafter of the kingdom, and notwithftanding their former friendfhip, hoftilities enfued between him and Pyrrhus, who haraffed him by incurfions into Theffaly. They mutually invaded each other's kingdoms; and in one inftance, Pyrrhus gained fo complete a victory over the principal general of his antagonift, and difplayed fo much courage, that he ftruck with admiration the Macedonians whom he had defeated, who deferted their own king, and chofe Pyrrhus for their fovereign. This occurred in the year B.C. 287. He held this crown, however, a fhort time; for Lyfimachus, in the following year, entering the country with a powerful army, and remonftrating againft the injuftice of conferring the kingdom on a foreigner, in prejudice to him, a native and commander under Alexander the Great, the allegiance of the Macedonians feemed to Pyrrhus fo little to be relied on, that he withdrew from the conteft, and returned to Epirus. The Romans, engaged in a war with the Tarentines, looked for affiftance to Pyrrhus. This prince eagerly liftened to the propofal, and communicated his determination to his prime-minifter Cyneas, who, being more prudent than his mafter, endeavoured to diffuade him from it. The enterprize was, however, refolved on, and Cyneas was fent with a body of troops to Tarentum, where he fubverted the Roman influence, which was beginning to prevail, and obtained the command of the citadel for an Epirot officer. Pyrrhus followed, and having left his fon Ptolemy regent of Epirus, landed in Italy, in the year 280 B.C., bringing with him an army of about 25,000 men, of whom 7000 were Macedonians, the veteran foldiers of Alexander the Great. He alfo brought a number of war-elephants, which was the firft time that thefe animals were feen, in that character, in Italy. He was greatly endangered in his paffage by a ftorm, which difperfed his fleet, and deftroyed fome of the fhips that kept company with him. On his arrival at Tarentum, he began to correct the licentious manners of the inhabitants, and enure them to military difcipline. At length he marched out to meet the Roman conful Valerius Lævinus, who was waiting for him on the bank of the Siris, in Lucania. The engagement was extremely obftinate, and Pyrrhus, who exerted himfelf in a manner worthy of his high reputation, was in great perfonal danger. Victory, however, decided in his favour, and he took poffeffion of the enemy's camp. In interring the dead he made no diftinction between his own men and the foldiers of his antagonift, but beftowed due encomia upon the bravery of his fallen foes. He followed up his victory, and had proceeded fo far as to obtain a diftant view of Rome. The advance of the other conful obliged him to retire, and he finifhed his campaign by returning to Tarentum. Senfible that he had engaged in no eafy tafk, he was delighted to receive an embaffy from the Romans, which he imagined was to folicit peace, but it was only to negociate an exchange of prifoners. In this embaffy was included the virtuous Fabricius, whom he in vain attempted to gain to his intereft by large offers. He then attempted to make a treaty, and fent his minifter, Cyneas, to Rome for that purpofe, but was unfuccefsful.

In the next campaign, two confuls with their armies marched againft the king of Epirus; the battle was extremely bloody, and the victory fo indecifive, that both parties claimed it: one of the confuls was killed, and Pyrrhus was feverely wounded; and fuch was the lofs of men, that to one who congratulated him as having been the conqueror, he frankly replied, "fuch another victory will ruin me." Both the confuls of the next year, one of whom was Fabricius, were employed to oppofe Pyrrhus, who had received frefh reinforcements from Epirus. They advanced to the Tarentine territory, where, while they were feeking an opportunity to engage, an offer was made them by the phyfician of Pyrrhus, to take him off by poifon. Detefting

ing the treachery, they informed the king of his danger, which so affected him, that he immediately liberated all his Roman prisoners without a ransom. He now sent Cyneas to Rome to renew the attempt at negociation, but was again unsuccessful. During the state of perplexity which a refusal had thrown him into, he was invited by the Syracusans and others to lend his aid against the Carthaginians, who had established themselves in Sicily. He accordingly seized the pretext for changing the field of action, and embarked the whole army for that island, leaving only a strong garrison in Tarentum. On his arrival he was received with general acclamations, and all the public force of Syracuse was put into his hands. He was soon so completely successful, that the Carthaginians sent deputies to Pyrrhus to treat for peace, but he refused to listen to any other condition, than that of their entirely evacuating the island. In confidence of success, he caused a son to be proclaimed king of Sicily, and then made preparations to cross over into Africa, and carry the war into the Carthaginian territories. These projects were not agreeable to the Sicilians, who became alienated from him, and whom he treated not as friends, but as a conquered people. After this he quitted Sicily, and embarked for Italy; in his voyage he was encountered at sea by a Carthaginian fleet, which sunk a number of his vessels and dispersed the rest, so that he reached a port in Italy with no more than twelve sail. Six years did he consume in Italy and Sicily, inflicting and suffering all the evils of war, and finally exhausted in force, and with diminished reputation. His restless spirit was not subdued; and for the purpose of employing and paying his soldiers, in conjunction with a body of Gauls, he made an irruption into Macedonia, where Antigonus Gonatus then reigned. His success was beyond his expectations, for he not only obtained the pillage of many cities, but defeated Antigonus in battle, and wrested from him almost the whole kingdom. He now marched with a powerful army into the Peloponnesus, at the request of Cleonymus, and appearing before Sparta, required the inhabitants to receive his friend as their king. Upon their determination to resist this mandate, he attacked the city, but was repulsed with the loss of many men: he now retired to Argos, where, through the treachery of Aristeas, a bloody conflict ensued, during which, a woman, who saw Pyrrhus just going to kill her son, hurled a tile from the top of the house, which brought the king to the ground. In this state a Macedonian dragged him to a porch, and was going to cut off his head, when Pyrrhus opened his eyes, and gave him so fierce a look, that his trembling hand failed in its office, and it was not till after repeated strokes, that he could execute his purpose. Thus in the year 272 B.C. terminated the life and exploits of this great warrior, whose career of restless enterprize death alone could stop. His military skill was held in the highest estimation by the Romans, who were so well able to judge of it by experience. Hannibal considered Pyrrhus as second only to Alexander, as a great general. He is said to have been the first who understood the art of encampments, and of properly drawing up an army, and some treatises which he wrote on these subjects are mentioned by the ancients. He was brave to the borders of rashness, and sometimes lost the commander in the soldier. He had unbounded ambition, and a disposition perpetually to engage in new enterprizes, for which, as we have seen, he readily abandoned such as proved more difficult than he had expected. He was fond of glory, but was possessed of generosity, which disposed him to acts of kindness, and to a grateful acknowledgment of obligations. All his sons were warlike, and he encouraged the disposition by the declaration, that he would leave the kingdom of Epirus to him who had the sharpest sword.

PYRRHUS *Campus*, or *Pyrrhon Pedium*, in *Ancient Geography*, a canton of Africa, in Mauritania Tingitana, in the country of the Nectiberes, according to Ptolemy.

PYRRHUS *Campus*, a canton of Africa, in Interior Libya, between the country of the Leucæthiopes and that of the Perorsi, according to Ptolemy.

PYRRHUS *Mons*, a mountain of India, on the sea-coast, on this side of the Ganges, according to the Periplus of Arrian.

PYRRSTEIN, in *Geography*, a town of Austria; 10 miles N.W. of Lintz.

PYRSEPHORUS, Πυρσηφορος, in the Athenian festival, Hephæstia, the same with Lampadephorus.

PYRULARIA, in *Botany*, so called, as it seems, because the fruit resembles a little pear, Michaux Boreali-Amer. v. 2. 231; has received a new appellation from Willdenow in his v. 4. 1114, *Hamiltonia*, which Mr. Pursh adopts, in his Flora, 178.—This genus, referred by Michaux and Willdenow to *Dioecia Pentandria*, is placed by Pursh in *Pentandria Monogynia*, though he allows it to be dioecious. It is said to be allied to NYSSA. See that article.

Eff. Ch. Calyx superior, five-cleft. Corolla none. Nectary a five-toothed disk. Drupa. Flowers dioecious.

1. *Hamiltonia oleifera* of Pursh, *Pyrularia pubera* of Michaux, is the only known species, a native of shady woods, on the mountains of Pennsylvania, in Virginia, near the sweet springs, and in Carolina, flowering in May and June. This is a *shrub*, from four to six feet high, very downy, with alternate, oblong, pointed, entire *leaves*. *Stipulas* none. *Flowers* very small, greenish-yellow, in terminal *clusters*. *Fruit* known in North America by the name of Oil-nut. The *root* is said by Michaux to have an unpleasant smell.

PYRUS, an ancient Latin name, which botanists have adopted, but of which the most correct orthography perhaps would be *Pirus*. This will appear as we trace its etymology, but more trouble than good would now arise from such a correction. The generality of critics have given rather a forced derivation of this word, from its Greek synonym, απιος, the *a* being supposed cut off, and an *r* introduced; but De Theis has proposed a much more probable one, from the Celtic *peren*, whence the Anglo-Saxons have taken *pere*, the English *pear*, and the French *poire*. According to the same writer, *api*, the Celtic name of a fruit of the same kind, is the origin of the Greek απιος, the German *apfel*, and our *apple*. *Api* is even the particular name of one sort of apple, in the French language.—Linn. Gen. 251. Schreb. 339. Willd. Sp. Pl. v. 2. 1012. Mart. Mill. Dict. v. 3. Sm. Fl. Brit. 531. Prodr. Fl. Græc. Sibth. v. 1. Ait. Hort. Kew. v. 3. 207. Pursh 339. Juss. 335. Tourn. t. 404. Lamarck Illustr. t. 435. Gærtn. t. 87. (Malus; Juss. 334. Tourn. t. 406. Cydonia; Juss. 335. Tourn. t. 405. Sorbus; Linn. Gen. 250. Schreb. 338. Juss. 335. Lamarck Illustr. t. 434. Cratægus; Linn. Gen. 250. Schreb. 338. Juss. 335. Lamarck Illustr. t. 433.)—Class and order, *Icosandria Pentagynia*. Nat. Ord. *Pomaceæ*, Linn. *Rosaceæ*, Juss.

Gen. Ch. *Cal.* Perianth superior, of one leaf, concave, with five spreading segments, permanent. *Cor.* Petals five, roundish, concave, inserted by their claws into the calyx. *Stam.* Filaments twenty, awl-shaped, shorter than the corolla, inserted into the calyx; anthers simple, roundish. *Pist.* Germen inferior, roundish; styles from two to five, thread-shaped, the length of the stamens; stigmas bluntish.

Peric.

Peric. Apple roundifh, umbilicated, flefhy, with from two to five membranous, more or lefs rigid, cells. *Seeds* two, rarely more, in each cell, oblong, obtufe, pointed at the bafe, convex on one fide, flat on the other.

Eff. Ch. Calyx five-cleft. Petals five. Apple inferior, of from two to five cells. Seeds two in each cell.

Our remarks under the article Mespilus apply equally to the prefent genus, as to the propriety of referring to it the whole Linnæan genus of *Sorbus*, and fome fpecies of *Cratægus* and *Mefpilus;* difregarding the difference in the number of their ftyles, which is evidently uncertain and variable, and diftinguifhing *Mefpilus* by its berry, *Pyrus* by its apple. Even this diftinction proves, in fome inftances, obfcure enough. We fhall, for convenience, follow Willdenow in the order of the fpecies, introducing our additional ones according to their affinities.

1. P. *arbutifolia.* Arbutus-leaved Dwarf Apple. Linn. Suppl. 256. Willd. n. 1. Ait. n. 1. Purfh n. 1. Wangenh. Amer. 89. t. 28. f. 64. (Mefpilus arbutifolia; Linn. Sp. Pl. 685. Cratægus virginiana, foliis arbuti; Mill. Ic. t. 109.)—Leaves obovate, pointed, ferrated; downy beneath; their mid-rib glandular above. Flowers corymbofe. Calyx downy.—Common in low copfes and fwamps, from Canada to Carolina, flowering in May and June. *Purfh.* Frequent in gardens. A bufhy *fhrub,* without thorns, three or four feet high. *Leaves* two inches long, neatly ferrated, more or lefs downy. *Flowers* white, terminal. *Fruit* red, the fize of a currant, mealy, and not eatable.

2. P. *melanocarpa.* Black Bilberry Apple. Willd. Enum. 525. Purfh n. 2. (P. arbutifolia β; Willd. Sp. Pl. n. 1. and Ait. n. 1. Mefpilus arbutifolia; Schmidt Arb. 86. *Purfh.*)—Leaves obovate-oblong, pointed, ferrated; fmooth beneath; their mid-rib glandular above. Flowers corymbofe. Calyx fmooth.—Found in the bogs of Canada, and on the high mountains of Pennfylvania, Virginia, and Carolina, flowering in May and June. The *fruit* is large and black, refembling in tafte the berries of *Vaccinium penfylvanicum. Purfh.*

3. P. *Botryapium.* Snowy Berry Apple. Linn. Suppl. 255. Willd. n. 2. Ait. n. 2. Purfh n. 3. Wangenh. Amer. 90. t. 28. f. 65. (Mefpilus canadenfis; Linn. Sp. Pl. 685. Schmidt Arb. t. 84.)—Leaves oblong-elliptical, ferrated, minutely pointed, finally fmooth. Flowers racemofe. Petals linear-lanceolate. Germen downy. Segments of the calyx fmooth.—Native of woods and hedges from Canada to Carolina, bloffoming in April and May. *Purfh.* Frequent in our fhrubberies. A fmall tree. The young *leaves* are covered with denfe woolly deciduous down. *Flowers* pure white, in lax terminal *clufters.* *Fruit* black, faid by Mr. Purfh to have a very agreeable tafte. It is feldom perfected with us.

4. P. *ovalis.* Oval Berry Apple. Willd. n. 3. Purfh n. 4. (Mefpilus Amelanchier? Walt. Carol. 148. Cratægus fpicata; Lamarck Dict. v. 1. 84.)—Leaves roundifh-elliptical, acute, ferrated, fmooth. Flowers racemofe. Petals obovate. Germen and fegments of the calyx downy.—Native of fwamps, from New Jerfey to Carolina, flowering in April and May. A fmall *fhrub;* the *fruit* black, eatable. *Purfh.* Lamarck, who firft diftinguifhed this fpecies, fays it is twice or thrice as tall as the following, at leaft in the French gardens, with rounder *leaves* and fmaller *flowers,* while the *fruit* is larger, being as big as a floe. The narrow coloured deciduous *bracteas* moreover, which occur in both fpecies, are in the prefent longer than each partial *flower-ftalk,* which is not the cafe with *P. Amelanchier.*

5. P. *Amelanchier.* Alpine Berry Apple. Linn. Suppl. 256. Willd. n. 4. Ait. n. 3. (Mefpilus Amelanchier; Linn. Sp. Pl. 685. Jacq. Auftr. t. 300. Mill. Ic. t. 178. f. 1. Vaccinia alba; Ger. Em. 1416.)—Leaves roundifh-elliptical, acute, ferrated; downy beneath. Flowers racemofe. Petals lanceolate. Germen fomewhat downy. Segments of the calyx fmooth.—Native of rocky mountainous fituations in Germany, Switzerland, France, and the ifle of Crete; common in fhrubberies, ever fince Gerarde's time, bloffoming in May. From three to fix feet high, or more when cultivated, making an elegant appearance with its copious drooping clufters of fnowy *flowers,* whofe *ftalks* are very woolly. *Fruit* blueifh-black, fweet, the fize of a currant.

6. P. *cretica.* Cretan Berry Apple. Willd. n. 5. Prodr. Fl. Græc. n. 1157. (Chamæcerafus Idæa; Alpin. Exot. 4.)—Leaves roundifh, emarginate, with a fmall point, ferrated; woolly beneath. Flowers racemofe. Petals lanceolate. Germen and fegments of the calyx woolly.—Found on the mountains of Crete. This differs from the laft, of which it is juftly fufpected of being a mere variety, in having rounder *leaves,* whofe pubefcence underneath is more permanent; as well as in having more woollinefs about the *flowers.*

7. P. *fanguinea.* Red Berry Apple. Purfh n. 5. (Mefpilus canadenfis γ, rotundifolia; Michaux Boreali-Amer. v. 1. 291.)—"Leaves oval, obtufe at each end, pointed, finely ferrated; fomewhat heart-fhaped at the bafe. Clufters of few flowers. Calyx fmooth. Petals linear, obtufe."—Found in Canada, and on the banks of the Columbia, flowering in April and May. A fmall *tree,* with blood-red *branches.* *Fruit* red, eatable. *Purfh.*

8. P. *communis.* Common Pear-tree. Linn. Sp. Pl. 686. Willd. n. 6. Ait. n. 4. Sm. Fl. Brit. n. 1. Engl. Bot. t. 1784.—Leaves ovate, ferrated, finally fmooth. Flower-ftalks corymbofe. Fruit elongated at the bafe.—Native of various parts of Europe, but even more general as a cultivated plant, the varieties of whofe fruit are many of them highly valuable for the table. The truly wild, or iron, pear is not eatable. It bloffoms in April or May. The *tree* is tall and handfome; the wood light, fine-grained, and tolerably hard, making neat furniture. The *branches,* at firft erect, fubfequently become curved downwards, and pendulous. The ferratures of the *leaves* commonly difappear by culture, as do the ftrong *thorns* found on the wild tree. When young, the *leaves* are downy beneath, and fringed with white. *Flowers* white, with pale red *anthers;* their inflorefcence corymbofe, not umbellate as in the apple. *Fruit* obovate, more or lefs elongated at the bafe.

9. P. *pollveria.* Woolly-leaved Pear-tree. Linn. Mant. 2. 244. Willd. n. 7. Ait. n. 5. (P. pollwilleriana; Bauh. Hift. v. 1. 59. Munch. Haufv. v. 3. part 2. 333.)—Leaves ovate, ftrongly ferrated; moft downy beneath. Flower-ftalks corymbofe, fubdivided.—Native of Germany, according to baron Munchhaufen. John Bauhin firft met with it in the garden of baron Pollwill, in Alfatia. It was fent to Kew, in 1786, by the late Mr. Græffer. This differs from the common Pear-tree in having the *leaves* downy on both fides, but efpecially beneath; the *flowers* cream-coloured, much fmaller and more numerous, even forty in each *corymb,* their partial ftalks being branched and forked. The *fruit* is fmall, fometimes but an inch long, and falls eafily when ripe.

10. P. *nivalis.* Snow Pear-tree. Jacq. Auftr. v. 2. 4. t. 107. Linn. Suppl. 253. Willd. n. 8.—Leaves obovate, obtufe, pointed, entire; hoary beneath. Flower-ftalks corymbofe. Fruit nearly globofe.—Native of mountains in Auftria, about the borders of woods and vineyards, flowering

flowering early in May. The *leaves* are whitifh and filky beneath; nearly fmooth above. *Flowers* large, white, ftrongly fcented, in a fimple downy *corymb*. *Fruit* about two inches in diameter, globofe, rather depreffed, purplifh-green. When gathered in October, as auftere as an unripe medlar; but after lying a few weeks, it firft acquires a fweet fcent, which is but temporary, and at length towards December, thefe pears become foft, like medlars, and very good eating.

11. P. *Malus*. Common Apple, or Crab. tree. Linn. Sp. Pl. 686. Willd. n. 9. Ait. n. 6. Sm. Fl. Brit. n. 2. Engl. Bot. t. 179. Fl. Dan. t. 1101. Mill. Illuftr. t. 44. (Malus fylveftris; Ger. Em. 1461.)—Leaves elliptic-oblong, pointed, ferrated, fmooth. Umbels fimple, feffile. Styles fmooth. — Native of woods and hedges throughout Europe, and ftill more valuable, for its innumerable and ufeful varieties, as a cultivated plant, than even the Pear, n. 8. The Crab itfelf, or Wild Apple, though always too auftere to be eaten raw, is fubject to fome varieties that are worthy of notice for kitchen ufe. This fpecies produces its elegant blufh-coloured bloffoms in May. The *branches* are more horizontal than thofe of *P. communis*, as well as more twifted and diforderly. The younger *leaves* are downy beneath. *Fruit* roundifh, concave, or umbilicated, at the bafe.

12. P. *dioica*. Dioecious Pear-tree. Willd. n. 10. Phytogr. fafc. 1. 8. Moench. Weiffenft. 87. t. 8. *Willd.* (Malus non florens, fructificans tamen; Bauh. Pin. 433.)—Leaves oval, pointed, ferrated. Flowers axillary, dioecious. Petals linear, the length of the calyx.—The native country of this fingular plant is unknown. Profeffor Willdenow, from whom we have dried fpecimens, fufpects it to be poffibly a variety of the preceding fpecies. The *flowers* are fmall, forming in appearance fhort downy *umbels*, at the ends of the branches, but each feparate ftalk is accompanied by a leaf. *Petals* yellowifh-green, not exceeding the *calyx*. *Styles* five, fmooth. We have feen the female plant only.

13. P. *fpectabilis*. Chinefe Apple-tree. Ait. n. 7. Willd. n. 11. Curt. Mag. t. 267. Schneev. Ic. t. 15.—Leaves oval-oblong, ferrated, fmooth. Umbels fimple, feffile, nearly fmooth, without bracteas. Styles woolly at the bafe.—Native of China, from whence Dr. Fothergill is faid to have imported it in 1780. The tree proves tolerably hardy in our gardens, flowering early in May. The *leaves* are furnifhed with copious fhallow ferratures, and have downy *footftalks* and *ribs*. The *umbels* are nearly, if not quite, fmooth, and confift of eight or ten large and handfome rofe-coloured *flowers*, for which alone this plant is cultivated, the *fruit*, which is yellow, an inch in length, and ufually elongated a little at the bafe, being fparingly produced, and of no value. We can difcover no *bracteas*, and if we are not miftaken, the want of them affords the fureft mark of diftinction between this fpecies and the two following.

14. P. *prunifolia*. Siberian Crab-tree. Willd. n. 12. Ait. n. 8. (P. Malus β; Ait. ed. 1. v. 2. 175. Cratægus cerafi folio, floribus magnis; Mill. Ic. t. 269.)—Leaves ovate, pointed, with fhallow ferratures. Umbels fimple, feffile, downy. Bracteas linear, toothed, deciduous. Styles woolly at the bafe.—Native of Siberia, according to Miller, who fays the feeds were fent from Dauria to Peterfburgh, and who had it, bearing flowers and fruit, at Chelfea, before the year 1758. This tree is now common in gardens, the fruit, which refembles a white-heart cherry in fize and colour, but which is liable, in both refpects, to vary, being efteemed for preferving, as well as for tarts; nor is it, when mellowed by froft, unpleafant to eat raw. The *leaves* are rather more downy than the laft, but their ribs are fmooth. *Flowers* copious, with a light fweet fcent, their colour much paler and their fize fmaller than *P. fpectabilis*. *Flower-ftalks* very downy. *Bracteas* fmooth, membranous, very narrow, above half an inch long.

15. P. *baccata*. Small-fruited Crab-tree. Linn. Mant. 75, excluding the reference to Miller. Willd. n. 13. Ait. n. 9. Pall. Roff. v. 1. p. 1. 23. t. 10. Gifeke Ic. fafc. 1. t. 12. (Cratægus cerafi foliis, floribus magnis; Amm. Ruth. 195. t. 31.) Leaves ovato-lanceolate, pointed, fharply ferrated, fmooth. Umbels fmooth, fimple, feffile. Bracteas linear, flightly toothed, deciduous. Styles naked. Fruit fmaller than the petals.—Found in low fituations, about the banks of rivers, in Siberia, flowering the end of May. We received fpecimens from the garden of the late Right Hon. Charles Greville, at Paddington, in flower April 21, 1803. This differs from the laft, with which fome botanifts have confounded it, in having broader, more acutely ferrated, fmoother *leaves*; fmooth *flower-ftalks* and *ftyles*; and a fmall red *fruit*, not bigger than a common haw. The *calyx* in both is deciduous, leaving a fcarred hollow on the top of the *fruit*.

16. P. *coronaria*. Sweet-fcented Crab-tree. Linn. Sp. Pl. 687. Willd. n. 14. Ait. n. 10. Purfh n. 7. Kalm's Travels, Englifh edition, v. 2. 166.—Leaves broad-ovate, fomewhat lobed or angular, ferrated, fmooth. Flower-ftalks corymbofe. Styles woolly in the lower part.—Native of woods in North America, from Pennfylvania to Carolina, flowering in May. It has long been cultivated in England, for the fake of the beauty and violet-like fragrance of its blufh-coloured *bloffoms*, as well as for its *fruit*, which is as big as a fmall golden-pippin, extremely acid, but excellent for preferving with fugar. The *leaves* are diftinguifhed by their breadth, and by being flightly lobed, like fome of the lefs deeply cut leaves of the Hawthorn, but thrice as large.

17. P. *anguftifolia*. Narrow-leaved Crab-tree. Ait. Hort. Kew. ed. 1. v. 2. 176. ed. 2. n. 11. Willd. n. 15. Purfh n. 8. (P. coronaria; Wangenh. Amer. 61. t. 21. f. 47.)—Leaves lanceolate-oblong, fhining, with tooth-like notches; contracted and entire at the bafe. Flower-ftalks corymbofe. Found in the low woods of Carolina, flowering in May. It refembles the foregoing fpecies, but the *fruit* is very fmall. *Purfh.* This is faid in Hort. Kew. to have been cultivated in 1750, by Mr. Chriftopher Gray. We have never examined it, nor have we any account of the *ftyles* being downy or otherwife.

18. P. *japonica*. Japan Apple-tree. Thunb. Japon. 207. Willd. n. 16. Ait. n. 12. Curt. Mag. t. 692. (Malus Japonica; Andr. Repof. t. 462. Buke; Kæmpf. Amoen. 844.)—Leaves elliptic-oblong, fharply ferrated, very fmooth. Stipulas lunate, deeply toothed. Flower-ftalks fomewhat aggregate. Calyx abrupt. Seeds numerous in each cell.—Gathered by Thunberg, on mount Fakona in Japan, where it flowers from February to April. It proves quite hardy in our gardens, into which fir Jofeph Banks introduced it in 1796, flowering at the fame feafon, and alfo frequently again in autumn. When the fpring is fevere, the beautiful deep fcarlet *bloffoms* require the fhelter of a glafs frame. The *ftem* is fomewhat thorny. *Leaves* deep green; the firft that come out are fhort and abrupt. *Stipulas* on the young branches, half an inch or an inch broad. *Fruit* globular, we have not feen it ripe. *Seeds* very numerous in each cell, one above another, fo that we cannot but feel fome fcruples as to the genus of this fpecies.

19. P. *Cydonia*. Common Quince-tree. Linn. Sp. Pl. 687. Willd. n. 17. Ait. n. 13. Jacq. Auftr. t. 342.

Woodv. Med. Bot. t. 79. (Malus cotonea; Ger. Em. 1452. Matth. Valgr. v. 1. 217.)—Leaves roundifh-elliptical, entire; downy beneath. Flowers folitary, ftalked. Calyx ferrated, reflexed.—Native of the rocky banks of the Danube. Naturalized in the hedges of Germany. Dr. Sibthorp found it wild in the northern parts of Greece, in which country it retains the ancient name κυδωνιά. This was among the firft exotic fruits cultivated in England, where it bloffoms in May or June, and ripens fruit in autumn. The *tree* is rather fpreading than tall. *Leaves* roundifh, various in fize; fmooth and light green above; white with foft denfe down beneath. *Flower-ftalks* and *calyx* more or lefs woolly. *Petals* large, flefh-coloured. *Fruit* large, yellow, very auftere and aftringent, but with a peculiar and very powerful fragrance. Cookery renders it mild, and to moft perfons highly grateful. There are three or four angular *feeds* in each cell, ranged horizontally, not, as in the laft, vertically. The Quince is fuppofed to be the golden apple of the Hefperides, fo famous in ancient fable.

20. P. *falicifolia*. Willow-leaved Crab-tree. Linn. Suppl. 255. Willd. n. 18. Ait. n. 14. Pallas Roff. v. 1. p. 1. 20. t. 9.—Leaves linear-lanceolate, hoary, nearly entire; downy beneath. Flowers folitary, almoft feffile.—Native of Siberia, America, and mount Hæmus. Sent to Kew, by Pallas, in 1780. It is a hardy tree, flowering early in fpring, and known by its hoary, narrow, willow-like *leaves*. The *flowers* are terminal, folitary, and nearly feffile; not axillary. *Fruit* pear-fhaped, an inch long, brown, not at all eatable till mellowed by froft, like medlars; and even then not very good.

21. P. *Chamæmefpilus*. Baftard Quince. Ehrh. Beitr. fafc. 4. 19. Sm. Prodr. Fl. Græc. Sibth. n. 1158. (Mefpilus Chamæmefpilus; Linn. Sp. Pl. 685. Willd. Sp. Pl. v. 2. 1011. Ait. Hort. Kew. v. 3. 206. Cratægus Chamæmefpilus; Jacq. Auftr. t. 231. Cotanafter Gefneri; Ger. Em. 1606.)—Leaves elliptical, fharply ferrated, fmooth. Flowers in corymbofe heads. Calyx very woolly within. Styles two, fmooth.—Native of the alps of Auftria, Savoy, and Switzerland, as well as of mount Athos, and the Pyrenées, flowering in June. A bufhy *fhrub*; the *leaves* two or three inches long and one wide; entire at the bafe; of a deep fhining green; their under fide paler, marked with many tranfverfe parallel veins. *Flowers* fmall, deep rofe-coloured. *Calyx* very denfely lined with long white wool. *Styles* and *feeds* but two. *Fruit* corymbofe, oval, of an orange fcarlet, the fize of a haw.

22. P. *Aria*. White Beam-tree, or White Wild Pear-tree. Ehrh. Beitr. fafc. 4. 20. Arb. 84. Sm. Fl. Brit. n. 7. Engl. Bot. t. 1858. Willd. n. 19. Ait. n. 15. (Cratægus Aria; Linn. Sp. Pl. 681. Fl. Dan. n. 301. t. 302. Aria Theophrafti; Ger. Em. 1327.)—Leaves elliptical, cut, and ferrated; white and downy beneath, with crowded parallel veins. Corymbs compound, woolly. Styles two or more.—Native of limeftone rocks, or chalky hills, in moft parts of Europe; not rare in the mountainous countries of England, flowering in May, ripening fruit in September. A handfome fmall *tree*, much cultivated in home plantations. The young *branches*, like the *ftalks*, *calyx*, and backs of the *leaves*, are very white, with mealy or cottony down. The *leaves* vary from an ovate or obovate figure, to a more correct oval, and are pretty regularly cut, as well as ferrated, but not finuated or lobed; their veins, or fide-ribs, numerous, ftraight and parallel; their upper fide fmooth. *Corymbs* fubdivided, many-flowered, cottony. *Petals* white, the fize of thofe of the Hawthorn. *Styles* two, often three, rarely four. *Fruit* nearly globular, fcarlet, dotted, meally and acid; its cells coriaceous rather than horny, equal in number to the ftyles, with two *feeds* in each.

23. P. *intermedia*. Swedifh White Beam-tree. Ehrh. Beitr. fafc. 4. 20. Arb. 94. Willd. n. 20. Arb. 268. Ait. n. 16. (Sorbus alpina, foliis finuofis; Fl. Dan. n. 302. t. 301. fig. in flower only. S. hybrida; Hudf. 216.)—Leaves elliptical, lobed, cut and ferrated; white and downy beneath, with rather diftant veins. Corymbs compound, woolly. Styles two or more.—Native of Sweden. Found by Mr. Waring, on the walls of caftle *Dinas y Brān*, North Wales. *Hudfon*. Specimens from the original plant prove the fame as thofe of Ehrhart, and differ from the common *P. Aria*, only in having the *leaves* fo far cut, as to be, in fome degree, pinnatifid, owing to which the tranfverfe veins are rather more diftant from each other. We can fcarcely admit it to be more than a variety, as Linnæus made it in Sp. Pl. 681. It is his Lapland plant, Fl. Lapp. n. 199.

24. P. *pinnatifida*. Baftard Mountain Afh. Ehrh. Beitr. fafc. 6. 93. Exficc. 145. Sm. Engl. Bot. t. 2331. (P. hybrida; Sm. Fl. Brit. n. 6, excluding the fynonyms of Hudfon and Withering. Sorbus hybrida; Linn. Sp. Pl. 684. Linn. Fil. fafc. 1. t. 6. Willd. Sp. Pl. v. 2. 1008. Ait. Hort. Kew. v. 3. 204. Fl. Dan. n. 302. t. 301. fig. in fruit.) Leaves oblong, deeply pinnatifid, or half pinnate; downy beneath. Corymbs compound, woolly. Styles about three.—Native of Sweden. Gathered wild, by the late Mr. J. Mackay, in rocky places on Cairn na Callich, and other mountains, at the north end of the ifle of Arran. It is frequent in plantations, flowering in May, and propagated by feed. This was thought by Linnæus to be a mule, between *Aria*, and *aucuparia* hereafter mentioned. It nearly accords with the former, but the *leaves* are more oblong and acute; very deeply pinnatifid, or even pinnate, in their lower part. The *flowers* and *fruit* almoft agree with thofe of *aucuparia*. The *ftyles* are ufually three or four.

25. P. *aucuparia*. Mountain Afh; Quicken, or Roan Tree. Ehrh. Beitr. fafc. 6. 94. Gærtn. v. 2. 45. t. 87. Sm. Fl. Brit. n. 5. (Sorbus aucuparia; Linn. Sp. Pl. 683. Willd. Sp. Pl. v. 2. 1008. Ait. Hort. Kew. v. 3. 204. Fl. Dan. t. 1034. Mill. Illuftr. t. 43. Engl. Bot. t. 337. S. fylveftris; Ger. Em. 1473. Matth. Valgr. v. 1. 238.) Leaves pinnate; leaflets equal, ferrated, fmoothifh. Corymbs compound, fomewhat panicled. Styles about three.—Native of mountainous places, in the colder parts of Europe; abundant in Scotland, Derbyfhire, &c. flowering in May, and very common in domeftic plantations. An elegant and very hardy *tree*, of flow growth, the wood being hard and tough. *Leaves* all diftinctly pinnate, of many pair of oppofite, oblong, fmooth, ferrated *leaflets*, more or lefs entire towards the bafe, with an odd one; the young ones downy beneath. *Flowers* very numerous, white, the fize of the three laft, but rather more panicled. *Fruit* fcarlet, acid and bitter, yet eatable when prepared with fugar. According to Lightfoot, this tree is found generally about the Druidical circles in North Britain, and is ftill believed, by the fuperftitious Highlanders, to be powerfully efficacious againft witchcraft.

26. P. *domeftica*. True Service Tree. Ehrh. Beitr. fafc. 6. 95. Exficc. 155. Sm. Fl. Brit. n. 4. Engl. Bot. t. 350. (Sorbus domeftica; Linn. Sp. Pl. 684. Willd. Sp. Pl. v. 2. 1009. Ait. Hort. Kew. v. 3. 204. Jacq. Auftr. t. 447. Matth. Valgr. v. 1. 237. Sorbus; Ger. Em. 1471.)—Leaves pinnate; leaflets equal, ftrongly ferrated, downy beneath. Flowers panicled. Styles five.—Native of the warmer parts of Europe. Dr. Sibthorp found

found it in Greece, as well as on mounts Hæmus and Athos, and in woods near Conftantinople. Ray fpeaks of it as wild in the mountainous parts of Cornwall and Staffordfhire. It is now rarely cultivated, being, though a handfome tree, yet of flow growth, and inferior in the value of its fruit to the Medlar. A folitary individual of this fpecies now and then occurs, about ancient manfions and very old orchards. It bloffoms in May. The *leaves* are larger, and the *flowers* twice the dimenfions of the laft, being the fize of hawthorn-bloffoms, rather panicled than corymbofe. *Fruit* like a fmall pear, reddifh, above an inch long, with five cells, anfwerable to the five *ftyles*; its cells with two valves, like thofe of a Common Pear; and though only one *feed* is perfected in each cell, Gærtner obferved two in an early ftate. This *fruit*, if tafted before it is mellow, occafions a moft intolerable forenefs at the back of the palate, lafting many hours. When ripe it is foft, brown, and agreeably acid. The name *Service* is evidently a corruption of *Sorbus*.

27. P. *torminalis*. Wild Service Pear-tree. Ehrh. Beitr. fafc. 6. 92. Sm. Fl. Brit. n. 3. Willd. Sp. Pl. n. 21. Ait. n. 17. (Cratægus torminalis; Linn. Sp. Pl. 681. Engl. Bot. t. 298. Fl. Dan. t. 798. Jacq. Auftr. t. 443. Mill. Illuftr. t. 42. Sorbus torminalis; Ger. Em. 1471. Matth. Valgr. v. 1. 239.)—Leaves fimple, fomewhat heart-fhaped, ferrated, acute, fmooth, feven-lobed; the lower lobes fpreading.—Native of Germany, Switzerland, England, and the Levant, in woods, flowering in April or May. A moderate-fized *tree*, with a hard wood, and fmooth bark. *Leaves* on long ftalks, without *ftipulas*, unequally lobed, pointed; their ribs fometimes downy beneath. *Corymbs* downy, much branched. *Flowers* fmaller than the laft. *Styles* three, four, or five. *Fruit* brown, dotted, twice the fize of a haw, very pleafantly acid and pulpy, when touched by froft, and often fold in the London fruit-fhops. By the fpecific name, it fhould feem to be of a griping quality. Tragus, in his p. 1010, reprefents it as powerfully expelling worms.

28. P. *hybrida*. Mule Service Pear-tree. Willd. n. 22. Moench. Weiffenft. 90. t. 6. *Willd.* — Leaves elliptical, ferrated, downy beneath; fimple or pinnate, the terminal one largeft. Flowers corymbofe. Calyx hairy.—This is afferted by Profeffor Willdenow, from whom we have fpecimens, to be a mule production, from the firft fpecies, *P. arbutifolia*, impregnated by the 25th, *aucuparia*. It retains indeed as great a refemblance to both parents as it poffibly could to what are fo diffimilar to each other. The fimple *leaves* are two inches or more in length, obtufe, ftrongly ferrated; the lateral *leaflets*, of the compound ones, half, or one-third, as large, unequal at the bafe. *Stipulas* ovate, toothed, recurved. *Flowers* not much unlike the laft, but their *cymes* fomewhat fmaller, with hairy, rather than downy, ftalks. It is curious that the rib of each *leaf*, on its upper fide, retains fome portion of the brown glands characteriftic of *P. arbutifolia*.

29. P. *anthyllidifolia*. Kidney-vetch-leaved Service-tree. —Leaves pinnate, entire; filky beneath. Corymbs axillary and terminal, of few flowers.—Gathered in the Sandwich iflands, by Mr. Menzies, to whom we are obliged for fpecimens, under the name of *Sorbus*, to which, now abolifhed, Linnæan genus there can be no doubt that this tree belongs, though we have not feen the fruit. The *leaves* are all uniformly pinnate, two or three inches long, of eight or nine pair, befides an odd one, of equal, oblong or obovate, obtufe, minutely pointed, entire leaflets, half an inch at leaft in length; fmooth and fhining above; paler and filky beneath. *Stipulas* lanceolate, a little hairy, deciduous. *Flower-ftalks* axillary and terminal, nearly the length of the leaves, downy, corymbofe, though each bears but three or four *flowers*, which are about the fize of *P. aucuparia*. *Bracteas* awl-fhaped. *Calyx* woolly. *Styles*, as far as we can fee, three, hairy at the bafe. The *leaves* of this very pretty and remarkable fpecies ftrikingly convey the idea, at firft fight, of fome kind of *Anthyllis*, efpecially *A. Barba Jovis*.

Pyrus, in *Gardening*, contains plants of the fruit-tree kind, of which the fpecies cultivated are the common pear-tree (P. communis); the common apple-tree (P. malus); the Chinefe apple-tree (P. fpectabilis); the Siberian crab-tree (P. prunifolia); the fweet-fcented crab-tree (P. coronaria); and the quince-tree (P. cydonia.)

With refpect to the firft, it is obferved that "the wild pear, the mother of all the orchard and garden varieties, is thorny. The ftipules are fetaceous, white (or reddifh), deciduous; the peduncles alternate; and the calyx clothed with a ferruginous wool."

There are numerous varieties; but thofe of moft importance for cultivation are,

The little mufk, which is often termed the fupreme. The fruit, when ripe, is of a yellow colour; the juice fomewhat mufky; and, when gathered before it be too ripe, it is a good fruit. It becomes ripe about the latter end of July, but continues good only a very fhort time.

The chio, or little baftard mufk, which is pretty much like the other, but fmaller. The fkin, when ripe, has a few ftreaks of red on the fun fide.

The green chiffel, or Haftings, which is a middle-fized fruit, that always remains green, and is full of juice when ripe. It becomes ripe in the beginning of Auguft.

The red mufcadelle, which is a large early pear, of great beauty; the fkin is of a beautiful yellow, ftriped with red, and the flefh has a rich flavour. It fometimes produces two crops in a year; the firft about the end of July, and the fecond in September, or thereabouts.

The little mufcat, which is a fmall pear, having the fkin very thin, and of a yellowifh colour, when ripe. This fruit has a rich mufky flavour, but does not keep long. It becomes ripe about the beginning of Auguft.

The lady's thigh, which is here commonly called jargonelle, is of a ruffet-green colour from the fun, but towards it inclining to an iron colour; the flefh is breaking, and has a rich mufky flavour. It becomes ripe about the middle of Auguft.

The Windfor, which has a fmooth fkin, and when ripe is of a yellowifh-green colour; the flefh is very foft, and, if permitted to hang but two or three days after it is ripe, grows mealy, and is good for nothing. It becomes ripe about the latter end of Auguft.

The jargonelle, which is commonly called cuiffe madame. According to Mr. Forfyth, it is certainly the true French jargonelle, and the pear that commonly goes by that name here is the real cuiffe madame, or lady's thigh; it being very probable that the names have been changed, in coming to this country. This pear is fomewhat like the Windfor; the fkin is fmooth, and of a pale green colour. It is a plentiful bearer; but the flefh is apt to be mealy, if it ftands to be ripe, which is about the middle of Auguft. It bears beft on ftandards.

The orange mufk, which is of a yellow colour, fpotted with black; the flefh is mufky, but very apt to be dry. It ripens about the latter end of Auguft.

The great blanquet, or bagpipe of Anjou, which has a fmooth fkin of a pale green colour; the flefh is foft, and full

full of juice of a rich flavour. It ripens about the middle of Auguft.

The little blanquet, which is much lefs than the former, of a pale colour, and the flefh tender, and full of a rich mufky juice. It ripens about the latter end of Auguft.

The long-ftalked blanquet has a very fmooth fkin, white, and a little coloured towards the fun, and is full of a rich fugary juice. It becomes ripe at the latter end of Auguft.

The fkinlefs or early ruffelet, which is of a reddifh colour, the fkin extremely thin, and the flefh melting and full of a rich fugary juice. It ripens in the latter end of Auguft.

The mufk robine, or queen's pear, (alfo called the amber pear,) which is fmall, and of a yellow colour when ripe; it has a rich mufky flavour, and is a great bearer. It ripens about the latter end of Auguft.

The mufk drone, which has a fkin of a yellow colour when ripe, and a rich mufky tafte; but is apt to grow mealy, if left too long on the tree. It ripens about the beginning of September.

The red orange, which is of a greenifh colour, but the fide next the fun changes to a purple colour, when ripe; the flefh is melting, and the juice fugary, with a little perfume. It ripens in the beginning of Auguft.

The caffolette, or green mufcat, is a fmall greenifh pear, with fome fpecks in the fkin. It is full of a rich perfumed juice, and ripens in the latter end of September.

The great onion, brown admired, or king of fummer, which is of a brownifh colour next the fun, and becomes ripe in the beginning of September.

The mufk orange, in which the fkin is green, and the flefh melting. It ripens in the beginning of September.

The avorat, or Auguft mufcat, which has a fmooth fkin of a whitifh yellow colour; the juice is richly fugared and perfumed, and it is efteemed one of the beft fummer pears yet known. It is a great bearer, and becomes ripe in the beginning of September.

The rofe, or thorny rofe, which is fhaped like the great onion pear, but much larger, of a yellowifh-green colour, but a little inclining to red next the fun. The flefh is breaking, and the juice mufky. It becomes ripe in the beginning of September.

The poire du puchet, which has the flefh foft and tender, and the juice fugary. It ripens in the beginning of September.

The perfumed pear, which is of a deep red colour, fpotted with brown; the flefh melting, but dry, and has a perfumed flavour. It ripens in the beginning of September.

The falviati, which is red and yellow next the fun, but whitifh on the other fide; the flefh is tender, and the juice fugary and perfumed. It ripens about the middle of September.

The rofe water, which has the fkin rough, and of a brown colour, the juice very fweet, tafting like rofe-water. It ripens in the latter end of September.

The ruffelet, in which the flefh is foft and tender, and the juice agreeably perfumed. It ripens in the latter end of September.

The great mouthwater, which has the flefh melting and full of juice. It ripens about the latter end of September.

The prince's pear, which has a highly-flavoured juice, and is a great bearer, ripening about the latter end of September.

The fummer bergamot, which is fometimes called Hamden's bergamot. The flefh is melting, and the juice highly perfumed. It ripens about the latter end of September.

The autumn bergamot, which is fmaller than the former; the flefh is melting, and the juice highly perfumed. It is a great bearer, and ripens in the beginning of October.

The fummer bonchrétien, which is very full of juice, and is of a rich perfumed flavour. It ripens about the middle of September.

The beurré rouge, (the red butter pear,) which has the flefh very melting and full of a rich fugary juice. It ripens in the beginning of October, and, when firft gathered from the tree, is one of the very beft forts of pears.

The dean's pear, which has the flefh melting and full of juice, which is very cold. It is a great bearer, and ripens in the beginning of October.

The Swifs bergamot has a melting flefh, and is full of juice. It ripens in the beginning of October.

The long green, in which the flefh is melting and full of juice. It ripens in the latter end of October. It is, by fome, reckoned the fame with the mouthwater.

The white and grey monfieur John, which are the fame; the difference of their colour proceeding from the different foils and fituations wherein they grow, or the ftocks on which they are grafted. If this pear be rightly managed, there are not many forts in the fame feafon to be compared with it. The flefh is breaking, and full of a rich fugared juice. It ripens in the latter end of October or beginning of November.

The flowered mufcat, which is an excellent pear; the flefh is very tender, and of a delicate flavour. It ripens in November.

The vine pear, which is of a dark red colour; the flefh very melting, and full of a clammy juice. It comes into eating in November.

The rouffeline pear, which is of a deep red colour, with fpots of grey; the flefh is very tender and delicate, and the juice very fweet, with an agreeable perfume. It ripens about the latter end of October, but does not keep.

The knave's pear, which has the flefh fine and tender, and the juice very much fugared. It ripens in the latter end of October.

The marquis pear is a pear which, when it does not change yellow in ripening, is feldom good; but if it does, the flefh will be tender, delicate, and very full of juice, which is fugared. It comes into eating in November.

The Crafane pear, which has the flefh extremely tender and buttery, and full of a rich fugared juice. It is the very beft pear of the feafon, and comes into eating about the latter end of December.

The Lanfac, or Dauphiné pear, which has the flefh yellow, tender, and melting; the juice is fugared, and a little perfumed. It is in eating the beginning of December.

The martin fec (the dry martin), which is almoft like the ruffelet in fhape and colour; the flefh is breaking and fine; and the juice fugared, with a little perfume. It is in eating about the beginning of December.

The amadot, which is rather dry, but high-flavoured: it is in eating about the middle of December.

The little lard pear, which is extremely fine; the flefh melting; the juice much fugared, and has an agreeable mufky flavour. It is in eating the latter end of December, and is efteemed one of the beft fruits in that feafon.

The Louifbon (the good Lewis), which has the flefh extremely tender, and full of a very fweet juice. It is in eating about the middle of December.

The Colmar pear, which is very tender, and the juice greatly fugared. It is in eating about the beginning of January, and is efteemed an excellent fruit.

The l'efchafferie, which has the flefh melting and buttery; the

the juice is fugary, with a little perfume. It is in eating about the firft of January. It bears beft on ftandards.

The virgouleufe pear, which is efteemed by fome as one of the beft fruits of the feafon; the flefh is melting, and full of a rich juice. It is in eating about the firft of January. In dry and cold feafons it is very apt to crack, which greatly diminifhes its value.

The ambrette, which is efteemed a very good pear; the flefh is quite melting, and full of fweet perfumed juice. It comes into eating about the beginning of January.

The epine d'hyver (the winter thorn pear), which has a very tender buttery pulp, of an agreeable tafte, with a fweet juice highly perfumed. It is in eating about the latter end of December.

The St. Germain pear, which is a fine fruit and keeps long; the flefh is melting, and very full of juice, which in a dry feafon, or if planted on a warm dry foil, is very fweet. It is in eating from December till February. Mr. Forfyth remarks, that it is "an excellent bearer, when planted as a dwarf ftandard, and comes in fucceffion after the fame fort of pears on wall-trees are over."

The St. Auftin, which is pretty full of juice, and which is often a little fharp; the flefh is tender but not buttery. It is in eating the latter end of December, and continues good two months or longer.

The Spanifh bonchrêtien, which is a large fine pear; the flefh is breaking, and the juice fweet. It is in eating in January.

The wilding of Caffay, which is alfo called the fmall winter butter pear, is a fmall fruit; the flefh is melting, and the juice very rich: it is an excellent bearer on ftandards. It is in eating in January.

The martin fire, or the lord martin, which is a good fruit; the flefh is breaking and full of juice, which is very fweet and a little perfumed. It is in eating in January.

Th winter ruffelet, which has the flefh buttery and melting, and generally full of a fweet juice. It is in eating in the latter end of January.

The franc real, or the golden end of winter, which is only efteemed for baking.

The brown beurré, which is of a reddifh-brown colour on the fide next the fun, and yellowifh on the other fide. The flefh is melting, and full of a rich juice. It ripens in October, and is efteemed an excellent pear.

The Holland bergamot, amofelle, or lord Cheney's, which is a very good pear; the flefh is half buttery and tender, and the juice is highly flavoured. It keeps from the end of January till April.

The German mufcat, which is an excellent pear; it is buttery and tender, and the juice is highly flavoured. It is in eating from February till April or May.

The pear of Naples, or Eafter St. Germain, which is half-breaking; the juice is fweet, and a little vinous. It is in eating in March.

The winter bonchrêtien, which is very large; the flefh is tender and breaking, and is very full of a rich fugared juice. It is in eating from the end of March till June.

The la paftorelle, which is tender and buttery, and the juice fweet. It is in eating in March.

The St. Martial, or the angelic pear, which has the flefh tender and buttery, and the juice very fweet. It is in eating in March.

The wilding of Chaumontelle, which is melting, the juice very rich, and a little perfumed. It is in eating in January.

The brown St. Germain, which is a very fine high-flavoured pear on dwarfs and ftandards, and comes in after the wall St. Germain. It continues in eating from December to the end of March.

The pear d'Auch, which was introduced by the late duke of Northumberland. It much refembles the Colmar, but is fuller towards the ftalk. It is in eating from Chriftmas to April, and is, without exception, the beft of all the winter pears.

The fwan's egg, which is a middle-fized pear, in a fhape like an egg; it is of a green colour, thinly covered with brown; the flefh is melting, and full of a pleafant mufky juice. It comes in eating in November. It is healthy, and bears well either as a ftandard or in any other way.

The bergamot de pafque, which has alfo the following names: the terling, the amofelle, the Paddington, and the Tarquin. It is a fine handfome fruit, green when gathered, and of a yellowifh or ftraw-colour when ripe. It comes into eating about the month of April, continues till June, and makes a very handfome appearance at table.

The golden beurré, which is a very fine pear; it is of a beautiful fcarlet colour next the fun, and of a gold colour on the other fide. The flefh is melting, and the juice high-flavoured. It ripens in October. It fucceeds beft on an eaft afpect, and a loamy foil. It is a plentiful bearer. Mr. Forfyth obferves, that it "was introduced from Burgundy by the late marfhal Conway, and was firft raifed, in this country, at his feat of Park Place, near Henley-upon-Thames, now the feat of lord Malmefbury."

The Williams's feedling pear, which refembles a fummer bonchrêtien, but is more juicy, is a great bearer, and ripens in September. Mr. Forfyth fays that it "will be a valuable acquifition to the market-gardeners, as it immediately fucceeds the Windfor pear."

The citron de Carmes, which is a middle-fized pear, of a yellowifh-green caft, full at the eye; of a round fhape, but tapering a little towards the ftalk, which is long. It becomes ripe in July.

And the true golden beurré, which in fhape and fize refembles the brown beurré; but is of a reddifh-brown colour next the fun. It is a very fine pear, but does not keep long. It comes into eating in October.

Mr. Forfyth gives the following felection from Anderfon's and Co's. Catalogue of Edinburgh.

Of the Summer Kinds.—The pear James, which is foon ripe, and foon rotten, has a little flavour, and is the earlieft pear in Scotland.

The early carnock, which is indifferent, of a yellow colour, and bright-red towards the fun; making a beautiful ftandard tree.

The lemon, lady's lemon, or lady Lamont, which is indifferently good, but principally valued for coming early, and being a good bearer in common.

The green pear of Pinkey, which is a fmall green pear, nearly round, of a fweetifh tafte or flavour.

The forrow cow, a Clydefdale pear, which is a large pear with a fhort ftalk; flat towards the eye; the colour red and yellow; the flefh tender, and mufked in its flavour.

The pear fanch, a Clydefdale pear, which is a big-bellied beautiful pear; the tree large, a great bearer, and fit for an orchard; but the fruit is not very good.

The grey honey, which is a pretty good pear.

The green orange pear, or orange vert, which is a very good pear.

The brute bone, chaw good, or the pope's pear, which is only an indifferent fort.

The golden knap, fuppofed Scotch, which is a fmall fummer pear, of tolerably good qualities.

The

The early achan, an indifferent fruit; greatly inferior to the winter pear of that name.

The hanging leaf, which is the name in Clydefdale, is good and beautiful; almoft round; its colour red and yellow; a delicious fweetnefs is found in its tafte.

The Scots bergamot, which is a large good pear, of a yellow and red colour; the flefh tender and juicy.

The Longueville, which is very good, but a precarious bearer; fuppofed French, though not in their catalogues under that name.

The mufked bonchrétien, gratioli, cucumber, or Spinola's pear, which is a very good pear when grafted on a free ftock; its pulp being fomewhat between fhort and tender, with a great deal of perfumed juice, its colour red on one fide, and white on the other.

And the faffron pear, which is a pretty large well-fhaped pear, fit for the orchard or the field.

Of the Autumnal Kinds.—The keather, which is a Clydefdale pear, of middling fize, and oblong fhape, its juice agreeable.

The French carnock, which is tolerably good.

The elfhin haft, or good-man pear, which is a long pear, flat towards the eye: its colour green and yellow; its flefh hard, dry, and fweet in the tafte.

The Drummond, or late Scotch carnock, which is very good, if eaten before it grows mealy; its colour a bright red and yellow.

The vicar, an oblong pear, with the colour yellow, red, and ftriped; tender, fweet, and mufked, but dry in eating.

The royal orange bergamot, which differs from the orange bergamot in being yellower, and fometimes having a faint red on one fide.

The green pear of Yair, which is fweet, juicy, and melting; of a moderate fize; taking its name from Yair, on Tweed-fide, where it was firft difcovered.

The rob hind, which is very indifferent.

The le befideri, the wilding of the foreft of Heri, in Bretagne, which is a yellowifh pear, of middle fize, but which is indifferent.

The unicorn pear, which is of a beautiful red and yellow colour; but rather auftere in the tafte or flavour.

Of the Winter Kinds.—The winter achan, which is a Scotch pear; among the beft early winter pears, and equal to moft of thofe of the French kind.

The brier bufh, which is Scotch; a good pear, and will ripen in moft feafons; it is a fmall pear, of a firm fubftance, and fweet tafte.

The Brompton park, which is a feedling fent by Jefferys of that name.

The round winter, which is a Clydefdale pear, a very excellent winter pear.

The poir portrail, or gate pear, which is proper for baking.

The la double fleur, or the double-flowering pear, which is a large flat beautiful pear, with a fmooth fkin, and blufh colour on one fide, and yellow on the other: it is the beft to preferve, taking a beautiful red colour from the fire.

And to thefe the following lift is added:—The Ambrofia pear, the Afhton town, the autumn mufk bonchrêtien, the bifhop's thumb, the bloody pear, proper for baking, the brocas bergamot, the barland, proper for perry, the befideri, fit for baking, the beurré du roi, the black pear, or Worcefter, fit for baking, the Britannia, the burdelieu, the Doyenne, or St. Michael, the caftillac, fit for baking, the Eafter St. Germain, the Ganfel's bergamot, the golden beurré, the grey beurré, the grey good-wife, the green fugar, the green bergamot, the Huntingdon pear, the huffcap, proper for perry, the king's Catharine, the lammas, the London fugar, the mufcat almain, the mufk blanquet, the Oldfield, proper for perry, the orange bergamot, the pear piper, the pyrus pollveria, the red admirable, the rough cap, proper for perry, the Scotch bergamot, the feven-angled, the filver-ftriped, the Spanifh red warden, beft for baking, the fquafh, proper for perry, the ftriped verte longue, and the white beurré.

And for fmall gardens, where there is room only for a few trees, the following are recommended as proper for furnifhing a regular fucceffion of fruit.

Summer Kinds.—The mufk pear, the green chiffel, the jargonelle, the fummer bergamot, and the fummer bonchrêtien.

Of the Autumn Kinds.—The orange bergamot, the autumn bergamot, the Ganfel's bergamot, the brown beurré, the Doyenne, or St. Michael, and the fwan's egg.

Of the Winter Kinds.—The Craffane, the Chaumontelle, the St. Germain, the Colmar, the d'Auch, the l'efchafferie, the winter bonchrêtien, and the bergamot de pafque.

And the fecond fort, in its wild ftate, is called the crab, or wilding, and is armed with thorns, as well as the wild pear. Miller mentions two varieties in the fruit of the crab, one white, the other purple towards the fun; but it is commonly yellowifh-green with a tinge of red. And alfo a variety with variegated leaves.

There are a great many varieties of the apple, but the following are given by Mr. Forfyth as the moft deferving of attention.

The Acklam's ruffet, which is a fmall Yorkfhire apple, of a ruffet colour toward the fun, and yellow on the other fide; it becomes ripe in January, and keeps till March.

The aromatic pippin, which is a very good apple, of a bright ruffet next the fun; and the flefh has a fine aromatic flavour. It ripens in October.

The Baxter's pearmain, which is a real Norfolk apple, of a handfome fize, and pale-green colour, full of fmall dark fpots. It is a fine kitchen fruit, and will keep till April. It is alfo a good eating apple.

The beauty of Kent, which is a fine large apple, refembling a codlin. It is ftreaked with a fine red towards the fun, and of a beautiful yellow, with fome ftreaks of red on the other fide. It is a very good apple, coming into eating in September, and keeping till the latter end of April.

The belle grifdeline, which is a new feedling raifed at Norwich, of much beauty, and never failing to afford crops. It was firft propagated by Mr. Lindley, who gave it this name. It is a handfome apple, refembling the burfdoff, of a yellow colour, with red towards the fun, and an excellent table apple, keeping till March.

The Bell's pearmain, which is a real Norfolk apple, large and handfome; red toward the fun, and yellow on the other fide. It is a fine kitchen fruit, and pretty good to eat raw, keeping till June.

The beft pool, which is a middle-fized apple, of a pale-green colour, ftreaked with red towards the fun. It is a good apple, in eating from January to April.

The black apple, which is a middle-fized fruit, of a dark mahogany colour next the fun, but fainter on the other fide. It is of a pleafant fweet tafte, keeping till the middle of April.

The Bland's fummer pippin, which is a handfome apple, of a gold colour, and an agreeable flavour. It is a great bearer, ripe in September, and keeps till Chriftmas.

The Blatche's fine fmall table apple, which is about the fize

fize of a fmall golden pippin; red toward the fun, and green on the other fide. It has a fugary tafte, and comes into eating in January.

The boomrey, which is a pretty large handfome apple, of a flat fhape, and deep-red colour; and the flefh is ftreaked with red. It is not fit to eat raw, but will do well for cyder, or for the kitchen. It keeps till April.

The Bovey redftreak, which is a handfome apple, of a flattifh fhape, beautifully ftreaked with a bright red next the eye, which is fmall, and of a yellow colour about the footftalk. It keeps till the latter end of October.

The broad-eyed pippin, which is a fine large apple, with a very large eye; the colour is a greenifh-yellow, with a little red toward the fun. It is a good apple, and keeps till May.

The brandy apple, which is about the fize of a golden pippin, flat-fhaped, and of a yellowifh ruffet colour. It is of a pleafant flavour; comes into eating in January, and keeps till March.

The burfdoff, or queen's apple, which is a beautiful fruit, red next the fun, and of a fine yellow on the other fide. It is a very fine apple; in Mr. Forfyth's opinion, next in perfection to the golden pippin, and about the fame fize. It is of a good flavour; ripening in January, and keeping till March.

The carnation apple, which is a beautiful middle-fized fruit, finely ftriped with red. It is ripe in January, and keeps till May.

The Carbury pippin, which in fize and fhape refembles the French crab, and is of a deep green colour. It is a good baking apple, keeping till March.

The caraway ruffet, which is a handfome ruffet-coloured apple, about the fize of a nonpareil.

The calville, red and white, which are good apples, and of a vinous tafte. Some have a red and fome a white pulp, the white being reckoned of a moft delicious tafte. They are in eating in September, and the following month.

The cat's-head, which is a large oblong apple, of a greenifh-yellow colour, with a little brownifh-red next the fun; fometimes the colour inclines to a ruffet. It is a good baking apple, and is in eating from October to December.

The cockagee, which is a conical-fhaped middle-fized apple, red on that fide next the fun, and of a fine yellow colour on the other. If properly managed, the fruit keeps till February. It is a famous cyder apple, and alfo bakes well.

The codlin, which is generally the firft apple that is brought to market. Its fruit is fo well known that it needs no defcription. It is in eating from July to December; and is good either for baking or boiling.

The Cornifh nonpareil, which is rather under the middle fize, is a little flatted, and of a ruffet colour. It is a very good apple, and keeps till the middle of March.

The Cornifh pearmain, which is of a middling fize, and long fhape; of a dull-green colour on one fide, and ruffet on the other. It is a very good apple, and keeps till the latter end of April.

The Court-of-Wick pippin, which is defcribed by Mr. Billingfly, in his "Survey of Somerfetfhire," as "the favourite apple, both as a table and cyder-fruit, taking its name from the fpot where it was firft produced. It originated from the pip or feed of the golden pippin, and may be confidered as a beautiful variety of that fruit. In fhape, colour, and flavour, it has not its fuperior: the tree is large, handfome, and fpreading, and a very luxuriant bearer. On the whole, it cannot be too ftrongly recommended." It is larger than the golden pippin, of a yellowifh-green colour, and a little tinged with red next the fun. It comes into eating in January.

The Cockles pippin, which is a handfome oval-fhaped apple, below the middle fize, of a ruffet colour, mixed with yellow and red. It keeps till April.

The corpendu, or hanging body, which is a very large apple, and has a red caft on the fide towards the fun; but is pale on the other fide. It takes its name from always hanging downwards; and comes into eating in September.

The Dalmahoy pippin, which is about the fize of a golden pippin, of a green colour, and a little ftreaked with red towards the fun. It has a tolerably good flavour, rather fharp; and is in eating from September to February.

The Dimock's red, which is under the middle fize, of a fine red colour, intermixed with a little yellow on the fide from the fun. It is ripe in January, and keeps till March.

The Dredge's feedling, which is a fine large apple, ftriped with red next the fun, and of a yellowifh-green on the other fide. This is an excellent kitchen apple, of a pleafant tafte, and keeps till the latter end of January.

The Dredge's beauty of Wilts, which is a beautiful apple, of a good fize, and one of the fineft yet known in point of general utility. It is of a fine bright yellow colour, fpotted with red towards the fun; and has an excellent vinous flavour. It is good either for the table or baking, and keeps till March.

The Dredge's ruffet, which is a fmall apple, of a greenifh-ruffet colour, and of a pleafant flavour. It is ripe in November, and keeps till Midfummer.

The Dredge's white lily, which is a fine apple, of an exceeding high flavour, and keeps till March.

The Dredge's fair maid of Wifhford, which is a fine middle-fized apple, of a yellowifh-green colour, with fome ruffet next the fun, of an excellent flavour. It is a great bearer, and is in eating from Chriftmas to Eafter, being an excellent defert apple.

The Dredge's queen Charlotte, which is a beautiful middle-fized apple, of a gold colour, with red towards the fun. It is of an excellent flavour, comes into eating about Chriftmas, and keeps till February.

The Dredge's fame, which is a good fized apple, red towards the fun, and ftreaked like the Ribfton pippin on the other fide. It is a moft excellent apple, being in eating from Eafter to Middfummer.

The dumpling apple, which is a handfome apple, and rather above the middle fize, flat fhaped, and of a greenifh-yellow colour, with fome faint ftreaks of red. It keeps till March.

The Dutch queening, which is a large apple, fomewhat refembling the cat's-head in fhape. The colour is red next the fun, and green on the other fide, with fometimes a little red. The fruit is fit only for the kitchen, and for making cyder. It is ripe in January, keeping till the end of March.

The Elton's yellow kernel, which is a handfome middle-fized apple, of a yellow colour. It is a good table apple, being in eating from January to March.

The Englifh rennet, which is a handfome apple, beautifully ftreaked with red, but darkeft towards the fun; of a tolerable flavour, but apt to grow mealy when kept too long. It keeps till the middle of May.

The embroidered apple, which is pretty large, and the ftripes of red very broad, from which circumftance it takes its name. It is commonly ufed as a kitchen apple, becoming ripe in October.

The everlafting ftriped apple, which is below the middle fize, of a conical fhape. The colour is a ftriped green towards the footftalk, and red towards the eye.

The fameufe, which is a pretty large apple, of a beautiful dark red, with a little yellow on the fide from the fun. Its flefh is very white, and full of a rich fugary juice; coming into eating about the latter end of October. It was introduced from Canada by Mr. Barclay of Brompton.

The fenouillet, ou pomme d'anis, the fennel or anife apple, which is a middle-fized fruit, of a grey colour; the pulp is tender, and has a fpicy tafte, like anifeed. It becomes ripe in September and October.

The flower of Kent, which is a large handfome apple, of a yellow colour, and pretty good flavour. It keeps till the middle of April.

The fox-whelp, which is a fmall apple, ftreaked with red. It is ripe in January. It is a cyder apple.

The Franklin's golden pippin, which is a handfome middle-fized apple, of a conical fhape and gold colour, beautifully marked with dark fpots. The fruit has a fine aromatic flavour, and deferves the firft place at the table; but it is a very fhy bearer. It comes into eating about the middle of November.

The French crab, which is a large handfome apple, of a deep green colour, with a little red next the fun. It will keep all the year; is a good baking apple, and, if the fummer be warm, pretty good for eating, and is a great bearer.

The French codlin, which is a pretty large apple, of a conical fhape, and green colour, with red towards the fun, coming into eating in January.

The Fearn's pippin, which is of the fhape and fize of a nonpareil. It is of a beautiful fcarlet next the fun, and of a golden yellow on the other fide. It makes a fine fhow at table, and keeps till the latter end of February.

The French Spaniard, which is a large apple, in form of a hexagonal prifm with the angles a little rounded, and of a yellowifh-green colour; it is pretty good, and keeps till the latter end of April.

The French or white rennet, which is a large fruit, of a yellowifh-green colour, with fome grey fpots. It has a fugary juice, and is good either for eating or baking.

The Gargey pippin, which is a handfome conical-fhaped apple, under the middle fize, of a greenifh-yellow colour, with a little red towards the fun. This is a pretty good apple, and keeps till May.

The gilliflower, which is a fine handfome apple, red towards the fun, and of a yellowifh-green on the other fide, having a fine flavour, and keeping till the latter end of March.

The golden rennet, which is a beautiful apple, a little flatted; of a fine red colour towards the fun, and yellow on the other fide. It is a good eating apple, and keeps till February.

The golden ruffet, which is a fine middle-fized apple, of a golden ruffet colour, from which it takes its name. It is a good apple, and keeps long.

The golden pearmain, which is a fine apple, above the middle fize, of a fine deep red towards the fun, with a little yellow on the other fide; when much expofed to the fun it is fometimes red all over.

The golden Mundi, which is a fine handfome apple, beautifully ftreaked with red; of a good flavour, excellent for baking, and will keep till January. It is a good fauce apple.

The golden Glocefter, which is a handfome middle-fized apple, of a flat fhape, and gold colour, with red toward the fun. It is a good apple, and keeps till March.

The golden knob is a handfome though rather fmall apple, of a fine gold colour, fometimes inclining to a ruffet. It has a pleafant flavour.

The golden pippin is well known; and the French own it to be of Englifh origin. It is almoft peculiar to this country; for there are few countries abroad where it fucceeds well. It is yellow as gold; the juice is very fweet; the fkin (efpecially where expofed to the fun) is often freckled with dark yellow fpots. It is certainly the moft ancient, as well as the moft excellent, apple that we have. It ripens in October, and keeps through the winter. It has feveral fub-varieties.

The Godolphin apple, which is a very handfome large fine fruit, ftreaked with red on the fide next the fun, and of a yellowifh colour on the other fide. It is in eating from the latter end of September to December.

The green dragon, which is a fine large apple, of an excellent flavour, and pale-green colour. It is rather too large for the table, and is therefore moftly ufed as a kitchen apple. It keeps till March.

The great or large ruffet, which is a middle-fized fruit, of a ruffet colour, with a little dark-red toward the fun. A pretty good apple, and keeps till April.

The Griddleton pippin, which is a large angular-fhaped apple, of a green colour, with a little blufh towards the fun. It is a baking apple, and keeps till March.

The Grumas's pippin, which is about the fize and fhape of a golden pippin; of a dingy-green colour next the fun, and of a dull yellow on the other fide. It is ripe in January, and keeps till April.

The Hagloe crab, which is a yellow-coloured conical-fhaped apple, below the middle fize. It is ripe in January; but is only fit for making cyder, or for baking.

The hall-door, which is a fine large apple, of a flat fhape, beautifully ftreaked with red toward the fun, and of a greenifh-yellow on the other fide. It is of a fine flavour, and is in eating from January till March.

The Hallingbury, which is a large flat-fhaped apple, with large ridges from the bafe to the crown. It is of a beautiful red toward the fun, and of a yellowifh colour on the other fide and towards the eye.

The Hampfhire nonfuch, which is a pretty large well-fhaped apple, of a greenifh-yellow colour, ftreaked with red. It keeps till the latter end of November.

The Harvey's ruffet, which is fo called in Cornwall, is a large ruffet-coloured apple, with a little red toward the fun. It is a famous kitchen fruit, and tolerably good raw, with a mufky flavour.

The Holland pippin, which is a middle-fized apple of a flattifh fhape. Its colour is yellow, in fome places inclining to green, with, fometimes, a little red toward the fun. It is a pretty good apple, keeping till the middle of April.

The hollow-eyed pippin, which is a middle-fized apple, of a yellow colour, beautifully fpotted with red toward the fun; and the eye is pretty deep. It is a good fharp-flavoured apple, keeping till the middle of May.

The hollow-eyed rennet of Cornwall, which is a handfome flat-fhaped apple, under the middle fize, of a greenifh-yellow colour, fometimes intermixed with ruffet. It is of an excellent flavour, and keeps till April.

The hedge apple, which is a new fruit, of middle fize and handfome conical fhape, red toward the fun, and of a ftraw colour on the other fide. It is of a tolerably good flavour, and keeps till the latter end of April.

The hogfhead apple, which is a fmall red fruit; the flefh is red, and the tafte auftere. It is a cyder apple, becomes ripe in January, and keeps till March.

The Hubbard's, or the ruffet pearmain, which is a real Norfolk apple; and, though not handfome, is one of the beft table apples. It is of a dark ruffet colour, becomes ripe in January, and keeps till April.

The John apple, which is a middle-fized handfome fruit, of a green colour, with a little red toward the fun; the footftalk being very fmall. It is an excellent cyder and baking apple, from Devonfhire; it is of an excellent flavour, and keeps till March.

The Ifle of Wight pippin, which is a handfome middle-fized apple, of a greenifh-yellow colour.

The juneting, or jenneting, which is a fmall yellowifh apple, red on the fide next the fun. It is a pretty fruit for early variety, and ripens about the latter end of June or beginning of the following month.

The kernel redftreak, which is of a greenifh-yellow, with broad ftreaks of a dark-red all over it, and a yellow ground finely fpeckled with red next the fun.

The kernel pearmain, which is a fmall handfome apple, red toward the fun, and of a yellowifh-green mixed with red on the other fide. It is of a good flavour, keeping till the middle of May.

The Kentifh pippin, which is a good fized apple, finely ftreaked with red. It is of a fine flavour, comes into eating about Chriftmas, and keeps till February.

The Kentifh nonpareil, which is a handfome flat-fhaped apple, of a light-ruffet colour, inclining to red toward the fun. It is of a good flavour, and keeps till May.

The king of the pippins, which is a middle-fized apple, of a fine gold colour, a little ftreaked with red towards the fun. It is ripe in January, and keeps till the latter end of March, when it becomes mealy.

The king apple, which is a middle-fized apple, of a conical fhape; and its colour is that of a beautiful red intermixed with a little yellow on one fide. This apple is of a pleafant fugary tafte, and keeps till the latter end of April.

The Kirke's feedling, which is a beautiful apple of a fine red colour towards the bafe, and yellow towards the eye. The footftalk is flender, and the eye large.

The Kirke's fcarlet pearmain, which is a handfome middle-fized apple, of a beautiful red toward the fun, and a little yellow on the other fide; becoming ripe in January.

The Kirke's fcarlet admirable, which is a good apple for baking, and of a beautiful fcarlet colour, is in eating about the month of January.

The Kentifh fill-bafket, which is a fpecies of codlin, of a large fize, and generally ufed for baking. It is in eating from Auguft to October.

The Kirton or crack'd pippin, which is a middle-fized apple, of a greenifh-yellow colour, with little dark fpots. The coat is generally rough towards the footftalk. It is a good apple for the table, coming into eating in September.

The lady's finger, which is an excellent table apple, of a conical fhape; red next the fun, and of a yellowifh caft on the other fide, having a fweet pleafant flavour, and keeping till May.

The large ftyre, which is a handfome cyder apple, of a yellow colour, with a little red next the fun. It becomes ripe in November.

The Lifbon pippin, which is a handfome middle-fized apple, of a flat fhape, a fine red toward the fun, and a reddifh-yellow on the other fide. The flefh is firm, and has a fharp pleafant tafte. It comes into eating in November.

The Loan's pearmain, which is a large oval-fhaped apple, of a dull green colour intermixed with a brownifh-red, deepeft next the fun. It is a pretty good table apple, of a fharp tafte, ripening in September, and keeping till May, but is apt to grow mealy.

The London pippin, or five-crowned pippin, which is a fine large apple, of a green colour, ftreaked with red toward the fun. It refembles the Ribfton pippin, but is larger. It has a pretty agreeable tafte; and will come into eating about the latter end of November. It is good for the kitchen and table; and a moft abundant bearer. It keeps till the middle of April.

The le calville d'automne, the autumn calville, which is a large fruit, of an oblong figure, and of a fine red colour toward the fun, having a vinous juice, and is much efteemed by the French.

The long laffer, which is a middle-fized apple, of an angular fhape, and fine yellow colour, with a beautiful red next the fun. It is of a tolerable flavour, and keeps till the middle of May, but is apt to become mealy.

The lemon pippin, which is a handfome oval-fhaped apple, of a gold colour. It is of a fine flavour, and will keep till the beginning of March.

The long feam, which is a large angular-fhaped baking apple of a pretty good flavour, with light green colour. It keeps till the latter end of January.

The lord Cheney's green, which is a middle-fized Yorkfhire apple, refembling the Yorkfhire greening. It is of a dark green colour, with a little of a chocolate colour next the fun. It is a baking apple, and keeps till the middle of May.

The lord Arundel's apple, which is large, of an angular fhape; the colour is green, with a little dingy red towards the fun. It is from France, and good for fauce, keeping well.

The lord Camden's rennet, which is a good-fized feedling, of a yellow colour, with a little brownifh-red next the fun. It is a good flavoured apple, and keeps till March.

The Lucas's pippin, which is a handfome, middle-fized, cylindrical-fhaped apple, of a beautiful orange colour. It is a pretty good fruit, and keeps till the latter end of April.

The maiden's blufh, which is a fmall apple, of a dark mahogany colour next the fun, but paler on the other fide, and fometimes of a greenifh caft. The tafte is auftere, and of courfe this fruit is not fit for the table; but does very well for baking, or for cider. It keeps till the beginning of March.

The Mansfield tart, which is a large Nottingham apple, but moft known in Yorkfhire. It is handfome, of a green colour, having a little caft of brownifh-red, with dark fpots next the fun, being a baking apple, and keeping till February.

The May gennet, which is rather under the middle fize, of a greenifh-yellow colour, flightly ftreaked with red next the fun. It keeps till April.

The major Hemmings's apple, which is a handfome middle-fized fruit, of a light green colour, with a little brownifh-red towards the fun. It is an excellent apple.

The margil, which is an excellent apple, about the fize of a nonpareil. It is of a red colour, with fome yellow on one fide; continues in ufe from November to the latter end of March; and is often fold in the London markets for a nonpareil.

The Margaret apple, which is a fine and beautiful fruit, yellow, ftriped with red, of a delicate tafte, fweet fcent, and generally eaten off the tree. It is ripe in Auguft.

The Minchall crabb, which is a handfome middle-fized Lancafhire apple, of a yellow colour, with fome brown fpots.

ſpots. It is common in the Mancheſter markets, and keeps till April.

The monſtrous rennet, which is a very large apple, turning red towards the ſun, and of a dark green on the other ſide. It is generally preſerved on account of its magnitude, as the fleſh is apt to be mealy. It becomes ripe in October.

The mother rennet, which is rather under the middle ſize, of a greeniſh colour, with a little bluſh towards the ſun. The eye is large and deep, and the footſtalk ſmall.

The New-England pippin, which is a large angular-ſhaped apple, of a green colour, with a little browniſh-red towards the ſun. It has a pretty good flavour, and keeps till March.

The Newton pippin, which, according to Mr. Forſyth, is an American apple, but ſaid to be originally from Devonſhire. It is a fine large apple, of a greeniſh-yellow colour and red, with dark ſpots next the ſun. When much expoſed, it is of a beautiful red towards the ſun, and of a gold colour on the other ſide. It has a fine flavour when not kept till it is too ripe, as then it becomes mealy. It is in eating from November to January.

The new red muſt, which is a fine large apple, of a pale red towards the footſtalk, and of a greeniſh colour towards the eye. It is a cider apple, and fit for baking.

The new red pippin, which is a beautiful middle-ſized apple, of a darp red colour, with a mixture of yellow on the ſide from the ſun. It keeps till March.

The nonſuch, which is a good bearer, and very fit either for the table or kitchen; the cooks, however, complain that it makes but a very ſmall proportion of ſauce. It is ripe in September and October.

The nine-ſquare, which, according to Forſyth, is a Glouceſterſhire apple. It is a large angular-ſhaped fruit, of a fine red towards the ſun, and yellow on the other ſide, with a ſmall mixture of red, keeping till April.

The Norfolk colman, which is a middle-ſized apple, of a mahogany colour towards the ſun, and a dark green on the other ſide. It keeps till Auguſt.

The Norfolk beefin, which is a good-ſized apple, rather flatted, of a deep red colour towards the eye, but paler towards the footſtalk.

The Norfolk paradiſe, which is a large apple, of a dark red colour towards the ſun, and green on the other ſide. It is a nice baking apple, and of a tolerable flavour for eating. It keeps till the middle of May.

The Norfolk ſtoring, which is a pretty large apple, of a dark red colour towards the footſtalk, and green towards the eye. It is of a pleaſant ſharp flavour, being in eating from the latter end of January to the latter end of April.

The northern greening, which is a fine oblong apple, full at the footſtalk, of a pale green colour, with a little red towards the ſun. It is nearly of an equal ſize from the baſe to the crown, and has a fine flavour, being ripe in January.

The nonpareil, which is a fruit deſervedly valued for the briſkneſs of its taſte. It is ſeldom ripe before Chriſtmas, and, if well preſerved, will keep till May. It is juſtly eſteemed one of the beſt apples that have been yet known.

The oak peg, or oaken pin, which is an oval-ſhaped middle-ſized fruit, of a green colour ſtriped with white. It is very full towards the footſtalk, which is ſmall, keeping till June.

The old Engliſh pearmain, which is an oval-ſhaped apple, of a middle ſize, and fine red colour, with a little yellow towards the eye. It is of a pleaſant ſweet flavour; and is in eating from January to March.

The old red muſt, which is a fine large apple, ſomewhat reſembling the new red muſt, both in ſhape and colour, with the addition of dark red ſpots towards the footſtalk.

The old red pippin, which is a middle-ſized apple, red towards the ſun, and of a greeniſh colour on the other ſide. It is a good apple, and keeps till March.

The orange pippin, which is about the ſize of a large golden pippin; of a beautiful gold colour, with a little pale red towards the ſun. It is a handſome apple, of a good flavour, and makes a fine appearance at table, being in eating in October, and keeps till March, but gets flat in the taſte when too long kept.

The Orleans pippin, which is a ſmall flat-ſhaped apple, of a dark red colour, reſembling the Orleans plum.

The paradiſe pippin, which is a handſome middle-ſized apple, of a reddiſh caſt. It comes into eating in October, but will not keep. It grows mealy when too ripe.

The pauſon, which is below the middle ſize, of a conical ſhape, and of a greeniſh-yellow, or light green colour. It is ripe in January.

The Pile's ruſſet, which is a middle-ſized longiſh-ſhaped apple, ruſſet about the footſtalk, yellow towards the middle, and of a browniſh-red about the eye. It is a very firm fruit, of a ſharp acid flavour, being much eſteemed for baking. It ripens in October, and will keep till April.

The pigeonette, which is rather below the middle ſize, of a conical ſhape. It is of a pink colour, pretty dark towards the ſun.

The Pearſon's pippin, which is a nice apple, about the ſize of a large golden pippin, of a yellowiſh colour, and the form a little flat. In Devonſhire, according to Mr. Forſyth, they put theſe pippins into the oven juſt after the bread is drawn, laying a weight over them to flatten them, in the ſame manner as they do the beefin in Norfolk, and bring them to table as a ſweetmeat. It is a very good deſert-apple, and keeps till March.

The pomme griſe, which is a fine apple, from Canada, of a flattiſh form, and ruſſet colour, ſtreaked beautifully with red. It ripens late, and keeps till March. It is an excellent eating apple.

The pomme d'api, which is much valued for its colour, being of a bright red. The tree is a good bearer, and the fruit is not ſubject to be ſhaken with high winds. The fruit ſhould be ſuffered to hang on the tree till October or November, if the froſt do not ſet in. It comes into eating in February and March, and keeps long; but is more admired for its beauty than its flavour, or fineneſs of taſte.

The pomme violette, the violet apple, which is a pretty large fruit, of a pale green, ſtriped with red towards the ſun. It has a ſugary juice, and a flavour of violets, from which it takes its name. It ripens in October, and continues in eating till February, or later.

The pomroy, or king's apple, which ripens nearly as ſoon as the juneting, and though not ſo beautifully covered, is larger and much better taſted. It has a ſub-variety, which is a winter apple.

The pound pippin, which is a large handſome apple, of a greeniſh colour, and is good for baking. It becomes ripe in January.

The poor man's profit, which is a dingy coloured oval-ſhaped apple, below the middle ſize. It is raiſed freely from cuttings; and keeps till January.

The queening, which is from Glouceſterſhire, is a large apple, of irregular ſhape, having large ridges from the baſe to the crown. It is of a dark red, but deepeſt towards the ſun. It is a good cider apple, and bakes well, keeping till the latter end of November.

The queening's kernel, which is a fine apple, above the middle fize, of a deep red colour. Covered very thick with fmall whitifh fpecks. It is a tolerably good apple, and keeps till the latter end of April.

The queen's pippin, which is a fmall handfome apple, of a yellowifh-green colour, fometimes inclining to red on the fide next the fun. It is a fine-flavoured apple, very fit for the table, coming into eating in January, and keeping till May, but is apt to grow mealy when kept too long. Mr. Forfyth fays, "the tree never grows to the height of other apple-trees."

The quince-apple, which is a middle-fized fruit, of a yellow colour, with a little red towards the eye. It is of a pleafant fharp flavour, ripe in January, and keeps till April.

The Ramborn, which is a large fruit, of a fine red next the fun, and ftriped with a yellowifh-green. It ripens about the middle of September.

The red pearmain, which is fmaller than the pearmains in general. It is of a deep red, with a little yellow on one fide. A pleafant fweet apple, and keeps till the middle of April.

The red-ftreak, which is a handfome middle-fized apple, beautifully ftreaked with red. It is a good cider apple, becoming ripe in January.

The red-ftreak feedling, from Longleat, which is from the Dorfetfhire red-ftreak, is a beautiful apple, of a yellow colour, ftreaked with red, particularly next the fun. Forfyth fays, it is fold in the Bath and Briftol markets in the latter end of September, and beginning of October. It is a pretty good apple, but does not keep long.

The red bag, which is a beautiful large Herefordfhire apple, of a longifh fhape, ftreaked all over with a dark red; and is in eating about the middle of October.

The red muft, which refembles the old red muft in fhape; but is of a dark red colour towards the fun, and yellow on the other fide. It is ripe about the middle of November.

The rennette grife, which is a middle-fized fruit, of a grey colour next the fun; it is a very good juicy apple, of a quick flavour, and ripens about the latter end of October.

The red fweet, which is a fmall round apple, red towards the fun, and of a greenifh-yellow on the other fide. It is a good bearer, according to Forfyth, "and much efteemed among the country people of Cornwall, for making a kind of tart or pie, one of their dainties at Chriftmas." It is a pretty good table apple, and keeps till March.

The Ribfton pippin, which is a fine apple, from Ribfton Hall, near Knarefborough, in Yorkfhire. It is a little ftreaked with red towards the fun, and yellow on the other fide, being one of the beft apples for eating and baking, and continues in ufe from the end of October till April. It bears very well as a dwarf, and no garden fhould be without it.

The Robinfon's pippin, which is about the fize of a golden pippin, of a green colour, and partakes of the flavour both of a golden pippin, and a nonpareil. It keeps till May.

The royal George, which is a fine large apple, of a beautiful yellow on one fide, and green on the other. It is a good apple, and keeps till June; but then grows mealy.

The royal nonpareil, which is a handfome apple, of a flattifh fhape, with a fmall footftalk and fine eye. It is about the fize of a common nonpareil, of a green colour, with red towards the fun. It is ripe in January, and keeps till the latter end of March.

The royal pearmain, which is a fine large apple, beautifully ftreaked with red. It is ripe in January, and keeps till March, being a pretty good apple.

The royal ruffet, or leather-coat ruffet, which is a large fruit, and one of the beft kitchen apples that we have. It is alfo a pleafant eating apple, and a great bearer, being in ufe from October to April.

The ruffet pippin, which is of a rough ruffet colour towards the fun, and of a green colour, fometimes inclining to yellow, on the other fide. It is a good keeping apple, and fit either for baking or eating raw. It is ripe about the beginning of February, and keeps till March.

The fummer pearmain, which is ftriped with red next the fun; the flefh is foft, but foon turns mealy; fo that it is not much efteemed. It is in eating in Auguft and September.

The filver pippin, which is a handfome middle-fized conical-fhaped apple, of a fine yellow colour, with a faint blufh towards the fun. The flefh is firm and very white, and of an excellent flavour. It keeps till the middle of May, or later.

The feek no farther, which is a handfome apple, rather above the middle fize, of a pale green colour, a little ftreaked with red. It is of a pleafant though not very high flavour; and is in eating from January to May; but is apt to be mealy when kept longer than the beginning of April.

The Sykehoufe, which is a handfome middle-fized apple, from Sykehoufe in Yorkfhire, of an orange colour towards the fun, fometimes inclining to red, and yellow on the other fide. This is a fine eating apple; ripe in January, and keeps till April.

The ftone pippin, which is of a green colour, ftreaked with red towards the fun. It is of a fharp tafte, and is in eating from January till the middle of May.

The Stoup codlin, which is a large handfome apple, of a pale-green colour, with a little red towards the fun. It is a baking apple, of a pleafant tafte, and keeps till May.

The ftriped nonpareil ruffet, which is a handfome apple, of a greenifh-ruffet colour, with a little brownifh-red towards the fun. It is about the fize of a large nonpareil, is ripe in January, and keeps till March.

The fpice apple, which is a handfome middle-fized angular-fhaped apple, of a yellow colour, and a pleafant flavour. It is ripe in January, and keeps till March.

The Skerm's kernel, which is a conical-fhaped middle-fized apple, beautifully ftreaked with red, deepeft towards the eye, and having a good deal of yellow towards the footftalk. It is ripe in January, and keeps till March.

The fpice rennet, which is a handfome apple, below the middle fize, red towards the fun, and yellow on the other fide.

The Spanifh pearmain, which is a middle-fized oblong apple of a carnation colour, and dark-red towards the fun. It is a pretty good apple, and keeps till the beginning of May.

The Spanifh onion, which is a handfome round apple of a ruffet colour, with a dull red towards the fun. This apple, which is rather below the middle fize, is very good for defert, keeping till March.

The Sharp's ruffet, which is below the middle fize, of a brownifh-red colour towards the fun, and a pale-green on the other fide. It is fhaped like the fruftum of a cone; is of a pretty good flavour; and keeps till May.

The Spencer's pippin, which is a middle-fized apple, of a yellowifh colour, with many dark fpots, being a baking apple, and keeping till the middle of May.

The Tankerton, which is a conical-fhaped yellow apple, with fometimes a little blufh towards the fun. It is an excellent

excellent ſauce apple, and bakes well, being of an agreeable taſte, but too large for the table. It will keep till February.

The tranſparent apple, which was introduced from St. Peterſburg; but it is more curious than uſeful: a tree or two, therefore, will be ſufficient for a garden. It ripens in September or October.

The Trevoider rennet, which is a ſmall handſome ruſſet-coloured apple, of an excellent flavour, and will keep till May.

The white corpendu, which is a middle-ſized long-ſhaped apple, of a yellowiſh colour. It is a good eating apple, and ripens in January.

The ward apple, which is a beautiful flat-ſhaped apple, rather below the middle ſize, of a fine red towards the eye, and of a yellowiſh-green towards the footſtalk. It is a ſharp flavoured fruit, and keeps till June.

The Wheeler's ruſſet, which is of middling ſize, the fleſh firm, and of a quick acid flavour; it is an excellent kitchen fruit, and keeps long. It ripens in October.

The wine ruſſet, which is a middle-ſized conical-ſhaped apple, of a dark ruſſet colour, and ſharp flavour. It keeps till the latter end of April.

The Wheeler's extreme, which reſembles the pomme griſe, and is about the ſize of a nonpareil. It is a flat-ſhaped apple, beautifully clouded with red on a yellowiſh-ruſſet ground; is of an excellent flavour, and keeps till April.

The white muſt, which is a middle-ſized handſome apple, of a greeniſh-yellow colour, with a little red towards the ſun; the flavour is rather tart, but agreeable. It is ripe in January.

The Whitmore pippin, which is a good-ſized handſome apple, ſtreaked with red towards the ſun, and of a pale-yellow on the other ſide. It has firm fleſh, of a tolerably good flavour, and is in eating from November to the latter end of April, or later.

The Wiltſhire cat's-head, which is a large handſome apple, red towards the ſun, and green on the other ſide. It is a very fine baking apple, and of a good flavour, being ripe in January.

The winter pearmain, or Herefordſhire pearmain, which is of a fine red next the ſun, and ſtriped with red on the other ſide; the fleſh is juicy, and ſtews well. It is fit for uſe in November, and, if properly managed, will keep till the latter end of March.

The winter pomroy, which is a pretty large conical-ſhaped apple, of a dark-green colour, a little ſtreaked with red towards the ſun. The coat is rather tough. It is a good baking apple, keeping till January.

The winter box apple, which is a middle-ſized fruit, of a light green colour, and keeps till February.

The woodcock, which is a good-ſized apple, of a dark red next the ſun, and paler, with a little mixture of yellow, on the other ſide. It is ripe in January, and keeps till March, being a good cider apple.

The Wright's nonpareil, which is a Salopian apple, being a great bearer, of a good ſize, and a little flatted. It is a good kitchen apple, and keeps till June. The tree is ſmaller in ſize than moſt other apple-trees.

The Yorkſhire greening, which is a good-ſized flatted apple, of a dull-red colour, with a little green towards the eye. It keeps till Auguſt, or often later.

The ſorts of apples adviſed for a ſmall garden are the following: the juneting, the golden pippins, the nonſuch, the Ribſton pippin, the nonpareils, the queen's apple, the Sykehouſe, the golden rennet, the aromatic pippin, the grey Leadington, the ſcarlet pearmain, the lemon pippin, the pomme griſe, the French crab, and different ſorts of ruſſetins and codlins, for baking.

But there are other varieties and ſub-varieties that may be equally valuable with many of the above ſorts.

Of the ſixth ſort there are the following varieties: the pear quince, with oblong-ovate leaves, and an oblong fruit lengthened at the baſe; the apple quince, with ovate leaves and a rounder fruit; the Portugal quince, with obovate leaves, and an oblong fruit, which is more juicy and leſs harſh than the others, and therefore the moſt valuable.

The quince is a very beautiful tree when in flower, as well as when the fruit is ripe in the autumn, and was cultivated in this country at an early period. According to Mr. Forſyth, the beſt ſort for planting in the fruit-garden is the Portugal, being the fitteſt for baking or ſtewing. It is of a fine purple colour when dreſſed, and is much better for marmalade than any of the other ſorts. The oblong kind, and the apple quince, are alſo planted in theſe ſituations, and other ſorts are employed in the ſhrubberies for producing variety. The above ſorts are likewiſe valuable for mixing with apples in making pies, puddings, &c. as they add a quickneſs to the flavour when flat.

Method of Culture in the Pear Kind.—Theſe trees are raiſed by grafting and budding upon any kinds of pear ſtocks; occaſionally upon quince ſtocks; and ſometimes upon white-thorn ſtocks; but the firſt ſort are preferable for general uſe to have large trees, and the ſecond for moderate growers.

The numerous varieties of theſe trees having been firſt accidentally obtained from ſeed, and as theſe ſeedlings rarely produce the ſame ſorts again, the approved kinds are continued and increaſed only by grafting or budding upon ſtocks raiſed from the kernels of the kinds juſt mentioned. In order to reſtrain the growth of theſe trees, white-thorn ſtocks have alſo been uſed; but theſe are not ſo generally ſucceſsful, and are almoſt in total diſuſe in the nurſeries: of courſe pear ſtocks are proper for general uſe, for principal large trees, both for walls, eſpaliers, and ſtandards; and quince ſtocks for ſmaller growths. For raiſing the ſtocks, the ſeeds or kernels of the different ſorts ſhould be ſown in the latter end of autumn, as November, or December, or early in the ſpring, in beds of light earth, covering them near an inch deep; they come up in the ſpring: and in autumn, winter, or ſpring following, the ſtrongeſt ſhould be planted out in nurſery-rows to remain for grafting and budding, for which, after having from one to two or three years' growth, they will be of proper ſize.

The operations of grafting and budding ſhould be performed in the uſual method; the former in the ſpring, and the latter in ſummer. (See GRAFTING and BUDDING.) For this purpoſe the grafts and buds ſhould be procured from ſuch trees as produce the fineſt fruit of the reſpective ſorts; thoſe deſigned as dwarfs for walls, eſpaliers, or ſtandard-dwarfs, being grafted or budded near the bottom; and in thoſe for half or full ſtandards, the ſtocks may either be previouſly trained up from three or four to ſeven or eight feet high to form a ſtem, then grafted near the top, or be grafted low in the ſtock, like the dwarfs, and the firſt main ſhoot trained for a ſtem the above height: the grafted trees, both dwarfs and ſtandards, ſhoot the ſame year, but the budded ones not till the ſpring after; and when their heads are two years old from the grafting and budding, they may, if thought proper, be planted out for good, or remain longer in the nurſery, as may be found convenient.

The dwarfs for walls, eſpaliers, &c. whether they remain longer in the nurſery, or be tranſplanted at a year old into the garden, ſhould have the firſt ſhoots from the graft or bud,

bud, when a year old, headed down in March to five or fix eyes, to force out a proper fupply of four, fix, or more lateral branches near the ground, to furnifh the wall or efpalier with bearers quite from the bottom, thefe readily producing others to cover the upper part.

Standards, fuppofing them to be grafted on high ftocks, may either be headed near the top of the ftock, or permitted to run up, as the cafe may require, fo that if fhortened it will force out laterals near the head of the ftem, and form a more fpreading full head; and if fuffered to run up with the firft fhoots entire, they form higher and generally more upright heads in the end. Such ftandards, however, as are grafted or budded as low in the ftock as for dwarfs, muft have the firft fhoot trained upright at full length, fix or feven feet high for a ftem: if for full ftandards, they may either be topped at fix feet height, to force out laterals near that part to form a fpreading head, or fuffered to run and branch in its own way to form a more erect and higher head.

The headed trees, both dwarfs and ftandards, on being cut down in the fpring, foon branch out from all the eyes immediately below; when care fhould be taken during the fummer to trim off all fhoots from the ftem, fuffering all the top fhoots to remain entire; when they will form handfome beginning young heads by the end of fummer, and in autumn, winter, or fpring following, may be finally planted out into the garden, &c.

When from neceffity they are retained longer in the nurfery, the whole fhould have proper pruning to reform irregular growths, and the different trees be trained accordingly, fuffering the whole to branch away at full length, not fhortening any after the above general heading down, when a year old, except it fhould feem occafionally neceffary, either to reduce any cafual irregularity, or to procure a more full fupply of lower branches; after which no further general fhortening fhould be practifed to thefe fort of trees; for, after having obtained a proper fet of regular branches near the head of the ftem, they readily furnifh more in their turn to increafe the head on the upper part.

In regard to planting out the trees, they are moftly of proper growth for this purpofe when from one or two to four or five years old, from the graft or bud; but if larger trees are required, thofe of fix or eight years old may be fafely tranfplanted; younger trees, however, always fucceed well, even when only two or three years old.

In felecting pear-trees for planting, Mr. Forfyth advifes the choofing of the oldeft trees that can be found inftead of the young ones, and fuch as have ftrong ftems; to have them carefully taken up, with as much of the roots as poffible, and carefully planted, after cutting in the roots a little, fpreading them as horizontally as can be done. Then to fill up all round the roots with light dry mould; forcing it in, about thofe which lie hollow, with a fharp-pointed ftick; filling the whole up to the top without treading the mould, till the hole be firft filled with as much water as it will contain, leaving it a day or two until the ground has abforbed the water; then to throw on fome frefh dry mould and tread it as hard as poffible, filling the hole up again with mould to within an inch of the top, and giving it a fecond watering, leaving the mould about three inches higher than the border, to fettle of itfelf, and to receive the rain that falls, for at leaft a month. When the mould has become quite dry, it may be trodden a fecond time; then make a large bafon all round the tree, and giving it another watering, mulching the top over with fome rotten leaves or dung, continuing to water the trees once a week in dry weather, and fprinkling the tops frequently with a pot, or hand engine, to keep the wood from fhrivelling till they have taken frefh root; and where the trees are planted againft a wall, the ftems fhould ftand floping towards it; the lower parts of them being fix inches from the bottom of the wall, to give them room to grow, as when planted clofe to the wall at bottom, the ftems, in growing, will be confined on the back, grow flat, and be very unfightly. If any roots are in the way, to hinder it from being planted near enough to the wall, they muft be cut off; at the fame time taking care that the tree does not lean to either fide, but that, when viewed in front, it appear perfectly upright. Sometimes ftandards and half-ftandards are feen planted a foot or two from the wall, which gives them a very difagreeable appearance; fix inches is, he thinks, quite fufficient. Much care fhould be taken not to wound the ftem or root of the tree in planting.

When young trees have two ftems, he advifes always to cut off one of them, leaving the ftouteft and ftraighteft, planting that fide outwards which has moft buds on it.

It is added, that when the buds begin to break well, the trees fhould be headed down to three or four eyes, to fill the wall with fine wood, but never afterward, except the leading fhoot to fill the wall, leaving the fore-right fhoots to be pruned, as hereafter directed. He has had fome trees that had forty pears on them the fecond year; while fome of the fame kind bore only eleven pears the fourteenth year after planting, with the common method of pruning. When fuch old trees as recommended above cannot be procured, the ftouteft and cleaneft of the one-year's old grafting fhould be provided. Where any of thefe trees become ftunted after a number of years, they fhould be headed down as hereafter directed, which will bring them into frefh vigour and fruitfulnefs. The proper feafon for planting them out is any time in open weather from the end of October till March, but the autumn or early winter are the moft advantageous periods. They fucceed well in any common garden foil, or good fertile orchard-ground, or field, that is not very wet, or of a ftiff or ftubborn quality, but moderately light and friable to the depth of one fpade at leaft, and if more the better. The ground fhould be prepared by proper trenching one or two fpades deep, as the depth of good foil will admit, wholly if for a full plantation, or only along the place for each row of trees, in the place for each tree; or only a hole for each tree at proper diftances. The proper diftance for planting the dwarf forts for walls or on efpaliers, is for thofe on free ftocks at not lefs than twenty feet, but if twenty-five, or more, the better, efpecially if the walls be rather low, &c. that there may be full fcope to extend their branches confiderably in a horizontal direction, as they will effectually fill that fpace, or even much more if it be allowed them; but they are often planted much nearer together. It is however of importance to give thefe trees fufficient room, and the higher the walls the better, as is evident by thofe trees growing againft the ends of high buildings, as they extend themfelves very confiderably every way. Some plant cherry-trees or other moderate fhooting fruit-trees in the intervals for a few years, till the pears advance in growth and approach one another, when they fhould be removed. They are to be planted in the ufual way, with their heads entire. See PLANTING.

However, for trees that are dwarfed by grafting or budding upon quince ftocks, from fifteen to eighteen feet may be a proper diftance for planting, either for walls or efpaliers. In refpect to the diftance at which pear-trees fhould be planted againft walls, it is obferved by Mr. Forfyth that when they are grafted on free ftocks, fuch as colmars, pear d'auche, crafanes, l'efchafferies, virgouleufes, and winter and fummer bonchrêtiens, it fhould at leaft be twelve yards diftant

diftant from each other, fuppofing the walls to be from welve to fixteen feet high; but when they are only ten feet, fifteen yards will be little enough for the purpofe.

And where they are planted on fouth walls, vines, peaches, nectarines, or apricots, may be planted between them, till the trees extend fo far as nearly to meet each other; then they may be removed to any other fituation in the garden where they are wanted. And where the pears are planted on weft walls, the fame fort of trees may be planted between them as on fouth walls; the fruit on a weft afpect will come into ufe to fucceed that on the fouth. On an eaft wall different forts of plums and cherries may be planted between the pear-trees till they almoft meet, then tranfplanted as ftandards or wall trees.

It is advifed that the borders for pear-trees in a large garden fhould not be lefs than from ten to twenty feet wide, with a foot-path about three feet from the wall, covered over at top with coal-afhes or road-fand, to make a dry walk for getting at the trees to cut and nail them, to gather the fruit, &c. And that the depth of the mould for them fhould never be lefs than three feet, laying the beft mould at top, to encourage the roots to come as near the furface as poffible. If the bottom be clay, it will be very neceffary, once in every five or fix years, to open the ground round the roots of the trees, and cut off all the large ones that are inclining to run into the clay; as, by this practice, the trees will throw out frefh roots that will run near the furface, provided the mould is good near the top of the borders. And it is fuggefted that a crop of early peas, lettuces, fpinach, or any other fmall crops, may be grown on the borders, during the winter and fpring; but no late crops by any means. If the ground can be fpared, he would advife to have no fummer crops, but keep the borders hoed, in particular after rain; otherwife the ground, if a ftrong loamy or clayey foil, will be apt to crack in dry weather; but by frequent ftirring between wet and dry this will in a great meafure be prevented, and the fun's rays admitted into the mould, which will greatly heighten the flavour of the fruit. When you can conveniently fpare the borders in winter, they fhould be ridged up to fweeten the mould, which may be very well done if you fow early peas on the fides of the ridges; which is by far the beft way to preferve the peas from the froft, and to prevent them from rotting, which will fometimes happen, if the land be ftrong, before they begin to vegetate; or, you may fow an early crop of carrots or fpinach on thefe borders.

With refpect to the general management in the training and pruning of thefe trees, if the young wall and efpalier trees thus planted are only one year old from the graft or bud, having their firft fhoots of a year old entire, thefe fhould in the fpring be headed down to five or fix inches, to force out lower horizontal branches; but if they have been previoufly headed, as advifed above, and have thrown out laterals to form a regular fet of horizontal branches, confifting of fix or more near the bottom, they fhould not now be fhortened, but trained to the wall or efpalier at full length horizontally, preferving an equal number on each fide five or fix inches afunder; they will readily emit a further fupply of horizontal fhoots to cover the wall, &c. regularly upward, and at the fame time not being fhortened, they gradually form themfelves for bearing, as every fhortening of the branches of thefe trees retards their bearing a year at leaft; if, however, there is a want of branches, fome of the middlemoft may be pruned fhort, and trained to the wall or efpalier. According as the trees fhoot in fummer, a further fupply of all the regular fhoots in every part where they occur, fhould be trained in at full length, unlefs it fhall feem neceffary to prune fome ftrong fhoots to obtain a greater fupply of horizontal branches the fame year, in order to furnifh the head as foon as poffible; at this time, however, difplace all the fore-right and other irregular growths of the year, continuing the fupply of regular fhoots clofe to the wall, as they advance in length during their fummer's growth. And in the winter pruning, the fupply of fhoots attained in fummer fhould be well examined, felecting all thofe that are well placed and properly fituated for training in, to increafe the number of horizontal branches on each fide, which fhould be left wholly entire, and at the fame time retrenching any fuperfluities and ill-placed fhoots omitted in fummer; then the whole fupply of regular horizontal branches in every part fhould be trained in ftraight and clofe to the wall or efpalier, equally on both fides of the tree, every branch at the full length, at four, five, or fix inches apart. See Wall, Espalier-*Trees*, and Pruning.

But there is another method fometimes practifed in training thefe trees for walls and efpaliers, which is, that after their firft heading down, and having thrown out feveral laterals, to felect three of the ftrongeft and moft regularly placed, one on each fide and one in the middle, nailing the two fide ones horizontally at full length, and the middle one upright: the tree having produced a further fupply of fhoots in the following year, add two or four of them as fide branches, arranging them on each fide of the ftem as the two former, training the middle fhoot ftill in an upright direction; obferving that where it does not furnifh horizontals low enough, it may be fhortened fo as to make it throw out fhoots at any requifite height, continuing the middle one always upward for a ftem, and the fide ones for bearers. In either of thefe methods of training the trees, continue yearly increafing the number of horizontal fhoots, till the full fpace of walling or efpalier is regularly covered with bearers at equal diftances, conftantly continuing them all at full length, as far as the fcope of walling, &c. will permit; as they naturally form fruit-fpurs at every eye, almoft their whole length, and the fame branches continue in a fruitful ftate a great length of time. When the trees have once filled the wall or efpalier with branches, they need but very little further fupply for many years, and that only occafionally, according as any worn-out or decayed branch occurs, and wants renewing with young wood. See Pruning.

And in the after-prunings in the fummer, which fhould be begun in May, or early in June, rub off all the fuperfluous and unneceffary fhoots of the year, and all fore-right and other ill-placed fhoots, retrenching them quite clofe, being careful to leave the terminating fhoot of every horizontal or bearer entire; and referving here and there a well-placed fhoot, towards the lower parts in particular, and where there are any apparent vacancies, to train up between the mother branches, till winter pruning, when, if not wanted, they muft be retrenched.

But in the winter pruning, which may be performed any time from the fall of the leaf until March, the branches fhould be generally examined, to fee if they are any where too much crowded, or trained irregularly; and where any fuch occur, they fhould be regulated as they may require; and where there are any vacancies, fome contiguous fhoots, referved in the fummer dreffing, fhould be laid in, and all the other fhoots not wanted muft be cut clean out clofe to the branches, being careful ftill to preferve the terminating fhoot of every branch entire, in all parts, as far as the allotted fpace admits, likewife all the fruit-fpurs in every part, faftening in all the branches regularly at full length. In pruning old trees at this feafon, where decayed and worn-out branches occur, they fhould be cut out, and young wood trained in its

its ftead; likewife, where any branch, through age or any other defect, is become barren, it fhould be retrenched, and fome eligible lower young branch, or fhoot, be laid in its place.

Where any of the choicer forts of thefe trees are become worn-out and barren, they fhould be renewed with young bearers, by heading the branches wholly down near the bottom in winter or fpring, when they break out in the old wood, and in the following fummer furnifh a large fupply of ftrong young fhoots, which fhould be trained according to the rules already laid down, when they will foon form a fort of new tree, and bear good fruit. After each winter pruning, the trees which are againft walls and efpaliers require a general nailing, &c. which fhould always be done with great regularity. See WALL-*Trees*, and ESPALIER-*Trees*.

The mode of training dwarf ftandard-trees of this fort is fhewn in fpeaking of trees of that kind. See DWARF-*Trees*.

In refpect to the culture of the borders where this fort of wall or efpalier-trees are growing, it is commonly digging them once more every year, adding manure occafionally in common with the other parts of the garden; but if fome good rotten dung be applied every other year, and the ground well dug or trenched every winter, it greatly promotes the fize and perfection of the fruit. In regard to ftandard-trees of this kind, any of the forts bear plentifully in any open fituation, though the fruit may not always be fo large and fine as thofe of wall and efpalier-trees: fummer and autumn pears, however, ripen in great perfection on ftandards, as alfo moft of the common winter pears. In planting them, trees of from two or three to four or five years old, having tolerable heads, are of a proper age and fize for the purpofe, and are preferable to older trees for any general plantation. They fhould be planted with all their heads entire, except retrenching any very irregular-placed branch, in the ufual manner of tree-planting. See PLANTING.

In their future growth they fhould be fuffered to branch naturally, fo as to form large branchy heads, fuffering them all to remain entire. The general culture of this fort of trees, in refpect to pruning, is very trifling, and only required occafionally, probably only once in feveral years; fuch as the retrenching any irregular growing branches, and thinning fuch branches as are very much crowded, cutting out all the decayed wood, and eradicating fuckers from the roots and ftems. See PRUNING.

When ftandard-trees are fituated in a garden, in which the ground is neceffarily dug over and trenched annually for the reception of the under crops, and occafionally enriched with dung, they generally produce finer fruit than in orchards, or other places where the ground is not in fimilar culture.

Mr. Forfyth obferves, that the method of pruning pear-trees is very different from that practifed for apple-trees in general, in which the conftant practice has been to leave great fpurs as big as a man's arm, ftanding out from the walls, from one foot to eighteen inches and upwards. The conftant pruning inevitably brings on the canker; and by the fpurs ftanding out fo far from the wall, the bloffom and fruit are liable to be much injured by the froft and blighting winds, and thus the fap will not have a free circulation all over the tree. The fap will always find its way firft to the extremities of the fhoots; and the fpurs will only receive it in a fmall proportion, as it returns from the ends of the branches; and the fruit ftanding at fo great a diftance from the wall is too much expofed to the weather, and, of courfe, is liable to be hard, fpotted, and kernelly.

The following method he has practifed where the trees were all over cankered, and the fruit fmall, and not fit to be fent to the table. He cut the tops off as near as poffible to where they were grafted, always obferving to cut as clofe to a joint or bud as poffible. The buds are hardly perceptible, but it can always be known where the joints, or forks, are, by the branches breaking out of the fides. He adds, that finding the pear-trees in Kenfington gardens in a very cankery and unfruitful ftate in the years 1784 and 1785, he took out the old mould from the borders againft the walls, and put in frefh loam in its ftead; at the fame time he pruned and nailed the trees in the common way, and left them in that ftate upwards of eighteen months, to fee what effect the frefh mould would have on them; but to his great furprife he found that it had no effect. After this trial he began to confider what fhould be done in order to recover thefe old trees. In this attempt he began with cutting down four old and decayed pear-trees of different kinds, near to the place where they had been grafted: this operation was performed on the 15th of May, 1786. Finding that they put forth fine fhoots, he headed down four more on the 20th of June in the fame year (for by this time the former had fhoots of a foot long), which did equally well, and bore fome fruit in the following year. One of the firft four he headed down was a St. Germain, which produced nineteen fine large well-flavoured pears next year, and in the third bore more fruit than it did in its former ftate when it was four times the fize. He left feven trees upon an eaft wall, treated according to the common method of pruning, which bore the following number of pears upon each tree. Epine d'hyver produced eighty-fix pears, and the tree fpread fifteen yards; a crafane produced one hundred pears, and the tree fpread fourteen yards; another crafane produced fixteen pears, and the tree fpread ten yards; a virgouleufe produced one hundred and fifty pears, and the tree fpread nine yards; a colmar produced one hundred and fifty pears, and the tree fpread nine yards; another colmar produced feventy-nine pears, and the tree fpread ten yards; a l'efchallerie produced fixty pears.

But feven trees headed down and pruned according to his own method, leaving the fore-right fhoots in fummer, bore as follows, in the fourth year after heading: a Louifbonne bore four hundred and fixty-three pears, and the tree fpread nine yards; another Louifbonne bore three hundred and ninety-one pears, and fpread eight yards; a colmar bore two hundred and thirteen pears, and fpread fix yards; a brown beurré bore five hundred and three pears; another brown beurré bore five hundred and fifty pears; a crafane bore five hundred and twenty pears; a virgouleufe bore five hundred and eighty pears. And he adds, that the branches of the four laft trees fpread nearly in the fame proportion as the firft three. He alfo ftates that a young beurré, the fecond year after heading, bore two hundred and thirty pears; and a St. Germain four hundred. All the above trees ftood in the fame afpect and the fame wall, and the fruit was numbered in the fame year. A great many pears which dropped from the trees are not reckoned. The trees that were pruned according to the old practice covered at leaft one-third more wall than the other.

From this ftatement it appears that the trees headed down bore upwards of five times the quantity of fruit that the others did; and that it keeps increafing in proportion to the progrefs of the trees. This is an important ftatement in the culture and management of old trees of this fort; and the following fact with refpect to ftandards is deferving of great attention: On the 20th of June he headed feveral ftandards that were almoft deftroyed by the canker; fome of them were fo loaded with fruit the following year, that he was

was obliged to prop the branches, to prevent their being broken down by the weight of it. In the fourth year after these standards were headed down, one of them bore two thousand eight hundred and forty pears. There were three standards on the same border with the above, two of which were St. Germain; the old tree was of the same kind. One of these trees, twenty years old, had five hundred pears on it, which was a great crop for its size: so that there were on the old tree, which had been headed down not quite four years, two thousand three hundred and forty pears more than on the tree of twenty years' growth. When the men numbered the pears, there was near a barrowful of windfalls at the bottom of the old tree, which were not included. These and other statements are given in his useful treatise on the "Culture of Fruit-Trees."

The following is the method he pursues in training trees that are cut near to the place where they are grafted. In the month of March, every year, he shortens the leading shoot to a foot or eighteen inches, according to its strength: this shoot will, if the tree be strong, grow from five to seven feet long, in one season; and, if left to nature, would run up without throwing out side-shoots. The reason for thus shortening the leading shoot is to make it throw out side-shoots, and if it be done close to a bud, it will frequently cover the cut in one season, leaving only a cicatrix. When the shoots are very strong, he cuts the leading ones twice in one season; by this method he gets two sets of side-shoots in one year, which enable him the sooner to cover the wall. The first cutting is performed any time during the spring, and the second about the middle of June. When you prune the trees, and cut the fore-right shoots, which should be done in February or March, always cut close to an eye or bud, observing where you see the greatest number of leaves at the lower bud, and cut at them; for at the footstalk of every one of these will be produced a flower-bud. The same will hold good in cutting the superfluous shoots on standard pears. He adds, that you will have in some sorts of pears, in a favourable season, from five to nine pears in a cluster. This cutting should not be later than March, or the beginning of April, on account of the leading shoot beginning to grow: the next topping, when the leading shoot grows quick enough to admit of it, should be about the middle of June; and the length of the shoots should be according to their strength, having from three eyes or buds, to six on a side. It is added, that the cankery part beginning to affect the new bark, he cut off all the canker at the bottom, and plastered the place with some cow-dung, mixed with wood-ashes and powder of burnt bones, put into as much urine and soap-suds as would make it of the consistence of thick paint; this he laid on with a painter's brush. After it had been applied about three hours, he patted it gently down, with his hand, close to the tree. By so doing, he gets rid of all the air-bubbles that may be under the composition, and makes it adhere to the tree, preventing it from being washed off by heavy rains. And in the beginning of August he shortens the fore-right shoots to about four inches long; by this time the shoot will have made its full growth for the season, and will produce fine strong eyes for the following year. Such shoots as grow near the stem of the tree, if any are wanted to fill up the wall, may be tucked-in as directed for peaches. This will prevent them from looking unsightly, and save them from the fury of the autumnal and winter winds. He further advises, that whenever the trunk is hollow, it be followed under ground till you have cut out all the decayed parts and rotten roots, otherwise you will lose the tree. By proceeding according to the foregoing directions, the roots will be renewed, while the tree is forming a fine handsome head. In the mean time the borders should be trenched, taking up all the roots, and adding some fresh mould to them, if you can conveniently get it; if you cannot, remove all the sour mould that is about the roots of the trees, and put in some taken from the border, at a distance from the wall; always remembering to lay the top spit next to the roots of the trees; also, to mix some vegetable mould, from the melon and cucumber beds, with rotten leaves, as a manure for the borders. He has headed down many trees that had not this preparation; and yet they throve very well, but did not send forth such fine roots and shoots as those that were so prepared. He concludes by observing, that if the above directions be followed, more pears will be procured in three or four years than can be done in twenty-five years by planting young trees, and pruning and managing them in the common way. It is added, that if it should be found, that, before the pears arrive at half their natural size, they get stunted, after cold blighting winds, and frosty nights, he would recommend a new operation to be performed when the weather begins to grow mild, which is to take a sharp penknife, and with the point of it make an incision through the rind of the pear from the footstalk to the eye, in the same way as in scarifying a bark-bound tree, taking care to penetrate as little into the flesh of the pear as possible. At the same time beat up some fresh cow-dung with wood-ashes, and with your fore-finger rub in a little of this composition where you made the scarification; as the wound heals, the composition will be discharged from the fruit; this will prevent the pears from cracking and bursting, which renders them good for nothing. The sorts that are most liable to this disorder are, he observes, the colmar, virgouleuse, and crasane. He only, however, recommends this operation for wall pears, as it may be thought by some a troublesome operation,and it will certainly take up some time.

Signs of Ripeness in the Fruit.—The maturity of the pear is generally known by its changing from a green to a yellow, or reddish colour, &c. and by the frequent falling from the tree; and when, with a gentle twist or turn upwards, it easily quits its hold: but these signs of ripeness are more particularly observable in summer and autumn pears; as winter pears, not being maturely ripe when gathered, often require a good pull before they quit the branches.

The summer pears ripen in succession in different sorts, from about the beginning or middle of July till the middle of September; many of the earliest ripening all at once, as it were, and continuing good but a few days, either on the tree or when gathered, nor will any of the sorts keep good long; and none of these sorts should hang on the tree till soft ripe, as in that case most of them would be mealy and insipid. These sorts should be gathered as soon as they are arrived to full growth, and just begin to colour and discover maturity, but before they become soft and mellow. For family use, they may be gathered from the tree according as they attain perfection; but the general crops of each sort should be always taken down before they ripen fully, and be laid in any dry room; none of the kinds will keep long, some only a few days, and scarcely any of them above a fortnight, though from different varieties ripening at different times, the succession is continued for eight or ten weeks.

The autumn sorts ripen in different varieties, from about the middle of September till the end of October; some of the forwardest become eatable on the tree, others requiring to lie some time after being gathered before they acquire perfection. The different sorts of these pears should be gathered according as they arrive to maturity: those designed to keep some time, may be gathered in dry weather, just when they have attained full growth, as shewn by their frequent dropping, and by their readily quitting the trees on being handled, and laid in a dry close room, or in baskets, each sort separately.

The winter kinds attain their full growth on the trees about the end of October or beginning of November; but the eatable kinds do not acquire maturity for that purpose on the tree, or for some considerable time after they are gathered, some probably in a month, others two or three, and some more, and some sorts not till the spring following. But the baking kinds may be used any time from October or November during their continuance. All winter pears should be indulged with as full growth on the tree as the weather will permit, even until the end of October, or first week in November, in the later kinds, if the season continues mild: be cautious, however, to get them gathered before attacked by much frost. And in gathering all the sorts for keeping, dry weather should be chosen, and when the fruit is also quite dry, being careful not to bruise them. See FRUIT.

Method of Forcing Pears.—These sorts of trees are sometimes forced by artificial heat, in some of the prime early kinds, to obtain a portion of fruit as early in the season as possible. This is effected by means of hot-walls and forcing-frames; having previously some trees of the choicest early summer pears, such as the jargonelle, or any other early sort, trained as wall-trees against a south wall, till advanced to some tolerable state of bearing; being then inclosed with glass frames, in the manner of forcing-frames or hot-walls, and having internally either flues for fire-heat, erected forward and extending long-ways, or otherwise a pit arranged in that direction, in the interval or space between the trees and the glass-work, for a bark or dung hot-bed; and by one or other of these methods a proper degree of artificial heat is produced internally to force an early growth in the trees, and forward them to early flowering and fruiting, managing them in the common way, as other trees in forcing-frames, so as to have some ripe fruit early in June, or some time in that month.

Method of Culture in the Apple Kind.—The whole of the varieties of the apple were first accidentally obtained by raising them from the kernels of the fruit; but as these cannot be depended upon to continue the same sort of fruit, grafting is the mode made use of to increase and continue the different varieties of them, which is performed upon crab, or any kind of apple stocks, raised from the kernels, for dwarfs as well as standards: and sometimes upon codlin and paradise apple stocks raised from cuttings and layers, when designed to have espaliers and other dwarf trees, or for small standards, as low as possible, to be confined within a moderate space: some sorts may also be raised by layers and cuttings, as the common codlin.

Stocks.—The method of raising the different sorts of stocks for the purpose is, in the crab and apple stocks, from the kernels of the fruit; but in the codlin and paradise stocks by cuttings and layers, to continue them with certainty of the same kinds and moderate growths. The crab and apple stocks may be raised from the kernels of any of the sorts, procuring them in autumn or winter, either from the fruit, or from such as have been pressed for verjuice and cider, clearing them from the grossest part of the pulp; then sowing them in beds of light earth, moderately thick, over the bed, or in drills, covering them about an inch deep. They come up in the spring; when, if the season prove dry, they should be watered occasionally, to forward and strengthen the growth of the plants; and in the autumn, winter, or spring following, the largest may be planted out in nursery-rows, shortening their tap-roots a little, and placing them in lines two feet and a half asunder, to remain for grafting: after having from one to two or three years' growth, they will be fit for grafting upon, particularly for dwarfs, or even for full and half standards, if intended to form the stem from the graft, which is an eligible method for these trees; but if the stock is to form the stem, they require three or four years' growth, to rise to a proper height, seven feet for full, and four or five for half standards. The modes of grafting all the sorts is the same as for other fruit-trees, and should be performed in March, either by whip or cleft-grafting, according to the size of the stock. See GRAFTING.

Having provided proper grafts of the different sorts of apples intended to be raised, the stocks designed for dwarfs of all sorts must be grafted within six inches of the ground; and the standards may also be grafted low, one shoot from the graft being trained up for a stem, or on tall stocks, at five or six feet in height, but for low and half standards, at from two or three, to four or five feet, and lower for dwarf standards. The grafts of all the sorts shoot the same year; and, by the autumn following, the trees having formed little heads, consisting of two, three, or four shoots, may then be planted out finally where they are to remain, or be retained a year or two, or longer, in the nursery, as may be requisite, training them for the purposes intended, as dwarfs, espaliers, &c. &c., and uprights for standards, heading the dwarfs down in March following, within six inches of the graft, to force out more lateral shoots below to form a fuller head, proceeding immediately to turn them near the bottom, so as to fill the espalier, &c. equally with branches, quite from within six or eight inches of the ground, regularly upward. In the standards, those grafted low must be trained with one shoot upright, at full length, for a stem, five or six feet high at least, for full standards before it is topped; though if grafted on tall stocks of height sufficient for a stem, the shoots from the graft may either be headed to five or six eyes; or, if to form a more spreading head, remain entire, and aspire more in height, and assume a more upright growth: in all the modes of training, care should be taken to keep the stems clear from all lateral shoots, displacing all such as soon as they appear, encouraging only a proper set of branches at top to form the head. When these trees have heads from one to two or three years old from the graft, they are of a proper age for planting out; though trees of four or five years old will also succeed very well, and even those of six or eight years' growth may also be safely planted if required. The nursery-grounds are mostly furnished with all the varieties of these trees for sale, either quite young from the graft, or trained of several years' growth.

Choice of Trees.—In choosing the different kinds of trees for planting, care should be taken to have a collection of the principal varieties, both in espaliers and standards, in proportion to the extent of the ground, as the trees of the best sorts are as easily raised and cultivated as the indifferent ones, allotting a smaller portion of the summer kinds, as such as ripen from August to about the middle of September, for immediate use off the trees, as they will not keep long; a larger supply of the autumn sorts, and most of all of the winter keeping apples: observing, in the summer kinds, that it is advisable to allot a principal supply of the common codlin in small standards, as being generally both a great bearer, and the fruit the most useful of the summer apples for culinary purposes, from its young green growth

growth in June or July, till its full maturity in Auguſt and September, when it becomes alſo a good eating apple: and as the tree is a moderate grower, it admits of being planted in ſmall ſtandards cloſer or more abundant in a ſmall extent of ground than moſt of the principal apple kinds.

In chooſing apple-trees from the nurſery, they ſhould, Mr. Forſyth ſays, have ſtrong, ſtraight, and clean ſtems. And he adviſes not to ſuffer the dwarf trees to run higher than twelve feet, as otherwiſe they become naked at bottom, the fruit is liable to be blown down, and the tops broken by high winds.

The proper ſeaſon for planting all the ſorts of apples is, in mild weather, from the end of October till March; but when planted in autumn, or early in winter, they eſtabliſh themſelves more firmly before the drought of the following ſummer. They ſucceed in any common ſoil and open ſituation, except in low very moiſt land, in which they are apt to canker, and ſoon go off: in a pliable mellow loam they generally anſwer very well. The ground ſhould be properly prepared, by good trenching, where the ranges of trees are to ſtand.

In the planting of eſpalier apple-trees they ſhould be ranged at no leſs than eighteen or twenty feet diſtance; the latter eſpecially for trees grafted on crab or apple ſtocks, which being free ſhooters, the branches readily fill that ſpace. For the trees grafted on codlin and paradiſe ſtocks, fifteen or eighteen feet may be ſufficient; though the latter, in particular, is ſometimes planted only twelve or fifteen feet aſunder, as being a very moderate ſhooter: it is, however, adviſable to allow every ſort full room, according to their growth, to have proper ſpace to extend their branches always at full length. The trees ſhould be planted with all their heads entire, only retrenching any very irregular growths, that do not range conſiſtently with the intended form, and pruning any broken roots. Then having opened a proper hole for each tree, plant them in the uſual manner, being careful to place them with their branches ranging the way of the eſpalier. As ſoon as the earth of the holes and of the roots is properly ſettled, all the branches ſhould be trained in horizontally to the right and left, an equal number on each ſide at full length, as above.

The general culture in eſpalier trees thus planted and trained, as the ſame branches or bearers continue fruitful many years, is to continue them as long as they remain of proper growths, conſtantly giving them a ſummer and winter pruning annually, as explained above. In wall-trees alſo, any of the principal choice varieties of eating apples may be trained, to forward and improve the growth, beauty, and flavour of the fruit; ſuch as jennetings, Margaret apple, golden pippins, golden rennets, pearmains, &c. or any other approved eating kinds, a tree or two of a ſort, againſt a ſouth, ſouth-weſt, or eaſt wall.

Standard apples, when planted in the garden, ſhould be arranged thinly, to admit of under crops growing freely, without being ſhaded by their ſpreading branches. Full ſtandards ſhould be chiefly planted for the general crops, and half and dwarf ſtandards for variety. The ſtandards, when trained as above, ſhould be planted out with all their heads entire, when in the kitchen garden, at thirty feet diſtance in the rows; and for an orchard, thirty feet diſtance every way. In planting, for each tree a wide hole ſhould be opened, trimming any long ſtraggling and broken roots, leaving all the others entire, and planting them with the uſual care. As ſoon as planted out, every tree ſhould be well ſtaked to ſupport them firmly upright, and prevent their being diſturbed in rooting by winds. See ORCHARD and PLANTING.

Smaller growing ſtandards, ſuch as codlins, or other low ſtandards grafted upon codlin ſtocks, and dwarfs upon theſe or paradiſe ſtocks, may, if required, be planted only at fifteen or twenty feet diſtance in the rows, and not leſs than twenty-five feet between the lines of trees; though, if there be room to allow a greater diſtance both ways, it will be advantageous, eſpecially in planting in kitchen gardens, in which it would be proper to allow double that diſtance between the rows of trees, of the larger growths of theſe kinds. The ſtandards thus planted with their heads entire, ſhould be ſuffered to advance with their branches at full length, and in general take their natural growth, when they ſoon form numerous natural ſpurs in every part for bearing.

In reſpect to pruning theſe ſtandards, little is required, only the occaſional retrenching any irregular croſs-placed bough, or the reducing to order any very long rambler; or when the head is become greatly crowded and confuſed to thin out ſome of the moſt irregular growths, likewiſe all ſtrong ſhoots growing upright in the middle of the head, and all dead wood, and ſuckers from the ſtem and root.

As to half and dwarf ſtandards of theſe trees, they may be diſperſed in different parts of the garden to cauſe variety, managing them as the full ſtandards. The former on dwarf paradiſe ſtocks, being very moderate ſhooters, may be planted in a little compaſs; and are ſometimes planted in pots for curioſity, to place on a table, amidſt a deſert, with the fruit growing on them. See DWARF-*Trees*.

It is obſerved by Mr. Forſyth, that in heading down old decayed apple-trees, for the ſake of ſymmetry, it will be neceſſary to cut at the forked branch as near as can be to the upper ſide of the fork, cutting them in a ſloping manner to carry off the wet, at the ſame time rounding the edges. To begin at the lower branches, cutting juſt above the lower fork; and proceeding upwards, cutting the reſt of the branches from one to ſix joints, or forks, according to their ſtrength, till you have finiſhed cutting-in the whole head. If any of theſe branches ſhould have the canker, all the infected part muſt be cut out. When the tree is all prepared; the compoſition ſhould be immediately applied, beginning at the top of the tree, and finiſhing with the powder of wood-aſhes and burnt bones as you deſcend, which will ſave it from being rubbed off during the operation; and the compoſition will prevent the ſun and air from injuring the naked inner bark. A tree thus prepared, will in the courſe of three or four years, produce more and finer fruit than a maiden tree that has been planted upwards of twenty years.

Theſe directions, if properly attended to, will be ſufficient, it is ſuppoſed, to enable any one to bring old decayed trees into a healthy bearing ſtate.

It is believed, that in large orchards and gardens, it may be neceſſary, at firſt, to head down only every other tree; cutting ſome of the branches of the reſt, which are in a decayed and cankery ſtate, and which bear no fruit. This will be preparing them to throw out new wood, and furniſh the tree much ſooner with bearing branches. He recommends the performing of the operation as early as poſſible; as by ſo doing the wood will be the ſtronger, as in May, or the two following months.

And it is added, that when the trees are become hollow, the ſame method ſhould be followed as directed for plums; but by no means to cut them down unleſs the tops are quite decayed; obſerving to cut the looſe rotten wood clean out of the hollow and other decayed parts, applying the compoſition; at the ſame time to open the ground, and cut out

 all

all the rotten parts that may be found in the lower part of the ftem, together with all the decayed roots, which, if this be not done, will infallibly injure the frefh wood and bark, and prevent a cure from being effected. He would recommend heading down all apple-trees that are much cankered and have ill-fhaped heads; as by fo doing much labour will be faved, and the trees will amply pay the proprietor. He advifes never to fhorten the young branches, except they are very thin, when it will be neceffary to do fo to fill the trees with young wood: nor prune any of the young wood: nor prune any of the young fhoots the fecond year (he means the year after they are cut), as many of the eyes, almoft to the end of the fhoot, will, if it be ftrong, become fruit-buds next year; and fo on every year. It is contended, that in the month of May in the firft year after the trees have been fo cut, it will be neceffary to go over them, and rub off with your finger and thumb all the fuperfluous young fhoots; leaving from three to fix eyes on each fhoot, according to the fize and ftrength of the branch cut. Thefe fhoots will bear from three to four years; by which time they will be pretty much exhaufted by the great quantity of fruit produced from them: they fhould then be cut down to two eyes to produce new wood. He always leaves three different years' branches on the tree, when the firft fhoot is cut off. This is fully fhewn in a plate in his ufeful work; and the next fhoot will be full of fruit-buds, if it has not been fhortened: when it begins to grow weak, it fhould be cut off; and the next cutting muft be made when the former branch is tired of bearing: by proceeding thus all over the tree with care and attention, the advantages of this method of pruning, above the common mode, will foon be perceived; as by it you will be able to keep the trees in a conftant ftate of bearing, which, if left to nature, would only produce a crop of fruit once in two or three years. When the fhoot that is done bearing is cut off, the compofition fhould conftantly be applied, rubbing off the fhoots where they are too numerous.

It is fuppofed, that the beft time to prune apple-trees is in the month of April, or in May, after the operation has been performed on the peaches, nectarines, and cherries: and that foon after this pruning, about the middle of May, it will be proper to look over the trees, and to pick off any caterpillars that may be on them. It will then be feen what fhoots are infected with the canker, and which might have efcaped your notice at the time of pruning; and wherever you obferve the leaft appearance of infection, which may be known by the wood appearing of a brownifh colour, the fhoot muft be cut down till you come to the found white wood. The fmall fhoots that crofs each other fhould be cut off, leaving the ftrongeft to fill up the tree, and make a fine handfome head. The fuckers that fpring from the root fhould be carefully grubbed up, and the fide-fhoots from the ftem cut off; for, if left to grow, they greatly weaken the tree. The knobs, where old branches have been cut off, fhould alfo be pared away, leaving the furface of the tree as fmooth as poffible: after which, the compofition fhould be applied: the young bark will foon begin to grow, and by degrees cover the old wounds with a frefh fmooth furface, and thus prevent the canker from gaining ground on the tree. He has feen fome old wounds of confiderable fize, healed over in one year: and he adds, in confirmation of the utility of this practice, that the trees which he pruned and dreffed, as above directed, in the courfe of the fummer, 1795, are all perfectly cured, the wounds being filled up with found wood, and covered over with new bark: they all continue in a healthy ftate, and bear fine handfome fruit. And he has advifed feveral nurferymen to follow the practice, heading down their apple-trees after the feafon of drawing for fale is over. Meffrs. Gray and Wear have headed a great many of fuch trees as were formerly thrown into the faggot-pile, and have been amply recompenfed for their trouble. Trees thus headed down, provided the ftems be ftrong, will, he thinks, in the firft and fecond year, produce as much fruit as will refund the purchafe-money; befides, a great deal of time will be faved, which would be loft by planting younger trees: as, where you can procure trees of the above defcription that have been headed down three or more years, they will be all covered with fruit buds; and, if carefully taken up and planted in the autumn, if the feafon proves favourable, they will have a tolerable crop of fruit the firft year. Such trees muft not be headed down like maiden trees, but only thinned off where the branches run acrofs and rub againft one another, which fhould never be fuffered in thefe cafes. He fays, he would never recommend training apple-trees as efpaliers; as by doing fo the air is kept from the quarters of the garden; and by conftant pruning and cutting off all the fide-fhoots which you cannot tie to the efpaliers, you prevent them from bearing, and, moreover, bring on the canker. And when the dwarf trees have handfome heads, more and much finer fruit will be gotten from one of them than from fix efpaliers; at the fame time, a free air is admitted to the crops in the quarters, and the conftant expence of the ftakes and labour, in laying the trees to the efpaliers is faved. Efpaliers may, he obferves, be converted into dwarf ftandards by fhortening the branches at different lengths, fo as that they may be able to fupport themfelves without the ftakes; but not to fhorten them all regularly; and if cut with judgment, as near to a leading fhoot, or an eye, as poffible, they will in the courfe of two years form fine heads, and in the third year bear fix times the fruit as they did in their former ftate, and of a finer flavour. The fame method of pruning as already laid down for ftandard apple-trees is alfo applicable to efpaliers.

It is remarked, that the borders where you make your croffings in gardens fhould be fix or eight feet broad at leaft, to let the trees fpread on each fide, at the diftance of twelve feet from tree to tree, and they fhould be well trenched, two feet and a half deep at leaft. If there fhould be gravel, or four clay, it muft be taken out, and good mould put in its place; leaving the ground as rough as poffible for the froft and rain to mellow it. When you level the ground it fhould be done after rain; you may then fow fome fmall crops in the border; fuch as lettuce or fpinach, or cabbage for tranfplanting; but let not any of the braffica tribe come to full growth. Leaving cabbage and broccoli on borders, near fruit-trees, draws the ground very much, fills the borders with infects, and alfo prevents the fun and air from penetrating into the ground. And when the fun can have free accefs to the border, it adds much to the flavour of the fruit. If you can fpare the ground on the crofs-borders in winter, it will be of great fervice to the trees to ridge it up as loofe as you can, and let it lie in that ftate all winter, to mellow and fweeten.

Where the foil is ftrong, he would recommend planting of apple-trees that are grafted on paradife ftocks; but if the foil be light, free ftocks will do much better: and when the ground is ftrong clay or brick-earth, it fhould be mixed with old lime-rubbifh or coal-afhes, ftreet-dung, or fand: but what he ufes for the borders againft the walls, and which he prefers to every other manure, is a vegetable mould produced from leaves of trees. Of this a good coat fhould be given once in two or three years, which will be fufficient, he thinks, for the borders where the wall-trees ftand, and much better than dung, which he by no means

approves

approves of for trees, unlefs it be perfectly rotten and mixed up with mould.

In refpect to grafting old apple-trees, he fays, it frequently happens, that through fome miftake or other, after waiting ten or twelve years for a tree to come into a bearing ftate, it is found that the fruit is neither fit for the table nor kitchen; in fuch cafes they fhould always be grafted the following fpring, obferving to graft on the fineft and healthieft fhoots, and as near as poffible to the old graft, and where the crofs-fhoots break out; as by fo doing you will have fome fruit the fecond year; and in the third, if properly managed, you will have as much as on a maiden tree of fifteen years ftanding; the canker, if any, muft be carefully pared off the branch, and the fcion muft be taken from a found healthy tree. Whenever an incifion is made for budding or grafting, from that moment the canker begins. He would, therefore, recommend to thofe employed in budding or grafting, as foon as the incifion is made, and the bud or graft inferted, to rub in with the finger, or a brufh, fome of the compofition before the bafs is tied on: then to cover the bafs all over with the compofition as thick as it can be laid on with a brufh, working it well in. If this operation be performed in a proper manner, and in a moift feafon, it will anfwer every purpofe without applying any grafting clay: as he has frequently done it, and found it fucceed perfectly to his wifhes. The matting which is wrapped round the bud fhould not be flackened too foon; for in that cafe you will find the incifion opened, which very often occafions the death of the bud. If, fays he, nurferymen and gardeners would give this method a fair trial, and ufe the fame compofition as he ufes for curing defects in trees, inftead of loam and horfe-dung (which binds fo hard as to prevent the rain and moifture from penetrating to the graft to moiften the wood and bark), they would find that the grafts would fucceed much better. The compofition, for this purpofe, fhould be rather fofter than grafting clay generally is; and inftead of applying fo large a mafs as is generally done of clay, it need not, in moft cafes, be more than two or three inches in circumference, to effect the purpofe.

Apples come to full growth in different forts fucceffively, from July until the end of October: the fummer kinds continue but a fhort time, but the autumn and winter apples keep from two or three to fix or eight months and longer, in different varieties. The figns of perfection or full growth of the different forts of apples, are by their affuming a lively colour, emitting a fragrant odour, frequently falling from the tree, and by quitting their hold eafily on being handled.

Gathering.—In the gathering of all the forts of apples for keeping, dry weather fhould always be chofen, and when the trees and fruit are alfo perfectly dry: obferve likewife, in gathering apples for the table, and all kinds of apples defigned for keeping any confiderable time, that they be pulled one and one by hand. See FRUIT.

The other fpecies may be increafed by grafting and budding them upon the common crab-ftock: they fhould have fheltered fituations, as they are rather tender while young. Thefe trees afford ornament and variety in the clumps and fhrubbery parts of pleafure-grounds.

Method of Culture in the Quince Kind.—Thefe trees may be raifed from the kernels of the fruit fown in autumn; but there is no depending on having the fame fort of good fruit from feedlings, nor will they foon become bearers. But the feveral varieties may be continued the fame by cuttings and layers; alfo by fuckers from fuch trees as grow upon their own roots, and likewife be increafed by grafting and budding upon their own pear-ftocks, raifed from the kernels in the fame manner as for apples.

The raifing by cuttings, layers, and fuckers, is performed in autumn, winter, or fpring, choofing young wood for the cuttings and layers, which fhould be planted and laid in the common method, when they will be rooted by the following autumn, then planted out into nurfery rows two feet afunder; plant the fuckers alfo at the fame diftance, and then train the whole for the purpofes intended: if for ftandards, run them up with a ftem to any defired height, from three to five or fix feet, then encourage them to branch out at top, to form a head; and thofe defigned as dwarfs muft be headed near the ground, and trained accordingly for efpaliers, or dwarf ftandards, as directed under thofe articles: the grafting or budding is effected on quince or pear-ftocks, and trained as above. When they have formed tolerable heads, they fhould be planted out finally.

Mr. Forfyth advifes that the layers or cuttings fhould be planted in a fhady place, in rows at about a foot diftant from each other, and about three inches from plant to plant in the rows; mulching them with rotten leaves, or rotten dung, which will keep the ground about them moift; and watering them frequently in hot weather. About Michaelmas thofe that are well rooted may be planted out, and thofe that are not fhould remain another year. They may alfo be propagated by budding or grafting; and thefe trees will bear fooner, and be more fruitful than thofe raifed by any other method.

He obferves, that the quince-tree may be pruned much in the fame way as an apple-tree, taking care to cut out all the old difeafed and dead wood, and the crofs branches in the middle of the tree, which are apt to injure each other by friction. In general you will find old trees much hurt by injudicious pruning: in that cafe they fhould be headed down, cutting out all the cankery parts, and alfo all the difeafed and dead wood where the tree is hollow, or where large branches have been cut or broken off, applying the compofition as for apple-trees: and as quince-trees are very apt to have rough bark, and to be bark-bound, in thefe cafes it will be neceffary to fhave off the rough bark with a draw-knife, and to fcarify them when bark-bound, brufhing them over with the compofition. It is alfo advifed to plant quince-trees at a proper diftance from apples and pears, as bees and the wind may mix the farina, and occafion the apples or pears to degenerate.

Standard quinces, defigned as fruit-trees, may be ftationed in the garden or orchard, and fome by the fides of any water, pond, watery-ditch, &c. as they delight in moifture, fuffering the whole to take their own natural growth: and as efpaliers, they may be arranged in affemblage with other moderate growing trees, fuch as apples and pears on paradife and quince-ftocks, cherries, &c. being trained as directed for apples and pears in efpaliers. They may alfo be planted in fhrubberies, either as full or low ftandards, and permitted to take their own way of growth. See ORCHARD.

PYSTERA, in *Ancient Geography*, an ifland fituated on the coaft of Afia Minor, over-againft Smyrna. Pliny.

PYTHAGORAS, in *Biography*. See PYTHAGOREANS.

Pofterity has been very liberal to this philofopher, in beftowing upon him all fuch inventions as others had neglected to claim, particularly in mufic; for there is fcarcely any part of it, as a fcience, with which he has not been invefted by his generous followers in biography.

Mufical ratios have been affigned to him, with the method of determining the gravity or acutenefs of founds by the greater or lefs degree of velocity in the vibrations of ftrings; the

the addition of an eighth to the lyre (Pliny, lib. ii. cap. 2.); the harmony of the fpheres (Plato); and the Greek mufical notation (Boethius). His right, indeed, to fome of thefe difcoveries has been difputed by feveral authors, who have given them to others with as little reafon, perhaps, as they had been before beftowed upon him.

But there is one difcovery, relative to mufic, that has, at all times, been unanimoufly affigned to him, which, however, appears to us extremely doubtful, not only whether it was made by him, but whether, in the manner it is related, it was ever made by any one.

We are told by Nicomachus, Gaudentius, Jamblichus, Macrobius, and all their commentators, "that Pythagoras, one day meditating on the want of fome rule to guide the ear, analogous to what had been ufed to help the other fenfes, chanced to pafs by a blackfmith's fhop, and obferving that the hammers, which were four in number, founded very harmonioufly, he had them weighed, and found them to be in the proportion of 6, 8, 9, and 12. Upon this he fufpended four ftrings, of equal length and thicknefs, &c. faftened weights, in the above-mentioned proportions, to each of them refpectively, and found that they gave the fame founds that the hammers had done; *viz.* the fourth, fifth, and octave to the graveft tone; which laft interval did not make part of the mufical fyftem before; for the Greeks had gone no farther than the heptachord, or feven ftrings, till that time." Principles and Power of Harmony, p. 8.

This is the fubftance of the account, as it has been lately abridged by Mr. Stillingfleet, who points out many incredible circumftances with refpect to the ftory in general, and denies that the weights 6, 8, 9, 12, would give the intervals pretended; but feems not to have feen the leaft difficulty in the fact, relative to *different hammers producing different founds upon the fame anvil.* The frontifpiece to M. Marpurg's Hiftory of Mufic, reprefents the Samian fage in the act of *weighing* the *hammers*.

But though both hammers and anvil have been fwallowed by ancients and moderns, and have paffed through them from one to another, with an oftrich-like digeftion, upon examination and experiment it appears, that hammers of different fize and weight will no more produce *different tones* upon the *fame anvil*, than bows or clappers of different fizes, will from the *fame ftring* or *bell*.

Indeed, both the hammers and anvils of antiquity muft have been of a conftruction very different from thofe of our *degenerate days*, if they produced any tones that were ftrictly *mufical*. Of the millions of well-organized mortals, who have paffed by blackfmiths' fhops, fince the time of Pythagoras, we believe no one was ever detained by a *fingle note*, much lefs by an harmonious *concord*, from thofe Vulcanian inftruments. A different kind of noife, indeed, will be produced by hammers of different weights and fizes; but it feems not to be in the power of the moft fubtle ear to difcover the leaft imaginable difference with refpect to gravity or acutenefs. But though *different noifes* may be produced from different bodies, in proportion to their fize and folidity, and every room, chair, and table, in a houfe, has a particular tone, yet thefe noifes can never be afcertained like mufical tones, which depend upon reiterated and regular vibrations of the aliquot parts of a ftring, or other elaftic body; and in wind inftruments, upon the undulations of the air conveyed into a tube. Noife may, indeed, be *forced* from a mufical ftring, or inftrument, by violence; but noife proceeding from bodies non-elaftic, or immufical, can never be *foftened* into found. M. Rouffeau (Dict. de Muf. art. *Bruit*) has ingenioufly imagined that noife is of the fame nature as found, with this difference, that to produce found, the *one* tone, with its confonant harmonics only, fhould be heard; fuch as the 8th, 12th, 15th, and 17th; whereas noife is produced by a jarring multitude of different tones, or even by one tone, when its vibrations are fo violent as to render audible a confiderable number of diffonant tones, of which the vibrations feldom or never coincide; fuch as the 7th, 9th, 11th, &c.

The long belief of this ftory proves that philofophers themfelves have fometimes taken facts upon truft, without verifying them by experiment. And as the tone of the hammers was afferted without proof, fo was the effect of their different weights faftened to ftrings: this Galileo difcovered. The numbers 6, 8, 9, 12, applied to different lengths of ftrings, would, indeed, give the intervals mentioned. But it is proved, that to produce thofe intervals by the *tenfion* of different weights, the weights muft be the fquares of thofe numbers; that is, 36, 64, 81, 144. It is aftonifhing how the blunder had been echoed from author to author, without experiment, till the time of Galileo. And Bontempi, in trying the power of weights upon ftrings in the Pythagoric proportions of 6, 8, 9, 12, found, that inftead of giving the 4th, 5th, and 8th of the graveft tone, they produced only the minor 3d, major 3d, and tritonus; fo that the whole account falls to the ground. But though modern incredulity and experiment have robbed Pythagoras of the glory of difcovering mufical ratios by *accident*, he has been allowed the fuperior merit of arriving at them by meditation and defign. At leaft the invention of the harmonical canon, or monochord, has been afcribed to him both by ancient and modern writers. (See MONOCHORD.) See Ariftid. Quint. p. 116. Prin. and Power of Harm. Hift. des Mathem. par. Montucla. Euler, Tentamen novæ Theor. Muf. and all the writers upon harmonics and temperament.

We fhall enter no deeper into this fubject here, than is abfolutely neceffary to explain the nature of the difcovery attributed to Pythagoras, to which mufic is indebted for the honourable appellation of *fcience*.

Pythagoras fuppofed the air to be the *vehicle* of found, and the agitation of that element occafioned by a fimilar agitation in the parts of the founding body, to be the *caufe* of it. The vibrations of a ftring, or any other fonorous body, being communicated to the air, affected the auditory nerves with the fenfation of found; and this found, according to him, was acute or grave, in proportion as the vibrations were quick or flow. It was alfo known, by experiment, that of two ftrings equal in every thing but length, the fhorter made the quickeft vibrations, and gave the acuter found; in other words, that the number of vibrations made in the fame time by two ftrings of different lengths, were inverfely as thofe lengths; that is, the greater the length, the fmaller the number of vibrations in any given time. By thefe difcoveries it was that found, confidered in the vibrations that caufe it, and the dimenfions of the vibrating or fonorous body, was reduced to quantity, and as fuch, became fubject to calculation, and expreffible by numbers. Thus, for inftance, the two founds that form an octave are expreffed by the numbers 1 and 2; which reprefent either the number of vibrations in a given time, or the length of the ftrings; and mean nothing more myfterious than that the acuter found vibrates twice, while the graver vibrates once; or, that the ftring producing the lower found is twice the length of that which gives the upper. If we confider the vibrations, the higher found is as 2, the lower as 1: the reverfe, if we confider only the lengths. In the fame manner, and in the fame fenfe, the 5th is expreffed by the ratio of 2 to 3, and the 4th by that of 3 to 4.

Such was the ancient philosophy of sounds, of which Pythagoras is recorded as the first teacher. But how much of this theory was founded on experiment and demonstration, and how much of it upon hypothesis; how much of it was known, and how much taken for granted, cannot certainly be determined. The story just now discussed is too much embarrassed with absurdities and impossibilities to guide us to any probable conjecture, as to the method by which Pythagoras *actually* arrived at his conclusions.

The discovery, as far as it relates to the length of strings, was easily made, because it depended upon an obvious experiment. It was, likewise, easily perceived, that a short string vibrated with more velocity than a long one; but between the certainty of this general fact, and the certainty that the vibrations were in a ratio exactly the inverse of the lengths, there is a considerable gulph. (See Smith's Harmonics, sect. i. art. 7, and note f.) We have no account of the bridge upon which Pythagoras got safely over. Experiment, here, is out of the question; for the slowest vibrations that produce musical sound, are far too quick to be counted or distinguished. The inference, however, was natural, though it does not appear that the ancients were able to support it by strict and scientific proof.

Indeed it was so late as the beginning of the present century, (1714. See Phil. Transf. and Methodus incrementorum directa et inversa, by Dr. Brook Taylor,) before this ancient theory of sound was fully confirmed, and the laws of vibrations, and the whole doctrine of musical strings, established upon the solid basis of mathematical demonstration.

The second musical improvement attributed to Pythagoras, was the addition of an eighth string to the lyre, which, before his time, had only seven, and was thence called a heptachord. It is supposed by several ancient writers, that the scale of this instrument, which was that of Terpander, consisted of two conjoint tetrachords, E F G A B ♭ C D; and that Pythagoras, by adding an eighth sound, at the top, and altering the tuning of the fifth, formed this scale: E F G A, B C D e, or a similar scale, consisting of two disjunct tetrachords.

How this scale was generated by the triple progression, or series of perfect 5ths, the abbé Roussier has lately very well discussed, in his "Memoire sur la Musique des Anciens." We shall endeavour to explain what is meant by the triple progression in music, which is the basis of this ingenious hypothesis; referring the reader to the Memoire itself for his proofs, as inserting them here would require too much time and space for a work of this nature.

Let any sound be representnd by unity, or the number 1; and as the 3d part of a string has been found to produce the 12th, or octave of the 5th above the whole string, a series of 5ths may be represented by a triple geometric progression of numbers, continually multiplied by 3, as 1 3 9 27 81 243 729; and these terms may be equally supposed to represent 12ths, or 5ths, either ascending or descending. For whether we divide by 3, or multiply by 3, the terms will be in the proportion of a 12th, or octave to the 5th, either way. The abbé Roussier, imagining that the ancients sung their scale backwards, as we should call it, by descending, annexes to his numbers the sounds following:

Term	I	II	III	IV	V	VI	VII
	1	3	9	27	81	243	729
	B	E	A	D	G	C	F

out of which series of 5ths, by arranging the sounds in diatonic order, may be formed the heptachord, or 7th, B C D E F G A; and to these, adding the duple of the highest sound, in the proportion of 2 to 1, the abbé supposes that Pythagoras acquired the octave, or proslambanomenos. This is throwing a mite into the charity-box of poor Pythagoras, without, however, telling us in what reign the obolum was coined; for we have met with no ancient author who bestows the invention of proslambanomenos upon this philosopher. The abbé does not let him or his followers stop here, but supposes an 8th term, 2187, added to the progression given above, by which a B ♭ was obtained, which furnished the minor semitone below B ♮. The system of Pythagoras, according to the abbé, was bounded by this 8th term, and the principle upon which it was built being lost, the Greeks penetrated no farther into the regions of modulation, where they might have enriched their music, but contented themselves, in after-times, with transpositions of this series of sound.

The abbé Roussier imagines, however, that though Pythagoras went no farther than the eighth term in triple progression, yet the Egyptians, in very high antiquity, extended the series to twelve terms, which would give every possible mode and genus perfect. A curious circumstance is observed by the same author, p. 28, § 47, with respect to the musical system of the Chinese, which well deserves mention here. "In collecting," says he, "what has already been advanced concerning the original formation of the Chinese system, it appears to begin precisely where the Greek left off, that is, at the VIIIth term of the triple progression, which is pursued as far as the XIIth term, by which series, arranged diatonically, the Chinese acquire their scale, e ♭, D ♭, B ♭, A ♭, G ♭, E ♭, in descending: or, as Rameau expresses the same intervals, in sharps, ascending, G✱, A✱, C✱, D✱, E✱, g✱."—It is observable that both these scales, which are wholly without semitones, are Scottish, and correspond with the natural scale of the old simple enharmonic, given p. 34. M. Jamard, a late French writer on music, pushing calculation still further than either the Egyptians or Chinese, has obtained, by pursuing the harmonic series, 1, 2, 3, 4, &c. &c. not only the enharmonic diesis, but even the minute intervals in the warbling of birds; it is wonderful he did not apply his ratios to human speech.

After musical ratios were discovered and reduced to numbers, they were made by Pythagoras and his followers, the type of order and just proportion in all things: hence virtue, friendship, good government, celestial motion, the human soul, and God himself, were harmony.

This discovery gave birth to various species of music, far more strange and inconceivable than chromatic and enharmonic: such as divine music, mundane music, elementary music, and many other divisions and subdivisions, upon which Zarlino, Kircher, and almost all the old writers, never fail to expatiate with wonderful complacence. It is, perhaps, equally to the credit and advantage of music and philosophy, that they have long descended from these heights, and taken their proper and separate stations upon *earth*: that we no longer admit of music that cannot be *heard*, or of philosophy that cannot be *understood*.

Aristides Quintilianus assures us, that music comprehends arithmetic, geometry, physics, and metaphysics, and teaches every thing, from *solfaing* the scale, to the nature and construction of the soul of man and the soul of the universe. To confirm this, he quotes, as a *divine saying*, a most curious account of the *end* and *business* of music, from one master Panacmus, which informs us that the province of music is not only to arrange musical sounds, and to regulate the voice, but to unite and harmonize every thing in nature. This writer, p. 102, in solving the question, whence it is that the soul is so easily affected by instrumental music, acquaints us, in the Pythagorean way, how the soul, frisking about, and

playing

playing all kinds of tricks in the purer regions of ſpace, approaches by degrees to our groſs atmoſphere; gets a taſte for matter and ſolidity, and at length acquires a warm and comfortable body to cover her nakedneſs. Here ſhe picks up nerves and arteries; there membranes; here ſpirit or breath; and all in a moſt extraordinary manner; eſpecially the arteries and nerves: for what ſhould they be made of, but the *circles* and *lines* of the ſpheres, in which the ſoul gets entangled in her paſſage, like a fly in a ſpider's web. Thus, continues he, the body becomes ſimilar in its texture to inſtruments of the wind and ſtringed kind. The nerves and arteries are ſtrings, and at the ſame time they are pipes filled with wind. "What wonder, then," ſays Ariſtides Quintilianus, "if the ſoul, being thus intimately connected with a body ſimilar in conſtruction to thoſe inſtruments, ſhould ſympathize with their motions."

Maſter Thomas Mace, author of a moſt delectable book, called "Muſick's Monument," would have been an excellent Pythagorean; for he maintains that the myſtery of the Trinity is perſpicuouſly made plain by the connection of the three harmonical concords, 1, 3, 5; that muſic and divinity are nearly allied; and that the contemplation of concord and diſcord, of the nature of the octave and uniſon, will ſo ſtrengthen a man's faith, "that he ſhall never after degenerate into that *groſs ſub-beaſtical ſin* of atheiſm." P. 268.

Pythagoras is ſaid, by the writers of his life, to have regarded muſic as ſomething celeſtial and divine, and to have had ſuch an opinion of its power over the human affections, that, according to the Egyptian ſyſtem, he ordered his diſciples to be waked every morning, and lulled to ſleep every night, by ſweet ſounds. He likewiſe conſidered it as greatly conducive to health, and made uſe of it in diſorders of the body, as well as in thoſe of the mind. His biographers and ſecretaries even pretend to tell us what kind of muſic he applied upon theſe occaſions. Grave and ſolemn, we may be certain; and vocal, ſay they, was preferred to inſtrumental, and the lyre to the flute, not only for its decency and gravity, but becauſe inſtruction could be conveyed to the mind, by means of articulation in ſinging, at the ſame time as the ear was delighted by ſweet ſounds. This was ſaid to have been the opinion of Minerva. In very high antiquity mankind gave human wiſdom to their gods, and afterwards took it from them, to beſtow it on mortals.

In peruſing the liſt of illuſtrious men, who have ſprung from the ſchool of Pythagoras, it appears that the love and cultivation of muſic was ſo much a part of their diſcipline, that almoſt every one of them left a treatiſe behind him upon the ſubject.

PYTHAGORAS's *Table*. See TABLE.

PYTHAGOREA, in *Botany*, received that appellation from Loureiro, in memory of the famous Pythagoras, who is ſaid to have written a book on the qualities of plants.—Loureir. Cochinch. 243. Claſs and order, *Octandria Tetragynia*. Nat. Ord. . . . . .

Gen. Ch. *Cal.* Perianth inferior, bell-ſhaped, of ſeven or eight linear, hairy, coloured leaves. *Cor.* ſuperior, bell-ſhaped, of ſeven or eight lanceolate, concave, hairy petals, the length of the calyx. *Stam.* Filaments eight, awlſhaped, longer than the corolla; anthers roundiſh, two-lobed. *Piſt.* Germen between the calyx and corolla, nearly ovate, hairy; ſtyles four, awl-ſhaped, reflexed, ſhorter than the ſtamens; ſtigmas acute. *Peric.* Capſule ovate, of four cells. *Seeds* numerous, roundiſh.

Eſſ. Ch. Calyx of ſeven or eight leaves, inferior. Corolla of ſeven or eight petals, ſuperior. Capſule of four cells, with many ſeeds.

1. P. *cochinchinenſis.*—Native of Cochinchina, where it is called *Xuong cá tiâ nhỏ lá.* A ſmall *tree*, with numerous branches. *Leaves* nearly ſeſſile, ovato-lanceolate, ſerrated, ſmooth; their longitudinal ribs red at the extremity. *Cluſters* axillary, long, nearly ſimple, with ſhort partial ſtalks. *Flowers* white.

Such is Loureiro's account, but we have no knowledge of the plant he deſcribes, nor can we offer any conjecture reſpecting its natural affinity. We have no faith in the exiſtence of a germen ſuperior to the calyx and inferior to the corolla, the only inſtance of the kind which Linnæus ever imagined, in *Sanguiſorba*, proving not well founded.

PYTHAGOREAN, or PYTHAGORIC *Syſtem*, among the *Ancients*, was the ſame with the Copernican ſyſtem among the moderns. See SYSTEM.

It was thus called, as having been maintained and cultivated by Pythagoras, and his followers; not that it was invented by him, for it was much older.

PYTHAGOREANS, a ſect of ancient philoſophers, who adhered to the doctrine of Pythagoras.

Pythagoras, the founder of this ſect, was of Samos, the ſon of a lapidary, and a pupil of Pherecydes, and flouriſhed (ſays Bayle) about five hundred years before Chriſt, in the time of Tarquin, the laſt king of Rome, and not in Numa's time, as many authors have ſuppoſed. See Cicero Tuſcul. Queſt. lib. iv. cap. 1.

The time of his birth, however, has been much diſputed. Dr. Bentley, in his "Diſſertation on the Epiſtles of Phalaris," relying chiefly on the authority of Eratoſthenes, refers the birth of Pythagoras to the 4th year of the 43d olympiad, B.C. 608. Lloyd, in his "Diſſertation concerning the Chronology of Pythagoras," aſcribes his birth to the 3d year of the 48th olympiad, B.C. 586. Dodwell places it in the 4th year of the 52d olympiad, B.C. 569, reſting in this date chiefly on the authority of Porphyry and Jamblichus. Upon the whole, the opinion of Lloyd ſeems to be the moſt probable, which is, that he was born about the year B.C. 586, and that he died about the 3d year of the 68th olympiad, B.C. 506; ſo that it ſeems pretty certain, that he was not born earlier than the 4th year of the 43d olympiad, B.C. 605, nor later than the 4th year of the 52d, B.C. 569. If we admit only the credible particulars of his childhood and early education, and pay no attention to the tales of Jamblichus and others, who even aſſerted that he was the ſon of God, we ſhall find that he was firſt inſtructed in his own country by Creſphilus, and afterwards by Pherecydes, in the iſland of Scyrus, and that after having paid his laſt tribute of reſpect to his preceptor, he returned to Samos, and purſued his ſtudies under the direction of his firſt maſter. Jamblichus, and other later biographers, mention his journey into Ionia, and his interviews with Thales and Anaximander, but of this journey we have no authentic record, nor is any effect of it diſcernible in his doctrine, which is eſſentially different from that of the Ionic ſchool. His firſt journey from the Grecian iſlands was probably into Egypt, which was celebrated in his time for that kind of wiſdom which beſt ſuited his genius and temper. In his way thither, Jamblichus aſſerts that he viſited Phœnicia, and converſed with the prophets and philoſophers that were the ſucceſſors of Mochus the Phyſiologiſt; which Mochus, Selden, and ſome others, will have to be Moſes.

Nor is it thought at all improbable that Pythagoras might wiſh to acquaint himſelf with the Phœnician philoſophy, of which he muſt, without doubt, have received a general report from his father, and from other merchants who traded to this coaſt. But that he derived his knowledge of numbers from the Phœnicians is not at all probable, becauſe their acquaintance with numbers extended no further than to the practical ſcience of arithmetic. It has been ſaid, indeed, that Pythagoras travelled, not only into Egypt and Chaldæa, but even into the Indies, to inform his underſtanding with regard to all branches of ſcience and prevalent cuſtoms; and that after returning to his own country, being unable to bear the tyranny of Polycrates, he retired into the eaſtern part of Italy, then called Magna Græcia, and eſtabliſhed his ſect, denominated from this circumſtance the "Italic Sect," or "Italic ſchool." Whatever opinion is entertained of this journey to the Eaſt, to which Le Clerc gives no credit, we muſt altogether reject other ſtories of his viſiting the temple on mount Carmel, and remaining there for ſeveral days, without food, paſſing among the inhabitants for a good dæmon, and obtaining from them religious honours; and of his proceeding into India, and there paſſing through ſeveral ceremonies of the Moſaic law.

Pythagoras, whilſt he was in Egypt, was introduced by the recommendation of Polycrates, tyrant of Samos, to Amaſis, king of Egypt, a diſtinguiſhed patron of literary men, and thus obtained acceſs to the colleges of the prieſts. Having found it difficult to gain this privilege, he performed many ſevere and troubleſome preliminary ceremonies, and even ſubmitted to circumciſion, a preſcribed condition of his admiſſion. He paſſed twenty-two years in Egypt, availing himſelf of all poſſible means of information with regard to the recondite doctrines of the Egyptian prieſts, as well as their aſtronomy and geometry, and Egyptian learning in its moſt unlimited extent.

Many writers of reputation, both Pagan and Chriſtian, who flouriſhed after the commencement of the Chriſtian era, relate, that after Pythagoras had left Egypt, he viſited the Perſian and Chaldæan Magi, and proceeded ſo far as to have intercourſe with the Indian Gymnoſophiſts. Jamblichus aſſerts, that he was taken captive by the victorious army of Cambyſes, and carried to Babylon, where he acquainted himſelf with the learning and philoſophy of the Eaſt; and that after the expiration of twelve years, when he was in the 60th year of his age, he returned to Samos. The circumſtance of his having viſited the Perſian magi is alſo mentioned by Cicero, Euſebius, Lactantius, and Valerius Maximus, though they take no notice of his captivity. In this journey to the Eaſt, as ſome have maintained, he attended upon the inſtructions of the celebrated Perſian ſage, Zoroaſter; and others, who have placed the life of Zoroaſter in an earlier period than that of Pythagoras, have aſſerted, that he converſed with certain Jewiſh prophets, who were at that time in Babylon, in a ſtate of captivity, and thus became acquainted with the Jewiſh laws and cuſtoms. However, ſeveral objections, particularly of a chronological kind, have been alleged againſt the narrative of Pythagoras's journey to the Eaſt. Chronologiſts unanimouſly agree, that Cambyſes invaded Egypt in the fifth year of his reign, or the third year of the 63d olympiad. According to Jamblichus, Pythagoras, after ſtaying twelve years in Babylon, and viſiting ſeveral other countries, went into Italy in the 62d olympiad. The ſame date is affixed to this journey by Diodorus and Clemens Alexandrinus; whilſt others place it about fourteen years earlier. Hence it appears, that if Pythagoras left the Eaſt before the 62d olympiad, after remaining there twelve years, he could not have been carried thither by Cambyſes in the 63d olympiad. Moreover, the whole narration of Pythagoras's journey into the Eaſt is contradicted by the expreſs authority of Antiphon (quoted by Porphyry), who ſays that Pythagoras, after his reſidence in Egypt, returned into Ionia, and opened a ſchool in his own country; and that, at the age of forty years, finding himſelf haraſſed by the tyranny of Polycrates, he withdrew into Italy; and according to this account, we have no interval for the ſuppoſed eaſtern expedition. The reality of this expedition is teſtified either by certain Alexandrian Platoniſts, who were deſirous of exalting, as much as poſſible, the wiſdom of thoſe ancient philoſophers, whom they conſidered as the oracles of wiſdom, or by certain Jewiſh and Chriſtian writers, who were diſpoſed to credit every tale which tended to give probability to the opinion that the Pythagorean doctrine was derived from the Oriental philoſophers, and ultimately from the Hebrew ſcriptures. In either caſe the authenticity of the relation is liable to juſt ſuſpicion; nor is there any probable argument to prove, that Pythagoras received inſtruction from any prophet of the Hebrew nation, during his ſuppoſed reſidence at Babylon. Brucker concurs with thoſe writers who are diſpoſed to reject this ſtory of Pythagoras's eaſtern journey as a mere fiction, and who concludes that, having never paſſed from Egypt to the Eaſt, he returned thence immediately to Samos. The ſtory of his having viſited the northern Druids is ſo deſtitute of probability and of evidence, as to merit no regard.

After his return from Egypt to his native iſland, he wiſhed to communicate the benefit of his twenty years' reſearches and ſtudies to his fellow-citizens, and with this view he attempted to inſtitute a ſchool for their inſtruction in the elements of ſcience; propoſing to adopt the Egyptian mode of teaching, and to communicate his doctrines under a ſymbolical form: but the Samians were either too ſtupid or too indolent to profit by his inſtructions. Although he was obliged to relinquiſh his deſign, he did not altogether abandon it. In order to engage the attention of his countrymen by ſome other means, he repaired to Delos; and after preſenting an offering of cakes to Apollo, he there received, or pretended to receive, moral dogmas from the prieſteſs, which he afterwards delivered to his diſciples under the character of divine precepts. With the ſame views he alſo viſited the iſland of Crete, ſo celebrated in mythological hiſtory; where he was conducted by the Corybantes, or prieſts of Cybele, into the cave of mount Ida, in which Jupiter is ſaid to have been buried. Here he converſed with Epimenides, an eminent pretender to prophetic powers, and was by him initiated into the moſt ſacred myſteries of Greece. About the ſame time he viſited Sparta and Elis, and was preſent during the celebration of the Olympic games, where he is ſaid to have exhibited a golden thigh to Abaris, in order to convince him that he was Apollo. Beſides other places which he viſited during his ſtay in Greece, he repaired to Phlius, where he firſt aſſumed the appellation of philoſopher. (See PHILOSOPHER.) Having thus added to the ſtores of learning which he had previouſly accumulated, and acquired a kind of authority which was calculated to command reſpect, he returned to Samos, and made a ſecond attempt, more ſucceſsful than his firſt, for eſtabliſhing a ſchool of philoſophy. In a ſemicircular kind of building, which the Samians had uſed as a place of reſort for public buſineſs, he delivered with an aſſumed authority of a ſacred nature, popular precepts of morality; and he alſo provided for himſelf a ſecret cave, into which he retired with his intimate friends and profeſſed diſciples, and here he gave his followers daily inſtructions, accompanied with a conſiderable parade of myſtery, in the more abſtruſe parts of philoſophy. His fame, and the multitude of his followers, increaſed. What he failed to accompliſh by the mere force of learning and ability, he effected by concealing his doctrines under the veil of myſterious ſymbols, and iſſuing forth his precepts as reſponſes from a divine oracle. About the beginning of the 59th olympiad, Pythagoras, deſirous of eſcaping the tyrannical government exercised in his native island by Syloson, the brother of Polycrates, left Samos, and, as we have already hinted, passed over into Italy, and attempted to establish his school among the colonies of Magna Græcia. It is probable that, in order to obtain credit with the populace, he about this time pretended to possess a power of performing miracles, and practised many arts of imposture. The first place at which he arrived in Italy was Crotona, a city in the bay of Tarentum, the inhabitants of which were very corrupt in their manners. But such were his reputation and influence, that he was treated with great respect, and people of all classes assembled to hear his discourses; insomuch that the manners of the citizens were soon totally changed from great luxury and licentiousness to strict sobriety and frugality. It is said that 600 (some say 2000), persons were prevailed upon to submit to the strict discipline which he required, and to throw their effects into a common stock for the benefit of the whole fraternity. The influence of his philosophy extended from Crotona to many other cities of Magna Græcia, and obtained for Pythagoras from his followers a degree of respect little short of adoration. If he had contented himself with delivering doctrines of philosophy and precepts of practical wisdom, he might probably have continued his labours, without molestation, to the end of his life. But he manifested a strong propensity towards political innovations; and he employed his influence in urging the people to the strenuous assertion of their rights, against the encroachments of their tyrannical governors. This course of conduct raised against him a very powerful opposition, which he was unable to resist and contend against, and which obliged him to retire to Metapontum. Here he found himself still surrounded with enemies, and was under a necessity of seeking an asylum in the temple of the Muses, where, not being supplied by his friends with sufficient food, he perished with hunger. The time of his death is uncertain; but according to the Chronicon of Eusebius, he died in the third year of the 68th olympiad, B. C. 506, after having lived, according to the most probable statement of his birth, to the age of 80 years. After his death his followers paid a superstitious respect to his memory. They erected statues in honour of him, converted his house at Crotona into a temple of Ceres, the street in which it stood was called the Museum, and appealed to him as a divinity, swearing by his name.

It appears, from the history of this philosopher, that with all his talents and learning, he owed much of his celebrity and authority to imposture. His whole manner of life confirms this opinion. Clothed in a long white robe, with a flowing beard, and, as some say, with a golden crown on his head, he preserved among the people, and in the presence of his disciples, a commanding gravity and majesty of aspect. He recurred to music for promoting the tranquillity of his mind, frequently singing, for this purpose, hymns of Thales, Hesiod, and Homer. He had such an entire command over himself, that he was never seen to express, in his countenance, grief, joy, or anger. He refrained from animal food, and confined himself to a frugal vegetable diet, excluding from his simple bill of fare, for mystical reasons, pulse or beans. By this artificial demeanour, Pythagoras appeared among the vulgar as a being of an order superior to the common condition of humanity, and persuaded them that he had received his doctrine from heaven. Pythagoras married Theano of Crotona, or, as some say, of Crete, by whom he had two sons, Telauges and Mnesarchus, who, after his death, took the charge of his school. Whether this philosopher left behind him any writings has been a subject of dispute. Many works have been enumerated under his name by Laertius, Jamblichus, and Pliny; but it is the declared opinion of Plutarch, Josephus, Lucian, and others, that there were no genuine works of Pythagoras extant; and it appears highly probable, from the pains which he took to confine his doctrine to his own school during his life, that he never committed his philosophical system to writing, and that the pieces to which his name was affixed at an early period, were written by some of his followers, upon the principles imbibed in his school. The famous golden verses attributed to Pythagoras, and illustrated with a commentary by Hierocles, were not written by our philosopher, but are to be ascribed to Epicharmus, or Empedocles. They may, however, be considered as a brief summary of his popular doctrines.

His "Method of instruction," formed upon the Egyptian model, was "exoteric," and "esoteric," that is, public and private. Those auditors, who attended his public lectures, did not properly belong to his school; but followed their usual mode of living. His select disciples, called his companions and friends, were such as submitted to a peculiar plan of discipline, and were admitted, by a long course of instruction, into all the mysteries of his *esoteric* doctrine.

Previously to the admission of any person into this fraternity, Pythagoras examined his features and external appearance; inquired how he had been accustomed to behave towards his parents and friends; marked his manner of laughing, conversing, and keeping silence; and observed what passions he was most inclined to indulge; with what kind of company he chose to associate; how he passed his leisure moments; and what incidents appeared to excite in him the strongest emotions of joy or sorrow. Nor after this examination was any one admitted into his society, till he was fully persuaded of the docility of his disposition, the gentleness of his manners, his power of retaining in silence what he was taught, and, in fine, his capacity of becoming a true philosopher. After the first probationary admission, the fortitude and self-command of the candidate were put to the trial by a long course of severe abstinence and rigorous exercise. The course of abstinence and self-denial comprehended food and drink, and clothing, all which were of the most plain and simple kind: and the exercises prescribed were such as could not be performed without pain and fatigue. To teach them humility and industry, he exposed them, for three years, to a continued course of contradiction, ridicule, and contempt, among their fellows. In order to restrain the powerful passion of avarice, he required his disciples to submit to voluntary poverty; he deprived them of all command over their own property, by casting the possessions of each individual into a common stock, to be distributed by proper officers, as occasion required. After this sequestration of their goods, they lived together on the footing of perfect equality, and sat down together daily at a common table. If any one afterwards repented of the connection, he was at liberty to depart, and might reclaim, from the general fund, his whole contribution. That his disciples might acquire a habit of entire docility, Pythagoras enjoined upon them, from their first admission, a long term of silence, called εχεμυθια. This initiatory silence, which probably consisted in refraining from speech, not only during the hours of instruction, but through the whole term of initiation, continued from two to five years, according to the propensity discovered by the pupil towards conceit and loquacity. With regard to himself, this was a judicious expedient, as it checked impertinent curiosity, and prevented every inconvenience of contradiction. Accordingly his disciples silenced all doubts and refuted all objections, by appealing to his authority. Αὐτὸς ἔφα, *ipse dixit*, decided every dispute. Moreover, during the years of initiation, the disciples were prohibited from seeing their master, or hearing his lectures, except from behind a curtain, or receiving instruction from some inferior preceptor.

To the members of the esoteric school (who were called γνήσιοι ὁμιλῆται, genuine disciples) belonged the peculiar privilege of receiving a full explanation of the whole doctrine of Pythagoras, which was delivered to others in brief precepts and dogmas, under the concealment of symbols. Disciples of this class were permitted to take minutes of their master's lectures, in writing, as well as to propose questions, and offer remarks, upon every subject of discourse. These were particularly distinguished by the appellation of the "Pythagoreans;" they were also called "Mathematicians," from the studies upon which they entered immediately after their initiation. After having made a sufficient progress in geometrical science, they proceeded to the study of nature, the investigation of primary principles, and the knowledge of God. Those who pursued these sublime speculations were called "Theorists," and those who devoted themselves more particularly to theology, were styled σεβαστικοὶ, religious. Others, according to their abilities and inclinations, were engaged in the study of morals, economics, and policy; and were afterwards employed in managing the affairs of the fraternity, or sent into the cities of Greece, to instruct them in the principles of government, or assist them in the institution of laws.

The brethren of the Pythagorean college at Crotona, called κοινόβιον, *coenobium*, about 600 in number, lived together as in one family, with their wives and children; and the whole business of the society was conducted with the most perfect regularity. Every day commenced with deliberation upon the manner in which it should be spent; and concluded with a retrospect of the events that had occurred, and of the business that had been transacted. They rose before the sun, that they might pay him homage; after which they repeated select verses from Homer and other poets, and made use of music, both vocal and instrumental, to enliven their spirits and fit them for the business of the day. They then employed several hours in the study of science. These were succeeded by an interval of leisure, which was commonly spent in a solitary walk for the purpose of contemplation. The next portion of the day was allotted to conversation. The hour immediately before dinner was filled up with various kinds of athletic exercises. Their dinner consisted chiefly of bread, honey, and water; for after they were perfectly initiated, they wholly denied themselves the use of wine. The remainder of the day was devoted to civil and domestic affairs, conversation, bathing, and religious ceremonies.

The "exoteric" disciples of Pythagoras were taught, after the Egyptian manner, by images and symbols, obscure and almost unintelligible to those who were not initiated into the mysteries of the school; and those who were admitted to this privilege were under the strictest obligation of silence with regard to the recondite doctrines of their master. The wisdom of Pythagoras, that it might not pass into the ears of the vulgar, was committed chiefly to memory; and when they found it necessary to make use of writing, they took care not to suffer their minutes to pass beyond the limits of the school.

Clemens observes, that the two orders above described corresponded very exactly to those among the Hebrews; for in the schools of the prophets there were two classes, *viz.* the sons of the prophets, who were the scholars; and the doctors or masters, who were also called *perfecti*: and among the Levites, the novices or tyros, who had their quinquennial exercises, by way of preparation. Lastly, even among the proselytes there were two orders; *exoterici*, or proselytes of the gate; and *intrinseci* or *perfecti*, proselytes of the covenant. He adds, it is highly probable, that Pythagoras himself had been a proselyte of the gate, if not of the covenant.

Gale endeavours to prove, that Pythagoras borrowed his philosophy from that of the Jews; to this end producing the authorities of many of the fathers, and ancient authors; and even pointing out the tracks and footsteps of Moses in several parts of Pythagoras's doctrine.

After the dissolution of the assembly of Pythagoras's disciples by the faction of Cylo, a man of wealth and distinction at Crotona, it was thought necessary by Lysis and Archippus, in order to preserve the Pythagorean doctrine from oblivion, to reduce it to a systematic summary; at the same time, however, strongly enjoining their children to preserve these memoirs secret, and to transmit them in confidence to their posterity. From this time books began to multiply among the followers of Pythagoras, till at length, in the time of Plato, Philolaus exposed the Pythagorean records to sale, and Archytas of Tarentum gave Plato a copy of his commentaries upon the aphorisms and precepts of his master. Of the imperfect records of the Pythagorean philosophy left by Lysis, Archytas, and others, nothing has escaped the wreck of time, except perhaps sundry fragments collected by the diligence of Stobæus, concerning the authenticity of which there are some grounds for suspicion; and which, if admitted as genuine, will only exhibit an imperfect view of the moral and political doctrine of Pythagoras under the disguise of symbolical and enigmatical language. The strict injunction of secrecy, which was given by oath to the initiated Pythagoreans, has effectually prevented any original records of their doctrine concerning Nature and God from passing down to posterity. On this head we are to rely entirely for information, and indeed concerning the whole doctrine of Pythagoras, upon Plato and his followers. Plato himself, while he enriched his system with stores from the magazine of Pythagoras, accommodated the Pythagorean doctrines, as he also did those of his master Socrates, to his own system, and thus gave an imperfect, and, we may suppose, in many particulars, a false representation of the doctrines of the Samian philosopher. It was farther corrupted by the followers of Plato, even in the old academy, and afterwards in the Alexandrian school. To which we may add, that the doctrine of Pythagoras itself, probably in its original state, and certainly in every form under which it has been transmitted to us, was observed, not only by symbolical, but by mathematical language, which is rather adapted to perplex than to illustrate metaphysical conceptions. In this fault Pythagoras was afterwards imitated by Plato, Aristotle, and others.

We extract from Brucker the following faint delineation of the Pythagorean philosophy: The end of philosophy is to free the mind from those incumbrances, which hinder its progress towards perfection, and to raise it to the contemplation of immutable truth, and the knowledge of divine and spiritual objects. This effect must be produced by easy steps, lest the mind, hitherto conversant only with sensible things, should revolt at the change. The first step towards wisdom is the study of mathematics, a science which contemplates objects that lie in the middle way between corporeal and incorporeal beings, and as it were on the confines of both, and which most advantageously inures the mind to

contemplation,

contemplation. The whole courſe of mathematical ſcience may be divided into four parts: two reſpecting numbers, and two reſpecting magnitude. Number may be conſidered either abſtractedly in itſelf, or as applied to ſome object. The former ſcience is arithmetic; of the latter kind is muſic. Magnitude may be conſidered as at reſt, or as in motion; the ſcience which treats of the former is geometry, that which treats of the latter is aſtronomy.

Arithmetic is the nobleſt ſcience; numbers the firſt object of ſtudy, and a perfect acquaintance with numbers the higheſt good. Numbers are either ſcientific or intelligible.

Scientific number is the production of the powers involved in unity, or the progreſſion of multitude from the monad or unity, and its return to the ſame. *Unity* and *one* are to be diſtinguiſhed from each other; the former being an abſtract conception, the latter belonging to things capable of being numbered. Number is not infinite, but is the ſource of that infinite diviſibility into equal parts, which is the property of all bodies.

Intelligible numbers are thoſe which ſubſiſted in the divine mind before all things, from which every thing hath received its form, and which always remain immutably the ſame. It is the model, or archetype, after which the world, in all its parts, is framed. Numbers are the cauſe of eſſence to beings: *τοὺς ἀριθμοὺς αἰτίας εἶναι τῆς οὐσίας.*

The monad, or unity, is that quantity, which, being deprived of all number, remains fixed; whence called monad, from *τοῦ μένειν*. It is the fountain of all number. The duad is imperfect and paſſive, and the cauſe of increaſe and diviſion. The triad, compoſed of the monad and duad, partakes of the nature of both. The tetrad, tetractys, or quaternion number, is the moſt perfect. The decad, which is the ſum of the four former, comprehends all arithmetical and muſical proportions.

According to ſome writers, the monad denotes the active principle in nature, or God; the duad, the paſſive principle, or matter; the triad, the world formed by the union of the two former; and the tetractys, the perfection of nature. Some have underſtood by this myſterious number, the four elements; others, the four faculties of the human mind; others, the four cardinal virtues; and others have been ſo abſurd as to ſuppoſe that Pythagoras made uſe of this number to expreſs the name of God, in reference to the word יהוה, by which that name is expreſſed in the Hebrew language. But every attempt to unfold this myſtery has hitherto been unſucceſsful.

The moſt probable explanation of the Pythagoric doctrine of numbers is, that they were uſed as ſymbolical or emblematical repreſentations of the firſt principles and forms of nature, and particularly of thoſe eternal and immutable eſſences, to which Plato afterwards gave the appellation of ideas. Not being able, or not chuſing, to explain in ſimple language the abſtract notions of principles and forms, Pythagoras ſeems to have made uſe of numbers, as geometricians make uſe of diagrams, to aſſiſt the conceptions of ſcholars. More particularly, conceiving ſome analogy between numbers and the intelligent forms which ſubſiſt in the divine mind, he made the former a ſymbol of the latter. As numbers proceed from unity, or the monad, as a ſimple root, whence they branch out into various combinations, and aſſume new properties in their progreſs, ſo he conceived the different forms of nature to recede, at different diſtances, from their common ſource, the pure and ſimple eſſence of deity, and at every degree of diſtance to aſſume certain properties in ſome meaſure analogous to thoſe of number; and hence he concluded, that the origin of things, their emanation from the firſt being, and their ſubſequent progreſſion through various orders, if not capable of a perfectly clear explanation, might, however, be illuſtrated by ſymbols and reſemblances borrowed from numbers.

Next to numbers, muſic had the chief place in the preparatory exerciſes of the Pythagorean ſchool, by means of which the mind was to be raiſed above the dominion of the paſſions, and inured to contemplation. Pythagoras conſidered muſic, not only as an art to be judged of by the ear, but as a ſcience to be reduced to mathematical principles and proportions. We have introduced, under the article PYTHAGORAS, the manner in which he is ſaid to have diſcovered the muſical chords, but ſhall here ſubjoin a more minute account. As Pythagoras was one day reflecting upon the ſubject, happening to paſs by a ſmith's forge, where ſeveral men were ſucceſſively ſtriking with their hammers a piece of heated iron upon an anvil, he remarked, that all the ſounds produced by their ſtrokes were harmonious except one. The ſounds, which he obſerved to be chords, were the octave, the fifth, and the third; but that ſound which he perceived to lie between the third and the fifth he found to be diſcordant. Going into the work-ſhop, he obſerved, that the diverſity of ſounds aroſe, not from the form of the hammers, nor from the force with which they were ſtruck, nor from the poſition of the iron, but merely from the difference of weight in the hammers. Taking, therefore, the exact weight of the ſeveral hammers, he went home, and ſuſpended four ſtrings of the ſame ſubſtance, length, and thickneſs, and twiſted in the ſame degree, and hung a weight at the lower end of each, reſpectively equal to the weight of the hammers: upon ſtriking the ſtrings, he found, that the muſical chords of the ſtrings correſponded with thoſe of the hammers. Hence it is ſaid, that he proceeded to form a muſical ſcale, and to conſtruct ſtringed inſtruments. His ſcale was, after his death, engraved in braſs, and preſerved in the temple of Juno at Samos.

Pythagoras conceived that the celeſtial ſpheres in which the planets move, ſtriking upon the æther through which they paſs, muſt produce a ſound; and that this ſound muſt vary, according to the diverſity of their magnitude, velocity, and relative diſtance. Taking it for granted, that every thing reſpecting the heavenly bodies is adjuſted with perfect regularity, he further imagined, that all the circumſtances neceſſary to render the ſounds produced by their motion harmonious, were fixed in ſuch exact proportions, that the moſt perfect harmony is produced by their revolutions. This fanciful doctrine reſpecting the muſic of the ſpheres gave riſe to the names which Pythagoras applied to muſical tones. The laſt note in the muſical octave he called *hypate*, becauſe he ſuppoſed the ſphere of Saturn, the higheſt planet, to give the deepeſt tone; and the higheſt note he called *neate*, from the ſphere of the moon, which being the loweſt, or neareſt the earth, he imagined, produced the ſhrilleſt ſound. In like manner of the reſt. It was ſaid of Pythagoras by his followers, who heſitated at no aſſertion, however improbable, which might ſeem to exalt their maſter's fame, that he was the only mortal ſo far favoured by the gods as to be permitted to hear the celeſtial muſic of the ſpheres. Pythagoras applied muſic to the cure of diſeaſes both bodily and mental. It was, as we have ſeen, the cuſtom of his ſchool, to compoſe their minds for reſt in the evening, and to prepare themſelves for action in the morning, by ſuitable airs, which they performed upon the lute, or other ſtringed inſtruments. The muſic was, however, always accompanied with verſe, ſo that it may be doubted, whether the effect was to be aſcribed more to the muſician

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or to the poet. It is faid of Clinius, a Pythagorean, that whenever he perceived himfelf inclined to anger, fpleen, or other reftlefs paffions, he took up his lute, and that it never failed to reftore the tranquillity of his mind. Of Pythagoras himfelf it is related, that he checked a young man, who, in the midft of his revels, was meditating fome act of Bacchanalian madnefs, by ordering the mufician, who had inflamed his paffions by Phrygian airs, to change the mufic on a fudden into the flow and folemn Doric mood. If the ftories which are related by the ancients concerning the wonderful effects of their mufic are to be credited, we muft acknowledge we are ftrangers to the method by which thefe effects were produced.

Befides arithmetic and mufic, Pythagoras cultivated geometry, which he had learned in Egypt; but he greatly improved it, by inveftigating many new theorems, and by digefting its principles, in an order more perfectly fyftematical than had before been done. Several Grecians, about the time of Pythagoras, applied themfelves to mathematical learning, particularly Thales in Ionia. But Pythagoras feems to have done more than any other philofopher of this period towards reducing geometry to a regular fcience. His definition of a point is, a monad or unity with pofition. He taught that a geometrical point correfponds to unity in arithmetic, a line to two, a fuperficies to three, a folid to four. Of the geometrical theorems afcribed to Pythagoras, the following are the principal: that the interior angles of every triangle are together equal to two right angles; that the only polygons which will fill up the whole fpace about a given point, are the equilateral triangle, the fquare, and the hexagon; the firft to be taken fix times, the fecond four times, and the third three times; and that, in rectangular triangles, the fquare of the fide which fubtends the right angle is equal to the two fquares of the fides which contain the right angle. Upon the invention of this latter propofition (Euclid, l. i. prop. 47.), Plutarch fays, that Pythagoras offered an ox, others, an hecatomb, to the gods. But this ftory is thought by Cicero inconfiftent with the inftitutions of Pythagoras, which, as he fuppofes, did not admit of animal facrifices. Pythagoras inferred the ftature of Hercules from the length of the Olympic courfe, which meafured fix hundred of his feet. Obferving how much fhorter a courfe fix hundred times the length of the foot of an ordinary-fized man was than the Olympic courfe, he inferred, by the law of proportion, the length of Hercules's foot; whence the ufual proportion of the length of the foot to the height of a man enabled him to determine the problem. Pythagoras alfo applied geometrical ideas as fymbolical expreffions of bodies, and of natural principles; but nothing certain, or intelligible, is preferved on this head.

On aftronomy, the doctrine of Pythagoras, or, however, of the ancient Pythagoreans, was as follows:

The term heaven either denotes the fphere of the fixed ftars, or the whole fpace between the fixed ftars and the moon, or the whole world, including both the celeftial fpheres and the earth. There are ten celeftial fpheres, nine of which are vifible to us; namely, that of the fixed ftars, thofe of the feven planets, and that of the earth; the tenth is the antichthon, or an invifible fphere oppofite to the earth, which is neceffary to complete the harmony of nature, as the decad is the completion of numerical harmony. And this antichthon may be the caufe of the greater number of the eclipfes of the fun than of the moon. Fire holds the middle place in the univerfe; or, in the midft of the four elements is placed the fiery globe of unity; the earth is not without motion, nor fituated in the centre of the fpheres, but is one of thofe planets which make their revolution about the fphere of fire. The revolution of Saturn is completed in thirty years, that of Jupiter in twenty, that of Mars in two, that of the Sun, and of Mercury and Venus, in one year. The diftance of the feveral celeftial fpheres from the earth correfpond to the proportion of notes in the mufical fcale. The moon and other planetary globes are habitable. The earth is a globe, which admits of antipodes.

From feveral of thefe particulars refpecting the aftronomical doctrine of Pythagoras, it has been inferred, that he was poffeffed of the true idea of the folar fyftem, which was revived by Copernicus, and has fince been fully eftablifhed by Newton.

From this preparatory ftudy the difciples of the Pythagorean fchool were conducted to the knowledge of natural, theological, and moral fcience. Concerning wifdom, in general, Pythagoras taught, that it is the fcience which is converfant with thofe objects, which are in their nature immutable, eternal, and incorruptible, and therefore alone can properly be faid to exift. The man who applies himfelf to this kind of ftudy is a philofopher. The end of philofophy is, that the human mind may, by fuch contemplation, be affimilated to the divine, and at length be qualified to join the affembly of the gods. In the purfuit of wifdom, the utmoft care muft be taken to raife the mind above the dominion of the paffions, and the influence of fenfible objects, and to difengage it from all corporeal impreffions, that it may be inured to converfe with itfelf, and to contemplate things fpiritual and divine. For this purpofe the affiftance of God, and of good dæmons, muft be invoked by prayer. Philofophy, as it is converfant with fpeculative truth, or with the rules of human conduct, is either theoretical or practical. Practical philofophy is only to be ftudied fo far as may be neceffary for the purpofes of life; theoretical philofophy is the perfection of wifdom. Contemplative wifdom cannot be completely attained, without a total abftraction from the ordinary affairs of life, and a perfect tranquillity and freedom of mind. Hence the neceffity of inftituting a fociety, feparated from the world, for the purpofe of contemplation and ftudy.

Active or moral philofophy, which prefcribes rules and precepts for the conduct of life, according to Ariftotle, was firft taught by Pythagoras, and after his death by Socrates. Among the moral maxims and precepts afcribed to Pythagoras are the following:

Virtue is divided into two branches, private and public. Private virtue refpects education, filence, abftinence from animal food, fortitude, fobriety, and prudence. The powers of the mind are reafon and paffion; and when the latter is preferved in fubjection to the former, virtue is prevalent. Young perfons fhould be inured to fubjection, that they may always find it eafy to fubmit to the authority of reafon. Let them be conducted into the beft courfe of life, and habit will foon render it the moft pleafant. Silence is better than idle words. A wife man will prepare himfelf for every thing which is not in his own power. Do what you judge to be right, whatever the vulgar may think of you; if you defpife their praife, defpife alfo their cenfure. It is inconfiftent with fortitude to relinquifh the ftation appointed by the Supreme Lord, before we obtain his permiffion. Sobriety is the ftrength of the foul, for it preferves its reafon unclouded by paffion. No man ought to be efteemed free, who has not the perfect command of himfelf. Drunkennefs is a temporary phrenfy. That which is good and becoming is rather to be purfued, than that which is pleafant. The defire of fuperfluity is foolifh, becaufe it knows

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no limits. All animal pleafures fhould rather be poftponed, than enjoyed before their time; and fhould only be enjoyed according to nature, and with fobriety. Much forethought and difcretion is neceffary in the production and education of children. Wifdom and virtue are our beft defence; every other guard is weak and unftable. It requires much wifdom to give right names to things.

Concerning public virtue, the doctrine of Pythagoras, as it is tranfmitted to the prefent time, refpects converfation, friendfhip, religious worfhip, reverence to the dead, and legiflation. Upon thefe heads he is faid to have taught thus:

Converfation fhould be adapted to the characters and condition of the perfons with whom we converfe: that difcourfe and behaviour, which might be proper among young perfons, may be exceedingly improper between the young and aged. Propriety and feafonablenefs are the firft things to be regarded in converfation. In all fociety, a due regard muft be had to fubordination. Refpect is due to a worthy ftranger, fometimes in preference even to countrymen or relations. It is better that thofe who converfe with you fhould refpect you, than that they fhould fear you; for refpect produces admiration, but fear produces hatred. It is an evident proof of a good education, to be able to endure the want of it in others. Between friends, the utmoft care fhould be taken to avoid contention, which can only be done by fhunning as much as poffible all occafions of ftrife, fuppreffing refentment, and exercifing mutual forbearance. Reproof and correction are ufeful and becoming from the elder to the younger; efpecially when they are accompanied, on the part of the reprover, with evident tokens of affection.

Mutual confidence is never for a moment to be interrupted between friends, whether in jeft or earneft; for nothing can heal the wounds which are made by deceit. A friend muft never be forfaken in adverfity, nor for any infirmity in human nature, excepting only invincible obftinacy and depravity. Before we abandon a friend, we fhould endeavour, by actions as well as words, to reclaim him. True friendfhip is a kind of union which is immortal.

The defign and object of all moral precepts is to lead men to the imitation of God. Since the Deity directs all things, every good thing is to be fought for from him alone; and nothing is to be done which is contrary to his pleafure. Whilft we are performing divine rites, piety fhould dwell in the mind. The gods are to be worfhipped not under fuch images as reprefent the forms of men, but by fuch fymbols as are fuitable to their nature, by fimple luftrations and offerings, and with purity of heart. Gods and heroes are to be worfhipped with different degrees of homage, according to their nature. Oaths are in no cafe to be violated.

The bodies of the dead are not to be burned. Next to gods and dæmons, the higheft reverence is due to parents and legiflators; and the laws and cuftoms of our country are to be religioufly obferved.—Thus much concerning the active or moral philofophy of Pythagoras.

Theoretical philofophy, which treats of nature and its origin, was the higheft object of ftudy of the Pythagorean fchool, and included all thofe profound myfteries, which thofe, who have been ambitious to report what Pythagoras faid behind the curtain, have endeavoured to unfold. Upon this fubject, nothing can be advanced with certainty, efpecially refpecting theology, the doctrine of which, Pythagoras, after the manner of the Egyptian priefts, was peculiarly careful to hide under the veil of fymbols, probably through fear of difturbing the popular fuperftitions. The ancients have not, however, left us without fome grounds of conjecture.

With refpect to God, Pythagoras appears to have taught, that he is the Univerfal Mind, diffufed through all things, the fource of all animal life, the proper and intrinfic caufe of all motion, in fubftance fimilar to light, in nature like truth, the firft principle of the univerfe, incapable of pain, invifible, incorruptible; and only to be comprehended by the mind.

Cicero (Nat. Deor. l. 1. c. 12.) afferts, that Pythagoras conceived God to be a foul pervading all nature, of which every human foul is a portion: and this doctrine was perfectly confonant to the opinions received in the countries which Pythagoras vifited, and where he learned theology. Juftin Martyr (Orat. ad Gentes) exprefsly ranks Pythagoras among the theiftical philofophers. "If any one," fays he, "wifhes to be informed more accurately concerning the doctrine of Pythagoras with refpect to one God, let him hear his opinion, for he fays, God is one: he is not, as fome conjecture, exterior to the world, but, in himfelf entire, pervades the univerfal fphere, fuperintends all productions, is the fupport of all nature, eternal, the fource of all power, the firft fimple principle of all things, the origin of celeftial light, the father of all, the mind and animating principle of the univerfe, the firft mover of all the fpheres." From a variety of paffages that might be cited, we may reafonably infer, that Pythagoras conceived the Deity to be the informing foul of the world, animating it in a manner fimilar to that in which the human foul animates the body.

Subordinate to the Deity, it was taught in the Italic fchool, that there are three orders of intelligence, gods, dæmons, heroes, who are diftinguifhed by their refpective degrees of excellence and dignity, and by the nature of the homage which is due to them; gods being to be preferred in honour to demi-gods or dæmons, and dæmons to heroes or men. Thefe three orders, in the Pythagorean fyftem, were emanations, at different degrees of proximity, from the fupreme intelligence, the particles of fubtle ether affuming a groffer clothing the farther they receded from the fountain. The third order, or heroes, were fuppofed to be invefted with a fubtle material clothing. Hierocles defines a hero to be a rational mind united with a luminous body. If to thefe three fpecies we add a fourth, the human mind, we have the whole fcale of divine emanation, as it was conceived by this fect of philofophers. All thefe they imagined to proceed from God, as the firft fource of intelligence, and to have received from him a pure, fimple, immutable nature. God, being himfelf one, and the origin of all diverfity, they reprefented him under the notion of monad, and fubordinate intelligences, as numbers derived and included in unity. Thus the numbers or derived intelligences of Pythagoras agree with the ideas of Plato, except, perhaps, that the latter were of a nature perfectly fpiritual, but the former were clothed with a fubtle etherial body.

The region of the air was fuppofed by the Pythagoreans to be full of fpirits, dæmons, or heroes, who caufe ficknefs or health to man or beaft, and communicate, at their pleafure, by means of dreams, and other inftruments of divination, the knowledge of future events. That Pythagoras himfelf held this opinion cannot be doubted, if it be true, as his biographers relate, that he profeffed to cure difeafes by incantations. It is probable that he derived it from the Egyptians, among whom it was believed that many difeafes were caufed by demoniacal poffeffions.

The material world, according to Pythagoras, was produced by the energy of the divine intelligence. It is an animated fphere, beyond which is a perfect vacuum. It contains

contains spheres, which revolve with musical harmony. The atmosphere of the earth is a gross, immutable, and morbid mass; but the air, or ether, which surrounds it is pure, healthful, serene, perpetually moving, the region of all divine and immortal natures. The sun, moon, and stars, are inhabited by portions of the divinity, or gods. The sun is a spherical body. Its eclipses are caused by the passing of the moon between it and the earth; those of the moon by the intervention of the *antichthon*, before explained. The moon is inhabited by dæmons. Comets are stars, which are not always seen, but rise at stated periods.

Concerning man, the Pythagoreans taught, that, consisting of an elementary nature, and a divine or rational principle, he is a microcosm, or compendium of the universe; that his soul is a self-moving principle, composed of two parts, the rational, which is a portion of the soul of the world, seated in the brain, and the irrational, which includes the passions, and is seated in the heart; that man participates in both these with the brutes, which, from the temperament of their body, and their want of the power of speech, are incapable of acting rationally; that the sensitive soul, θύμος, perishes, but the rational mind, φρὴν, is immortal, because the source whence it is derived is immortal; that after the rational mind is freed from the chains of the body, it assumes an ethereal vehicle, and passes into the regions of the dead, where it remains till it is sent back to this world, to be the inhabitant of some other body, brutal or human; and that after suffering successive purgations, when it is sufficiently purified, it is received among the gods, and returns to the eternal source from which it first proceeded.

The doctrine of the Pythagoreans, respecting the nature of brute animals, and μετεμψυχώσις, *the transmigration of souls*, were the foundation of their abstinence from animal food, and of the exclusion of animal sacrifices from their religious ceremonies. The latter doctrine is thus beautifully represented by Ovid, who introduces Pythagoras as saying:

" Morte carent animæ: semperque priore relicta
Sede, novis domibus habitant, vivuntque receptæ.
Omnia mutantur; nihil interit; errat et illinc,
Huc venit, hinc illuc, et quoslibet occupet artus
Spiritus, eque feris humana in corpora transit,
Inque feras noster: nec tempore deperit ullo,
Utque novis fragilis signatur cera figuris,
Nec manet ut fuerat, nec formas servat easdem,
Sed tamen ipsa eadem est, animam sic semper eandem,
Esse, sed in varias doceo migrare figuras."

" What then is death, but ancient matter drest
In some new figure, and a varied vest:
Thus all things are but alter'd, nothing dies;
And here and there th' unbodied spirit flies,
By time, or force, or sickness dispossess'd,
And lodges where it lights, in man or beast;
Or hunts without, till ready limbs it find,
And actuates those according to their kind;
From tenement to tenement is tost,
The soul is still the same, the figure only lost:
And as the soften'd wax new seals receives,
This face assumes, and that impression leaves;
Now call'd by one, now by another name,
The form is only chang'd, the wax is still the same;
So death, thus call'd, can but the form deface,
Th' immortal soul flies out in empty space,
To seek her fortune in some other place."

DRYDEN.

This doctrine Pythagoras probably learned in Egypt, where it was commonly taught. Nor is there any sufficient reason for understanding it, as some have done, symbolically.

Among the symbols of Pythagoras, recited by Jamblichus and others, are the following: Adore the sound of the whispering wind. Stir not the fire with a sword. Turn aside from an edged tool. Pass not over a balance. Setting out on a journey, turn not back, for the furies will return with you. Breed nothing that hath crooked talons. Receive not a swallow into your house. Look not in a mirror by the light of a candle. At a sacrifice, pare not your nails. Eat not the heart, or brain. Taste not that which hath fallen from the table. Break not bread. Sleep not at noon. When it thunders, touch the earth. Pluck not a crown. Roast not that which has been boiled. Sail not on the ground. Plant not a palm. Breed a cock, but do not sacrifice it, for it is sacred to the sun and moon. Plant mallows in thy garden, but eat them not. Abstain from beans.

The precept prohibiting the use of beans, is one of the mysteries which the ancient Pythagoreans never disclosed, and which modern ingenuity has in vain attempted to discover. Its meaning was probably rather dietetic, than physical, or moral. But enough of these enigmatical trifles. Pythagorean precepts of more value are such as these: Discourse not of Pythagorean doctrines without light. Above all things govern your tongue. Engrave not the image of God in a ring. Quit not your station without the command of your general. Remember that the paths of virtue and of vice resemble the letter Y. To this symbol Persius refers, when he says,

" Et tibi quæ Samios diduxit litera ramos,
Surgentem dextro monstravit limite collem."

" There has the Samian Y's instructive make
Pointed the road thy doubtful foot should take;
There warn'd thy raw and yet unpractis'd youth,
To tread the rising right-hand path of truth."

Brucker's Hist. Philos. by Enfield, vol. i. b. 2. c. 12.

After the death of Pythagoras, the care and education of his children, and the charge of his school, devolved upon Aristæus of Crotonia, who, having taught the doctrine of Pythagoras 39 years, was succeeded by Mnesarchus, the son of Pythagoras. Pythagorean schools were afterwards conducted in Heraclia by Clinias and Philolaus; at Metapontum by Theorides and Eurytus; and at Tarentum by Archytas, who is said to have been the eighth in succession from Pythagoras. The first person who divulged the Pythagorean doctrine was Philolaus; see his article.

PYTHAGORIC ABACUS. See ABACUS and TABLE.

PYTHAGORIC *Sect*, or *Italic School*. See PYTHAGOREANS.

PYTHAGORIC *Tetractys*. See TETRACTYS.

PYTHAGORIC *Theorem*, or *Proposition*, is the 47th of the first book of Euclid. See TRIANGLE and HYPOTHENUSE.

PYTHEAS, in *Biography*, an ancient mathematician, astronomer, and geographer, was a native of the Greek colony of Marseilles, in Gaul, and flourished in the time of Aristotle and Alexander the Great. He contributed to the improvement of science by accounts which he wrote of his travels and voyages, and other works. To him is attributed a book, entitled γῆς περίοδος, or the circuit of the earth; and in the abridgement of Artemidorus the Ephesian, he is placed in the number of those who have written a "Periplus

"Periplus of the World;" and he is supposed to have written a treatise "De Oceano:" none of these pieces have reached modern times, though some of them were extant in the fourth century. From fragments collected out of Strabo, it appears that Pytheas introduced into them, as the testimony of others, a number of marvellous and incredible circumstances, which drew on him the censure of that author and Polybius. The last named author maintained it to be utterly impossible for a private person, who was even in want, to have travelled so far as he pretended to have done by sea and land. He, however, probably visited all the countries of Europe that are situated upon the ocean, discovered the island of Thule, or Iceland, and penetrated a considerable distance into the Baltic. This fact has been proved by Gassendi, who shews, that Pytheas was well acquainted with the northern countries, and accurately marked the distinction of climates, by the difference which he observed in the length of the days and nights in different latitudes. He also attempts to prove that Eratosthenes and Hipparchus improved their geographical works by availing themselves of the labours of Pytheas, without due acknowledgments of their obligations. There is no doubt that Pytheas was a skilful observer of the heavens, for he taught that there is no star in the precise situation of the pole, and he rendered himself famous among astronomers, by being the first calculator of the meridian altitude of the sun at the summer solstice at Marseilles. This fact he ascertained by erecting a gnomon of a given height, and finding the proportion between that height and the length of the meridian shadow. The result was found to correspond exactly with that of an observation made by Gassendi, at the same place, in the year 1636. To obviate such objections as that advanced by Polybius against the reality of Pytheas' voyages, it has been said, that he probably was furnished with the means of prosecuting them at the public expence. For as the republic of Marseilles was then powerful at sea, largely engaged in commercial pursuits, and sent Euthymenes to make such discoveries in the southern parts of the world, as might lead to the extension of its trade, it seems very probable, that Pytheas was dispatched on the public account into the northern regions for the same purposes.

PYTHEUM, in *Ancient Geography*, a town of Macedonia, in the country of the Pelasgioites. Ptolemy places it between Azorium and Gonnus.

PYTHIA, or PYTHIAN, in *Antiquity*, the priestess of Apollo, by whom he delivered oracles. See DELPHOS.

She was thus called from the god himself, who was entitled *Apollo Pythius*, from his slaying the serpent Python; or, as others will have it, απο τȣ πυθεσθαι, because Apollo, the sun, is the cause of rottenness; or because the carcase of Python was left there to putrefy; or, according to others, from πυνθανομαι, *I enquire*, because people went to hear and consult his oracles.

This priestess was to be a pure virgin. She sat on the covercle, or lid, of a brazen vessel, mounted on a tripod; before she ascended which, after fasting three days, she used to wash her whole body, and especially her hair, in Castalio, a fountain at the foot of Parnassus, where the poets, men inspired by the same deity, used to wash, and drink; and thence, after shaking the laurel-tree that grew by it, and sometimes eating the leaves, which were supposed to conduce to inspiration, and were succeeded by a violent enthusiasm, she delivered her oracles, or rather explained those of the god; *i. e.* she rehearsed a few ambiguous and obscure verses, which were taken for oracles. The oracle being pronounced, she was taken down from the tripod and conducted back to her cell, where she continued for several days, to recover herself from the violent agitation and conflict. Lucan informs us, that speedy death was frequently the consequence of her enthusiasm. See ORACLE.

Diodorus Siculus (lib. xvi.) informs us, that these priestesses were at first virgins, but that after one of them was deflowered by Echecrates, a Thessalian, choice was made of women above fifty years of age; that so they might either be secured from the attempts of lust, or if they should at any time be forced to the violation of their chastity, having passed the time of child-bearing, they might remain undiscovered, and not bring the oracles or religion into contempt; nevertheless they wore the habit of virgins, thereby to signify their purity and virginal modesty.

All the Pythiæ did not seem to have had the same talent at poetry, or to have memory enough to retain their lesson.

Plutarch and Strabo make mention of poets, who were kept in pay, as interpreters of Jupiter, &c.

PYTHIA, or PYTHIAN *Games*, were solemn games instituted in honour of Apollo, and in memory of his killing the serpent Python with his arrows.

The Pythia were celebrated in Macedonia, in a place called *Pythium*. They were next in fame after the Olympic games, but were more ancient than they; for it is pretended they were instituted immediately after the defeat of the serpent. The Pythia were also celebrated at Delphi; and they were these that were the most renowned. Their first founder, and the precise time of their institution, are not known.

The Pythian games, according to Pausanias, were first instituted by Jason or Diomedes, king of Etolia, and restored by Eurylochus of Thessaly, in the third year of the 48th olympiad, or the year of the world 3364, and 584 years before the birth of Christ; from which time the Greeks reckoned sometimes by Pythiades, as they had been accustomed to do by Olympiads. They were at first celebrated every eight years, but afterwards every four years, in the third year of each olympiad; so that the pythiade, which was a term of four years, served as an epocha for the inhabitants of Delphi. At first they consisted of poetical and musical contests, but in process of time they consisted of the other exercises of the pancratium, which were performed in the Olympic games. The victors were crowned with branches of laurel; though, at the first institution, the crown was of beech-leaves. The Romans are said to have adopted these games in the year U.C. 642, and to have given them the name of Apollinares ludi.

A part of Pindar's poems was composed in praise of the victors in the Pythian games. See GAMES.

The critics are divided on the subject of the serpent Python. The poets say, that Juno made use of it to persecute Latona, and prevent her bringing into the world Apollo and Diana, whom she had conceived of Jupiter; and that it was for this reason that Apollo afterwards killed it.

Strabo says, it was no other than a famous villain, one Draco, that Apollo freed the world from. Dickinson, in his "Delphi Phœnicizantes," maintains the Python of the Greeks to be the Typhon of the Phœnicians; and the Typhon of the Phœnicians to be the Og of Scripture; and Apollo, who slew it, he will have to be Joshua. See TYPHON.

PYTHON, in *Ancient Geography*, a name anciently given to the city of Delphi.

PYTHOPOLIS, a town of Asia Minor, in Bithynia, on the river Soloonte, according to Plutarch, founded by Theseus.

Thefeus.—Alfo, a town of Afia Minor, in Caria; afterwards called Niffa.—Alfo, a town of Afiatic Myfia.

PYULCON, from πυον, *pus*, and ἑλκω, *to draw*, an old furgical inftrument anciently employed for drawing the matter out of finufes.

PYURIA, in *Medicine*, from πυον, *pus*, and ουρον, *urine*, a term ufed by Sauvages and others to denote all purulent and mucous difcharges from the bladder. See CATARRHUS *Veficæ*.

PYXIDANTHERA, in *Botany*, from πυξις, *a box*, and ανθηρα, *an anther*, becaufe, according to Michaux, each cell of the anthers opens by a fort of lid; fee DIAPENSIA, to which genus the plant in queftion is referred by Mr. Purfh, in his *Fl. Amer. Sept.* v. 1. 148, under the name of *D. cuneifolia*, after Mr. Salifbury.

PYXIS NAUTICA, in *Navigation*, the feaman's compafs. The word πυξι literally fignifies *a box*.

PYXIS, among *Anatomifts*, is alfo ufed for the cavity of the hip-bone. See ACETABULUM.

PYXIS, a fmall metal cafe for containing the confecrated fpecies in the Catholic church. Anciently it was made in the form of a dove and fufpended over the altar.

PYXUS, in *Ancient Geography*, a fmall river of Italy, in Lucania; which took its rife northward towards Sontia, and running fouthward difcharged itfelf into a gulf of the fame name, E. of Pyxus, or Pyxuntum.

PYXUS, or PYXUNTUM, *Poli-Caftro*, a town of Italy, belonging to Lucania, fituated at the bottom of a fmall gulf, E. of a fmall river of the fame name. It was founded by Mirathus, prince of Zanele and Rhegium, in the year 471 B.C. It became a Roman colony in the year 194 before the fame era.

PYXUS *Promontorium*, a fmall cape of Italy, E. of a peninfula of Laconia, which had on the W. the promontory Palinurum. This promontory is found at the entrance of a fmall gulf of the fame name.

PZINENIN, in *Geography*, a town of Bohemia, in the circle of Boleflau; 12 miles E. of Jung-Buntzel.

Q.

Q, A confonant, borrowed from the Latin or French, for which the Saxons generally ufed cp, *cw*; and the fixteenth letter of the alphabet.

The name of this letter is *cue*, from *queue*, Fr. *tail*; its form being that of an O with a tail.

The Q has this peculiar to it, that it is always followed by an U, and is therefore reckoned among the mutes.

The Q is formed from the Hebrew, ק, *koph*; which moft other languages have borrowed; though fome of them have rejected it again, particularly the Greeks, who now only retain it as a numeral character, called κοππα επισημον.

In effect, there is that refemblance between the Q and the C, in fome languages, and the K in others, that many grammarians, in imitation of the Greeks, banifh the Q as a fuperfluous letter. Papias even affirms, that all the Latin words now wrote with a Q, were written among the ancient Romans with a C; but we want better authorities for this. For, though that may hold in many cafes, infomuch that fome write indifferently *quur*, or *cur*; *cum*, or *quum*; *quotidie*, or *cotidie*, &c. yet it does not thence follow, that they ever wrote *cis*, *cæ*, *cid*, for *quis*, *quæ*, *quid*. What infcriptions authorize fuch a reading?

Far from this, the ancients fometimes fubftituted Q for C; and wrote *quojus*, *quoi*; for *cujus*, *cui*, &c.

Varro, however, and fome other grammarians, as we are told by Cenforinus, &c. would never ufe the Q. The truth is, its ufe or difufe feems to have been fo little fettled, and agreed on, that the poets ufed the Q or C indifferently, as beft fuited their meafures; it being a rule, that the Q joined the two following vowels into one fyllable; and that the C imported them to be divided.

Hence it is, that Lucretius ufes *cuiret* for three fyllables, in lieu of *quiret*; *acua*, for *aqua*; and that Plautus ufes *relicuum*, for *reliquum*; as in *quod dedi, datum non vellem relicuum non*; where the *cuum* muft be two fyllables, otherwife the trochiac verfe will be lame of a foot.

In the French, the found of the Q and K are fo near akin, that fome of their niceft authors think the former might be fpared. Ramus adds, that, till the eftablifhment of royal profeffors in the univerfity of Paris, under Francis I. they always ufed Q in the Latin the fame as in the French; pronouncing *kis*, *kalis*, *kantus*, &c. for *quis*, *qualis*, *quantus*. See K.

Some very learned men make Q a double letter, as well as K and X. According to them, Q is evidently a C and U joined together. It is not enough that the found is the fame, but they fee the traces of the C U in the figure of the Q; the V being only laid obliquely, fo as to come within the cavity of the C; as C<.

To confirm this, they fay the ancients wrote *qi*, *qæ*, *qid*. Though Jof. Scaliger, Littleton, &c. think this is no proof of the point; for in Gruter's infcriptions we find not only the Q, but alfo the C, put for Q U; as *Cintus*, *Quintus*; *ficis* for *fiquis*, &c. Yet nobody ever imagined the C a double letter.

Q, among the *Ancients*, was a numeral letter, fignifying 500; as in the verfe,

"Q velut A cum D quingentos vult numerare."

A dafh over it, as $\overline{Q}$, denoted it to fignify five hundred thoufand.

Q is alfo ufed as an abbreviature in feveral arts. *Q. pl.* in phyficians' bills, ftands for *quantum placet*, or *quantum vis*, as much as you pleafe of a thing; *q. f.* for *quantum fufficit*, or as much as is neceffary.

Q, in the proper names of the Romans, fignifies Quintus, or Quintius. Upon the French coins this letter denotes that they were ftruck at Perpignan.

Q seems the initial of no word in *Music*, except in old madrigals, where it frequently is placed at the top of the page for *quinta pars*, the fifth part, in a polyphonic composition.

Q. D. is frequently used, among *Grammarians*, &c. for *quasi dictum*, as if it were said, &c. or as who should say.

Q. E. D. among *Mathematicians*, signifies *quod erat demonstrandum*, which was to be demonstrated.

Q. E. F. *quod erat faciendum*, which was to be done.

QUAB, in *Ichthyology*, the name of a Russian fish, which some report to be at first a tadpole, then a frog, and at last a fish. Dr. Mounsey, who made many enquiries concerning these pretended changes, apprehends that they are all fabulous. He had an opportunity of seeing the fish itself, and found that they spawned like other fishes, and grew in size, without any appearances to justify the report. He adds, that they delight in very clear water, in rivers with sandy or stony bottoms, and are never found in standing lakes, or in rivers passing through marshy or mossy grounds, where frogs choose most to be. Phil. Trans. vol. xlv. p. 175.

QUABES, in *Geography*, a people of Africa, in the interior country between Rio Sestos and Sierra Leona, inhabiting the southern banks of the river Sestos. They had been formerly conquered by Flansire, king of Folgia; but having thrown off their subjection, they have since remained a free people, though under the protection of the emperor of Monou, or Manou; which empire is called by English geographers, and also by M. d'Anville, Mendi Manow.

QUACHA, or QUAGGA, in *Zoology*. See EQUUS.

QUACHILTO, in *Ornithology*, the name of a very beautiful Brasilian bird, of the moor-hen kind, called also *yacacintli*, and *porphyrio Americanus*. It is the FULICA *Purpurea*, (which see); and is of a fine blackish purple colour, variegated with white; its beak is white while young, but becomes red as it grows older, and has a naked space at its basis, resembling, in some sort, the coot; its legs are of a yellowish-green; it lives about the waters and feeds on fish, yet is a very well-tasted bird. It imitates the crowing of a common cock, and makes its music early in the morning. Marggrave's Hist. Brasil.

QUACHY, in *Zoology*, a name given to the *Coati*, or VIVERRA *Nasua*; which see.

QUACK, in *Medicine*. See EMPIRIC.

QUACKENBRUCK, in *Geography*, a town of Westphalia, in the bishopric of Osnabruck, situated on the river Hase, which runs through it in seven streams, that unite in two below the town; 20 miles N. of Osnabruck. N. lat. 52° 42′. E. long. 8° 3′.

QUADIANS, QUADI, in *Ancient Geography*, a people of Germany, whose territories extended from the Danube to Moravia, and the northern part of Austria. They are comprehended by some writers under the ancient name of Suevi, part of whom forced their way into Spain, and formed a kingdom there. Their country is at present known by the name of Moravia; for it extended from the mountains of Bohemia to the river Marus, now the March, and consequently comprised that province. Ptolemy mentions the following cities in the country of the Quadians; *viz.* Eburodunum, Eburum, Medoslanium, and Celemantia, now, according to Cluverius, Brin, Olmutz, Znaim, and Kalminz. The Quadians were a warlike people, had kings of their own, and agreed in customs, manners, and religion, with the other German nations. They, without doubt, joined their countrymen against Lollius, Germanicus, Caius, and Galba, who attempted to reduce Germany, and to subdue the several nations which inhabited that extensive country. The emperor Domitian marched against them, but was defeated by the Marcomans, and put to flight. The Quadians submitted to the emperor Titus Antoninus, and it appears by his coins, supposed to have been struck about the year 139, that they acknowledged, as sovereign, a king appointed by that prince. They joined the Marcomans, in the famous war made by that people on the empire under the reign of Marcus Aurelius; but being reduced to great distress they sent ambassadors to sue for peace, and with them they restored all the Roman deserters, and about 13,000 prisoners, whom they had taken during the war. They thus obtained peace, upon condition, that they should not traffic, for the future, within the Roman dominions, nor settle within six miles of the Danube; but, disliking these conditions, they again joined the Marcomans, and renewed the war. In the prosecution of this contest, which was long and sanguinary, they were totally defeated; their king Ariogeses was taken prisoner; but the emperor spared his life, confining him to the city of Alexandria, the metropolis of Egypt. The Quadians, however, seem to have continued in arms till the reign of Commodus, who granted them peace upon the following terms: that they should keep at the distance of five miles from the Danube;—that they should surrender their arms, and supply the Romans with a certain number of troops when required;—that they should assemble but once a month in one place, and in the presence of a Roman centurion;—and that they should not make war upon the neighbouring nations without the consent of the people of Rome. In the year 214, the king of the Quadians was Gaiobomar, who was assassinated by order of Caracalla. In the 4th year of the reign of the emperor Valerian, the Quadians joined the Sarmatians, and invading Illyricum, ravaged that province; but they were defeated by Probus, then tribune of a legion, and afterwards emperor. In the year 260, the 7th of the emperor Gallienus, they made a sudden irruption into Pannonia, but they were expelled, without their booty, by Regillianus. Upon the death of Probus, who had kept the barbarians in awe, A.D. 283, the Quadians, in conjunction with the Sarmatians, broke into Illyricum and Thrace, and having ravaged those provinces, and advancing towards Italy, they were met by Carus, the successor of Probus, on the borders of Illyricum, and totally defeated; 16,000 being killed on the spot, and 20,000 being taken prisoners. In the 19th year of the emperor Constantius, the Quadians made an irruption into Pannonia and Mœsia; and having pillaged both provinces, returned home with an immense booty. They returned again in two years, and laid waste Valeria. Constantius was provoked by these invasions, and leaving Milan, advanced to the confines of the Quadians, and conferred with their chiefs, who excused past hostilities, and promised, for the future, to live in peace and amity with the emperor. They soon, however, forgot their promise; and in the following year joined the Sarmatians, and laid waste a great part of Pannonia and Mœsia: but at the approach of Constantius, they repassed the Danube, and returned home. The emperor determining to punish them for their treachery, passed the Danube on a bridge of boats, and began to destroy their country. The Quadians, unable to resist, sued for peace, and obtained it, upon delivering up hostages, and setting at liberty all the prisoners they had taken. In the year 374, their king Gabinius being treacherously murdered by Marcellianus, duke of Valeria, they crossed the Danube in the utmost rage, and falling upon the reapers, in harvest time, killed the greatest number of them, laid waste the country, and took many captives. They afterwards followed Equitius, general of the troops in Illyricum, who had been acceffory to the murder of their king, into Valeria, and committed dreadful devaftations in the countries through which they paffed. In their way they met with two legions, the Pannonian and Mœfian, who had been fent to oppofe them, and taking advantage of a conteft which fubfifted among them about precedency, they cut them both in pieces. In this irruption the Quadians had been joined by the Sarmatians; but the latter were defeated with great flaughter by Theodofius. then duke of Mœfia, and afterwards emperor. Againft the Quadians Valentinian I. marched in perfon; and having made great preparations for his propofed expedition into their country, he took the field; paffed the Danube at Acinium, now Gran, or Buda, in Lower Hungary, entered the enemy's country, and deftroyed it with fire and fword. At length, the Quadians fued for peace; but whilft the emperor was fpeaking to the meffenger with great warmth, and threatening to extirpate their whole nation, he fell to the ground in a fit, and foon afterwards expired. Upon his death a treaty was concluded with the Quadians. Their reftlefs fpirit and difpofition for war manifefted themfelves again in the year 379, when they invaded Illyricum; but they were driven out, with fome lofs, by the emperor Gratian. In 407 they entered Gaul with the other barbarians, over-ran its provinces, and committed dreadful ravages. From this time no farther mention is made of the Quadians; fo that they were either fubdued, or utterly extirpated by the Goths, who had fettled in Pannonia and Illyricum. Anc. Un. Hift. vol. xvii.

QUADRA, in *Building*, any fquare border, or frame, encompaffing a baffo-relievo, pannel, painting, or other work.

The word is alfo ufed, erroneoufly, for a frame or border, of any other form; as round, oval, or the like.

Quadra and Vancouver's *Ifland*, in *Geography*, a name given to the ifland of Nootka, in compliment to fignor Quadra, the Spanifh commander at Nootka Sound, and captain Vancouver, who expected to obtain poffeffion of the fettlement in the year 1792. See Nootka, and Nootka *Sound*.

QUADRAGESIMA, a term fometimes ufed for the time of Lent, becaufe confifting of forty days.

Hence fome monks are faid to lead a quadragefimal life; or to live on quadragefimal food all the year.

Quadragesima *Sunday* is the firft Sunday in Lent; fo called becaufe it is about the fortieth day before Eafter.

On the fame account, the three preceding Sundays are called Quinquagefima, Sexagefima, and Septuagefima.

QUADRAGESIMALS, Quadragesimalia, denote Mid-lent contributions, or offerings.

It was an ancient cuftom for people to vifit their mother-church on Mid-lent Sunday, and to make their offerings at the high altar; and the like was done in Whitfun-week. But as thefe latter oblations, &c. were fometimes commuted for by a payment of pentecoftals, or Whitfun-farthings; fo were the former alfo changed into a cuftomary payment, quadragefimals, denarii quadragefimales; and fometimes Letare, Jerufalem, from a hymn fo called, fung on that day, beginning "Jerufalem, mater omnium," &c.

QUADRANGLE, in *Geometry*, a quadrangular, or quadrilateral figure; or a figure which has four fides, or four angles.

To the clafs of quadrangles, or quadrangular figures, belong the fquare, parallelogram, trapezium, rhombus, and rhomboides.

A fquare, &c. is a regular quadrangle; a trapezium, an irregular one.

Quadrangular figures are not proper for fortification; the flanks, and flanked angles, being too fmall.

QUADRANGULARIS Piscis, the *Square-fifh*, in *Ichthyology*, the name of a fifh, which, in its moft ufual fize, is about fifteen inches long, four inches high in the middle, and three inches and a half over; the forehead is fquare, a little hollow, and, by the eminence of the eye-brows, two inches and a half over; the nofe blunt, and not very fteep, with two holes in the place of noftrils, and the mouth very fmall; the back is a little convex toward the tail, and on the fides a little obtufely angled; as is alfo the belly, which is plain and flat, and a little rifing toward the tail; it has five fins, two near the gills, two near the tail, and the tail-fin, which is confiderably long. Part of the head and tail are covered with a foft fkin, the reft of the body with a kind of cruft, adorned all over with little round knots, reduced for the moft part into hexagonal figures, and fubdivided into equilateral triangles. Grew, Muf. Reg. Sac. p. 110.

QUADRANS, in *Antiquity*, the fourth part of the *as*, or pound. See As.

Quadrans, in our *Cuftoms*, is the fourth part of a penny, or a farthing.

QUADRANT, Quadrans, in *Geometry*, an arc of a circle, containing 90 degrees, or one-fourth of the entire periphery.

Sometimes, alfo, the fpace, or area, included between this arc and two radii, drawn from the centre to each extremity thereof, is called a quadrant, or, more properly, a quadrantal fpace; as being a quarter of the entire circle.

Quadrant alfo denotes a mathematical inftrument, of great ufe in navigation and aftronomy, for the taking of altitudes, angles, &c.

The quadrant is varioufly contrived, and furnifhed with different apparatus, according to the feveral ufes for which it is intended; but they have all this in common, that they confift of a quadrant, or quarter of a circle, whofe limb is divided into 90 degrees; and that they have a plummet fufpended from the centre; and are furnifhed with pinnulæ or fights, through which to look.

Quadrant, *the Common*, or *Surveying*, (reprefented *Plate* VI. *Surveying*, *fig.* 13.) is made of brafs, wood, or other matter, ufually twelve or fifteen inches radius. Its circular limb is divided into 90°, and each of thofe fubdivided into as many equal parts as the fpace will allow, either diagonally or otherwife. On one edge, or femi-diameter, are fixed two immoveable fights; and in the angle, or centre, is hung a thread, with a plummet. To the centre is likewife, fometimes, fixed a label, or moveable index, bearing two other fights, like the index of a telefcope. And, in lieu of the immoveable fights, there is fometimes fitted a telefcope; though this more peculiarly belongs to the aftronomical quadrant.

On the under fide, or face, of the inftrument, are fitted a ball and focket; by means of which it may be put in any pofition, for ufe.

Befides the effentials of the quadrant, there is frequently added on the face, near the centre, a kind of compartiment, called the *quadrat*, or *geometrical fquare*; as in the figure: this, in fome meafure, making a diftinct inftrument of itfelf. See its defcription and ufe under the article Quadrat.

The quadrant is to be ufed in different fituations, according to the dimenfions to be taken. To obferve heights and depths, its plane is difpofed at right angles to the horizon; but to take horizontal diftances, the plane is difpofed parallel to it.

Heights and diftances, again, may be taken two ways;

viz. by means of the fixed fights and plummet, and by the label.

QUADRANT, *Ufe of the Surveying. To take the height or depth of an object with the fixed fights, and plummet.*—Place the quadrant vertically, and the eye under the fight next the arc of the quadrant: thus direct the inftrument to the object, *e. gr.* the top of a tower, till the vifual rays of it ftrike through the fights upon the eye.

This done, the portion of the arc intercepted between the thread and the femidiameter, on which the fights are faftened, fhews the complement of the object's height above the horizon, or its diftance from the zenith; and the other portion of the arc intercepted between the thread and the other femidiameter, fhews the height itfelf of the object above the horizon.

The fame arc likewife gives the quantity of the angle made by the vifual ray, and a horizontal line, parallel to the bafe of the tower.

Note, to obferve depths, the eye muft be placed over that fight next the centre of the quadrant.

From the height or depth of the object in degrees thus found, which fuppofe 35° 35′; and the diftance of the foot of the object from the place of obfervation carefully meafured, which fuppofe 47 feet; its height or depth in feet, yards, &c. is eafily determined by the moft common cafe in trigonometry.

For we have here, in a triangle, one fide given, *viz.* the line meafured, and we have all the angles; for that of the tower is always fuppofed a right angle: the other two, therefore, are equal to another right angle; but the angle obferved is 35° 35′, therefore the other is 54° 25′.

The cafe, then, will be reduced to this: as the fine of 54° 25′ is to 47 feet, fo is the fine of 35° 35′ to a fourth term, *viz.* $33\frac{1}{2}$ feet; to which add the height of the obferver's eye, fuppofe 5 feet; and the fum, $38\frac{1}{2}$ feet, is the height of the tower required.

QUADRANT, *the farther ufe of the, in taking of altitudes of objects, both acceffible and inacceffible,* fee under the article ALTITUDE.

QUADRANT, *Ufe of the, in taking heights and diftances by the index and fights.*—To take, *e. gr.* a height, as that of a tower whofe bafe is acceffible; place the plane of the inftrument at right angles to the plane of the horizon, and one of its edges parallel to it, by means of the plummet, which, in that cafe, will hang down along the other. In this fituation turn the index, till, through the fight, you fee the top of the tower; and the arc of the limb of the quadrant between that fide thereof parallel to the horizon and the index will be the height of the tower in degrees; whence, and from the diftance meafured as before, its height in feet, &c. may be found by calculation, as in the former cafe: or, without calculation, by drawing from the data, on paper, a triangle fimilar to the great one, whofe bafe is the diftance; and its perpendicular, meafured on the fcale, is the height of the tower.

QUADRANT, *Ufe of the, in meafuring horizontal diftances.*—Though the quadrant be a lefs proper inftrument for this purpofe than a theodolite, femicircle, or the like, becaufe angles greater than quadrants cannot be taken by it, yet neceffity fometimes obliges perfons to have recourfe to it.

The manner of its application is the fame with that of the femicircle; all the difference between the two inftruments confifting in this, that the one is an arc of 180°, and can therefore take an angle of any quantity; and the other is only an arc of 90°, and is therefore confined to angles of that quantity. See, therefore, SEMICIRCLE.

QUADRANT, in *Aftronomy,* is an inftrument by which the altitude of a heavenly body is meafured, and is compofed of one-quarter, or one-eighth of a circle, accordingly as the meafurement is made by means of direct vifion, or by the reflected image of the object to be viewed. When a fufpended circle was made ufe of with revolving fights, called an aftrolabe, the accuracy of an obfervation could never be depended on, partly becaufe the radius was fmall, and partly becaufe the inftrument vibrated when fufpended by the hand, and was otherwife inconvenient to ufe, as well as liable to have its equipoife difturbed by the various pofitions of the index and fights: therefore, fuch a portion of the circle was adopted as was competent to meafure the greateft poffible altitude, and an increafe of radius was thereby obtained, which promifed to contribute to accuracy, without affecting the portability of the inftrument. But though the conftruction was varied by different ingenious men, the quadrant was but little, if at all, conducive to the improvement of nautical or of aftronomical fcience, till the application of telefcopic fights, and an improved mode of graduating the limb, together with the addition of a vernier fcale, gave it powers on which the mariner and aftronomer could confide. Quadrants have been conftructed of different materials, fuch as wood, ivory, brafs, &c. and of various dimenfions, agreeably to the ufes for which they were intended, in order to accommodate purchafers of every denomination; but as it is not our province to notice every plaything that has ufurped the appellation of quadrant, we will confine our account to fuch inftruments chiefly as have been of actual fervice in navigation and aftronomy. We have, however, already anticipated the hiftory, we might here have introduced, of the various improvements fucceffively made in quadrants, at the beginning of our article CIRCLE; and under the article GRADUATION we have given, at confiderable length, the different methods of dividing and fubdividing aftronomical inftruments in general; to which articles we beg to refer our readers, who wifh for information on thofe points, and which may be read in conjunction with our prefent article.

Our arrangement of quadrants will be moft fyftematic, if we divide them into two claffes, *viz.* thofe which meafure altitudes by direct vifion, and thofe which determine meafurements in all directions, vertically, horizontally, and obliquely, by means of reflection. The former clafs have been found ufeful in aftronomy chiefly, and the latter in navigation, where the motion of a fhip interferes with the fteadinefs of any fixed pofition of an inftrument.

The firft quadrant, in its rude ftate, was probably a quarter of the aftrolabe enlarged, with fixed fights placed in, or parallel to, the vertical line paffing through zero; and a fine thread, or wire, ftretched by a plummet, indicated the altitude on the divided limb, according to the reprefentation in *fig.* 4. of *Plate* I. of *Aftronomical Inftruments.* This conftruction might be ufed in obfervations of the fun, without injuring the eye of the obferver, by allowing the folar ray to pafs through the firft fight-vane, or hole, fo as to fall on the fecond, at fome diftance from the former, while the thread refted nearly in contact with the elevated limb; but the want of minute, and at the fame time accurate fubdivifions, and the fenfible thicknefs of the thread, were impediments to accuracy that did not admit of remedy, until another mode of reading the altitudes was devifed, and until a method was contrived of rendering the light of the fun tolerable to the eye of an obferver. The former of thefe defiderata was accomplifhed firft by diagonal fcales, with a fiducial edge of an index, and afterwards by that admirable contrivance, fometimes called a Nonius, but more properly denominated a Vernier, from the name of its inventor;

ventor; the latter was effected by femi-opaque glafs, introduced at firft without, but afterwards, with better effect, with telefcopic fights; at the fame time, enlarging the vifual angles fubtended by the fun, and yet diminifhing the intenfity of his light by a partial tranfmiffion through the fmoaked or coloured glafs.

Davis's Quadrant, or Back-Staff.—In the year 1590, captain John Davis, a native of Sandridge, near Dartmouth, previoufly to his failing into the South feas under the command of Mr. Cavendifh, contrived that inftrument, which is reprefented in *fig.* 2. of *Plate* I. of *Aftronomical Inftruments*, and which has been called the *Englifh quadrant*, or *back-ftaff*. This inftrument difpenfed with the ufe of the plumb-line, and confequently was better adapted to nautical purpofes than the old quadrant, or than the fore-ftaff, that preceded it; but wanted the telefcopic fights, which have given fubfequent inftruments the advantage over it. It was, however, probably the firft quadrant in which the horizon was ufed as one of the objects in a back obfervation, and from which the reflecting inftruments afterwards borrowed an ufeful principle, where altitudes are concerned; though it was in the ufe of the *fore-ftaff*, (defcribed under our article CIRCLE,) that the horizon was firft made one of the extreme limits of an altitude, taken by a forward obfervation. Captain Davis found that pear-tree anfwered very well as the material on which his inftrument was conftructed, and an ingenious arrangement of two divided arcs and three vanes conftituted his plan, according to the following defcription. The vane at A was called the horizon-vane; the one feen at B the fhade-vane, becaufe its fhadow fell on the horizon-vane during the inftant of completing an obfervation; and the third, at C, was denominated the fight-vane, by reafon of its being the vane to which the eye was applied in taking an obfervation. The arc of fmaller radius, D E, contained 60°, and the other, F G, of larger radius, contained only 30°, in continuation of the former, making together the whole quadrant. The arc D E was divided into whole degrees only, on account of the fmallnefs of its radius; but the arc F G had its degrees fubdivided by concentric and diagonal lines, as feen in the figure. The manner of afcertaining the altitude of a heavenly body, by the joint ufe of thefe two arcs, is not obvious at firft fight of the inftrument, but may be thus explained. When the altitude of the fun is taken, the horizon-vane is fitted to the extreme end or centre A of the quadrant, and the fhade-vane B is put to within about 10° or 15° of the fuppofed co-altitude, but to a lefs quantity than the co-altitude, while the fight-vane remains for adjuftment on the arc F G. Things being in this ftate, the back of the obferver is turned to the fun, and the quadrant is fo elevated, that the fhadow of the upper edge of the fhade-vane B falls upon the upper edge of the flit in the horizon-vane A, when viewed through the fmall hole in the fight-vane. If now, in this fituation, the horizon is feen through the faid flit, the obfervation is exact; but if not, the fight-vane is moved backwards or forwards on the arc F G, accordingly as the fky or fea is feen, till the horizon appears in its place, while the fhadow of the fhade-vane refts on the required fituation in the flit of the horizon-vane, and then the obfervation is finifhed; and the fum of the two readings on the refpective arcs, B and C, as read by the fiducial edges of the vanes, is the co-altitude or zenith diftance of that limb of the fun, upper or lower, which was obferved from the correfponding limb of the fhadow. If a lens, of a focal length equal to the radius of the fmaller arc, were ufed, the focal luminous point occafioned thereby would be a better object to meafure the place of, than a fhadow with an edge not fufficiently defined. This inftrument, it fhould feem, was not capable of taking the altitude of a ftar or planet, nor of the moon, unlefs her difc was large enough at the time to project a fhadow.

Elton's Quadrant.—An index bearing a fpirit-level, with a vernier-fcale near the fight-vane, was added to the quadrant of Davis fome time afterwards, by one Elton, the ufe of which was to take altitudes *without an horizon;* but the fimilarity of the two inftruments renders a more particular defcription of this addition fuperfluous. An infpection of *fig.* 8. *Plate* I. will fufficiently explain the difference.

Gunter's Quadrant.—Among the numerous and ufeful contrivances of the ingenious profeffor of aftronomy in Grefham college, was a portable quadrant, which now claims our attention, and which was contrived in, or a little before, the year 1618. The object of the inventor was not to conftruct an inftrument capable of meafuring altitudes more accurately than that of captain Davis, which we have juft defcribed, but to make a quadrant fo comprehenfive in its ufes, that, like the logarithmic fcale, which he divided, it might fhew by infpection refults, which had previoufly required long and tedious calculations; and in this point of view it is ftill to be confidered. Befides the quadrantal arc for meafuring altitudes, this inftrument has various curves ftereographically projected on it, fuch as the equator, the tropics, the ecliptic, and the horizon, on a fuppofition that the eye is fituated in one of the poles, all which are reprefented in *fig.* 3. of *Plate* XXIII. of *Aftronomical Inftruments*. The projection, according to Bion, is thus effected; when the quadrantal arc B C has been graduated, from its centre A, with a convenient radius A T, defcribe the arc T D to reprefent one of the tropics; and let the line A T be taken as the tangent of 56° 46′, or half the fun's greateft declination (fuppofed here to be 23° 32′), added to the radius or tangent of 45°; then to find the point E in this line for the equinoctial, there will be this proportion, as the tangent of 56° 46′ : 1000 :: radius : 655; and therefore, if $\frac{655}{1000}$ parts of the line A T be taken, it will be the proper radius of the arc E F, or equinoctial.

To find the centre of the occult arc E D, which reprefents the ecliptic, let the meridional line A D be fo divided by the point G, that if A F be taken as radius, A G may be the tangent of 23° 32′, the fun's greateft declination; in which cafe A G will be $\frac{431}{1000}$ of the line A F, and the occult arc E D defcribed from the point G will be one-fourth of the ecliptic, which may be divided into figns and degrees thus: as radius is to the tangent of any degree's diftance from the neareft equinoctial point, fo is the co-fine of the fun's greateft declination, to the tangent of that degree's right afcenfion; for example, fuppofing the right afcenfion of the firft point of ♉ to be 27° 54′, draw a line from A, the centre of the quadrantal arc, to this degree and minute on the faid arc, and note where it interfects the occult arc of the ecliptic, and this point will be the beginning of the fign ♉; and in like manner any other part may be inferted.

The line E T, or line of declination, may be divided thus; taking A E for the radius of the equinoctial, or tangent of 45°, let the tangents of 46°, 47°, 48°, &c. up to 68° 30′, be fucceffively taken and laid down on the line E T, and the points of excefs above the tangental point of 45° will be the dividing lines of the fcale for 1°, 2°, 3°, &c. up to 23° 32′, or greateft declination.

When the fcale of declination is finifhed, the quadrantal arc may be taken as the meafure of right afcenfions, and then the place of a ftar or any other heavenly body may be inferted on the plane of the quadrant thus; let a line be drawn

drawn from A to the degree and minute of right afcenfion, counted from B towards C, and the point in this line, where an occult arc, drawn through the declination from the centre A, interfects it, will be the place of the heavenly body in queftion.

The two parallel arcs contained between the tropic T D and the quadrantal arc B C, are the fcales of days and months, which are divided by the aid of a table of meridian altitudes of the fun for each day, calculated for the particular latitude, for which the quadrant is conftructed. It is hardly neceffary to obferve, on the conftruction of fuch table, that if the latitude and declination be both north, or both fouth, the declination muft be added to the co-latitude for the greateft altitude; but if of contrary denominations, fubtracted. The degrees and minutes contained in fuch table are transferred into the fcale of months by a line extending acrofs it from the centre A to the quadrantal arc, as before.

The centre of the horizon will be in the meridional line A C, and if a point H be taken fuch, for the co-latitude 38° 28′ for inftance, that A H may be the correfponding tangent to radius A F, then $\frac{7}{10000}$ of that radius will be its diftance from A, and the occult arc defcribed from H, with the extent H E, beginning at E in the equinoctial, and ending at the tropic T D, will be the required horizon. This horizontal arc may be divided thus; as radius is to the fine of the latitude, fo is the tangent of any number of degrees in the horizon, to the tangent of a correfponding arc in the quadrant; and from a table thus conftructed any point in the horizon may be put in by interfection of a line drawn from A to the tabular number as read on the quadrantal arc, as in the former cafes.

A third table of the fun's altitude for inferting the hour lines may be calculated thus; when the fun is in the equator, as radius is to the co-fine of the latitude, fo is the co-fine of any hour from the meridian, to the fine of the fun's altitude at that hour; but when the fun has declination, fay, as the co-fine of the hour from the meridian is to radius, fo is the tangent of the latitude, to the tangent of a fourth arc; then if the latitude and declination have like denominations, and the hour fall between noon and fix o'clock, fubtract the declination from the faid fourth arc, and the remainder will be a fifth arc; but if the latitude and declination have unlike denominations, or the hour be between fix and midnight, add the declination to the fourth arc, and the fum will be a fifth arc, which muft be thus ufed; as the fine of the fourth arc, is to the fine of the latitude, fo is the co-fine of the fifth arc, to the fine of the altitude fought. The determination of fuch table by this fundamental method is however operofe, and Margett's horary tables, which give the fucceffive altitudes in any given latitude, would greatly fhorten the labour, by giving the refults by infpection, which may at the fame time be inferted by transfers from the quadrantal arc, fimilar to thofe we have already defcribed. When the horary points are put in for each fucceffive hour, when the fun is in the equator, at each tropic, and at a few intermediate places, the horary lines may be drawn through the faid points, which will give the hour for any given day, when the inftrument is ufed as hereafter defcribed.

A fourth table, for putting in the azimuth lines, will require the fun's altitude to be calculated for each degree of azimuth, when the fun is at the equator, at each tropic, and at other intermediate places, which may be done thus: when the fun is in the equator, as radius is to the co-fine of the azimuth from the meridian, fo is the tangent of the latitude, to the tangent of the fun's altitude at the azimuth in the equator: but out of the equator the rule is, as the fine of the latitude, is to the fine of the declination, fo is the co-fine of the fun's altitude at the equator at a given azimuth, to the fine of a fourth arc. When the latitude and declination have the fame name, in all azimuths from the prime vertical to the meridian, add this fourth arc to the arc of altitude at the equator; but when the azimuth is above 90°, fubtract the altitude at the equator from this fourth arc; alfo when the latitude and declination have unlike names, fubtract the faid fourth arc from the arc of altitude at the equator, for the altitude at the propofed azimuth. The points correfponding to the tabular numbers, thus afcertained, muft be inferted by interfection of lines drawn from A, as before, to the quadrantal arc B C, and lines uniting thofe points will be the lines of azimuth for each hour in every day of the year. But to complete the inftruments, two fights or vanes muft be fixed on the meridional line A C, and a fmall plumb-line, with an adjuftable bead, muft be fufpended from the point A of the quadrant.

In addition to the lines already defcribed, Gunter's quadrant has fometimes a fquare under the angular point A, called a *quadrat*, as feen in the figure, two fides of which are divided into ten equal parts each, and thefe again fubdivided into others, the ufe of which is to meafure angular diftances; and fometimes the large fquare is fubdivided into a number of fmaller ones, for the purpofe of performing arithmetical proportions by infpection. See Bion on the Conftruction and principal Ufes of Mathematical Inftruments.

It would be tedious to enumerate all the ufes of this quadrant, and to exemplify all the problems that it is capable of performing, or rather of illuftrating (for great accuracy cannot be expected in the indication of fo fmall an inftrument); but we will fpecify a few of the moft ufeful, which may be varied by reverfing the proceffes, and by altering the data, to a great extent.

Problem I.—*To find the Sun's Right Afcenfion.*

Stretch the thread from the point A over the fun's place, as marked in the graduated ecliptic, and the degree cut by it in the quadrantal arc will give the correfponding right afcenfion.

Prob. II.—*To find the Sun's Declination.*

Stretch the thread as before, and flide the bead till it refts on the fun's place for the given day, and then turn it to the fcale of declination, where the correfponding degree will be feen under the bead.

Prob. III.—*To find the Sun's Meridian Altitude on any Day.*

Extend the thread over the day of the month given, in its proper fcale, till it reaches the quadrantal arc, and the fun's greateft altitude for that day will be indicated thereby.

Prob. IV.—*To find the Hour of the Day.*

Extend the thread over the day of the month, and, holding it there, flide the bead till it lies on the line of twelve o'clock; then elevate the quadrant fo that the folar ray may pafs through the upper fight-hole exactly upon the fecond, and allow the plummet to reft, and then the bead will indicate the hour, before or after noon, as the cafe may be. In a fimilar manner the fun's altitude may be meafured by the thread falling on the quadrantal arc, when the folar ray paffes as above defcribed.

Prob. V.—*To find the Sun's Amplitude.*

Let the bead be rectified for the given time, and be brought

brought afterwards to the horizon, while the thread remains ſtretched, and it will indicate the riſing or ſetting amplitude, as the caſe may be.

Prob. VI.—*To find the Aſcenſional Difference.*

Rectify the bead as in the laſt problem, and bring it to the horizon, in which ſituation the thread, extended to the quadrantal arc, will ſhew the aſcenſional difference in degrees, which converted into time will ſhew how much the ſun riſes before ſix in ſummer, and after ſix in winter, and conſequently will give the exact length of the given day.

Prob. VII.—*To find the Sun's Azimuth.*

Rectify the bead for the given time, and obſerve the ſun's altitude as explained in prob. 4. Then extend the thread to the complement of that altitude, and the bead will indicate the azimuth correſponding, and *vice verſâ*.

Prob. VIII.—*To find the Hour of the Night by a Star.*

Put the bead on the thread to the diſtance that will indicate the ſtar's declination, and look through the ſight for the ſtar till the plummet reſts on the plane of the quadrant, and in that ſituation the bead will ſhew, in the hour lines, the ſtar's diſtance in time from the meridian of the place; in the next place ſubtract the ſun's right aſcenſion in time from that of the ſtar, as given in ſome catalogue, and to the remainder add the obſerved diſtance from twelve o'clock in ſidereal time, and the ſum will be the hour nearly, or the approximate diſtance of the ſun from noon, which may be corrected by applying the ſun's variation of right aſcenſion ſince the preceding noon, which in every ſix hours will be about a minute.

Sutton's quadrant, and Collins's ſector on a quadrant, are very ſimilar, both in conſtruction and uſe, to the quadrant we have here deſcribed, and the dial on a card, by Ferguſon, is nearly related to it, particularly as it has been lately improved by the Rev. W. Pearſon.

Of Aſtronomical Quadrants.—The quadrants which we have hitherto deſcribed may be conſidered as by no means perfect, but as approximating only to an inſtrument, that is really uſeful in an obſervatory for determining the exact place of a heavenly body; hence the quadrant, which we propoſe next to deſcribe, has obtained the name of *aſtronomical*, from its ſuperior pretenſions to accuracy in the meaſurement of altitudes taken above the horizon, and therefore merits our more particular attention.

An aſtronomical quadrant may be either portable or fixed; in the former caſe it is uſually mounted on a tripod, with adjuſting ſcrews in the feet, and has a horizontal motion as well as a vertical one, in order that it may take altitudes in any azimuth, or be made to follow the body obſerved in its apparent path; but in the latter caſe it is fixed againſt a ſteady wall, with its plane in, or very nearly in the meridian, and is therefore denominated a *mural quadrant*.

The firſt aſtronomical quadrant, of which we have any account left us, is that which Ptolemy uſed; it was the fourth part of a circle placed faſt againſt a ſtone pier, or quadrangular log of wood, with zero of the arc in the horizontal line, and a pin of wood projecting from the central point threw a ſhadow on the limb when the ſun ſhone, which ſhadow was uſed by way of index: but it is obvious that much accuracy was not to be expected from ſuch an inſtrument, however well conſtructed or divided. We might mention here the quadrants of Tycho Brahé and Hevelius, but the former has been noticed under our article Circle, and the latter was deſtroyed in the conflagration of the owner's houſe in Dantzic. In more recent times, aſtronomical quadrants have been made on accurate principles, and with great care, eſpecially by Graham, Siſſon, Bird, Ramſden, Cary, and Troughton, ſeveral of whoſe inſtruments we will now deſcribe, as far as any difference in their conſtruction renders diſtinct accounts neceſſary. We will proceed, as we have done on former occaſions, chiefly in the order of time, which, generally ſpeaking, will be found to be alſo in the order of ſucceſſive improvements.

Mural Quadrant by Graham.—Before we proceed to deſcribe the mural quadrant, contrived and made by Graham, and fixed at the weſt ſide of the ſtone pillar in the middle room at the Royal Obſervatory at Greenwich, at the expence of king George I., and for the uſe of that eminent aſtronomer Dr. Halley, it may be proper to mention that Flamſteed, and his aſſiſtant Sharp, had previouſly uſed an arc of a circle fixed againſt a ſtone pier in the meridian, which they had themſelves conſtructed, and which was removed at Flamſteed's death. We muſt, therefore, conſider their inſtrument as having been the prototype of Graham's mural quadrant, or arc, as it has been alſo called ſometimes. In *fig.* 4. of *Plate* XXIII. of *Aſtronomical Inſtruments*, is given a repreſentation of the mural quadrant of Graham's conſtruction, which will equally repreſent that of Bird, conſtructed after the ſame model, and which is the ſame that both Dr. Smith, and Stone, the editor of Bion's work, have given in their reſpective accounts.

The body of this quadrant is compoſed chiefly of bars of iron united together, as ſeen in the figure; ſome, to form the plane of the quadrant, placed flat-ways; and others, to give ſtrength and ſtability, fixed edge-ways. Theſe bars are all of the ſame dimenſions, namely 2.9 inches wide, and 0.175 thick, and are united together by right-angled ſhort bent bars in various places, both at the interſections made by the ſides of the ſmall ſquares, and at other ſituations, ſo that while great firmneſs is obtained, great weight is avoided. The quadrantal arc is compoſed of two bars, one of iron, united to the iron frame, and the other of braſs, on which the diviſions are made, as deſcribed under our article Graduation; this braſs bar is pinned faſt to the iron one, and being more ſlender than the iron, accommodates itſelf thereto, and, as time has proved, does not alter the ſhape of the arc, as we have lately been aſſured by Mr. Troughton. The breadth of the limb is 2.2 inches, the braſs limb being more remote than the anterior edge of the iron arc by 1.2 inch, and the ſurface was planed, or rather ſcraped, by a tool fixed to a radial bar, that revolved on a vertical axis of motion, placed in the centre of the arc, and reſting with its ſuperior end in a fixed beam above the plane of the quadrant, when this plane was lying in a horizontal poſition, it being impracticable to put ſo large a body in any ordinary lathe. The original diviſions of Graham were inſerted on two ſeparate arcs, one graduated into 90° and its ſubdiviſions, and the other divided into 96 parts and its ſubdiviſions, as we have before explained in the article juſt referred to; but the diviſions, being laid down by rough dividing, are not now made uſe of, but a quadrantal arc of 96, with its ſubdiviſions, put in by Bird in 1753 between the two arcs of Graham, is that which all obſervations taken by Graham's quadrant are now referred to, and the readings are transformed into degrees, minutes, and ſeconds, by an appropriate table. The readings were at firſt obtained by a double vernier-piece carried by the teleſcope, that revolves round the centre of the arc, one ſide of which vernier-piece read with the arc 90°, and the other with the arc of 96 parts, or grand diviſions; the degree was ſubdivided into 12 parts, or 5′ ſpaces, and 10 parts on its vernier equalled 11 out of the ſaid 12 parts, ſo that

$\frac{1}{120}$

$\frac{1}{11}$ of a degree, or $5'\frac{1}{2}$, was the length of one of the vernier divifions, and $\frac{1}{11}$ of this, or 30″, was the fmalleft quantity indicated by this vernier; but on the arc of 96 grand divifions there was, as in Bird's arc, 16 equal parts, or fubdivifions, in every grand divifion, and the vernier for this arc had 17 divifions on it, occupying the fpace of 16 fubdivifions in the arc, fo that the length of this vernier was $\frac{17}{16}$ of $\frac{90^\circ}{96} = 59'.83$ nearly, and one divifion of it $\frac{59'.83}{17} = 3'.52$ nearly.

Hence in the firft vernier its number 11 is *one lefs* than its equivalent arc contains on the limb of 90°; but in the fecond, the number 17 is *one more* than its equivalent arc contains in the arc of 96 parts, on which account the reading of one vernier is in the direction from right to left, but that of the other, on the contrary, from left to right; one meets, and the other overtakes the dividing ftrokes of the divided limb; and for the fame reafon, in the common Hadley's quadrant, or rather octant, fometimes 19 fubdivifions, and fometimes 21 on the limb, act againft 20 in the vernier, but then the readings are *not* in the *fame direction*. The telefcope is clamped to the arc in any fituation by the mechanifm for flow motion in the ufual way, which probably was firft adopted in one of the large quadrants, and its counterpoife beyond the centre of the arc, gives it the advantage of remaining in any pofition. It has crofs hairs in the focus of the eye-glafs. When the lines of the vernier are none of them coincident with any one on the limb of either quadrantal arc, the portions lefs than what the verniers profefs to indicate were *eftimated* by the eye, by examining the fituation of other pairs of dividing lines, to the right and left of thofe neareft to a coincidence; and to a want of a micrometrical nut to the fcrew of flow motion may be attributed the remark, that has been made, that the readings thus taken, even with fo large radii as 96.85 and 95.8 inches, were not to be depended upon to 10″. That the motion of the telefcope might be quite eafy, and that the centre of the quadrant might be relieved of its weight, the following contrivance was introduced; *a b* reprefents an iron axis laid acrofs the top of the wall, having two brafs plates fixed perpendicularly to its ends, with notches cut in them for this axis to turn in, which axis points to the centre of the quadrant at right angles to its plane: to that end of it next to the quadrant, at *a*, an iron arm, *c d*, is fixed, having two brafs plates, *c e*, *d f*, almoft perpendicular to it; to thefe are rivetted two flender flips of deal, whofe remote ends meet at *g*, near the eye-piece of the telefcope, and are held together by a brafs cap. Through a fmall plate fixed to one fide of a collar, embracing this lower end of the telefcope, there paffes a fcrew-pin at *g*, parallel to the telefcope; which pin, being fcrewed into the cap at the end of the faid flips of deal, holds up the telefcope againft the centre-work, while the flips are braced by other crofs flips of the fame light wood. The counterpoife *i* is fupported by the rod *h i* at *b*, the retiring end of the axis *a b*; and a pair of brafs rollers *k l*, acting againft the limb of the inftrument, give freedom to the motion of the telefcope thus counterpoifed, and complete the conftruction. The quadrant being thus put together, fome ftrong but fmall plates of brafs are made faft to its pofterior face, and bent fo as to fall into as many hold-fafts in the wall, into which they are refpectively fcrewed; but the weight of the whole is fupported chiefly by two pins or bolts inferted into the holes A and B, made in pieces of metal attached to fuch angular points of the iron bars, as beft fupport the centre of gravity of the whole: the pin A is made faft into the wall, but allows a motion round it, and the pin B fixes the quadrant after its extreme radii are adjufted, one horizontal, and the other vertical: this pofition was given by means of a plumb-line of fine filver-wire, that at firft was fo fufpended as to bifect both the centre of the quadrantal arc and the point 90° on the limb, but which was transferred afterwards to an adjuftable point of fufpenfion out of the centre, with a correfponding dot made on the arc of excefs of the limb. The plane of the quadrant was made vertical, as compared with the plumb-line, by the fcrews of the hold-fafts; and the telefcope was adjufted parallel to this plane by comparifon with a tranfit telefcope viewing together both high and low ftars in fucceffion; but the line of collimation of the telefcope could not be fixed properly, as it regarded the true horizontal line of the quadrant paffing through its zero, without the aid of Graham's fector. This fector was, therefore, fo adjufted to a ftar near the zenith, that it meafured the fame zenith-diftance, with its plane turned to the eaft, as it did when turned to the weft, and had its error afcertained in this way, and afterwards an altitude, taken with the quadrant, was made to correfpond with fuch corrected altitude of a ftar taken with the rectified fector in reverfed pofitions, which property the mural quadrant does not poffefs. The method of performing this adjuftment for collimation will be underftood from our directions hereafter given, when treating of *Ramfden's portable aftronomical Quadrant.*

Bird's Mural Quadrant.—After the defcription we have given of Graham's mural quadrant, we fhall have no occafion to dwell long on the ftructure of Bird's, which was made of brafs entirely, after a fimilar model, but divided in both its arcs, of 90°, and of 96 grand parts, with more fkill than Graham proved himfelf mafter of in this part of his labours. Smith and Stone defcribe Graham's quadrant as fixed to the eaft fide of the pier at Greenwich, and looking to the fouth, which was the fituation for taking meridian altitudes of the greateft number of ftars; but fince the year 1753, it has been placed on the weft fide, looking towards the north, and Bird's then took its original place.

This quadrant, which was procured in the time of Dr. Bradley, was firft placed on the weft fide of the pier, in 1750; and the obfervations of himfelf and of Dr. Mafkelyne, taken by it fince it was placed on the eaft fide, have contributed largely to complete the beft catalogues of the heavenly bodies, which otherwife muft have been very defective. While, however, Mr. Pond, the prefent aftronomer royal, was engaged in making his well-known table of declinations, with one of Troughton's circles, at Weftbury, he found reafon to fufpect the accuracy of the total arc of this quadrant, from a comparifon of his own determinations with thofe previoufly made with Bird's quadrant; and a fubfequent examination of the arc by Troughton juftified his fufpicion. With an apparatus exprefsly contrived for the occafion, this celebrated mathematical inftrument-maker meafured the total length of the quadrantal arc, and found it too fmall by 7″, exclufive of another fimilar error of 2″, occafioned by the wear of the axis of motion; though, on a rigid trial of the intermediate divifions, he did not detect more than *one fecond* of error, or rather of *inequality*, among the neighbouring divifions in any part of the arc. This trial was made in the prefence of the prefent aftronomer royal, in the year 1807; and the refult, while it ferves to correct paft obfervations, by the addition of 1″ to every fucceffive 10° of altitude, would have tended to correct all future obfervations by a like addition, had not the large tranfit-circle, lately made and fixed in the fame obfervatory by Troughton,

fuperfeded

fuperfeded the ufe of both the quadrants by its fuperior accuracy. The quadrantal arc of Graham's quadrant has not lately undergone a fimilar trial; but Troughton thinks it probable that the iron inftrument has preferved its figure better than the brafs one, and that confequently the addition of the brafs arc on the face of the iron one has had no undue influence in altering either its temporary or permanent dimenfions. At firft, the telefcope of Bird's quadrant was not braced; but after a trial, it was found to bend a little by a counterpoife of 80 pounds, and was afterwards braced by frame-work furrounding it, that prevented its yielding. A trial was made by Dr. Bradley of the total arc, in January 1753, after it had remained three years on the weft fide of the pillar; and though its weight is eight hundred pounds, the error was found to be not more than *two feconds*. He did the fame again in July, in the year 1759, when it had remained fix years and a half in its new fituation, on the eaft fide of the pillar, and found the arc exactly 90°. Thefe examinations, having been made in the extremes of cold and heat, fhew that change of temperature did not affect the total arc; and that, therefore, the 7″ diminution of the arc, detected by Troughton, is occafioned by a change of figure in the fpace of 48 years. The difference of the readings of the two arcs has never yet amounted to 4″, which is a ftanding proof of the accuracy and fkill of Bird as a divider. Near the eye-piece of the telefcope is a good micrometer, that not only gives flow motion in taking obfervations, but meafures the number of *feconds* that the reading lines of the vernier is fhort of coincidence in any obfervation: and formerly the quantity indicated by the vernier had thefe feconds added, to obtain the whole meafure; but, by Smeaton's advice, the vernier is now difregarded, and the addendum, obtained by feveral turns of the micrometer-fcrew alone, is ufed to complete the fimple reading of the divifions and fubdivifions, or 5′ fpaces; in other words, the fcrew, and not the vernier, fubdivides the laft 5′ fpace in the obferved arc, and gives what is due to the obfervation. The adjuftments of this inftrument, which was made of eight feet radius, on purpofe to take the place of Graham's, are made in all refpects as they are made in its predeceffor; and the fector, which ferves for adjufting Graham's line of collimation by ftars near the zenith, is ufed for the fame purpofe in Bird's quadrant. If any of our readers wifh to fee the original plan of all the feparate parts of Bird's quadrant, and to read his defcription of them, we beg leave to refer them to his quarto pamphlet, entitled "The Method of conftructing Mural Quadrants," publifhed by order of the commiffioners of the Board of Longitude, in the year 1768. In this pamphlet, however, it is not mentioned that the vernier of the arc of 90° fubdivides the fpace of 5′ into ten parts of 30″ each, by having ten divifions thereon, reading with eleven fubdivifions of the limb; but we know that this was the original reading of the vernier.

Jeremiah Siffon's Mural Arc.—Perhaps it would have been more confonant to the order of time, if we had fpoken of the younger Siffon, who was Bird's contemporary, and at one time his employer, next after Graham; but the hiftories of the two mural quadrants at Greenwich being connected, demanded that thefe inftruments fhould follow each other in immediate fucceffion. In the year 1768, Jeremiah Siffon, the fon of Jonathan, made the large mural arc at the king's private obfervatory in Richmond gardens, which extends 45°, or more, beyond a quadrant, and confequently reaches beyond the north pole; which circumftance gives it the advantage of being put in the meridian, by an obfervation of the pole-ftar. The divifions of this arc are into degrees and its fubdivifions, but the ftrokes are not cut very neatly; and the reading, as was the cafe with Bird's quadrant at firft, is performed partly by a vernier, and partly by a micrometer-fcrew. We have felected this inftrument, as a fpecimen of Siffon's conftruction, principally on account of a power that it poffeffes, which is very important, but which probably was not contemplated, and confequently not intended by the maker himfelf: the extenfion of the divided limb, to feveral degrees beyond the north pole, affords the means of ufing this inftrument in the manner that Troughton's large mural circle is now ufed, at Greenwich Obfervatory, by the prefent aftronomer royal; namely, to meafure the polar diftances of the ftars directly from the *true polar point*, without any reference to the latitude of the obfervatory, which method is one of the greateft modern improvements in making aftronomical obfervations. It is much to be defired that this mural arc fhould be divided again by Troughton, or fome other fuperior divider, and that it have microfcopic micrometers applied to it, which may be placed by adjuftment over any optional part of the divifions, and at any affumed diftance from each other; for though it would not then, as it does not now, poffefs the valuable property of oppofite readings, and of a motion in altitude to reverfe the oppofite arcs, by reafon of its being lefs than a femicircle, yet being compactly made, and of large radius, it is capable of receiving divifions fuperior to thofe on the quadrants which we have juft defcribed; and as the fituation and ftructure of the obfervatory are excellent, the appointment of a regular obferver to co-operate with the aftronomer royal would be highly conducive to the interefts of aftronomy. We hope that this hint may be taken up in a quarter where the power exifts of realifing our wifhes in this refpect. Aftronomical clocks, and various other auxiliary inftruments, are already in the obfervatory; fo that the principal expence of inftruments, as well as of an appropriate and elegant building, is already incurred.

Portable Aftronomical Quadrant by Ramfden.—It frequently happens that fuperior artifts vary the conftruction of their inftruments to fuit the views of the purchafer, or the fcale on which they are to be conftructed. We will felect out of the quadrants made by the late ingenious Mr. Ramfden, that which he made for Dr. Shepherd for the obfervatory of Chrift-college, Cambridge, and which profeffor Vince has defcribed at confiderable length in his "Treatife on Practical Aftronomy." The figure exhibiting this quadrant is the 5th of *Plate* XXIII. of *Aftronomical Inftruments*, which requires but little explanation. The tripod on which the quadrant is mounted has fcrews of adjuftment to fet the ftem, on which the horizontal motion is performed, perpendicular, which is proved to be fo in all directions when the plumb-line bifects both the fuperior and inferior dots during the whole revolution round a horizontal circle. The vifible ftem is a brafs tube, and through it afcends a folid fteel vertical axis, which fitting clofely at the fuperior and inferior ends, has not the leaft fhake, and preferves the pofition once given it fo long as the feet fcrews are unmolefted. The telefcope is of the achromatic conftruction, and has the ufual apparatus for flow motion, the fcrew of which is made a micrometer to fubdivide the fmall refiduum of the angle that the vernier alone will not indicate, when the coincidence is not perfect. The telefcope lies on a bar that carries the counterpoife, and in which is the centre of its motion. It has a fyftem of wires in the focus of the eye-glafs, which are adjuftable by fcrews, both upwards and fideways, as well as in a circular direction, fo that the adjuftments for collimation, and for zero in the altitude circle, may be effected thereby. The point of fufpenfion of the plumb-line is alfo adjuftable by a proper fcrew apparatus. At the top of the vertical tube, or ſtem, is a ſmall horizontal circle with a clamping apparatus for ſlow horizontal motion, by means of which the whole quadrant, with its attached teleſcope, turns gradually round in azimuth. When obſervations are made in or near the zenith, the plumb-line falls in the way of the teleſcope, and is obliged to be removed, on which account the large quadrant made by Ramſden for the duke of Marlborough, and now placed at Blenheim, has the plumb-line ſuſpended at the poſterior face of the inſtrument. This inconvenience is, however, remedied by the addition of a ſpirit-level ſuſpended from an adjuſtable horizontal braſs rod, under the uppermoſt radial bar of the quadrant, and this level not only ſupplies the place of the plumb-line when taken off, but at all times ſerves as a check on its adjuſtment, and, when furniſhed with a graduated ſcale, may very well be made its ſubſtitute. The conſtruction of Ramſden's portable quadrant was probably borrowed from Bird's, as well as his method of dividing the larger inſtruments that exceeded the reach of his dividing engine; but the inſtrument before us has no other horizontal or azimuth circle, except what is uſed plain, for the purpoſe of giving ſlow motion. Neither is there a ſecond horizontal teleſcope fixed permanently in that ſituation by which the teleſcope of obſervation may have its collimation determined, and the zero of its vernier adjuſted.

The vernier of this quadrant reads with two ſets of diviſions, like that of the mural quadrant by Bird, but the radius being ſmall, the ſubdiviſions are made into four parts each; the inner arc is divided into 90°, and the ſubdiviſions into 15′ each, but the outer one into 96 parts, or grand diviſions, and theſe again each into four parts, or ſubdiviſions; and thoſe two arcs operate as a check on each other. The micrometer ſub-divides the 15′ into 3″; but it is neceſſary to convert the reading of the arc of 96 grand diviſions into a correſponding quantity, expreſſed in degrees, minutes, and ſeconds, which may be done by direct proportion, or, which is more feaſible, by a table that we have ſubjoined, calculated for this purpoſe. The readings of the arc of 96 are put down with titles *diviſions*, *ſub-diviſions*, and *vernier*, where 16 (and ſometimes 32) on the vernier are equal to *one* ſub-diviſion, and *four* ſub-diviſions to *one* diviſion; for example, ſuppoſe the reading to be thus, 21 div. 2 ſub. 11 ver. we ſhall have from the table

			°	′	″
Diviſions	21	=	19	41	15.
Sub-diviſions	2	=		28	7.5
Vernier	$\frac{11}{16}$	=		9	40.1
Total			20	19	2.6

When, however, the coincidence of the vernier is not perfect, the quantity brought up by the micrometer-ſcrew muſt be added as a fractional portion of 52.″8, which is the value of one ſtep of the vernier, when 16 is the number of ſteps, but if 32 are inſerted, then 26″.4 would be the value of one ſtep forwards from zero.

A Table for the Reduction of the Grand Diviſions, Sub-diviſions, and Vernier, of the Arc of 96, into Degrees, Minutes, and Seconds.

Grand Diviſions.						Sub-diviſions.		Vernier.		
	° ′ ″		° ′ ″		° ′ ″		′ ″		′ ″	
1	0 56 15	33	30 56 15	65	60 56 15	1	14 3.7	1	0 26.4	
2	1 52 30	34	31 52 30	66	61 52 30	2	28 7.5	2	0 52.8	1
3	2 48 45	35	32 48 45	67	62 48 45	3	42 11.2	3	1 19.1	
4	3 45 0	36	33 45 0	68	63 45 0			4	1 45.5	2
5	4 41 15	37	34 41 15	69	64 41 15			5	2 11.8	
6	5 37 30	38	35 37 30	70	65 37 30			6	2 38.2	3
7	6 33 45	39	36 33 45	71	66 33 45			7	3 4.6	
8	7 30 0	40	37 30 0	72	67 30 0			8	3 30.9	4
9	8 26 15	41	38 26 15	73	68 26 15			9	3 57.3	
10	9 22 30	42	39 22 30	74	69 22 30			10	4 23.7	5
11	10 18 45	43	40 18 45	75	70 18 45			11	4 50.0	
12	11 15 0	44	41 15 0	76	71 15 0			12	5 16.4	6
13	12 11 15	45	42 11 15	77	72 11 15			13	5 42.8	
14	13 7 30	46	43 7 30	78	73 7 30			14	6 9.1	7
15	14 3 45	47	44 3 45	79	74 3 45			15	6 35.5	
16	15 0 0	48	45 0 0	80	75 0 0			16	7 1.9	8
17	15 56 15	49	45 56 15	81	75 56 15			17	7 28.2	
18	16 52 30	50	46 52 30	82	76 52 30			18	7 54.6	9
19	17 48 45	51	47 48 45	83	77 48 45			19	8 21.0	
20	18 45 0	52	48 45 0	84	78 45 0			20	8 47.3	10
21	19 41 15	53	49 41 15	85	79 41 15			21	9 13.7	
22	20 37 30	54	50 37 30	86	80 37 30			22	9 40.1	11
23	21 33 45	55	51 33 45	87	81 33 45			23	10 6.4	
24	22 30 0	56	52 30 0	88	82 30 0			24	10 32.8	12
25	23 26 15	57	53 26 15	89	83 26 15			25	10 59.2	
26	24 22 30	58	54 22 30	90	84 22 30			26	11 25.5	13
27	25 18 45	59	55 18 45	91	85 18 45			27	11 51.9	
28	26 15 0	60	56 15 0	92	86 15 0			28	12 18.3	14
29	27 11 15	61	57 11 15	93	87 11 15			29	12 44.6	
30	28 7 30	62	58 7 30	94	88 7 30			30	13 11.0	15
31	29 3 45	63	59 3 45	95	89 3 45			31	13 37.4	
32	30 0 0	64	60 0 0	96	90 0 0			32	14 3.7	16

Adjuſtments.—

Adjuftments.—1. *To adjuft the axis of the pedeftal vertical.*—This adjuftment may be performed either by the *plumb-line* or by the *level*, both which methods we will explain in fucceffion. We have already faid that when the wire of the plumb-line will continue to bifect both the upper and lower dot, while the inftrument is turned quite round in azimuth, its axis is vertical in all directions, but this could not be effected unlefs the plumb-line paffing through the two dots were alfo parallel to the axis; this adjuftment, therefore, is made partly by the fcrews at the feet of the tripod, and partly by the fcrew that moves the piece bearing the upper dot in a lateral direction. In the firft place then turn the quadrant in azimuth till its plane, or, which is the fame thing, the telefcope lies parallel to a line joining any two of the three feet, and turn one of thefe two fcrews till the wire bifects the lower dot, and with the proper fcrew bring the upper dot to the fame wire; then reverfe the telefcope by turning 180° in azimuth, and if both dots are again bifected, the axis is vertical in the direction that the telefcope has pointed; in the next place turn the telefcope the fpace of a quadrant till it points in the fame direction as the third foot of the tripod, and make the wire bifect the lower dot by the fcrew of this foot, and it will be found to bifect the upper dot alfo, if the firft adjuftment of the dot was properly made, but if not, repeat the operation till both dots are bifected in all the reverfed fituations of the telefcope, and then the axis will be vertical in every direction.

In making this adjuftment by the level alone, the procefs muft be thus; firft, the level muft be made parallel to the rod on which it hangs, and fecondly, this rod muft be put perfectly horizontal, and the level will then be horizontal alfo, with the bubble in the middle. In order to make the level parallel to the rod, place it parallel to a line joining two of the feet fcrews, and bring the bubble to the middle by one of the feet fcrews in queftion; then take off and reverfe the pofition of the level, and if the bubble is found in the middle now, the parallelifm is perfect, if not, one half of the error muft be rectified by the fame foot-fcrew, and the other half by the adjufting fcrews at the end of the rod, by releafing one and fcrewing up the other. A repetition or two of this procefs will make the bubble ftand in the middle in both of the reverfed fituations. In the next place, with the level thus parallel to the rod of fufpenfion, turn the quadrant round its axis an entire femicircle as nearly as can be eftimated, and if the bubble will now reft in the middle, the rod is level, and being at right angles with the axis of the quadrant's motion, proves that this axis is vertical in every direction; but if the bubble is found to run to one end of the tube, bring it one halfway back by the rod's adjufting fcrews, releafing one and fixing the other, as the cafe may be, and the other half by the proper foot-fcrew. A repetition of this procefs will foon fettle the bubble in the middle during a whole revolution in azimuth, and then the adjuftment of the axis is perfect, as well as of the rod and level.

2. The fecond adjuftment is that by which the *line of collimation* of the telefcope is made parallel to the horizontal line that paffes from the centre of the quadrant to zero on the limb, or quadrantal arc, at the fame time that zero on the vernier coincides with zero on the limb. This important adjuftment may be made in feveral ways, fome of which are tedious and otherwife objectionable; but we will confine ourfelves to two which apply, one to the vertical, and the other to the horizontal line of the quadrant, which two methods, when duly effected, will not only check each other, but detect the error of the *total arc*, if there is any, at the fame time; which is an acquifition of the utmoft importance. Firft then, to adjuft by the vertical line, let the axis of the quadrant be firft made truly perpendicular in all directions by the adjuftment we have already defcribed, and fix on a ftar within a few degrees of the zenith, when exactly on the meridian, and meafure its altitude by the crofs-wire in the field of view in the ufual way, and note down the refult; do the fame on a fucceffive night foon after, if poffible on an evening of fimilar temperature, with the quadrant turned half round in azimuth, and note again the refult; if thefe readings prove to be at equal diftances from the point 90°, one on the quadrantal arc, and the other on the arc of *excefs* beyond 90°, the horizontal wire is truly placed in the eye-piece, but if not, *half* of the difference of the readings muft be corrected by the proper fcrew for raifing or lowering the faid wire. This may be done by directing the telefcope to a diftant mark till the crofs-wire bifects it, then by moving the fcrew of flow motion of the vernier the *half quantity* required, and by bringing back (up or down) the crofs-wire thus difplaced to its original mark again. This operation repeated will place the crofs-wire in fuch fituation, that zero on the vernier will be in its proper place with refpect to the point 90°; or the *half difference* thus afcertained may remain, without altering the crofs-wire, as an *error of adjuftment* to be conftantly applied with the fign + or −, as the cafe may be, in all fubfequent obfervations. Again, to adjuft by the horizontal line paffing through zero of the quadrantal arc, it will be neceffary to have a fecond telefcope turning on pivots in adjuftable Ys attached to the back of the quadrant, on the fame level with the faid horizontal line of the quadrant. This telefcope may be called the *adjufting* telefcope, and may be alfo ufed to *watch* a diftant mark, before and after an altitude is taken, in order to detect any deviation in the pofition of the vertical axis, that may happen during the operation of meafuring. Let the adjufting telefcope bifect a fine diftant mark with its crofs-wire, and turn the tube of the telefcope round one halfway on its pivots, as it lies in a horizontal pofition, and if the wire now bifects the fame mark it is truly fixed, if not, look out for a new mark a little higher or lower, as the cafe may be, and make it cut that in the reverfed pofitions of the crofs-wire, by means of the proper fcrew for this purpofe; now this adjufting telefcope will be adjufted for collimation: in the next place, put zero on the vernier to zero on the limb, and direct the telefcope of obfervation to the fame diftant mark, by which the adjufting telefcope had its wire adjufted, and let this mark be bifected by both telefcopes, the level and plumb-line at the fame time fhewing that the vertical axis is perpendicular; now turn the quadrant half round in azimuth, and reverfe the adjufting telefcope fo as to view the fame diftant mark again, and if it is found to bifect it as before, the horizontal line of the quadrant is right, and alfo the quadrantal arc without error, fuppofing the telefcope of obfervation to have its adjuftment for collimation as fixed by the point 90°, above defcribed; but if this adjuftment of the point zero on the limb be *firft made*, half the apparent error muft be rectified by the fcrew at the eye-piece, by means of reverfed pofitions and new marks; and then afterwards the adjuftment by a ftar near the zenith will detect the error of the whole arc. If, however, no error in the total arc exifts, then the adjuftment for collimation may be made either from the horizontal or from the vertical meafurement, as may be moft convenient; one of which is more practicable by day, and the other by night. When this delicate and very effential adjuftment is finally fettled, the object-glafs of the telefcope fhould not be difturbed, and therefore it would be advifeable to have its interior furface well cleaned previoufly.

It was taken for granted that the crofs-wire was perfectly

horizontal

horizontal during the time the preceding adjuftment was made, or, which is the fame thing, that the parallel vertical wires were perpendicular to the horizon. This is proved in a fimple manner thus; direct the telefcope to a fine fmall diftant mark, and make the adjuftment for vifion, if neceffary; then if one of the vertical wires will continue to bifect the faid mark through the whole field of view while the telefcope is elevated or depreffed, the wires are right, but if not, they muft be made fo by the proper fcrews for that purpofe, near the focus of the eye-glafs. This preparation ought to precede the laft adjuftment, and when once made, feldom requires altering, except in cafe of accidental injury.

It has alfo been affumed in the preceding adjuftment, that the maker of the inftrument placed the plane of the quadrant parallel to the axis of its motion, and alfo the line of collimation of the telefcope parallel to the faid plane. The former may be known to be true thus; if, when the plumb-line is adjufted, at its centre of fufpenfion, juft to efcape touching the limb, (which fhould always be the cafe,) the quadrant's motion in azimuth will not alter it in this refpect, the plane is truly fixed; but if not, the fcrews, that fix the quadrant to its axis, muft be reforted to for the alteration, which is beft done by the maker. When there is no plumb-line, a fmall fpirit-level, fixed at right angles to the plane of the quadrant, will anfwer the fame purpofe; for the refting of the bubble during the quadrant's revolution in azimuth, will be a proof that the plane to which it is at right angles is vertical. With refpect to the parallel pofition of the telefcope, as this is guided by the vernier fliding on the limb, it is the bufinefs of the maker to adjuft it properly, which he will beft do by a comparifon with a good tranfit inftrument of the paffages of a high and of a low ftar in each of the two inftruments; but a *fmall* deviation of the telefcope with refpect to parallelifm, though to be avoided if practicable, will not fenfibly affect the meafurement of altitudes, which is the fole bufinefs of this inftrument. If, however, this deviation is confiderable, the eye-end of the telefcope muft be fet nearer to or farther from the limb, as the cafe may be, by the maker himfelf. We have been the more minute in defcribing thefe adjuftments, not only becaufe they are indifpenfably neceffary in making good obfervations, but becaufe they will apply, one or other of them, by means of the plumb-line, or of the fpirit-level, to all other aftronomical quadrants that have a motion in azimuth.

We have before us the drawing of a large and beautiful quadrant made by Mr. Cary, for Leopold, the late grand duke of Tufcany, with two telefcopes and a graduated azimuth circle, but the defcription we have given of Ramfden's inftrument will equally apply to his, except as to the dimenfions.

Portable Aftronomical Quadrant by Troughton.—Though we have defcribed Ramfden's portable aftronomical quadrant with much minutenefs, and have detailed the moft ufeful methods of making fuch adjuftments as will apply to the other portable quadrants that have a motion in azimuth, yet we fhould do violence to our own feelings, as well as to the ingenuity of an exifting artift of the firft eminence, if we withheld from the public eye the great improvements that he has made in this inftrument fince the death of Ramfden. *Fig.* 6. of the fame plate that contains Ramfden's inftrument, is a reduced perfpective view of the improved aftronomical quadrant of Troughton, which was made by him and fent to Bilboa in Spain, about the time that aftronomical circles began to be conftructed. It has been afferted, under our article CIRCLE, that this inftrument, as conftructed by Troughton, (and we may now add, by Thomas Jones, who has learnt his mode of dividing,) is greatly fuperior to any quadrant that can be made, on account of properties which the circle exclufively poffeffes; but fo far as a quadrant's accuracy can be depended on, Troughton's improved conftruction is to be preferred to all others. And, indeed, when we confider that fimplicity, fteadinefs of performance, and permanence of the adjuftments once made in this inftrument, are properties which it peculiarly poffeffes, along with comparative cheapnefs, it is probable that there will always be purchafers, when fuch an inftrument is on fale, provided the improver will confent to make fuch inftrument with limited powers, when he can have rapid fale for thofe which he now conftructs, with all the advantages that the circle affords.

The radius of this quadrant is three feet, and the body is made double, that is, of two quadrantal frames united into one, by fmall pillars holding their planes parallel, and enfuring the two properties, not often united in other men's inftruments, of lightnefs and ftrength at the fame time. The tripod, on which the quadrant is fupported, is a frame of mahogany, braced in different directions, fo as to refift any ordinary preffure, when the quadrant is put in motion, or the telefcope ufed. The three feet-fcrews are furnifhed with each a Hooke's joint and long handle, fo that the obferver may make an adjuftment with any of thefe fcrews without ftooping, and confequently without withdrawing his attention from the plumb-line apparatus, or fpirit-level, that indicate the quantity of adjuftment that may be neceffary from any individual fcrew. About the middle of this pedeftal, or frame-work of the tripod, is a three-armed horizontal bracing piece, on which the ftem of the quadrant refts; and this ftem is kept vertical by a focket of brafs made faft to the centre of the table, that furmounts the pedeftal, in which focket the vertical axis turns both fteadily and freely, while it refts on the three-armed bracing piece below. The azimuth or horizontal circle is centered on this axis, but fo as to admit of a motion round it of about two degrees, for the purpofe of putting the zero of the quadrant right when the telefcope is in the plane of the meridian. This fmall motion is produced by the tangent fcrew feen in front, and the other tangent fcrew regulates the flow motion of the telefcope and vernier, by taking hold of the folid vernier plate, that reads at oppofite points, and that may be clamped, when in ufe, to the azimuth circle, which is alfo a folid circular plate of brafs, fubdivided into 10′ fpaces, and reading by the verniers alone to 10″.

The vernier or index-plate is of confiderable depth, and hollow, terminating with a chamfered edge below, and contains in it a triangular frame not feen, foldered to it, and oppofed, for the fake of ftrength, by another fimilar frame feen above its plane. From the frame within the hollow index-plate arife three fmall pillars, which fupport the upper triangular frame at the three corners, and paffing through it receive fo many milled nuts on their tapped ends, by which means the whole are compactly united. Thefe milled nuts are ufeful for adjufting the plane of the quadrant parallel to the vertical axis of the quadrant's motion in azimuth; and it is here where the quadrant is to be feparated from the ftand for clofe package. Upon the upper triangular frame is foldered faft a fhort but ftrong conical tube, that fupports the long column that terminates with a fupplementary cone. From nearly the lower extremity of this long column a couple of braces afcend about twenty inches to the upper part of the body of the quadrant, and, by being made faft to it, complete the fteadinefs of the ftructure in an admirable manner. The telefcope, which is about forty-two inches long, and achromatic, as well as furnifhed with an adjuftable fyftem of Spider's threads, tapers from the object-glafs down-

downwards, to prevent any inclination to bending by its weight, and has an axis of motion of four inches and a half long, that passes through the thick pillar, that connects the two quadrantal portions of the double frame at the exact centre of motion, and of the divided arc. The counterpoise is applied at the redundant end of the telescope, and the vernier borne by its end, near the eye-piece, divides the 5′ spaces of the vertical arc into 5″, while a micrometrical microscope, attached to the metal of the telescope, subdivides this last quantity into *single seconds*. A nicely ground spirit-level hangs on the horizontal bar, with its proper adjustment apparatus, which alone will ascertain the position of the quadrant to a *second;* but, as if this were not sufficient, a plumb-line is made to descend, free from dust, or agitation by the wind, from an adjustable point of suspension through the hollow column, where there is little or no disturbance from a motion in azimuth, and ensures the position still more certainly. The water vessel in which the plummet is immersed, to prevent vibration, is contained in the hollow short cone before described, as containing a triangular frame within it, and the situation of the wire is examined in two directions, at right angles to each other, by microscopes looking across the bore of the column, at a convenient height for the observer to see without a change of position of his body, when he has been just observing at the telescope. The mark used for each wire to bisect is a luminous disc, known by the name of *Ramsden's ghost*, from its being only the *image* of a luminous point without substance, occasioned by a contracted aperture of a tube, fixed at the remote side of the column into which light enters, and by which it is directed without parallax. Besides these appendages, there is a secondary or adjusting telescope, such as the elder Sisson made for his spirit-level, and such as we have already described, as furnishing the means of adjusting the horizontal line of a quadrant that moves in azimuth, and of ascertaining the error of the whole quadrantal arc, by comparison with the adjustment by a star near the zenith. (See *Portable Astronomical Quadrant by Ramsden*, before described.) Lastly, the radial bars that bear the quadrantal arc, taper downwards from the centre, thereby giving strength to the part most liable to alter its figure by weight, as it is supposed Bird's mural quadrant has done in a small degree for want of such precaution. This quadrant has an arc of excess at each end, and is capable of all the adjustments we have above described in an exquisite degree.

Of Nautical Quadrants, measuring by Reflection.

Sir Isaac Newton's reflecting Quadrant.—A manuscript account of a quadrant, measuring altitudes and distances by reflection, of the hand-writing of sir Isaac Newton, was found among the papers of Dr. Halley after his death, which quadrant, according to Stone, was actually made in the year 1672, when Dr. Halley was preparing to go to the South seas, to make an addition to his catalogue of fixed stars; but the manuscript account was not produced, or even mentioned, when Hadley's instrument was shewn to the Royal society, nor was made known till the year 1742. (See Phil. Trans. N° 465.) Hence some doubt has been entertained whether sir Isaac Newton or Hadley was the first inventor of the reflecting quadrant. The most probable inference is, that each invented his own, seeing that though the principle is the same in both constructions, yet the mode of applying it is different, as will be seen from a comparison of the figures, and from our description of each in succession. Sir Isaac Newton's quadrant was preserved for several years at the house of Mr. Heath, who was a mathematical instrument maker in the Strand, London, and it is probably in existence at this time. Dr. Hooke is also said, by Dr. Pratt, to have invented a quadrant that was, or might be, used at sea with one reflection only; and, indeed, he is asserted to have been the first man who proposed the use of a *mirror* in a nautical instrument. See Circle.

Sir Isaac Newton's quadrant, represented by *fig.* 7. of *Plate* I. of *Astronomical Instruments*, consists of an entire sectoral plate of brass, P Q R S, to the plane of which the telescope A B is fixed and lies parallel, and an index, which is moveable about an axis of motion at A. The limb D Q was accurately divided into half degrees, and, as is said, half minutes, on a scale of four feet radius, and was subdivided by a diagonal scale into $\frac{1}{12}$th of a minute. The principle on which this semi-division is founded is this; *viz.* "If a fixed ray of light be reflected at a plane reflector, and if the reflector be made to revolve about an axis perpendicular to the plane passing through the incident and reflected rays, which may be called the plane of reflection, the angular velocity of the reflected ray will be *double* to the angular velocity of the reflector." See Vince's Practical Astronomy, p. 7, &c.

Hence one small mirror, G, is made fast to the plane of the sectoral plate, and perpendicular thereto, but inclined in an angle of 45° to the axis, or length of the telescope, and in such a way, as to cover one half of the aperture, while another similar mirror is borne by the index, in such a position, that when the index is at zero, both the mirrors are not only perpendicular to the plane of the quadrant, or rather octant, but are parallel to each other. Now, according to the principle that we have just mentioned, when the index is moved forward, a ray of light from any fixed luminous body, when caught by the index mirror, will be reflected on the fixed mirror, and an eye directed through the fixed telescope towards the said body, will see it divide into two bodies the instant that the index begins to move; that is, the body itself will be seen *stationary* through one half of the telescope's aperture, and its *image* will be seen in the other half *in motion*, and this motion has double the velocity that the index has, which bears the revolving reflector; and on this account it is, that the divisions for half degrees and half minutes, are read as whole degrees and whole minutes, as well as the $\frac{1}{12}$th read as $\frac{1}{6}$th by the diagonal scale. From this short explanation of the principle and structure of sir Isaac Newton's reflecting quadrant, it is easy to perceive that the construction is derived immediately from the principle in the simplest, though in practice not the best manner; for the instrument itself illustrates the principle in the most obvious way; but, from its magnitude and mode of being used, it is very inconvenient to be supported without a stand, which on board a ship is inadmissible.

Perhaps it might be on this account that Dr. Halley did not pay more attention to it than he appears to have done, according to the information that we at this distance of time possess. However, it is evident, that the instrument before us is capable of measuring either vertical, horizontal, or oblique angles, in the way it professes.

Cole's Quadrant by single Reflection.—*Fig.* 2. of *Plate* XXIII. of *Astronomical Instruments*, is the figure of an instrument, which, like Dr. Hooke's contrivance, measured altitudes by single reflection, as we conceive, the drawing having fallen into our hands without the description. An arc composed of an entire quadrant, and an index with a single mirror fixed to it at its centre of motion, constitute its leading features, while a sight-vane, at the remote end of the prolonged index, instead of a telescope, has a plane hole, through which the sun is viewed after reflection from the index-glass, his rays having first passed through a coloured glass.

glafs. This conftruction, with the addition of fir Ifaac Newton's fecond mirror, would conftitute an union of two inftruments, that would greatly refemble the combination adopted by Mr. Hadley, which follows next in our lift of quadrants; but which may not have been copied from fuch union; for Cole has got the vernier fcale, which is preferable to the diagonal one adopted by Hadley, and therefore probably he followed Hadley, though the quadrant before us has not recommended itfelf to general ufe, as being an improvement.

Hadley's Quadrant.—As we cannot help confidering Hadley's *quadrant*, or more properly *octant*, as a near relative at leaft to his friend fir Ifaac Newton's, we will defcribe it next in order, while the principle of its conftruction is frefh in the reader's memory. The circumftance of Mr. Hadley's being prefident of the Royal Society was favourable to the early notice of his inftrument; and the intereft that the Britifh nation took, and muft ever take, from its infular fituation, in nautical improvements, contributed to its early adoption, at a time when fuch an inftrument was greatly wanted.

Mr. Hadley, we learn, tried various modifications in the conftruction, but that which has been approved from long ufage is the one we fhall felect for defcription. *Fig.* 1. in *Plate* XXIII. of *Aftronomical Inftruments*, is the reprefentation of Hadley's octant, as it is now conftructed with a vernier, which it had not at firft, and which is preferable to the diagonal divifions at firft applied by Hadley, as well as by fir Ifaac Newton. For the fake of lightnefs, united with ftrength, the frame of the inftrument, when made of any of the hard woods, is put together ufually as is reprefented in the figure, but when made all in brafs, and particularly when the limb is extended to 120 half degrees, reading as 120°, in which cafe it is called a *fextant*, the beft modern makers make it double; that is, have two feparate light frames, united by fhort pillars, ftanding at right angles to their planes, which thus become parallel. This conftruction, we believe, was introduced by Mr. Troughton, and allows a more fteady motion to all the moveable and adjuftable parts, by lengthening their axes of motion, which penetrate acrofs both parts of the double frame, and by that contrivance have longer bearings. But we are now propofing to defcribe a quadrant of Hadley's own conftruction. A B C is a frame of fome hard wood, fuch as ebony, which may be of any convenient radius, from eighteen inches downwards to three, or lefs, if required for the pocket, and A D is the index bearing the vernier at D, together with the ufual clamping apparatus for flow motion, in making the contact in any obfervation. This apparatus, together with the powers of the vernier, and mode of ufing it, have been explained under our article Circle, (fee alfo Vernier,) and therefore may be referred to by the reader unacquainted with their ufes. When the radius is very fmall, the vernier fubdivides half degrees, and has thirty divifions on it, but has twenty or fifteen, accordingly as the degree of the limb is fubdivided into *thirds* or *fourths* of a degree. The peculiar excellence of this inftrument, either in the form of an octant or fextant, is, that all forts of angles can be meafured with it on board a fhip, even while the fhip is toffed by the waves; and alfo, that it requires no other auxiliary means, than the natural horizon, which at fea is always, or moftly prefent, when a heavenly body can be feen. The plumb-line and fpirit-level are equally difpenfed with: to which may be added, that, if any accidental injury be received, a circumftance not improbable in the hands of failors, the adjuftments are fo fimple, that, generally fpeaking, the derangements may be eafily rectified. In the beft inftruments, a fmall telefcope is fcrewed into the fight-vane, which not only prevents parallax, by limiting the line of fight between two parallel wires, but affifts the fight greatly in obtaining exact contacts. There is ufually an arc of excefs at each end of the limb, one of which is ufeful in adjufting the index-error by the fun or moon, and the other is ferviceable when angular diftances are meafured beyond a quadrantal arc; indeed it would be well if the arc were always extended to meafure 120°, or more, for then a fextant would be competent to meafure all forts of angles that the mariner can require, to find his latitude, time, and longitude.

When the octant has not the tangent fcrew of flow motion for adjuftment in making the contact, the index is nicely moved by hand, and then fixed by a fcrew behind it for this purpofe, and in either cafe the examination and noting down of the altitude, or horizontal angle taken, may be read at any time, for hours afterwards, which is another important advantage that this inftrument poffeffes in common with the fextant; for where more obfervers than two are not prefent, one obferver may thus manage to take both an altitude and a diftance in a lunar obfervation with two feparate inftruments in quick fucceffion, while another obferver is taking the altitude of the fecond object; or with the help of Margett's horary tables, the fecond altitude may be had by infpection, when the hour, latitude, and declination of the body are known, in which cafe *one obferver* can take a lunar obfervation with tolerable accuracy. The limb of the inftrument is beft of metal, fuch as brafs, filver, or platina, when made and divided in the beft way by a fuperior dividing engine, fuch as Troughton's; but in ordinary inftruments a piece of ivory is frequently let into the wood, and fometimes the divifions are made even on the wood itfelf, which is liable to be affected by moifture. The index is moft frequently entirely of brafs, and wider as it afcends to the centre of motion, to prevent lateral bending, which would deftroy the accuracy of the readings. When an obfervation is made by the larger fort, the right hand fhould be applied to the lower extremity of the index to give it fteady motion, while the left holds the lower end of the remote radial bar; and the plane of the inftrument muft be kept in the line that joins the two objects, of which the horizon is one, when an altitude is taken, and then the inftrument is held vertical. In bringing down the image of an object to the horizon by a *fore* obfervation, the body of the obferver muft gradually incline towards the horizon, and a little vibrating motion will affift in determining the exact plane of contact; but in taking a horizontal angle, the obferver will handle the inftrument as beft fuits his convenience. The mirror at A is placed over the centre of motion of the index, in a direction pointing to zero on the vernier, and perpendicular to the flat face of the index: this index-glafs, being completely filvered, reflects the light it receives directly at right angles on the glafs E, when the zero of the vernier is at the zero of the limb; but as the limb proceeds forwards, this angle alters, and, as we have faid, is *double* of the meafure of the real angle to be meafured and indicated. This glafs E is alfo fixed perpendicular, and has fcrews of adjuftment for perpendicularity above its focket of brafs, and a tail-piece with a fixing-fcrew behind the frame, for fixing the parallelifm; the want of which is called the *index-error*: one half only of this glafs, which is called the *fore-horizon* glafs, is filvered, and the other half remains unfilvered, in order that both the direct rays tranfmitted through the unfilvered part, and the reflected rays coming from the filvered part, may meet at the eye, on which account the middle of this glafs, where the line of feparation croffes, is the part to be viewed

viewed in making a contact, otherwise both the image of one object, and the substance of the other, could not be seen at the same instant. F is the sight-vane, with two holes, usually an upper and a lower, inserted into the first radial bar of the frame, so that the holes are at the same distance from the plane of the instrument as the line of separation is in the half-silvered glass E, to prevent parallax of the reflected rays, and in the best instruments this vane, with its telescope, has an adjustable motion to and from the plane, in order that more or less light may fall on either of the bodies observed, which is not only useful, but necessary, in taking a lunar distance; for by this adjustment the image of one body may be made as luminous as the real body of the other, by increasing the light of one, while it decreases that of the other; that is, by making more of the silvered, or of the unsilvered part of glass E, fall before the object-glass of the small telescope, when this adjustment is necessary. It may be necessary to observe here, that every silvered glass of sensible thickness has two reflections, one on the anterior, and the other, which is the principal one, on the posterior or silvered face, and in many cases errors may be occasioned by these double reflections; to remedy which, Dr. Maskelyne proposed, that the silvered portion of the posterior face should be ground rough and painted black, taking care that the grinding be so performed, that the line of separation between the polished and unpolished parts be parallel to the plane of the octant. In the *back* horizon-glass, which is that seen with its sight-vane at G, with adjustments similar to those of the *fore* horizon-glass at E, the whole posterior face is silvered, except a slit, that divides it in a line parallel to the plane of the frame, through which slit the body is observed in a back observation. But when the sun is the body observed, his light is generally too intense for the eye to bear, particularly when the small telescope is used; to render the rays tolerable to the eye, a coloured glass, or glasses, must be interposed, and a blank tube instead of a telescope be used, by which means the sun may be viewed without doing injury to the eye; and usually a system of coloured glasses are slided into a square hole, as at H, and a joint in each allows them, or any one of them, to be brought forwards into the situation where the direct rays must pass to the eye. The same remedy is also sometimes applied at the eye-piece of the blank tube, when the sun alone is observed. The plane of the back horizon-glass is placed not only parallel to the plane of the frame, but at right angles to the plane of the fore horizon-glass, in order that the same readings may apply in both kinds of observation, and this object was effected by the maker by the simple rectangular position of the two horizon glasses to each other, and by reversing the position of the body in making a back observation; for as the inclination of the index-glass to the fore horizon-glass gives *double* the angle directly measured; so *twice* the *complement* of this inclination to the back horizon-glass gives the same quantity, and on the same part of the graduated limb, when measured in a reversed position.

Adjustments.—The adjustments of every instrument are of the utmost importance to the accuracy of observations taken thereby, but they are particularly so in the instrument before us, because a small deviation from parallelism in the fore horizon-glass, or from perpendicularity in the back horizon-glass, as compared with the index-glass, (with the vernier at zero of the limb,) will *double* the *error* occasioned by it in the quiescent situation, as soon as motion is given to the index-glass. 1. The first adjustment is, *to set the index-glass perpendicular to the plane of the instrument:* this is done by first sliding the index to about 40° or 45° of the limb, while the octant is held with its plane nearly parallel to the horizon, then a glance into the index-glass will shew, whether the sharp edge of the limb seen by reflection, is an exact and straight continuation of the same edge of the limb seen by direct vision, and if this is not the case, it must be made so by the screws that adjust the bed of the mirror; and in all cases where two screws are to be used, one must be released as much as the other is screwed inwards. Dr. Mackay proposes to place two small pieces of metal as adjusting tools, with each a horizontal line drawn on it, at equal heights from the plane of the limb, at some distance from each other, so that the horizontal line of one may be a continuation of the horizontal line of the other, when one is viewed by reflection, and the other by direct vision, but the sharp edge of the inner part of the limb will answer all ordinary purposes. 2. The second adjustment is, *to set the fore horizon-glass perpendicular to the plane of the instrument:* this is done by first fixing the zero of the vernier at zero on the limb, and while the plane of the frame is held parallel to the horizon, by applying the eye to the lower hole of its sight-vane; then if the horizon, or any distant horizontal line, appear to be a straight line, the glass is placed perpendicular already; but if the parts seen by reflection and by direct vision do not constitute a straight line, they must be made to do so by the screws at the bed of the glass, one or other of which must be screwed in, as the fracture of the line demands; that is, if the line seen by reflection appear *above* that seen by direct vision, that screw must be urged *inwards* which is on the *farther* glass, and *vice versâ*, until the fractured line be straight. 3. The third adjustment is, *to rectify for the index-error* of the fore horizon-glass, or to place it parallel to the index-glass, when the zero of the vernier is placed at zero on the limb. To do this properly, a bright distant object must be chosen, such as the sun, moon, or star, and while the zeros coincide, look through the vane, or telescope, and observe if the body and its image coincide; that is, if the image is invisible: in this case, the fore horizon-glass is parallel to the index-glass, or is truly adjusted; but if not, release the tail-piece or lever behind this horizon-glass, and with the thumb-piece give it a small motion, till the body and its image coincide, in which situation it must be fixed by the fixing nut before released. Sometimes the act of screwing will displace in some degree the tail-piece, and thereby again occasion a sensible index-error. When this cannot be completely avoided, the error must be ascertained and allowed for with its sign + or — in every subsequent observation, while it remains unaltered. This error may be ascertained by measuring the diameter of the sun, first forwards on the limb, and then backwards on the arc of excess, and one half of the difference of the measures will be the *index-error* + or —, as the case may be. 4. The fourth adjustment is, *to set the back horizon-glass perpendicular to the plane of the instrument:* this adjustment is similar to the second, and may be performed by the directions there given, supposing them to be for the back horizon-glass and its vane, instead of the fore horizon-glass. 5. The fifth and last adjustment is, *to set the back horizon-glass perpendicular to the plane of the index-glass produced, the zero of the vernier being placed at zero on the limb:* this adjustment at sea is performed thus; let the vernier be put as much to the right of zero, as is equal to twice the dip of the horizon, in the situation where the observer stands, then hold the quadrant in a vertical position, and apply the eye to the back-horizon vane: now, if the horizon seen by reflection happen to coincide with that seen by direct vision, the glass is already right; but if not, the lever or tail-piece behind the frame at this place must be released by the proper fixing screw,

ſcrew, and turned ſlowly by the thumb-ſcrew or nut, till this coincidence is perfect, and then the lever muſt be made faſt again; the reflected horizon will be inverted when viewed in the manner here deſcribed. When the inſtrument is uſed in a back obſervation on the land, which is not likely to happen often, the adjuſtment will require ſome artificial aid: by Dollond's method, an index is applied to the back horizon-glaſs, by which it may be put parallel to the fore horizon-glaſs, by the third adjuſtment applied thereto, and then, by a graduated arc of 90°, inſerted on purpoſe, the index of the back horizon-glaſs is ſet perpendicular to its former ſituation, and conſequently is made perpendicular to the plane of the fore horizon-glaſs. By Mr. Blair's method, the under edge of the index-glaſs is ground and poliſhed, ſo as to be at right angles to the plane of the glaſs, and hence the back horizon-glaſs is adjuſted, by making the direct and reflected horizons agree, while the vernier ſtands at zero on the limb, exactly as is done in the third adjuſtment. But we are to ſuppoſe the inſtrument not furniſhed with either of the above named auxiliary means; when this is the caſe, a long level ſpace muſt be choſen in ſome common or park, where three ſtaves can be put up in the ſame ſtraight line exactly, and at an interval from each other of not leſs than 500 yards, but if 600 or 700 the better; then, the vernier being truly placed at zero, let the plane of the octant be held horizontally with its back horizon-glaſs exactly on the top of the middle ſtaff, and let one of the rods be viewed directly through the back ſight-vane, then if the other rod, ſeen by reflection, coincide with it, the poſition of the back horizon-glaſs is true, but if not, it muſt be made ſo, by the tail-piece behind, as before directed; if in fixing the tail-piece a derangement ſhould take place, which cannot be *exactly* done away by a ſecond or third trial, then the index-error for the back obſervation muſt be aſcertained.

This error may be obtained by reverſed obſervations by two methods; thus, let the coincidence of the two extreme ſtaves be made from the middle ſtaff as juſt directed, by a motion of the vernier, inſtead of the tail-piece of the back horizon-glaſs, and read the quantity moved forwards or backwards; then turn the downward face of the frame upwards, and repeat the operation, and read again; now, if theſe two readings are found to be one on the limb, and the other on the arc of exceſs, half of their difference will be the error ſought, + or −; but if they both are read on the ſame ſide of zero, half their ſum, + or −, will be the error; when they are both read on the limb, or if the greater quantity be read on the limb, when the leſs is on the arc of exceſs, the ſign will be −, and *vice verſâ*. By the ſecond method, inſtead of reverſing the plane of the inſtrument, let the obſerver reverſe his poſition, making the right-hand ſtaff to be the left-hand one, and *vice verſâ*, and then let him repeat his firſt obſervation, with the ſame face of his inſtrument up that he had in that, and the ſame reſult will follow, that was obtained by reverſing the plane of the inſtrument. Theſe two modes of obtaining the error in queſtion, by reverſed obſervations, may be made to check each other, and will then give an average of the two reſults, for the error to be applied to each ſubſequent obſervation, taken with the back horizon-glaſs in its laſt determined poſition.

Examination of the Inſtrument.—Theſe ſeveral adjuſtments being finiſhed, the obſerver might proceed to make his obſervations, provided he could rely on the ſkill and credit of the maker of his inſtrument; but if not, he would act prudently to examine the materials of which it is compoſed, before he relies on its performance, and alſo to put to ſome teſt the accuracy of the diviſions on the vernier and limb, as well as the care that has been taken in ſelecting glaſſes of uniform thickneſs, and of good poliſh. The exactneſs of the total arc may be aſcertained from compariſon with meaſurements taken with a circle, or ſome well-known ſuperior inſtrument; or by careful trigonometrical meaſurement on ſome level and extenſive ground, where the ſides of the triangle can be accurately meaſured, for which purpoſe Troughton's new chain of five-feet links is admirably calculated: but the intermediate diviſions may be examined by the vernier itſelf, by ſtepping the arc with it; and if all parts of the arc are found alike divided, when examined by the coincidence of the extreme ſtrokes of the vernier, the intermediate ſtrokes of the vernier itſelf may laſtly be examined by the ſtrokes on the limb taken in various places. Dr. Mackay recommends a table of corrections to be made, in caſe of errors being detected in the dividing, but we ſhould rather recommend new diviſions from a good engine, the inſerting of which can now be performed at a trifling expence. When the planes of the mirrors are examined, try if a candle reflected appears in two images; if it does, the two faces of the glaſs are not parallel, and conſequently the glaſs is not fit for its purpoſe.

To try whether the ſurfaces of the mirrors be perfect planes, bring two diſtinct diſtant objects into good contact, and let them be ſeen at the upper edge of the ſilvered part; then move the inſtrument in its own plane, and move the image and body along the line of ſeparation or edge of the ſilvered part, and if the coincidence is not diſturbed the plane is perfect, but not otherwiſe. Alſo, when an obſervation is taken of the ſun, and the vernier has been fixed by the fixing ſcrew, read the altitude, as the dark glaſs, or glaſſes, may have been uſed; then remove them from the ſocket that holds them, and reverſe their planes, by putting their remote faces neareſt; and if, after this change, the ſame altitude is given, the planes are parallel, otherwiſe *half the difference* muſt be applied, in all ſuch caſes, as an *error* of the *coloured glaſſes*. This examination is beſt made exactly at noon, when the ſun's altitude is not ſenſibly changed during the examination; unleſs a good chronometer or regulator, duly regulated, and put to exact time, be at hand; for then the ſucceſſive examinations may take place at equal diſtances from noon. Or the ſame thing may be done by means of a luminous object placed at a diſtance, and ſo elevated, that an artificial horizon may give its *double* altitude before and after the coloured glaſſes are reverſed in poſition. The beſt artificial horizons are either a veſſel of pure mercury, with a roof of good glaſs framed over it to prevent agitation by the wind; or otherwiſe a piece of black glaſs, well poliſhed, and placed on ſcrews of adjuſtment, with a good ſpirit-level in a glaſs tube, ſo ground, that it will reverſe in poſition, and will place the glaſs in a perfect level in the two requiſite directions, at right angles to each other.

It may be proper to examine further if the two holes in the ſight-vane are ſo made that the ſun or other luminous body dazzles the eye more in looking through one, than in looking through the other, the intention being that one ſhall take in more of the ſilvered part, and the other more of the unſilvered part of the glaſs, ſo as to accommodate the quantity of direct light to the ſtrength of the eye.

Illuſtration of the Uſe.—When Hadley's octant, or ſextant, is uſed for altitudes at ſea, the ſun, moon, or ſtar, as the caſe may be, muſt be viewed in the way that the eye can beſt bear, with or without the dark glaſſes, teleſcope, &c. as occaſion may require, and as experience will dictate; and in a fore obſervation the body obſerved muſt have its image brought gradually down, ſo as to be in exact contact with the

the horizon: if the ſun or moon be obſerved, either the upper or lower limb muſt be ſubſtituted for the centre, and the obſervation muſt be afterwards reduced to the centre, by applying the ſemi-diameter, + or —, from the proper column for the given day, as given in the Nautical Almanac, or Ephemeris; in doing this, the face of the obſerver muſt be turned towards the object whoſe altitude is to be meaſured, and while the index is gradually moved forward along the limb, the image will deſcend till it approaches the horizon: in this ſituation, care muſt be taken that the contact of the image be made with the viſible horizon at the line of ſeparation, between the ſilvered and unſilvered parts of the fore horizon-glaſs, that both objects may be viſible together; and alſo that the index may not be puſhed too far, ſo as to require a retrograde motion in finiſhing the contact: therefore fix the clamping piece, if there is a tangent ſcrew, and complete the contact by a ſlow motion, and the altitude will remain unaltered till the vernier has been examined by a magnifying glaſs, which ought always to be at hand, to aſſiſt the eye in examining the coincidence of ſome one line of the vernier with ſome line of the limb; or, when there is not an exact coincidence, in eſtimating the quantity that is beyond coincidence, as compared with the contiguous quantity that is ſhort of it. To ſucceed well in perfecting a fore obſervation taken at the horizon, the obſerver muſt learn to give a vibratory ſlow motion of his body to the right and left, his heel being the centre of motion, that the image obſerved may be made to move backwards and forwards in the arc of a circle, of which the horizon is a tangent, in order that the altitude may not be taken at one ſide of the tangental point, and conſequently be too great. Care muſt alſo be taken that the faint ſecondary image reflected from the poſterior face be not miſtaken for the primary image, reflected from the proper, or anterior face of the mirror. When the altitude is marked down, as read on the limb and vernier, the corrections muſt be applied, for either the ſun or moon, for parallax, refraction, dip of the horizon, and ſemi-diameter, before the true altitude of the centre is obtained: but for a ſtar no parallax is wanted, nor yet allowance for ſemi-diameter; theſe apparently diminutive bodies being ſituated at ſuch an immenſe diſtance from the earth, as to ſubtend no ſenſible angle, nor to have any perceptible parallax in altitude.

It is from meridian altitudes thus taken, that, by the application of a heavenly body's declination, + or —, as the body may be below or above the equator, the co-latitude, and conſequently the latitude, is readily determined; and alſo, the latitude being known, from an altitude taken towards the eaſt or weſt, that the time is determined at one obſervation, but more accurately by a ſeries of equal altitudes taken at oppoſite ſides of the meridian; the reduction, however, for the ſun's change of declination during the interval, muſt, in this caſe, be taken from tables of correction for equal altitudes, ſuch as are contained in the pamphlet of the late Mr. Wales.

In making the *back* obſervation, the coloured glaſs, or glaſſes, muſt be ſelected, as before, to ſuit the eye, and the plane of the inſtrument held vertically, as in the fore obſervation, but the face of the obſerver muſt view the point of the horizon *oppoſite* the ſun, or that pointed to by his own ſhadow; firſt, let the eye be directed through the vane of the back horizon-glaſs to the tranſparent ſlit that divides the mirror, and let it view the horizon, then move the index till the image of the ſun is juſt ſeen on the ſilvered part of the glaſs; a vibratory motion now given to the octant from the eye, as the centre of motion, will make the ſun's image move in a curve of which the convex part appears uppermoſt; in this ſituation, let the ſlow motion by the tangent ſcrew, if any, bring this image till one of its limbs coincides with the horizon ſeen through the tranſparent ſlit, and the obſerved altitude will be determined as before. Whenever the horizon is clear both before and behind the obſerver, he may reverſe his inſtrument and alſo his body haſtily, when the ſun is on the meridian, and make the fore and back obſervations check each other, which will alſo, from time to time, prove the reſpective poſitions of the two mirrors, and lead to a detection of the error of the back horizon-glaſs, when that of the former is known, which it may always be from a double meaſure, one back and one forwards, of the ſun's diameter. If the difference of the altitudes of the ſame body taken both ways be equal to the known index-error of the fore horizon-glaſs, it will be known that the back horizon-glaſs has no error; but if the ſaid quantities are not the ſame, their difference, + or —, will be the index-error of the back horizon-glaſs; hence the back horizon-glaſs may be adjuſted from a knowledge of the error of adjuſtment of the fore horizon-glaſs, which method, we believe, was never before ſuggeſted.

QUADRANT, *Hadley's, Theory of.* It is a firſt principle in optics, that the angle of incidence, whatever be the inclination of the incident ray, is equal to the angle of reflection, *i. e.* if the angle of incidence D B A be 30°, the angle of reflection D B C will be alſo 30°. It is alſo plain, that if while the radiant A (*Plate* II. *Navigation, figs.* 1 and 2.) remains in the ſame place, the mirror E F, by revolving round B, moves into the poſition fe, then the alteration in the angle between the incident and reflected ray will be double to the angle ſhewing the change of poſition in the mirror. Suppoſe the mirror changes 10° from the radiant, then the perpendicular B D goes 10° farther from the radiant A into the poſition B d; and the incident angle d B A is 40°, and the reflected angle d B c is 40°; ſo the angle A B C is altered from 60° to 80°; a difference of 20° for 10° change of poſition in the mirror. Suppoſe again the mirror to change, in poſition, 10° towards the radiant A, then the perpendicular is changed into B d, 10° nearer to the radiant; and the angle D B A of 30° becomes d B A of 20° = d B c; ſo that the angle A B c is 40°, whereas A B C was 60°; that is, by altering the poſition of the mirror 10°, the angle A B C was altered 20°. It may be otherwiſe demonſtrated, that with a Hadley's quadrant, the angle of elevation under which an object is ſeen, is equal to twice the arc which the index has paſſed over. The inſtrument or angle A C B (*fig.* 3.) is 45°; $a\,b$ is a reflecting glaſs fixed parallel to C B; C D is the index with a reflecting glaſs at G, ſo fixed as to be parallel to $a\,b$, when C D coincides with C B; S the ſun; S G a ſolar ray reflected from G to F, and from F to E, the place of the eye; and H F E the horizontal line at the time of the obſervation. Then will the angle of elevation I G S be equal to twice the angle B C D; for the angle of reflection D G F = the angle of incidence S G C = C G L. And the angle of reflection b F E = the angle of incidence a F G = F L E ($a\,b$ being parallel to L E) = F E L. But I G C = H P C = P C E + P E C (the external angle being equal to the two internal and oppoſite) = P C E + F L E = P C E + G C L + C G L. Or, I G C = I G S + S G C = P C E (or G C L) G C L + C G L = 2 B C D + C G L. Conſequently I G S = 2 B C D. See Robertſon's Navigation, book ix. p. 295, &c. p. 390, &c.

Mr. Mitchell has recommended Hadley's quadrant for ſurveying, and eſpecially the ſurveying of harbours, and alſo for piloting ſhips into harbours. Phil. Tranſ. vol. lv. art. 10. p. 70.

Mr. Wales, in captain Cook's Voyage, applied it to meafuring the quantity eclipfed in an eclipfe of the fun; in which operation it anfwers the purpofe of a micrometer, to a great degree of certainty. See an account of the improvements fuggefted in the conftruction of thefe inftruments, and alfo of the various ufes to which they may be applied, in Magellan's Defcription des Octants & Sextants Anglois, &c. 4to.

Other quadrants have been contrived fince, by fome ingenious artifts, all of which have their merit; but the particulars of their conftruction are too many for this place; and perhaps, on the whole, nothing preferable to Mr. Hadley's invention has yet been found.

Quadrant, *Horodictical*, is a pretty commodious inftrument; thus called from its ufe in telling the hour of the day.

Its conftruction is fo fimple and eafy, and its application fo ready, that we fhall defcribe both, for the ufe of fome who may want other conveniences.

Quadrant, *Conftruction and Ufe of the Horodictical.* From the centre of the quadrant, C, (*Plate* XIX. *Aftronomy, fig.* 8.) whofe limb A B is divided into 90°, defcribe feven concentric circles at intervals, at pleafure; and to thefe add the figns of the zodiac in the order they are reprefented in the fcheme.

2. Applying a ruler to the centre C, and the limb A B, mark upon the feveral parallels the degrees correfponding to the altitude of the fun when therein, for the given hours; connect the points belonging to the fame hour with a curve line, to which add the number of the hour. To the radius C A fit a couple of fights, and to the centre of the quadrant C, tie a thread with a plummet; and, upon a thread, a bead to flide.

If, now, the bead be brought to the parallel in which the fun is, and the quadrant be directed to the fun till a vifual ray pafs through the fights, the bead will fhew the hour.

For the plummet, in this fituation, cuts all the parallels in the degrees correfponding to the fun's altitude. Since, then, the bead is in the parallel which the fun then defcribes, and through the degrees of altitude to which the fun is elevated every hour there pafs hour-lines, the bead muft fhew the prefent hour. Some perfons, who are not very nice, reprefent the hour-lines by arcs of circles, or even by ftraight lines; and that without any fenfible error.

Quardant, *Sinical*, is an inftrument of ufe in navigation. It is reprefented *Plate* II. *Navigation, fig.* 4, and confifts of feveral concentric quadrantal arcs, divided into eight equal parts by radii, with parallel right lines croffing each other at right angles.

Now any of the arcs, *e. gr.* B C, may be accounted a quadrant, of any of the great circles of the fphere, chiefly of the horizon and meridian: if, then, B C be taken for a quadrant, *e. gr.* of the horizon, either of the fides, *e. gr.* A B, may reprefent the meridian; and the other, A C, will reprefent a parallel, or line of eaft and weft; and all the other lines parallel to A B will alfo be meridians; and all thofe parallel to A C will be eaft and weft parallels, or eaft and weft lines.

Again, the eight fpaces into which the arcs are divided by the radii, reprefent the eight points of the compafs in a quarter of the horizon; each containing 11° 15'.

The arc B C is likewife divided into 90°, and each degree is fubdivided into 12', diagonalwife.

To the centre is fixed a thread, as A L; which being laid over any degree of the quadrant, ferves to divide the horizon.

If the finical quadrant be taken for a fourth part of the meridian, one fide thereof, A B, may be taken for the common radius of the meridian and the equator; and then the other, A C, will be half the axis of the world. The degrees of the circumference, B C, will reprefent degrees of latitude, and the parallels to the fide A B, affumed from every point of latitude to the axis A C, will be radii of the parallels of latitude, as likewife the fine-complements of thofe latitudes.

Suppofe, then, it be required to find the degrees of longitude contained in 83 of the leffer leagues, in the parallel of 48°. Lay the thread over 48° of latitude, on the circumference, and count thence the 83 leagues, on A B, beginning at A; thefe will terminate at H, allowing every fmall interval four leagues, and the interval between the broad lines twenty leagues. Then tracing out the parallel H G, from the point H to the thread; the part A G of the thread fhews that 125 greater, or equinoctial leagues, make 6° 15', allowing twenty leagues to a degree, and three minutes for one league; and therefore that 83 leffer leagues A H, which make the difference of longitude of the courfe, and are equal to the radius of the parallel G I, make 6° 15' of the faid parallel.

If the fhip fail on an oblique courfe, fuch courfe, befides the north and fouth greater leagues, gives leffer leagues eafterly and wefterly; to be reduced to degrees of longitude of the equator. But thefe leagues being made neither on the parallel of departure, nor on that of arrival, but in all the intermediate ones, we muft find a mean proportional parallel between them.

To find this, we have on the inftrument a fcale of crofs latitudes. Suppofe, then, it were required to find a mean parallel between the parallels of 40° and 60°. With your compaffes take the middle between the 40th and 60th degree on the fcale: this middle point will terminate againft the 51ft degree, which is the mean parallel required.

Quadrant, *Ufe of the Sinical.* There are formed triangles upon this inftrument fimilar to thofe made by a fhip's way, with the meridians and parallels; the fides of which triangles are meafured by the equal intervals between the concentric quadrants, and the lines N. and S.E. and W.

The lines and arcs are diftinguifhed, every fifth, by a broader line; fo that if each interval be taken for one league, there will be five between one broad line and another; and if every interval be taken for four leagues, then there will be twenty leagues, which make a fea degree, from one broad line to the other.

Now, fuppofe a fhip to have failed 150 leagues northeaft, one fourth north; which is the third point, and makes an angle of 33° 45' with the north part of the meridian. Here are given two things; *viz.* the courfe, and the diftance failed; by which a triangle may be found on the inftrument, fimilar to that made by the fhip's courfe, and her longitude and latitude; and hence may the unknown parts of the triangle be found.

Thus, fuppofing the centre A to reprefent the place of departure; count, by means of the concentric arcs, along the point the fhip failed on, as A D, 150 leagues from A to D; then is the point D the place the fhip is arrived at, which note. This done, let D E be parallel to the fide A C; and then there will be formed a right-angled triangle A E D, fimilar to that of the fhip's courfe, difference of longitude, and latitude: the fide A E gives 125 leagues for the difference of latitude northwards; which makes 6° 15', reckoning twenty leagues to a degree, &c. and the fide D E gives 83 leffer leagues anfwering to the parallels; which

which being reduced, as shewn above, gives the difference of longitude. And thus is the whole triangle found.

QUADRANT, in *Gunnery*, called also the *gunner's square*, is an instrument serving to elevate or point cannons, mortars, &c. according to the places they are to be levelled or directed to.

It consists of two branches, made of brass or wood; one about a foot long, eight lines broad, and one line in thickness; the other four inches long, and of the same thickness and breadth as the former. Between these branches is a quadrant divided into ninety degrees, beginning from the shorter branch, and furnished with a thread and plummet. See its figure represented in *Plate* I. *Gunnery*, *fig.* 5.

The use of this instrument is easy; nothing more being required but to place the longest branch in the mouth of the cannon or mortar, and elevate or lower it, till the thread cuts the degree necessary to hit a proposed object. See *Pointing of a* GUN.

Sometimes, also, on one of the surfaces of the long branch, is noted the division of diameters, and weights of iron bullets; as also the bores of pieces. See CALIBER.

QUADRANT *of Altitude*, is an appendage of the artificial globe, consisting of a lamina or slip of brass, the length of a quadrant of one of the great circles of the globe; and divided into ninety degrees.

At the end, where the divisions terminate, there is a nut rivetted on, and furnished with a screw, by means of which the instrument is fitted on to the meridian; and is moveable round upon the rivet, to all points of the horizon. See its figure in *Plate* XIX. *Astronomy*, *fig.* 9.

Its use is to serve as a scale in measuring of altitudes, amplitudes, azimuths, &c. See the manner of its application under the *Use of the* GLOBE.

QUADRANTAL, in *Antiquity*, a vessel in use among the Romans for the measuring of liquids.

It was at first called *amphora*; and afterward *quadrantal*, from its form, which was square every way, like a die.

Its capacity was eighty libræ, or pounds of water, which made forty-eight sextaries, two urnæ, or eight congii.

QUADRANTAL *Space*, in *Geometry*. See QUADRANT.

QUADRANTAL *Triangle*, is a spherical triangle, one of whose sides at least is a quadrant of a circle, and one of its angles a right angle.

QUADRANTATA TERRÆ, in our *Ancient Law Books*, is used for a quarter of an acre, now called a *rood*; which see.

QUADRAS ISLES, in *Geography*, islands situated on the N.W. coast of North America, between Pintard's sound and the straits of Fuca; among which lies NOOTKA'S *sound*, which see. They were so called by Capt. Ingraham, after the name of a Spanish commander of two schooners, who passed through this channel in the year 1792.

QUADRAT, QUADRATUM, called also *geometrical square*, and *line of shadows*, is an additional member on the face of the common Gunter's and Sutton's quadrants; of some use in taking altitudes, &c.

The quadrat more distinctly exhibited in *Plate* VI. *Surveying*, *fig.* 13. has each of its sides divided into a hundred equal parts, commencing from the extremes; so that the number 100 falls on the angle, representing tangents to the arc of the limb.

The divisions are distinguished by little lines from 5 to 5, and by numbers from 10 to 10; and the divisions being occasionally produced across, form a kind of lattice, consisting of 10,000 little squares.

The proportion here is, as radius is to the tangent of the angle of altitude at the place of observation (*i. e.* to the parts of the quadrat cut by the thread), so is the distance between the station and the foot of the object, to its height above the eye. See ALTITUDE.

Use of the Quadrat, Geometrical Square, or *Line of Shadows.* 1. The quadrant being vertically placed, and the sights directed to the top of the tower, or other object, whose height is required; if the thread cut the side of the quadrat marked *right shadows*, the distance from the base of the tower to the point of station is less than the tower's height. If the thread falls on the diagonal of the square, the distance is just equal to the height. If it fall on that side marked *versed shadows*, the distance exceeds the height.

Hence, measuring the distance, the height is found by the rule of three; inasmuch as there are three terms given. Indeed, their disposition is not always the same; for when the thread cuts the side of right shadows, the first term in the rule of three ought to be that part of the side cut by the thread; the second, the side of the square; and the third, the distance measured. If the thread cut the other side, the first term is the whole side of the square; the second, the parts of the side cut by the thread; and the third, the distance.

For an instance of each. Suppose, *e. gr.* in looking at the top of a steeple, the thread cut the side of right shadows in the point 40, and that the distance measures 20 poles, the case then will stand thus: as 40 is to 100, so is 20 to a fourth term, which we find to be 50; the height of the steeple in poles. Again, supposing the thread to fall on the other side, in the point 60, and the distance to measure 35 poles; the terms are to be disposed thus: as 100 is to 60, so is 35 to a fourth term, *viz.* 21, the height required. See ALTITUDE.

Use of the Quadrat without Calculation.—The preceding cases may be formed without calculation, where the divisions of the square are produced both ways, so as to form the area into little squares.

Thus, suppose, 1. The thread to fall on 40 in the side of right shadows, and the distance be measured 20 poles; seek among the little squares for that perpendicular to the side which is 20 parts from the thread; this perpendicular will cut the side of the square next the centre, in the point 50, which is the height required in poles.

2. If the thread cuts the side of versed shadows in the point 60, and the distance be 35 poles; count 35 parts on the side of the quadrat from the centre; count also the divisions of the perpendicular from the point 35 to the thread, which will be 21, the height of the tower in poles.

Note, In all cases the height of the centre of the instrument is to be added. See ALTITUDE, and SHADOW.

QUADRAT, in *Astrology*, called also *Quartile*, an aspect of the heavenly bodies, in which they are distant from each other a quadrant, or ninety degrees. See ASPECT.

QUADRAT, in *Printing*, is a sort of space; that is, a piece of metal, cast like the letters, to be used occasionally in composing, in order to form the intervals between words, at the end of lines, &c. See PRINTING.

There are quadrats of divers sizes, as *m* quadrats, *n* quadrats, &c. which are respectively of the dimensions of such letters.

QUADRATA, in *Ancient Geography*, a town of Higher Pannonia, placed on the banks of the Save by Antonine's Itinerary.

QUADRATA, in *Geography*, a town of Naples, in the province of Bari; five miles N.W. of Ruvo.

QUADRATA is the Italian term in canto fermo for Gregorian or square black notes.

QUADRATA *Legio*, among the Romans. See *Square* LEGION.

QUADRATIC EQUATION, in *Algebra*, is an equation of which the higheſt power of the unknown quantity riſes only to the ſecond degree. If this power enters alone, it is called a *ſimple quadratic;* and when the ſecond power and ſimple quantity both occur, it is termed an *adfected quadratic* equation, thus:

$x^2 \pm a x = b$, is an *adfected quadratic*, and

$x^2 = b$, or $a x^2 = b$, a *ſimple quadratic* equation.

Some authors claſs all ſuch equations as contain two different powers of the unknown quantity, the one being the double of the other, under the general term quadratics, ſuch as $x^4 \pm a x^2 = b$, $x^{2m} \pm a x^m = b$, &c. each of which is called a quadratic equation, becauſe their ſolution depends upon preciſely the ſame principles as the former.

Every quadratic may be reduced to the form $x^2 + a x = b$; in which it is, however, to be underſtood, that a and b may be either poſitive or negative; and the general ſolution of it is expreſſed by the formula

$$x = \frac{-a}{2} \pm \sqrt{\left(\frac{a^2}{4} + b\right)}$$

If we give to a and b all the variety of ſigns they admit of, quadratic equations may be divided into four diſtinct claſſes, *viz.*

1. $x^2 + a x = - b$
2. $x^2 - a x = - b$
3. $x^2 + a x = + b$
4. $x^2 - a x = + b$;

and their ſeveral roots will be exhibited by the following formulæ, *viz.*

1. $x = \frac{-a}{2} \pm \sqrt{\left(\frac{a^2}{4} - b\right)}$
2. $x = \frac{a}{2} \pm \sqrt{\left(\frac{a^2}{4} - b\right)}$
3. $x = \frac{-a}{2} \pm \sqrt{\left(\frac{a^2}{4} + b\right)}$
4. $x = \frac{a}{2} \pm \sqrt{\left(\frac{a^2}{4} + b\right)}$

See EQUATIONS.

From theſe forms it is obvious that every quadratic equation has two roots ariſing out of the ambiguous ſign $\pm$, prefixed to the ſecond member of the root. It is alſo obvious, that if in the 1ſt and 2d form, b be greater than $\frac{a^2}{4}$, the two roots in both forms are imaginary, or impoſſible; but if b be leſs than $\frac{a^2}{4}$, then they are in each form both real, being in the 1ſt both negative, and in the 2d both poſitive; becauſe the quantity exhibited under the radical form is, in both equations, leſs than that without the radical; and conſequently both the ſum and difference will have the ſame ſign as $\frac{a}{2}$.

In the 3d and 4th forms, the roots are neceſſarily both real, but one poſitive and the other negative; the 3d form having its greateſt root negative, and 4th its greateſt root poſitive; as is obvious by inſpection.

It is, however, not neceſſary to conſider quadratic equations under theſe four forms, as the ſolution of them all may be reduced to one general rule, as exhibited in the preceding part of this article, and which may be given in words as follows. Having reduced the propoſed equation to any one of the above forms, the roots of it will be equal to half the co-efficient of the ſecond term, with its ſign changed; plus and minus the ſquare root of the ſquare of that half co-efficient prefixed to b, with its proper ſign, whether plus or minus. The principles on which the preceding formulæ are obtained, are theſe, *viz.* $(x \pm \frac{1}{2} a)^2 = x^2 \pm a x + \frac{1}{4} a^2$; therefore, if an equation be propoſed under the form $x^2 \pm a x = \pm b$, by adding $\frac{1}{4} a^2$ to both ſides, we ſtill preſerve the equality, and render the firſt ſide a complete ſquare, that is, we have

$$x^2 \pm a x + \tfrac{1}{4} a^2 = \tfrac{1}{4} a^2 \pm b;$$

and, by extraction,

$$x \pm \tfrac{1}{2} a = \pm \sqrt{(\tfrac{1}{4} a^2 \pm b)};$$

conſequently

$$x = \mp \frac{a}{2} \pm \sqrt{(\tfrac{1}{4} a^2 \pm b)},$$

which form includes all the preceding formulæ. We ſhall not here give the ſolution of any examples, as the reader will find ſufficient exerciſes under the article EQUATION; but it may not be amiſs to ſhew other methods of obtaining the roots of quadratic equations, *viz.* by ſines and tangents, continued fractions, &c.

The Solution of Quadratic Equations by means of a Table of Sines, Tangents, &c.—Here, referring to our preceding four forms, the ſolution of them may be exhibited as follows:

Form 1. $x^2 + a x = - b$.

Put $\frac{2}{a} \sqrt{b} = \text{ſin. } z$; then

$$x = \begin{cases} - \sqrt{b} \times \text{tan. } \frac{1}{2} z \\ - \sqrt{b} \times \text{cot. } \frac{1}{2} z \end{cases} \quad \text{or,}$$

$$x = \begin{cases} - \frac{1}{2} a \, (1 - \text{coſ. } z) \\ - \frac{1}{2} a \, (1 + \text{coſ. } z) \end{cases}$$

Form 2. $x^2 - a x = - b$.

Put $\frac{2}{a} \sqrt{b} = \text{ſin. } z$; then

$$x = \begin{cases} + \sqrt{b} \times \text{tan. } \frac{1}{2} z \\ + \sqrt{b} \times \text{cot. } \frac{1}{2} z \end{cases} \quad \text{or,}$$

$$x = \begin{cases} + \frac{1}{2} a \, (1 - \text{coſ. } z) \\ + \frac{1}{2} a \, (1 + \text{coſ. } z) \end{cases}$$

Form 3. $x^2 + a x = b$.

Put $\frac{2}{a} \sqrt{b} = \text{tan. } z$; then

$$x = \begin{cases} + \sqrt{b} \times \text{tan. } \frac{1}{2} z \\ - \sqrt{b} \times \text{cot. } \frac{1}{2} z \end{cases} \quad \text{or,}$$

$$x = \begin{cases} + \frac{1}{2} a \, (\text{ſec. } z - 1) \\ - \frac{1}{2} a \, (\text{ſec. } z + 1) \end{cases}$$

Form 4. $x^2 - a x = b$.

Put $\frac{2}{a} \sqrt{b} = \text{tan. } z$; then

$$x = \begin{cases} + \sqrt{b} \times \text{cot. } \frac{1}{2} z \\ - \sqrt{b} \times \text{tan. } \frac{1}{2} z \end{cases} \quad \text{or,}$$

$$x = \begin{cases} + \frac{1}{2} a \, (\text{ſec. } z + 1) \\ - \frac{1}{2} a \, (\text{ſec. } z - 1) \end{cases}$$

The above formulæ reſult immediately from the conſtruction of quadratic equations. Thus, in the two firſt forms, let A B, (*Plate* XIII. *fig.* 6. *Analyſis*,) repreſent a, and C D = $\sqrt{b}$, then A D and D B will be the required roots from the known conſtruction of equations. See CONSTRUCTION.

Now here it is obvious that the ſin. z repreſents the ſin. of C E D, C E D, and therefore angle D C B, which is $= \frac{1}{2}$ angle C E D, $= \frac{1}{2}$ angle z. Confequently D B $=$ C D $\times$ tan. $\frac{1}{2} z$, and A D $=$ C D $\times$ cot. $\frac{1}{2} z$, becaufe the angle C A D $=$ the angle B C D; which agree with the leading formulæ above given. As to the two latter formulæ for the two firft cafes, they are obvious without any explanation.

In the 3d and 4th cafes, let A B reprefent a, and D C $= \sqrt{b}$, then A D and D B will reprefent the two roots; join B C, and draw D E parallel to B C, fo fhall C E $=$ B D, and the angle C D E $= \frac{1}{2}$ the angle B O C. Now here the tan. z will reprefent the tan. of B O C, and $\frac{1}{2} z =$ C D E; but C E $=$ B D is obvioufly equal to D C $\times$ tan. C D E $= \sqrt{b} \times$ tan. $\frac{1}{2} z$; and in the fame manner A D $= \sqrt{b} \times$ cot. $\frac{1}{2} z$. The two latter formulæ require no illuftration.

The fame refults might have been obtained, though not perhaps quite fo obvioufly, from the preceding analytical folution.

There are but few cafes in which it is advifable to employ the methods above defcribed to the folution of quadratics, and therefore one example will be confidered a fufficient illuftration.

Exam.—Given $x^2 + \frac{7}{44} x = \frac{1695}{12716}$, to find the two roots of the equation by fines and tangents.

Here tan. $z = \frac{88}{7} \sqrt{\frac{1695}{12716}}$

log. 1695	3.2291697
log. 12716	4.1043505
	2) $-$ 1.1248192
log. $\sqrt{\frac{1695}{12716}}$	$-$ 1.5624096
log. 88	1.9444827
co. log. 7	9.1549020
log. tan. z	10.6617943

whence $z = 77° \; 42' \; 32''$, and $\frac{1}{2} z = 38° \; 51' \; 16''$

log. tan. $\frac{1}{2} z$	9.9061115
log. $\sqrt{\frac{1695}{12716}}$	$-$ 1.5624096
	9.4685211
deduct radius	10.0000000
log. x	$-$ 1.4685211

or $x =$ .2941176 the pofitive root; and if cot. $\frac{1}{2} z$ be taken inftead of tan. $\frac{1}{2} z$, the other value of x will be found $=$ $-$ .4532085. See Bonnycaftle's Algebra, vol. i. p. 141.

For the folution of quadratic equations by the method of *continued fractions*, we muft refer the reader to the "Effai fur la Théorie des Nombres," by Le Gendre.

The root of a quadratic equation may be exhibited under the form of a continued furd, as follows:

Let $x^2 - a x = b$, or $x^2 = a x + b$; then

$$x = \sqrt{b + a x}$$

Or, by fubftituting for x, under the radical, its whole value $\sqrt{b + a x}$, we have

$$x = \sqrt{b + a \sqrt{b + a x}}$$

Subftituting again for x as above, we obtain

$$x = \sqrt{b + a \sqrt{b + a \sqrt{b + a x}}}$$

and by continuing thus our fucceffive fubftitutions for x, we have

$$x = \sqrt{b + a \sqrt{b + a \sqrt{b + a \sqrt{b + \&c.}}}}$$

which is an analytical expreffion for the pofitive value of x in the propofed equation.

It is obvious, however, that fuch an expreffion as this is of little or no ufe for folving quadratic equations; but we have by means of the latter, a very ready means of finding the ultimate value of fuch a continued furd. Suppofe, for example, the value of the following continued furd were required, *viz.*

$$\sqrt{12 + \sqrt{12 + \sqrt{12 + \sqrt{12 + \&c.}}}}$$

Affume

$$x = \sqrt{12 + \sqrt{12 + \sqrt{12 + \sqrt{12 + \&c.}}}}$$

By fquaring both fides

$$x^2 = 12 + \sqrt{12 + \sqrt{12 + \sqrt{12 + \&c.}}}$$

Or, fince the latter part

$$\sqrt{12 + \sqrt{12 + \sqrt{12 + \&c.}}} = x$$

this becomes

$$x^2 = 12 + x, \text{ or } x^2 - x = 12;$$

whence $x = \frac{1}{2} \pm \sqrt{12\frac{1}{4}} = 4$, which is the value of the infinite furd propofed.

Again, let there be propofed the following infinite furd, *viz.*

$$\sqrt{5 + 4 \sqrt{5 + 4 \sqrt{5 + \&c.}}}$$

Affume the infinite fum $= x$, then by fquaring

$$x^2 = 5 + 4 \sqrt{5 + 4 \sqrt{5 + 4 \sqrt{5 + \&c.}}}, \text{ or}$$

$$x^2 = 5 + 4 x, \text{ or } x^2 - 4 x = 5;$$

whence $x = 2 \pm \sqrt{4 + 5} = 5$, the value fought. For other examples of this kind, fee SURDS.

QUADRATING *of a Piece*, among *Gunners*, is the feeing that a piece of ordnance be duly placed, and poifed in its carriages; and that its wheels be of an equal height, &c.

QUADRATO, in *Mufic.* See QUADRO.

QUADRATO-CUBUS, QUADRATO-QUADRATO-CUBUS, and QUADRATO-CUBO-CUBUS, are names ufed by Diophantus, Vieta Oughtred, and others, for the fifth, feventh, and eighth powers of numbers. See POWER.

QUADRATO-QUADRATUM, or BIQUADRATUM, the fourth power of numbers; or the product of the cube multiplied by the root.

QUADRATRIX, in *Geometry*, a mechanical line, by means of which we would find right lines equal to the circumference

cumference of circles, or other curves, and of the ſeveral parts of it.

Or, more accurately, the quadratrix of a curve is a tranſcendental curve deſcribed on the ſame axis, the ſemi-ordinates of which being given, the quadrature of the correſpondent parts in the other curve is likewiſe given. See Curve.

Thus, *e. gr.* the curve A N D (*Plate* XIII. *Analyſis*, *fig.* 7.) may be called the quadratrix of the parabola A M C, ſince it is demonſtrated, that A P M A is $=$ PN^2, or $APMA = AP \times PN$, or $APMA = PN \times a$, a conſtant quantity, &c.

The moſt eminent of theſe quadratrices are, that of Dinoſtrates, and that of Mr. Tſchirnhauſen, for the circle; that of Mr. Perks for the hyperbola.

Quadratrix *of Dinoſtrates*, is a curve A M *m m* (*fig.* 8.) by which the quadrature of the circle is effected, though not geometrically, but mechanically; it is thus called from its inventor Dinoſtrates.

Its geneſis is thus: divide the quadrantal arc A N B into any number of equal parts, in N, *n*, &c. by a continual biſection; divide the radius A C into the ſame number of parts in the points P, *p*, &c. Draw radii C N, C *n*, &c. Laſtly, on the points P, *p*, &c. erect perpendiculars P M, *p m*, &c. The curve formed by connecting theſe lines is the quadratrix of Dinoſtrates.

This curve may be deſcribed by continual motion; if we ſuppoſe the radius C N by its extreme N to deſcribe uniformly the arc A B, and at the ſame time a ruler P M, always parallel to itſelf, to move uniformly along A C, in ſuch a manner that when the ruler P M arrives at C, the radius C N may coincide with C B; and thus the continual interſection of C N with the ruler P M will deſcribe the quadratrix A M D.

Here, from the conſtruction, $ANB : AN :: AC : AP$; and therefore, if $ANB = a$, $AC = b$, $AN = x$, $AP = y$; $ay = bx$. See Quadrature.

Quadratrix *Tſchirnhauſiana*, is a tranſcendental curve A M *m m* B (*fig.* 9.) by which the quadrature of the circle is likewiſe effected; invented by Mr. Tſchirnhauſen, in imitation of that of Dinoſtrates.

Its geneſis is thus conceived; divide the quadrant A N B, and its radius A C, into equal parts, as in the former; and from the points P, *p*, &c. draw the right lines P M, *p m*, &c. parallel to C B; and from the points N, *n*, &c. the right lines N M, *n m*, &c. parallel to A C. The points A, M *m*, being connected, the quadratrix is formed; in which $ANB : AN :: AC : AP$. And therefore, if $AB = a$, and $AC = b$, $AN = x$, and $AP = y$; $ay = bz$. See Quadrature.

This curve may be alſo deſcribed by continued motion, if two rulers, N M and P M, perpendicular to each other, be made to move uniformly and parallel to themſelves, the one along the quadrant of the circle A C, and the other along the radius.

QUADRATUM-CUBI, Quadrato-quadrato-quadratum, and Quadratum *Surdoſolidi*, &c. are names uſed by the Arabs for the ſixth, eighth, and tenth powers of numbers. See Power.

Quadratum *Os*, in *Comparative Anatomy*, *os carré* of the French; a ſmall bone in the head of birds, to which the lower mandible is articulated. See Birds, in *Comparative Anatomy*, in the diviſion relating to the bones.

QUADRATURE, in *Geometry*, ſignifies literally the finding of a ſquare equal in area to any given figure, which was the method the ancients made uſe of when they had in view the determination of the ſurface of any ſpace; but the term *quadrature* has now a more indefinite ſignification; implying, in general, the determination of the area of a figure, without any reference to the geometrical exhibition of it, in a ſquare or other rectilinear form.

All rectilinear figures being immediately reduced to, or dependent upon, the area of triangles, their quadratures have been known from the higheſt antiquity; but the quadratures of curvilineal ſpaces are, with very few exceptions, of modern date, two only having been known till near the beginning of the eighteenth century.

The firſt curvilinear ſpace whoſe quadrature was accurately determined, was the lune of Hippocrates, of which an account will be found under the article Lune. Archimedes next found the area of the common parabola; which he obtained in a very ingenious manner, by inſcribing an iſoſceles triangle in the parabola, then two iſoſceles triangles on the equal ſides of the former, four others on theſe, and ſo on, which he found to have a certain relation, decreaſing in the proportion $1, \frac{1}{4}, \frac{1}{16}$, &c. the infinite ſum of which ſeries would therefore expreſs the area of the parabola, or the area of all the triangles of which he thus conceived it to be compoſed; and which ſum he found to be $1\frac{1}{3}$ or $\frac{2}{3}$ of the circumſcribing rectangle. After this time, a period of near two thouſand years elapſed, without producing the quadrature of a ſingle curvilinear figure, although the ſubject ſeems to have engaged the attention of the moſt eminent mathematicians during that long interval, particularly the quadrature of the circle. This figure, being the moſt ſimple in appearance and conſtruction of any contained under a curve line, was well calculated to excite the curioſity of mathematicians. Archimedes doubtleſs attempted the ſolution of this problem; but failing in producing the exact quadrature, he contented himſelf with giving an approximation, ſhewing by the inſcription and circumſcription of a polygon of ninety-ſix ſides, that the diameter being 1, the circumference was greater than $3\frac{10}{71}$, but leſs than $3\frac{10}{70}$; and as it was known, even before the time of Archimedes, that the area of a circle is equal to that of a right-angled triangle, whoſe altitude is equal to the radius, and baſe equal to the circumference of the circle, it follows, that the area would be greater than $\frac{223}{284}$, but leſs than $\frac{220}{280}$.

It would be uſeleſs to attempt in this place to enumerate the various abſurd quadratures which have been, from time to time, publiſhed by minor geometers, with all that conceit and confidence which ſeldom fail to accompany inferiority. Some attributed their ſucceſs to divine inſpiration; others to their own ſuperior talents: ſome offered large ſums of money to thoſe who ſhould diſcover any error in their inveſtigation, while others expected great rewards from their government, as a recompence for their diſcovery, fooliſhly attaching great importance to a problem, which, if it could be accurately ſolved, would ſerve no other purpoſe but to gratify the curioſity of mathematicians. Many of theſe attempts, however, have been rendered ſomewhat amuſing by an exceſs of abſurdity. This is particularly the caſe with regard to the work of Jaime Falcon, a Spaniard of the order of Nôtre Dame, of Monteſa, publiſhed at Anvers in 1587. This treatiſe opens with a dialogue in verſe between himſelf and the circle, which thanks him very affectionately for having ſquared him; but the good and modeſt knight attributes all the honour of the diſcovery to the holy patron of his order. See Montucla's "Hiſtoire des Recherches ſur la Quadrature du Circle;" or his "Hiſtoire des Mathematiques," vol. iv. p. 619.

Referring thoſe readers who have the curioſity to examine the reveries above-mentioned to the two preceding works, we propoſe to give here an abſtract from the ſame, of what

has

has been done on this ſubject, by way of approximation. We have already obſerved that Archimedes was the firſt who gave an approximation of the ratio of the diameter to the circumference of a circle, placing it between the limits 1 to $3\frac{10}{70}$, and 1 to $3\frac{10}{71}$; and it is ſaid that Apollonius and Philo found more accurate approximations, which, however, have not been tranſmitted to us.

Towards the year 1585, Metius, combatting the falſe quadrature of Simon Duchêne, gave the ratio of 113 to 355, which is very exact, being only $\frac{3}{10000000}$ in exceſs. Vieta found a ſtill nearer approximation, carrying it to ten decimals, whereas the former is true only to ſix places. He alſo gave a kind of ſeries, the infinite ſum of which was equal to the entire circle.

Adrianus Romanus carried the approximation to ſeventeen figures, and Ludolph van Ceulen to thirty-ſix; which he publiſhed in his work "De Circulo et Adſcriptis;" and of which Snellius publiſhed a Latin tranſlation in 1619. He afterwards verified Van Ceulen's approximation by ſome theorems of his own invention, which greatly facilitated the computation, and which he publiſhed in 1621, under the title of "Willebrordi Snellii Cyclometricus de Circuli Dimenſione, &c."

Deſcartes found a geometrical conſtruction from which it was eaſy to draw an expreſſion in the form of a ſeries; and Huygens afterwards diſcovered ſome curious theorems connected with this ſubject, but did not advance the approximation, though he made ſome uſeful rules for approximating towards the length of the circular arc.

One of the moſt curious diſcoveries connected with this ſubject, which had yet been publiſhed, was that given by Wallis in his "Arithmetica Infinitorum," in 1655: where he ſhews that the ratio of a circle to the ſquare of its diameter, is truly expreſſed by the infinite fraction

$$\frac{3^2 \cdot 5^2 \cdot 7^2 \cdot 9^2 \cdot 11^2 \cdot \&c.}{2. \; 4^2. \; 6^2. \; 8^2. \; 10^2. \; 12^2. \; \&c.}$$

If we limit ourſelves, as we muſt do to, a finite number of terms, we ſhall have a ratio alternately too great and too ſmall, according as we take an even or an odd number of terms: thus, $\frac{3}{2}$ is too great; $\frac{3 \cdot 3}{2 \cdot 4}$ too ſmall; $\frac{3 \cdot 3 \cdot 5}{2 \cdot 4 \cdot 4}$ too great; and $\frac{3 \cdot 3 \cdot 5 \cdot 5}{2 \cdot 4 \cdot 4 \cdot 6}$ too ſmall, and ſo on; but each of theſe is a nearer approximation than the preceding ones. But in order to approach ſtill nearer in both caſes, the author propoſed to multiply the whole product by the ſquare root of a binomial, *viz.* unity, plus unity divided by the laſt figure, with which the ſeries terminated either in the numerator or denominator; in which caſe, the product will be a much nearer approximation; it will be too great if we uſe the laſt figure of the numerator, and too ſmall if the laſt of the denominator. Thus we ſhall have for the ratio ſought, alternately in exceſs and defect.

In exceſs.	In defect.
$\frac{3 \cdot 3 \cdot 5 \cdot 5}{2 \cdot 4 \cdot 4 \cdot 6} \surd (1 \times \frac{1}{5})$	$\frac{3 \cdot 3 \cdot 5 \cdot 5}{2 \cdot 4 \cdot 4 \cdot 5} \surd (1 \times \frac{1}{6})$
$\frac{3 \cdot 3 \cdot 5 \cdot 5 \cdot 7 \cdot 7}{2 \cdot 4 \cdot 4 . 6 . 6 . 8} \surd (1 \times \frac{1}{7})$	$\frac{3 \cdot 3 \cdot 5 \cdot 5 \cdot 7 \cdot 7}{2 \cdot 4 \cdot 4 . 6 . 6 . 8} \surd (1 \times \frac{1}{8})$
&c.	&c.

Prior to the above ſeries of Dr. Wallis, however, ſome thing of an equivalent expreſſion, though given under a different form, was diſcovered by lord Brounker, which is as follows. The circle itſelf being 1, the ſquare of its diameter is expreſſed by the infinite continued fraction.

$$1 + \cfrac{1}{2 + \cfrac{3^2}{2 + \cfrac{5^2}{2 + \cfrac{7^2}{2 + \cfrac{9^2}{2 + \&c.}}}}}$$

of which the law of the denominators is obvious. See Circle.

Such was the progreſs which mathematicians had made towards the ſolution of this intereſting problem prior to the invention of fluxions, which, by reducing the quadrature of all curves to one general principle, again revived the hopes of ſucceſs with regard to the circle, notwithſtanding ſome pretended demonſtrations of its impoſſibility; and its quadrature was accordingly again attempted with the greateſt eagerneſs. The quadrature of a ſpace, and the rectification of a curve, were now reduced to that of finding the fluent of a given fluxion but ſtill the problem was found to be incapable of a general ſolution in infinite terms. The fluxion of a given fluent was found to be always aſſignable, but the converſe propoſition, *viz.* of finding the fluent of a given fluxion, could only be effected in particular caſes; and amongſt the exceptions, to the great regret and diſappointment of geometricians, was included the caſe of the circle with regard to every form of fluxion under which it could be obtained. Some exceedingly near approximations have, however, ſince been made towards the true ratio of the diameter to the circumference of the circle, but theſe belonging rather to the article Rectification than to Quadrature, we ſhall enter again upon the ſubject under the former term, and ſhall occupy the remainder of the preſent article on the quadrature of curves in general.

On the Quadrature of Curves by Fluxions. In order to exhibit more diſtinctly and at large the uſe of fluxions, according to the modern method of notation, in finding the areas of curves, we ſhall premiſe the two following caſes.

Caſe 1.—Let A R C (*Plate* XIII. *Analyſis*, *fig.* 10.) be a curve of any kind, whoſe ordinates R *b*, C B, are perpendicular to an axis A B. Imagine a right line *b* R *g*, perpendicular to A B, to move parallel to itſelf from A towards B; and let its velocity, or the fluxion of the abſciſſe A *b*, in any propoſed ſituation of that line, be denoted by *b d*; then will the rectangle *b n* expreſs the fluxion of the generated area A *b* R, which (if A $b = x$, and b R $= y$) will be $= y \dot{x}$: whence, by ſubſtituting for y or $\dot{x}$ (according to the equation of the curve,) and taking the fluent, the area itſelf will become known.

Caſe 2.—Let A R M (*fig.* 11.) be any curve whoſe ordinates C R, C R, are all referred to a point or centre; and conceive a right line C R H to revolve about the given centre C, and a point R to move along the ſaid line, ſo as to deſcribe the curve live A R M. If this point were to move from Q, without changing its direction or velocity, it would proceed along the tangent Q S (inſtead of the curve), and deſcribe areas Q *s* C, Q S C, about the centre C, proportional to the times in which they were deſcribed; becauſe, having the ſame altitude C P, they are as the baſes Q *s* and Q S. Conſequently, if R S be taken to denote the value of $\dot{z}$ the fluxion of the curve line A R, the correſponding fluxion

fluxion of the area A R C will be juftly reprefented by the uniformly generated triangle Q C S; which, expreffing C P by s, will be $= \frac{QS \times CP}{2} = \frac{s\dot{z}}{2}$: whence the area itfelf may be determined. But fince, in many cafes, the value of $\dot{z}$ cannot be computed (from the property of the curve) without trouble, the two following expreffions, for the fluxion of the area, will be found more commodious, *viz.* $\frac{sy\dot{y}}{2t}$ and $\frac{y^2\dot{x}}{2a}$; where $t =$ R P, and $x =$ the arc B N of a circle, defcribed about the centre C, at any diftance $a =$ C B. Thefe expreffions are derived from that above in the following manner; *viz.* $\dot{z} : \dot{y} :: y\,(CR) : t\,(RP)$; therefore $\dot{z} = \frac{y\dot{y}}{t}$; confequently $\frac{s\dot{z}}{2} = \frac{sy\dot{y}}{2t}$. Moreover, becaufe the celerity of R in the direction of the tangent is denoted by $\dot{z}$, that in a direction perpendicular to C Q (whereby the point R revolves about the centre C) will, therefore, be $= \frac{CP}{CR} \times \dot{z} = \frac{s\dot{z}}{y}$; which, being to $\dot{x}$ the celerity of the point N about the fame centre as the diftance or radius C R (y) to the radius C N (a), we fhall, by multiplying extremes and means, have $\frac{as\dot{z}}{y} = y\dot{x}$, and, confequently, $\frac{s\dot{z}}{2} = \frac{y^2\dot{x}}{2a}$. In the examples fubjoined, the letters x, y, z, and u will be ufed to denote the abfciffe, ordinate, curve-line, and area refpectively.

Quadrature *of a Right-angled Triangle.* Let the bafe A H (*fig.* 12.) $= a$, the perpendicular H M $= b$, and let A B (x) be any portion of the bafe, confidered as a flowing quantity, and B R (y) be the correfponding ordinate. Then, the triangles A H M and A B R being fimilar, we fhall have $a : b :: x : y = \frac{bx}{a}$. Whence $y\dot{x}$ (the fluxion of the area A B R) $= \frac{bx\dot{x}}{a}$; and its fluent (fee *Inverfe Method of* Fluxions) or the area itfelf $= \frac{bx^2}{2a}$, which, when $x = a$, and B R coincides with H M, will become $\frac{ab}{2} = \frac{AH \times HM}{2}$ = the area of the whole triangle A H M. See *Menfuration of* Triangles.

Quadrature *of a Circular Sector.* Let A O R (*fig.* 13.) be the fector; A O or O R, its radius, $= a$, the arc A R, confidered as variable by the motion of R, $= z$, and R r $= \dot{z}$; the fluxion of the area will be $\frac{a\dot{z}}{2}$ = the triangle O R r: whence the area itfelf is $= \frac{az}{2} = AO \times \frac{1}{2}AR$: that is, the area of any circle is expreffed by a rectangle under half the circumference and half the diameter. See Circle.

Quadrature *of a Semicircle.* Let the femicircle be A R E H (*fig.* 14.); its diameter A H $= a$, A B $= x$, and B R $= y$, &c. and we have y^2 (BR^2) $= ax - x^2$ (A B $\times$ B H), and, confequently, $\dot{u}$ ($y\dot{x}$) $= \dot{x}\sqrt{(ax - x^2)} = a^{\frac{1}{2}} x^{\frac{1}{2}} \dot{x} \times \left(1 - \frac{x}{a}\right)^{\frac{1}{2}}$; which expreffion being refolved into an infinite feries, we fhall have $\dot{u} = a^{\frac{1}{2}} x^{\frac{1}{2}} \dot{x} \times \left(1 - \frac{x}{2a} - \frac{x^2}{8a^2} - \frac{x^3}{16a^3} - \frac{5x^4}{128a^4}, \&c.\right) = a^{\frac{1}{2}} \times \left(x^{\frac{1}{2}}\dot{x} - \frac{x^{\frac{3}{2}}\dot{x}}{2a} - \frac{x^{\frac{5}{2}}\dot{x}}{8a^2} - \frac{x^{\frac{7}{2}}\dot{x}}{16a^3}\right)$, &c. Whence, the fluent of every term being taken, there will arife $u = a^{\frac{1}{2}} \times \left(\frac{2x^{\frac{3}{2}}}{3} - \frac{x^{\frac{5}{2}}}{5a} - \frac{x^{\frac{7}{2}}}{28a^2} - \frac{x^{\frac{9}{2}}}{72a^3} - \frac{5x^{\frac{11}{2}}}{704a^4}, \&c.\right) = x\sqrt{ax} \times \left(\frac{2}{3} - \frac{x}{5a} - \frac{x^2}{28a^2} - \frac{x^3}{72a^3} - \frac{5x^4}{704a}, \&c.\right)$ = the area A B R. When $x = \frac{1}{2}a$, the ordinate B R will coincide with the radius O E; in which cafe the area becomes $= \frac{1}{2}a\sqrt{\frac{1}{2}aa} \times (\frac{2}{3} - \frac{1}{10} - \frac{1}{112} - \frac{1}{576} - \frac{5}{11264}, \&c.) = \frac{a^2\sqrt{\frac{1}{8}}}{2} \times (0.6666 - 0.1 - 0.0089 - 0.0017 - 0.0004, \&c.) = 0.1964\,a^2$; which, multiplied by 2, gives $0.3928\,a^2$ for the area of the femicircle, nearly. In order to obtain a more converging feries, let the arc A R be $= \frac{1}{3}$ A E $= 30°$, and the fine B R (being half the chord of double the arc or half the fide of a hexagon, *i. e.* half the radius), will be $= \frac{1}{2}$ A O; and A B (x) $=$ A O $-$ O B $=$ A O $- \sqrt{(OR^2 - BR^2)}$; which, radius being 1, will be $= 0.1339746$ nearly: fubftitute this quantity, with the value of a in the above feries, $\sqrt{ax^3} \times (\frac{2}{3} - \frac{x}{5a} - \frac{x^2}{28a^2} - \&c.)$ and we fhall have $0.0693505 \times (0.6666666 - 0.0133975 - 0.0001603 - 0.0000042 - \&c.) = 0.0693505 \times 0.6531046 = 0.0452931$ = the area A B R: which, added to the area O B R ($=$ O B $\times \frac{1}{2}$ B R $= \sqrt{\frac{3}{4}} \times \frac{1}{4} = 0.2165063$) gives 0.2617994 for the area of the fector A O R; the treble of which, or 0.7853982 (A R being $= \frac{1}{3}$ A E), will be the content of the whole quadrant A O E; which number, found by taking only four terms of the feries, is true to the laft decimal place.

We might have found a feries of more rapid convergency, but fhall referve that part of our inveftigation for the article Rectification.

Quadrature *of the Lunes.* See Lunes.

Quadrature *of the Ellipfe.* The ellipfe, alfo, is a curve whofe precife quadrature in definite terms is not yet effected. Indeed the area of an ellipfe, being an exact mean proportional between the areas of the circles defcribed upon its two axes, is obvioufly dependent upon the latter; and it is, therefore, ufelefs to repeat the operation.

Quadrature *of the Parabola.* Let the curve A R M H (*fig.* 15.), be the common parabola, in which y^2 (BR^2) $= ax$ (A B $\times$ a, the parameter). See Conic *Sections.* Whence we have $y = a^{\frac{1}{2}} x^{\frac{1}{2}}$, and $\dot{u}$ ($y\dot{x}$) $= a^{\frac{1}{2}} x^{\frac{1}{2}} \dot{x}$; and, therefore, $u = \frac{2}{3} \times a^{\frac{1}{2}} x^{\frac{3}{2}} = \frac{2}{3} a^{\frac{1}{2}} x^{\frac{1}{2}} \times x = \frac{2}{3} yx = \frac{2}{3} \times$ A B $\times$ B R. Hence a parabola is $\frac{2}{3}$ of a rectangle of the fame bafe and altitude.

The value of the area may alfo eafily be found in terms of y. Thus x being $= \frac{y^2}{a}$, we have $\dot{x} = \frac{2y\dot{y}}{a}$, and $\dot{u}$ ($y\dot{x}$) $= \frac{2y^2\dot{y}}{a}$: whence $u = \frac{2y^3}{3a} = \frac{2y}{3} \times \frac{y^2}{a} = \frac{2y}{3} \times x = \frac{2}{3} \times$ A B $\times$ B R. See Parabola.

In the cubic parabola, whofe equation is $p^2 x = y^3$; we have

have $y = p^{\frac{2}{3}} x^{\frac{1}{3}}$; multiply this by $\dot{x}$, and we have $y\dot{x} = p^{\frac{2}{3}} x^{\frac{1}{3}} \dot{x}$, for the fluxion of the area. Therefore fluent $y\dot{x} = \frac{3}{4} p^{\frac{2}{3}} x^{\frac{4}{3}} = \frac{3}{4}$ of xy, that is, area $= \frac{3}{4}$ of circumfcribing rectangle.

And in the fame manner, it will be found that in the general parabola, whofe equation is $a^{n-1} x = y^n$; the area $= \frac{n}{n+1} \times$ circumfcribing rectangle.

QUADRATURE *of the Hyperbola.* The analytical quadrature of this curve was firft given by N. Mercator of Holftein, the firft inventor of infinite feriefes. But Mercator finding his feries by divifion, fir Ifaac Newton and M. Leibnitz improved upon his method; the one feeking them by the extraction of roots, the other by a feries prefuppofed. See HYPERBOLA.

QUADRATURE *of the Afymptotic Spaces in an Hyperbola.* Let D E F (*fig.* 16.) be an hyperbola, of which the afymptotes are C M and C N; to find the area E G H F, comprehended between the ordinates G E and F H.

Let C G $= a$, G E $= b$, G H $= x$, F H $= y$; then by the property of the hyperbola, C G $\times$ G E $=$ C H $\times$ H F, or $ab = (a - x) y$, or $y = \frac{ab}{a+x}$; and, therefore, $y\dot{x} = \frac{ab\dot{x}}{a+x}$; the fluent of which is $ab \times$ hyp. log. $(a + x)$, which fluent, however, requires a correction, for when $x = 0$, the area $= 0$; but the above expreffion when $x = 0$ is $ab \times$ hyp. log. of a, therefore the correction is $- ab \times$ hyp. log. of a, that is, the correct fluent which expreffes the area is $ab \times$ hyp. log. $(a + x) - ab \times$ hyp. log. a, or area E G F H $= ab \times$ hyp. log. $\frac{a+x}{a}$.

If C G and G E each $= 1$; $y\dot{x} = \frac{\dot{x}}{1+x}$, the fluent of which is hyp. log. $(1 + x)$, which requires no correction.

QUADRATURE *of the Cycloid.* Let C A L (*fig.* 17.) be a cycloid, A D the axis, A B D the generating circle, A F a tangent at the vertex, C F parallel to A D.

Take any point P in the arc, and draw P M perpendicular to A M. Then the fluxion of the external area A M P $=$ P M $\times$ the fluxion of A M.

Let A E $= x$, A D $= 2a$; then B E $= \sqrt{(2ax - x^2)}$ and the fluxion of B E $= \frac{(a-x)\dot{x}}{\sqrt{(2ax - x^2)}}$.

Alfo P B $=$ the arc B A; therefore the fluxion of P B $= \frac{a\dot{x}}{\sqrt{(2ax - x^2)}}$; and the fluxion of P B $+$ B E, or of A M $= \frac{(2a - x)\dot{x}}{\sqrt{(2ax - x^2)}}$; therefore the fluxion of the area A P M, or P M, $\times$ by the fluxion A M $= \frac{(2ax - x^2)\dot{x}}{\sqrt{(2ax - x^2)}} = \dot{x}\sqrt{(2ax - x^2)}$.

But the fluent of this fluxion is the fame as that found above for a circle, whofe radius is a, and verfed fine x; that is, the area A B E; and, therefore, when $x = 2a$, the whole external area C F A is equal to the area of the femicircle A B D. But C D being equal to the femicircumference A D, the whole rectangle C D A F $=$ four times the femicircle A B D, and confequently the internal area A C D $=$ three times the femicircle A B D; or the whole area of the cycloid equal three times the area of its generating circle.

QUADRATURE *of the Logiftic,* or *Logarithmic Curve.* Let the fubtangent P T (*fig.* 18.) $= a$, P M $= x$, P $p = dx$; then will

$$\frac{y\dot{x}}{\dot{y}} = a$$

$$y\dot{x} = a\dot{y}$$

and fluent of $y\dot{x} = ay$.

Wherefore the indeterminate fpace H P M I, is equal to the rectangle of P M into P T.

Hence, 1. Let Q S $= z$; then will the indeterminate fpace I S Q H $= az$; and, confequently, S M P Q $= ay - az = a(y - z)$; that is, the fpace intercepted between the two logiftic femiordinates is equal to the rectangle of the fubtangent into the difference of the femiordinates.

2. Therefore the fpace B A P M is to the fpace P M S Q as the difference of the femiordinates A B and P M is to the difference of the femiordinates P M and S Q. See LOGARITHMIC *Curve.*

QUADRATURE *of the Logarithmic Spiral.* Let C B A C (*fig.* 19.), be the area propofed: let the right line A T touch the curve at A, upon which, from the centre C, let fall the perpendicular C T: then, fince by the nature of the curve, the angle T A C is every where the fame, the ratio of A T (t) to C T (s) will be conftant: and, therefore, the fluent of $\frac{s}{t} \times \frac{y\dot{y}}{2} = \frac{s}{t} \times \frac{y^2}{4} =$ the required area.

QUADRATURE *of the Spiral of Archimedes.* Let C R R (*fig.* 20.) be the curve, whofe area C R g C is required. Let A C be a tangent at the centre C, about which centre, with any radius A C ($= a$), fuppofe a circle A gg to be defcribed: then the arc or abfcifs A g correfponding to any propofed ordinate C R, being to that ordinate in a conftant ratio (*e. gr.* as m to n) we have x (A g) $= \frac{my}{n}$; therefore $\dot{u} = \frac{y^2\dot{x}}{2a} = \frac{my^2\dot{y}}{2an}$; confequently $u = \frac{my^3}{6an} =$ the area C R R g C. See SPIRAL *of Archimedes.*

QUADRATURE *of Defcartes' Curve,* which is defined by the expreffion, $b^2 : x^2 :: b - x : y$.

$$\text{Since } b^2 y = bx^2 - x^3$$
$$y = (bx^2 - x^3) \div b^2$$
$$y\dot{x} = (bx^2\dot{x} - x^3\dot{x}) \div b^2$$
$$\text{flu. } y\dot{x} = x^3 \div 3b - x^4 \div 4b^2.$$

QUADRATURE *of all Curves comprehended under the general Equation,* $y = \sqrt[m]{(x + a)}$.

$$\text{Since } y = (x + a)^{\frac{1}{m}}$$
$$y\dot{x} = \dot{x}(x + a)^{\frac{1}{m}}$$
$$\text{Make } (x + a)^{\frac{1}{m}} = v$$
$$\text{Then } x + a = v^m, \text{ or } x = v^m - a$$
$$\text{Whence } \dot{x} = mv^{m-1}\dot{v}$$

$y\dot{x} = mv^m\dot{v}$, the fluent of which is $\frac{mv^{m+1}}{m+1} = \frac{m}{m+1}(x + a)(x + a)^{\frac{1}{m}} = \frac{m}{m+1}(x + a)^{\frac{m+1}{m}}$.

Let $x = 0$; the remainder will be $\frac{m}{m+1} a \sqrt[m]{a}$.

Whence,

Whence, the area of the curve $= \frac{m}{m+1}(x+a)\sqrt[m]{(x+a)}$ $- \frac{m\,a}{m+1}\sqrt[m]{a}$.

See on the fubject of this article Maclaurin's Fluxions, and Simpfon's Fluxions, vol. i. fect. 7. p. 121, &c.

QUADRATURE, in *Aftronomy*, that afpect, or fituation of the moon, when fhe is 90 degrees diftant from the fun.

Or, the quadrature is when fhe is in a middle point of her orbit, between the points of conjunction and oppofition; which happens twice in each revolution, *viz.* in the firft and third quarter.

When the moon is in her quadrature, fhe exhibits that phafis which we call the half-moon, *i. e.* fhe fhines with juft half her face; and is faid to be bifected, or dichotomized.

In the moon's progrefs from the fyzygies to her quadrature, her gravity towards the earth is continually increafing by the action of the fun; and her motion is retarded for the fame reafon. Her motion then, in her orbit, is floweft as her gravity to the earth is greateft when in the quadratures.

In her recefs from the quadratures to the fyzygies, the gravity continually decreafes, and the velocity increafes. The ratio is thus: as radius is to the fum, or difference of one and a half the cofine of double the diftance of the moon from the fyzygy, and half the radius; fo is the addition of gravity in the quadratures to the diminution or increafe of it in any other fituation. See SYZYGY.

Hence the moon's orbit is more convex in the quadratures, than in the fyzygies; and hence the circular figure of the moon's orbit is changed into an oval, whofe greater axis goes through the quadratures; and hence, alfo, the moon is lefs diftant from the earth at the fyzygies, and more at the quadratures.

It is no wonder, therefore, that the moon fhould approach nearer the earth when her gravity is diminifhed; that accefs not being the immediate effect of this diminution, but of the inflexion of the orbit towards the quadratures.

In the quadratures, and within thirty-five degrees of them, the apfides of the moon go backwards, or move *in antecedentia*; but they move forwards in the fyzygies. See APSIDES.

The moon's orbit undergoes various alterations in each revolution. Its excentricity is the greateft when the line of the apfides is in the fyzygies; and the leaft, when in the quadratures.

Confidering one entire revolution, the nodes move flower and flower as the moon approaches the quadratures, and they reft when fhe is in them; but confidering feveral revolutions, the nodes go back fafter in the quadratures.

The inclination of the plane of the moon's orbit increafes as the nodes go from the fyzygies, and is greateft when the nodes are in the quadratures. See MOON and NODES.

QUADRATURE *Lines*, or *Lines of Quadrature*, are two lines frequently placed on Gunter's fector.

They are marked with the letter Q, and the figures 5, 6, 7, 8, 9, 10; of which Q fignifies the fide of a fquare, and the other figures the fides of polygons of 5, 6, 7, &c. fides. S there ftands for the femi-diameter of a circle; and 90 for a line equal to ninety degrees in circumference.

QUADRATUS, in *Biography*, an early Chriftian writer, who flourifhed under the reigns of Trajan and Adrian. He is ftyled by Jerome and Eufebius "a difciple of the apoftles," and he was reported to have been endowed with the gift of prophecy. According to Eufebius, Quadratus prefented to the emperor Adrian, in the year 126, an apology for the Chriftian religion, with a view of mitigating the fufferings inflicted upon the profeffors of that period. This is fuppofed to have been the firft written apology prefented on the fame fubject to any of the Roman emperors, and it produced a confiderable effect on the mind of Adrian. Of this work only a fragment remains, which is preferved by Eufebius, and which is extremely valuable on account of the teftimony which it affords to the reality of the miracles of Chrift and his apoftles, by afferting that fome of thofe miracles were wrought on perfons who were living at the time when Quadratus wrote. Nothing is known refpecting the time and manner of his death. Lardner.

QUADRATUS, in *Anatomy*, a name given to feveral mufcles of the body, on account of their form.

QUADRATUS *Femoris*, *le carré*, *ifchio-trochantérien*; is fituated at the upper and back part of the thigh, and extends from the tuberofity of the ifchium to the great trochanter. It is flattened, quadrilateral, and tolerably thick. The pofterior furface is covered by the gluteus maximus, the fciatic nerve, and the femi-membranofus; the anterior furface covers the obturator externus, the extremity of the tendon of the pfoas magnus, and the back of the trochanter minor. The fuperior edge is parallel to the inferior geminus; and the inferior to the upper fibres of the adductor magnus. The inner edge, or origin of the mufcle, is fixed to the outer fide of the tuberofity of the ifchium, in front of the femi-membranofus; the outer is attached to the bony ridge, which runs from the great to the fmall trochanter. It is tendinous at its two attachments, and flefhy in other parts. It will rotate the thigh outwards upon the pelvis; or, if the former be fixed, it will move the pelvis upon the thigh. When the thigh has been carried upwards and outwards, it will reftore the limb to its natural pofition.

QUADRATUS *Genæ*, a mufcle of the lower lip; fee the article DEGLUTITION, where it is defcribed under the name of *depreffor labii inferioris*.

QUADRATUS *Lumborum*. See LUMBORUM.

QUADRATUS *Occipitis*, a name of the pofterior or occipital portion of the *Epicranius*; which fee.

QUADRELLA, in *Geography*, a town of Naples, in Lavora; 20 miles E.N.E. of Naples.

QUADRELS, in *Building*, a kind of artificial ftones, perfectly fquare; whence their name. They are made of a chalky, or whitifh and pliable earth, &c. dried in the fhade for at leaft two years.

They were formerly in great requeft among the Italian architects.

QUADRICEPS, in *Anatomy*, a name under which it has been propofed to defcribe the extenfors of the knee-joint, *viz.* the vaftus internus and externus, the cruræus, and rectus; and the adductors of the thigh, with the pectinalis.

QUADRIGA, formed from *quatuor*, *four*, and *jugum*, *yoke*, in *Antiquity*, a car, or chariot, drawn by four horfes, harneffed abreaft.

Various are the accounts we have of the inventor of the quadriga. Cicero makes it the invention of Minerva. Hyginus attributes it to Erichthonius IV. king of the Athenians; which fentiment Virgil alfo follows in his Georgics, lib. iii. ver. 113. Æfchylus gives Prometheus the honour of it. Tertullian, De Spectac. lib. ix. fays, it was invented among the Argians, by Trochilus, in honour of Juno; and at Rome, by Romulus, in honour of Mars, or Quirinus. Ado of Vienne, Chronic. act iii. will have it to have been invented by one Procidus, about the time of the eftablifhment of the kingdom of Athens. Laziardels, Hift.

Hist. Univerf. Epitom. lib. xxiv. fays the fame of Triptolemus. Laftly, if there be not opinions enough already, Herodotus gives us another; and fays, the Greeks borrowed it from the Libyans. Pliny tells us, that his feal was a quadriga, lib. xvi.

On the reverfes of medals we frequently fee Victory, or the emperor, in a quadriga, holding the reins of the horfes; whence thefe coins are called, among the curious, *nummi quadrigati*, and *victoriati*. See BIGATI.

QUADRIGA, from *quatuor* and *juga*, yokes, in *Surgery*, a bandage for the fternum and ribs, fo called from its refemblance to the trappings of a four-horfe car. It was formerly employed in cafes of fractured ribs; but, as it is not now in ufe, a more particular account of it feems unneceffary.

QUADRIGEMINA CORPORA, in *Anatomy*, a part of the brain, known more commonly by the terms nates and teftes. See BRAIN.

QUADRILATERAL, in *Geometry*, a figure whofe perimeter confifts of four right lines, making four angles; whence it is alfo called a quadrangular figure.

If the feveral angles be right, the figure is a rectangular quadrilateral. If oblique, an oblique-angular quadrilateral.

If the fides of a quadrilateral be equal, and the angles right, the figure is a fquare.

If the fides be equal, but the angles unequal, the figure is a rhombus.

If the angles be equal, and the fides unequal, the figure is a rectangle.

If only the oppofite angles and fides be equal, the quadrilateral is a rhomboides.

If the oppofite angles and fides be unequal, the quadrilateral is a trapezium.

If any fide of a quadrilateral, infcribed in a circle, be produced out of the circle, the external angle will be equal to the oppofite, internal angle.

Hence, the two oppofite angles of any quadrilateral figure infcribed in a circle, always make two right angles: and, therefore, no oblique-angled parallelogram can have a circle defcribed about it, becaufe its oppofite angles being equal, muft together be greater or lefs than two right angles. See CIRCLE.

QUADRILL, QUADRILLA, a little troop or company of cavaliers, pompoufly dreffed and mounted; for the performance of caroufals, jufts, tournaments, runnings at the ring, and other gallant divertifements.

The word is borrowed from the Italian, being a diminutive of *fquadra*, a company of foldiers ranged in a fquare: for *fquadrare* is, properly, to difpofe any thing fquare; whence their *quadriglia*, the French *fquadrille* and *quadrille*, and our *quadrill*. The French formerly wrote *fquadrille*, and *efquadrille*.

A regular caroufal is to have at leaft four, and at moft twelve, quadrills.

Of thefe quadrills, each is to confift of at leaft three cavaliers, and at moft of twelve.

The quadrills are diftinguifhed by the form of their habits, or the diverfity of their colours.

QUADRILLE, a well-known game at cards; and which has been, in feveral cafes, the object of mathematical computations. See M. De Moivre's Doctrine of Chances, 3d edit. p. 97, &c.

QUADRIO, FRANCESCO SAVERIO, in *Biography*, a Jefuit, author of a voluminous hiftory and defcription of every kind of Italian poetry, "Della ftoria e della Ragione d'ogni Poefia," eight vols. 4to. publifhed at Bologna between the years 1739 and 1752.

The author feems a mere compiler, without felection, tafte, or accuracy. It is a heavy work, hardly interefting enough to ftimulate a regular perufal; and from the diforder of arrangement, very difficult to confult. Crefcembeni is as fuperior to Quadrio in every requifite of an hiftorian of literature, as Tirabofchi is to Crefcimbeni.

QUADRIPARTITION, the dividing by four; or a taking of the fourth part of any number, or quantity.

Hence quadripartite, &c. fomething divided into four.

QUADRIREME, QUADRIREMIS, a galley, or veffel, with four oars on a fide; the invention of which was attributed by the ancients to the Carthaginians.

QUADRISETÆ, the four-haired flies, a term ufed by the writers in natural hiftory to exprefs thofe flies of the feticaude or hair-tailed kind, which have four hairs or briftles growing from the tail, as the others have three, two, or one.

QUADRIVIUM, the centre of four ways, where four roads meet and crofs each other. By ftatute, pofts with infcriptions are to be fet up at fuch crofs-ways, as a direction to travellers, &c. 8 & 9 W. III. c. 10.

QUADRIVIUM, befides the centre of four ways, was a fcholaftic divifion, ufed in the middle ages in our univerfities, to exprefs the higheft clafs of philofophical learning and fcience; comprehending arithmetic, geometry, aftronomy, and mufic: as the trivium did grammar, rhetoric, and logic. During this period, mufic, fuch as it was, muft have been highly prized to be ranked with the moft fublime fciences, and thought an effential part of a learned education.

QUADRO, Ital. literally means fquare, and in mufic, at prefent, it implies a natural, ♮, or Gothic B, in oppofition to *tondo*, round, or the round ♭, ufed for a flat. The durum hexachord is fometimes called the quadro hexachord, from the circumftance of B being ♮.

It was the opinion of Padre Martini and the prince abbot of St. Blafius, that accents and points, enlarged, disfigured, and lengthened, became mufical characters for time as well as tune. At firft, when lines and fpaces were ufed, from their being chiefly employed in a fquare form for writing the chants eftablifhed by St. Gregory, they acquired the name of Gregorian notes, quadrata, and in barbarous Latin, quadriquarta. As the church is flow in receiving new doctrines, and generally a century later in admitting thofe improvements or corruptions in mufic (the reader may call them which he pleafes) that are adopted by the laity as the fortunate efforts of cultivated genius, the notation of chants was at firft cenfured and prohibited by feveral councils; and figurative harmony being regarded as a *crying fin* by pope John XXII., was formally excommunicated by a bull from the conclave 1321. See NOTES, and TIME-TABLE.

QUADRUGATA TERRÆ, in *Old Law Records*, denotes a team-land; or fo much as can be tilled by four horfes.

QUADRULA, in *Natural Hiftory*, a word fometimes ufed in the fame fenfe as teffela, and fpoken of the cubic pyrites. Sometimes it is ufed alfo as the name of thofe little fpangles of fhining matter that are mixed among fand. Thefe are generally fragments of talc; and are of various colours, white, yellow, and blackifh.

Solinus has ufed the word quadrula to exprefs the fragments of yellow talc that are found in that fand called *ammochryfos*, or golden fand. He miftakes thefe fhining particles for maffes of real gold, and makes the fand itfelf a kind of precious fubftance ranked among the gems, and brought from Perfia; but in this he does not agree with the reft of the ancients.

QUADRUPED. The effential character of quadrupeds

peds is, that they have a hairy body and four feet, and that the females are viviparous, and give fuck to their young.

Quadrupeds are diftinguifhed, by the number of their feet, from other animals, which have only two feet, as birds; from thofe which have no feet, as fifhes and reptiles; and from thofe which have more than two feet, as infects.

Ariftotle diftributes quadrupeds into three claffes; denominating thofe whofe feet are terminated by a hoof in one piece, *folipedes;* thofe which have a cloven hoof he diftinguifhed by the name of forked or cloven-footed; and thofe whofe feet are digitated he called *fiffipedes.* With this general divifion he contented himfelf, without defcending to a methodical diftribution of each clafs into their feveral orders, genera, &c. Gefner, Aldrovand, Jonfton, and many other naturalifts, have adopted the diftribution of Ariftotle: but we are indebted for the regular fyftematic arrangement of quadrupeds to Mr. Ray, who publifhed his "Synopfis Methodica Animalium Quadrupedum et Serpentini generis," &c. in 1693. According to this writer, quadrupeds are divided into thofe which are hoofed, *ungulata;* and thofe which are clawed, or digitate, *unguiculata.*

Quadrupeds, *Hoofed*, are either,

1. *Whole-hoofed, folipeda,* μωνοχηλα, μωνυχα, *folidungula;* as the horfe and afs, the onager or wild afs, the mule; and the zebra of Africa, or the fine ftriped Indian or African afs, almoft like a mule in form and ftature.

Of the whole-hoofed kind, Ariftotle has obferved, that no one hath two horns (he might have faid any horns); no one hath the talus, or aftragalus; nor have the males any appearance of teats.

2. *Cloven-footed:* and that either, 1. Into two divifions only; as the διχηλα, or bifulcate kind; which are again fubdivided into fuch as are,

Firft, *Ruminant,* μηρυκαζοντα, that is, fuch as chew the cud; and thefe either have hollow and perpetual horns, as the bull, fheep, and goat kind; or deciduous horns, as the hart and deer kind, which ufually fhed their horns annually.

Of the *bull* kind are reckoned thefe; the common bos or bullock, of which the male is taurus, the female vacca; the German urus, urochs, or aurochs; the bifon; the bonafus; the bubalus, or bufalo; and the bos Africanus of Bellonius, Obf. lib. ii. c. 50. which he takes to be the bubalus of the ancients.

Of the *fheep* kind, befides the common fort, are reckoned the Arabian ovis laticauda, whofe tail is fometimes of thirty pounds weight; the ovis ftrepficeros Cretica Bellonii; the ovis Africana, with fhort hair inftead of wool; and the ovis Guineenfis, or Angolenfis, of Marcgrave, Hift. Brafil. lib. vi. c. 10.

Of the *goat* kind are, befides the common capra domeftica, the ibex, or German fteinbock, found on the tops of the alps; the rupicapra, French chamois, or German gems; the gazella Africana, or antelope; the gazella Indica; the gazella Africana with fhorter, annulated, and bent horns; the capra fylveftris Africana Grimmii; the capra Mambrina, or Syriaca of Gefner; the bucephalus, or mofchelaphus Caii, in Gefner; the tragelaphus Caii, in Gefner; and the tragelaphus of Bellonius.

Of the *hart*, or *deer* kind, are reckoned, the cervus, ελαφος, or red deer; the cervus platyceros, or palmatus, the fallow deer; alce, or the elk; rangifer, the rein deer; the axis Plinii, according to Bellonius; the caprea Plinii, the cuguacu-ete, and cuguacu-apara, of Marcgrave; the caprea Groenlandica.

Secondly, of animals whofe feet are divided into two parts only, and which do not chew the cud, there is only the hog and fwine kind. Under this head, befides the common fwine, are reckoned the wild boar, or fwine; the Guineenfis Marcgravii; the porcus Indicus, or babyrouffa; the tajacu or aper Mexicanus mofchiferus of Dr. Tyfon, called, by Marcgrave, tajacu caaigoara; by others, quauhtla coymatl, and quapizotl; and by Acofta, and fome others, zaino.

2. There are fome quadrupeds, whofe hoof is cloven into four divifions, and thefe feem to be not ruminant; as the rhinoceros, the hippopotamus, the tapijerete of Brafil, the capy-bara of Brafil, and the animal mofchiferum.

Quadrupeds, *Clawed* or *Digitate.* Of this kind, there is, firft, a fort whofe claws are not divided or feparated, but adhere to one another, and are covered with one common fkin, but with obtufe nails, fticking out round the margin of the foot; as the elephant, which is anomalous, and not clearly referrible to this kind, or to that of cloven-footed quadrupeds.

A fecond fpecies of this digitate kind of quadrupeds, which has only two claws, is the camel; and though thefe have no horns, they both ruminate, and have alfo the four ftomachs of horned ruminant animals.

Of the camel there are two forts; one having but one hunch on the back, the other two.

To this kind alfo belong the Peruvian glama, which fome have reckoned among the fheep kind; as alfo the pacos, the ovis Indica, or Peruviana vulgo, which is much lefs than the glama.

A third fpecies of this unguiculate kind includes fuch animals as the Greeks called Πλατυωνυχα, and Ανθρωπομορφα, which have the foot divided into many claws, with broad nails on them; as the ape and monkey kind.

Of thefe, fome have no tails, and are called fimiæ, or apes: others have tails, and are called monkies, cercopitheci; and fuch as have either long or fhort tails, if they are of a larger fize, are called papiones, or baboons. There are great numbers and varieties of this fpecies of quadrupeds; of which naturalifts have defcribed thefe, *viz.* the orang-outang, or homo fylveftris of Dr. Tyfon, defcribed by him in a particular difcourfe; the guariba of Brafil, Marcgravii; the cagui of Brafil, greater and leffer; the cay of the fame region, defcribed by Lerius; the caitaia of the fame country; the cercopithecus barbatus Guineenfis, two or three forts of it; the cercopithecus Angolenfis major; the cercopithecus non barbatus Clufii; the cercopithecus Cluf. called fagouin. Laftly, if apes and monkies have their fnouts very prominent, like dogs, they are called cynocephali.

A fourth fpecies of this unguiculate kind is, when, though the claws are many, yet they are not covered at the end with broad flat nails, like monkies or apes; but are rather like the talons of hawks, &c. crooked and fharp-pointed.

Thefe, in refpect of their teeth, may be divided into fuch as have many dentes primores, or incifores (that is, cutting teeth) in each jaw, of which there are two forts; a greater, which either have a fhort, round head, as the cat kind; or a leffer fort, having a long flender body, with very fhort legs, as the weafel or vermin kind. There are alfo fome of this fpecies of quadrupeds which have only two large remarkable teeth in each jaw: thefe are the hare kind; and thefe live only upon herbs, grafs, &c.

Of the *cat* kind of quadrupeds are reckoned to be the lion; the tyger; the pardalis, whofe male is pardus, and female panthera; the leopard; the lupus cervarius, or lynx; the catus pardus, or cat-a-mountain; the common cat; and the bear.

Of the *dog* kind are reckoned the wolf; the lupus aureus, or jackall; befides the common dog, of which kind they

they enumerate the maſtive, or maſtiff; the canis venaticus Graius, Græcus, or Scoticus, the greyhound; Graius Hibernicus, or the Iriſh greyhound; the canis venaticus ſagax, indagator, ſectator ferarum, &c. the hound; canis venaticus Hiſpanicus, or aviarius, the ſpaniel for land or water; vertagus, or tumbler; canis Οικεῖος, or domeſticus, the houſe-dog; canis melitæus, or the lap-dog; canis Getulus, or Iſlandicus, the ſhock: and of all theſe ſorts there are many varieties of mongrels, and hybridous breeds.

Other ſpecies of the dog kind are, the fox; the animal zibethicum, or civet-cat, as it is corruptly called, but by its teeth and ſnout is plainly of the dog tribe; the American coati, or rackoon, or rattoon; the yzquiepatl; the carigueya, maritucaca, carigoy, ropoza, or opoſſum; the taiubi; the taxus, or meles, the badger, grey, or pate; the lutra, or otter. To theſe ſome add the phoca, ſea-calf or ſeal; the equus marinus, morſe, or ſea-horſe, miſtaken by ſome for the hippopotamus; the Dutch call him walrus, the Danes and Icelanders roſmarus; laſtly, the manati, or vacca marina, the ſea-cow.

Of the *vermin*, or *weaſel* kind of quadrupeds, is, firſt, the muſtela vulgaris, the common weaſel, in Yorkſhire called foumart, or fitchet, γαλεη: the viverra Indica, called quil and quirpele; another ſort called mungo, and mungathia, of a reddiſh-grey; the muſtela, ermine, or ſtoat, and muſtela ſylveſtris, the ferret; putorius, the pole-cat; martes, or foyna, the martin, or martlet; muſtella zibellina, the ſable: laſtly, the genetta; and the ichneumon Bellonii.

Of the *hare* kind of quadrupeds are, firſt, lepus, or the common hare; cuniculus, the rabbet, or coney; tapeti, or Braſil coney, and the aperea of Braſil; the hyſtrix, or porcupine, and the hyſtrix Americanus, or cuanda of Braſil; caſtor, fiber, or the beaver; ſciurus vulg. or ſquirrel; the Virginian, Zeylandic, Barbary, and American flying ſquirrel; mus domeſticus, major and minor, the common rat and mouſe: to theſe alſo may be referred mus major aquaticus, the water-rat; the muſk-rat, mus avellanarum, major and minor; the dormouſe or ſleeper, mus Noricus, Cricetus, Alpinus, ſeu marmotta; the cavia cobaya, or cuniculus Americanus, the Guinea-pig; the aguti, and paca of Braſil; the mus Norwegicus, or leming; the glis Geſneri, or the rell; the mus Indicus, &c.

Quadrupeds, *Anomalous*. To theſe ſeveral kinds, the following anomalous ones muſt alſo be added:

1. Such four-footed viviparous animals as have a longiſh ſnout, with their feet divided into many claws, and toes, and having teeth; as the echinus terreſtris, or common urchin, or hedge-hog; erinaceus Indicus albus; tatu or ármadillo prima of Marcgrave; tatuete of Braſil, or the ſecond ſpecies of the armadillo, according to Marcgrave; tatu apara, his third ſpecies of armadillo; tatu muſtelinus, Soc. Reg. Muſ. the weaſel-headed armadillo; talpa, the molewarp, or moldwarp; and the mus araneus, ſhrew, hardy ſhrew, ſhrewmouſe.

2. Quadrupedous and viviparous animals with a longiſh ſnout, having their feet divided into many claws or toes, but without teeth; as the tamandua guacu of Braſil, Marcgravii, urſus formicarius Cardani, the great antbear; the tamandua of Braſil, or Marcgrave, the leſſer ant-bear.

3. Anomalous flying quadrupeds, with a ſhorter ſnout, and their feet divided as above; being of the bat kind, or flitter-mice, of which there are ſeveral ſizes, and of different forms.

4. There is one very anomalous animal, which has but three claws on each foot; and that is the ai or ignavus of Marcgrave, the ſloth or ſluggard.

5. Viviparous and ſanguineous quadrupeds, breathing with lungs, but having only one ventricle in the heart; as the rana aquatica, the frog, or froſh; rana arborea, ſeu ranunculus viridis, the ſmall tree or green frog; bufo, ſive rubeta, the toad; teſtudo, the tortoiſe, in Greek χελωνη; of theſe there are land and water ones, and many different ſpecies in foreign parts.

6. Oviparous quadrupeds, with a long tail ſtretched out horizontally. Such are the lizard kind; as lacertus omnium maximus, the crocodile; cordylus, ſive caudiverbera, uromaſtrix Græcis, larger than the green lizard; tapayaxin Novæ Hiſpaniæ, or lacertus orbicularis of Hernandez; lacertus vulgaris, the common eft, ſwift, or newt; lacertus viridis, the green lizard; lacertus fucetanus Aldrovandi, at Rome and Naples called the tarantula; lacertus Indicus, called ſenembi and iguana; lacertus Braſilienſis, called tejuguacu, and temapara by Marcgrave; the taraguira ameiva, taraguico Arcuraba, Americima, Curapopeba, Teiunhana, &c. of Marcgrave; the lacertus Indicus; the ſcincus, or crocodilus terreſtris; the ſeps, or lacerta chalcidica, a kind of footed ſerpent; ſtellio, the ſwift, or ſpotted lizard; ſalamandra, called the ſalamandra aquatica, the water-eft, lacerta volans Indica; and the chamæleo, or cameleon.

This ſyſtem of Mr. Ray obtained very generally among naturaliſts, till, in the year 1735, Linnæus firſt publiſhed his ſyſtem. This was followed by ſeveral others, varying in the arrangement of the animal kingdom, even to the laſt edition of 1767. Under the claſs, which he denominates *Mammalia*, (which ſee,) he comprehends not only all the animals which we call quadrupeds (the lizard genus, or rather the reptiles pedati excepted), but alſo the cetaceous order, or whales, cachalots, and porpeſſes: juſtifying this arrangement of whales with quadrupeds, from the agreement of theſe animals in the ſtructure of the heart, in the reſpiration by means of lungs, in their having moveable eye-lids and ears, in being viviparous, furniſhed with teeth, and other particulars, by which they differ ſo materially from fiſhes, as more than to counterbalance their living with them in the ſame element. The mammalia are divided into ſeven orders, the diſtinctions of which are principally eſtabliſhed on the difference in the numbers, ſituation, and form of the three kinds of teeth, *viz.* the primores or inciſores, called fore-teeth, or cutting-teeth; the laniarii or canini, called dog-teeth, canine or lacerating teeth; and the molares, double teeth or grinders. But Linnæus does not entirely neglect the feet. See the characters of the ſeveral orders under Primates, Brutæ, Feræ, Glis, Pecora, Bellua, and *Cete* or Whale. This part of the Linnæan ſyſtem, including a few ſpecies deſcribed in the Appendix of the third tome, and in the Mantiſſa of 1771, contains about two hundred and thirty ſpecies.

Mr. Pennant, in his "Synopſis of Quadrupeds," and profeſſor Martin, in his "Elements of Natural Hiſtory," by including ſome animals that were unknown to Linnæus, and giving the rank of ſpecies to ſeveral that were conſidered by him as varieties, have extended the number of mammalia to two hundred and eighty-nine ſpecies. Mr. Klein, in 1751, publiſhed a new ſyſtem of quadrupeds, intitled "Quadrup. Diſpoſitio breviſque Hiſt. Natur." in which he diſtributes them into two orders, the firſt comprehending thoſe whoſe feet are terminated by one or more hoofs, and the ſecond thoſe which are digitated; and each of theſe orders is ſubdivided into five families or claſſes. In his firſt order he follows the general arrangement of Mr. Ray, which he has conſiderably improved: but in the ſecond, by a ſervile regard to a method founded on the number of toes, he has combined very oppoſite animals; the camel and the ſloth, the mole and the bat,

bat, the glutton and apes. Mr. Briffon, in 1756, publifhed another fyftem, in which he has arranged animals by the number or defect of their teeth; beginning with thofe that are toothlefs, fuch as the ant-eater, and ending with thofe that have the greateft number, fuch as the opoffum. By this arrangement, fome quadrupeds, very diftant from each other in their manners, are too nearly connected. We fhall fay nothing of Mr. Buffon's "Hiftory of Quadrupeds," though it contains much valuable information, becaufe he feems to have difregarded fyftematic arrangement. Mr. Pennant has introduced fome ufeful alterations in his "Hiftory of Quadrupeds;" this ingenious naturalift has followed Mr. Ray in his greater divifion of animals into *hoofed* and *digitated*; but, after the manner of Mr. Klein, he has formed feparate genera of the rhinoceros, hippopotamus, tapiir, and mufk. The apes are continued in the rank in which Mr. Ray placed them, and are followed by the maucaucos. The carnivorous animals are arranged according to the fyftem of Linnæus, omitting the feal, mole, fhrew, and hedge-hog. The herbivorous or frugivorous quadrupeds occupy the clafs affigned to them by Mr. Ray, to which he has allotted likewife the fhrew, the mole, and the hedge-hog. The fourth fection of digitated quadrupeds confifts of thofe which are abfolutely deftitute of cutting teeth, fuch as the floth and armadillo. The fifth fection is formed of thofe which are deftitute of teeth of every kind, fuch as the manis and ant-eater. The third and fourth orders or divifions which Mr. Pennant has added, are the *pinnated* and the *winged* quadrupeds: the firft comprehends the walrus, the feals, and (in conformity to preceding writers) the manati. But thefe, he obferves, feem as the links between the quadrupeds and the cetaceous animals. The bats are winged quadrupeds, and form the next gradation from this to the clafs of birds. See Pennant's Hift. of Quadrupeds, ed. 8vo. 1781. Preface. See Classification.

Quadrupeds, *Alated.* Among the many fabulous things with which natural hiftory has been loaded, ftories of flying quadrupeds feem to claim a very high rank; the gryphon, the quadruped dragon, and a great many other imaginary animals, having been introduced fo ferioufly among the defcriptions of real animals, that too many have been taught to believe them. Scheuchzer, in his "Phyfica Sacra Jobi," has done much toward difcountenancing fuch relations; and Hyacinthus Gemma, who has written exprefsly "De Fabulofis Animalibus," has added much on the fame occafion; yet all is not done. The world have late hiftories of lemmas and bafilifks, which never exifted but in the imagination of the relator, or in the fubtle contrivance of the fabricator; as is evidently the cafe in the bafilifks which we find in the mufeums of the curious, and which are all made out of the ray-fifh. And the generality of readers are fo fond of any thing that is marvellous, that thefe things are fure to be remembered, while perhaps all the truths in the book are forgotten.

Upon the whole, the ftandard of the flying or alated quadrupeds feems to be properly enough reducible to this: that the words flying and alated are not fynonimous terms, and that there are three kinds of flying among the quadruped clafs. The firft abfolute and fwift, flying as perfect as in birds: this peculiarly belongs to the bat; which is the only alated or winged quadruped, properly fpeaking. 2. An imperfect flying by means of certain membranes ferving as wings, but imperfectly, and not turning quick, or enduring long flights: fuch is the flying of the lizard, which is not properly an alated animal. And laftly, the imperfect flying of the fquirrel kind, which even in that fpecies called, by way of eminence, the flying fquirrel, is not properly flying, but only long leaping; the creature being able to turn but very little out of a right line, and only to fufpend itfelf during a fhort time in a leap from a high place to a lower. Phil. Tranf. N° 247. p. 34.

Quadrupeds, in *Agriculture*, all fuch animals as walk on four legs, and are of the domeftic kind, as horfes, neat cattle, fheep, fwine, and many other forts, which are beneficial either for the purpofes of working, fattening, or in any other way. Some animals of this nature are difpofed for one of thefe purpofes in preference to others; while others are capable of being made to ferve more than one of them. Thus, horfes of the lighter and more active kind are adapted to the faddle, and fome forts of road work, and thofe of the more heavy fort to all defcriptions of team work in the field or other places. And neat cattle of the ox kind, in the lefs heavy breeds, as the Devonfhire, Herefordfhire, and fome others, are well fuited to team labour as well as fattening; while thofe of the more heavy forts, as the Lancafhire breed, or long horfes, &c. are better calculated for feeding only. Among fheep, fome breeds are valuable for their mutton as well as their wool; fome for the former, or latter, of thefe articles only; and others again for their ready difpofition in taking on flefh. In fwine, fome breeds are much better formed than others; require much lefs food, in proportion to their fizes, in keeping and fattening, and are more difpofed to feed, &c.

The fame is likewife the cafe with fome other animals of this defcription, which fhould conftantly be taken into the account in felecting and choofing them for the ufe of the farmer.

Quadrupeds of all forts, fhould alfo, in all cafes, be well adapted in their numbers, natures, and kinds, to the qualities of the lands as farms, their extents, and the quantities of labour to be performed upon them, as much in the fuccefs of farming depends on this being properly done. They fhould likewife be conftantly well kept and in proper condition, according to the different intentions for which they are defigned, as badly fed or half-ftarved animals never anfwer any good purpofe for the farmer, they always requiring a much larger proportion of food for reftoring or bringing them again into proper order and for fattening them, than would otherwife have been neceffary; and they never ultimately turn out fo well, or produce fo much advantage, as might have been the cafe under other circumftances. And, in labouring animals, where this is the cafe, they are never capable of performing nearly fo much work, in confequence of which a vaft continual lofs is fuftained, though fcarcely perceived. See Live-*Stock*, and Team.

QUADRUPLATORES, among the Romans, were informers, who had the fourth part of the confifcated goods for their pains.

QUADRUPLE, a fum or number multiplied by four, or taken four times.

Quadruple is particularly ufed for a gold coin, worth four times as much as that of which it is the quadruple.

The quadruple of the Spanifh piftole is a piece of four piftoles, called alfo the *double doubloon.*

The quadruple of the louis d'or is a piece of gold coined in the reign of Louis XIII. in 1641. The legend on one fide is CHRISTUS VINCIT, REGNAT, IMPERAT: and on the middle of this fide it has a crofs with four crowns, and cantoned in four fleurs-de-lis: on the other fide it has the legend, LUDOVICUS DECIMUS TERTIUS DEI GRATIA FRANCORUM REX, with the head of Louis XIII. Its value under this king was twenty livres.

Quadruple *Croche*, in *French Mufic*, is a note with four hooks or four ties, one degree quicker than our demifemiquaver,

femiquaver, and for which we have no name. The term *croche*, in French a quaver, is not derived from *crotchet*, but from the tail being *crooked*. And why our crotchet, with a *ftraight tail*, has its name, is a whimfical abfurdity, for which we are unable to account.

QUÆ *eft eadem*, in *Pleading*, is ufed to fupply the want of a traverfe. (2 Lill. Abr. 405.) In a *claufum fregit* fuch a day, the defendant pleads the plaintiff's licence to him to enter on the fame day, and that *virtute inde* he entered; he need not fay, *quæ eft eadem tranfgreffio*.

QUÆ *Plura*, a writ that anciently lay where inquifition had been made by an efcheator, of fuch lands or tenements as any man died feifed of, and all was fuppofed not to be found by the office or inquifition.

This writ was to inquire what more lands or tenements the parties died feifed of. But it is now made ufelefs, by taking away the courts of wards and offices poft mortem.

QUÆ *Servitia*. See PER *quæ fervitia*.

QUÆRENS *non invenit plegium*, a return made by the fheriff upon a writ directed to him with this claufe, *viz. Si A. fecerit B. fecurum de clamore fuo profequendo, &c.* F. N. B. 38.

QUAERNES, in *Geography*, a town of Norway; 55 miles N. of Romfdal.

QUÆSTA, in our *Ancient Writers*, denotes an indulgence, or remiffion of penance, expofed to fale by the popes.

QUÆSTIONARII, in our *Ancient Law Books*, were people who went about with indulgences from door to door, defiring charity either for themfelves or others.

Matt. Weft obferves, 1240, that the king, "Terram fuam per papale queftionarios, depauperari, &c. permifit."

QUÆSTOR. See QUESTOR.

QUÆSTUS, in *Law*, is that eftate, or thofe effects, which a man hath by acquifition or purchafe; in contradiftinction to *hæreditas*, which is what he hath by defcent. See ACQUEST, and GOODS.

Glanv. lib. vii. "aut habet hæreditatem tantum, vel quæftum tantum, aut hereditatem & quæftum."

QUAG, in *Agriculture*, a name given to any fort of wet, fwampy, moraffy, or boggy fituation in land, which has a tremulous or fhaking feel under the foot, and which produces nothing but a coarfe graffy herbage that is unfit for the food of animals. Low as well as high grounds are fubject to fpots of this kind wherever water is confined and retained near the furface. They are to be removed by proper means of draining, and the application of folid earthy matters of different kinds upon the furfaces of them, with the ufe of rollers in order to confolidate the whole. See BOG and SWAMP.

QUAGGA, in *Zoology*. See EQUUS.

QUAGLIATI, PAOLO, in *Biography*, the mufic-mafter of the celebrated traveller, Pietro della Valle, at Rome, in the beginning of the 17th century. His difciple, della Valle, fays, "that he was an excellent maeftro di cappella, who introduced a new fpecies of mufic into the Roman churches, not only in compofitions for a fingle voice (*monodie*), but for two, three, or four, and very often more voices, in chorus, ending with a numerous crowd of many choirs or choruffes, finging together; fpecimens of which may be feen in many of his motets that have been fince printed. And the mufic of my *cart*, or moveable-ftage, compofed by the fame Quagliati, in my own room, chiefly in the manner he found moft agreeable to me, and performed in mafks through the ftreets of Rome during the carnival of 1606, was the firft attempt at an opera, or fecular drama in mufic, which had been heard in that city." See OPERA, RECITATIVE, and PIETRO DELLA VALLE.

QUAGMIRE, in *Agriculture*, the name of a fort of foft miry fhaking or quaking bog, fwamp, or morafs, which is frequently and commonly met with in low hollow fituations, where there is none, or very little defcent, for the difcharge of the ftagnant water or wetnefs. They are formed in many different ways according to the nature of the circumftances which firft gave rife to them, and that of the places in which they are found. The author of the "Treatife on Landed Property" has remarked, that befides the common moory quagmires or bogs, there is a fpecies which is conftantly charged with moifture, yet does not accumulate a thick covering of moory earth, owing probably, it is fuppofed, to the want of fertility in the water by which it fed. Thefe forts of quagmires are, in his opinion, for the moft part, found in mountainous and hilly fituations. Other kinds are occafionally feen on large peat moffes, and hollow meadows, in fpots where the water is confined and kept up nearly to their upper parts, and where there is much decay of vegetable productions on their furfaces, and the reception of earthy materials from other places. Thefe quagmires occupy large fpots of ground in many different fituations, and are, of courfe, a great lofs to individuals and the public, as little or nothing of any ufe is ever produced by them. (See MORASS.) They are, for the moft part, capable of being readily drained by proper means, a fort of improvement which ought never to be neglected where it can be performed with any chance of fuccefs.

QUAHU, in *Geography*, a diftrict of Africa, on the Gold Coaft, in the kingdom of Acambou, or Aquamboe; which fee.

QUAHVITLA, in *Botany*, a name ufed by fome authors for the tree from which the refin commonly called gum copal is procured.

QUAICHA, in *Geography*, a town of Africa, in Sennaar; 38 miles E.S.E. of Gieffim.

QUAIL, COTURNIX, or Tetrao coturnix of Linnæus, in *Ornithology*, the leaft of all the birds of the gallinaceous kind. They have, however, the genius of the cock kind, and may be bred to fight like our game cocks.

This was an old cuftom among the Athenians, and is ftill kept up in fome parts of Italy, and in Afia.

Quails are birds of paffage, fome entirely quitting our ifland, others fhifting their quarters from one county to another, and fheltering themfelves among the weeds near the fea-fide; with us they frequent the corn-fields, and fometimes the meadows. They begin to fing in April, and make their nefts in the month of May, building on the ground, and feldom lay more than than fix or feven whitifh eggs, marked with ragged ruft-coloured fpots.

Quails are to be taken by means of the call during their whole wooing time, which lafts from April to Auguft. The proper times for ufing the call are at fun-rifing, at nine o'clock in the morning, at three in the afternoon, and at fun-fet; for thefe are the natural times of the quail's calling. The notes of the cock and hen-quail are very different, and the fportfman who expects to fucceed in the taking of them, muft be expert in both; for when the cock calls, the anfwer is to be made in the hen's note; and when the hen calls, the anfwer is to be made in the cock's. By this means they will come up to the perfon, fo that he may, with great eafe, throw the net over them, and take them. If a cock-quail be fingle, on hearing the hen's note he will immediately come; but if he have a hen already with him, he will not forfake her. Sometimes, though only one quail anfwers to the call, there will three or four come up;

and

and then it is beſt to have patience, and not run to take up the firſt, but ſtay till they are all entangled, as they will ſoon be.

The quail is a neat cleanly bird, and will not run much into dirty or wet places: in dewy mornings they will often fly inſtead of running to the call; and in this caſe, it is beſt to let them go over the net, if it ſo happens that they fly higher than its top, and the ſportſman then changing ſides, and calling again, the bird will come back, and then will probably be taken in the net.

The calls are to be made of a ſmall leather purſe, about two fingers wide, and four fingers long, and made in the ſhape of a pear; this is to be ſtuffed half full of horſe-hair, and at the end of it is to be placed a ſmall whiſtle, made of the bone of a rabbet's leg, or ſome other ſuch bone; this is to be about two inches long, and the end formed like a flageolet, with a little ſoft wax. This is to be the end faſtened into the purſe; the other is to be cloſed up with the ſame wax, only that a hole is to be opened with a pin, to make it give a diſtinct and clear ſound. To make this ſound, it is to be held full in the palm of the hand, with one of the fingers placed over the top of the wax: then the purſe is to be preſſed, and the finger is to ſhake over the middle of it, to modulate the ſound it gives into a ſort of ſhake. This is the moſt uſeful call; for it imitates the note of the hen-quail, and ſeldom fails to bring a cock to the net, if there be one near the place.

The call that imitates the note of the cock, and is uſed to bring the hen to him, is to be about four inches long, and above an inch thick; it is to be made of a piece of wire, turned round and curled, and covered with leather; and one end of it muſt be cloſed up with a piece of flat wood, about the middle of which there muſt be a ſmall thread or ſtrap of leather, and at the other end is to be placed the ſame ſort of pipe, made of bone, as is uſed in the other call. The noiſe is made by opening and cloſing the ſpiral, and gives the ſame ſound that the cock does when he gives the hen a ſignal that he is near her.

QUAKERS, in *Eccleſiaſtical Hiſtory*, the common denomination of a ſociety of Chriſtians, who appeared firſt in England about the middle of the ſeventeenth century, and who continue to be diſtinguiſhed from others by peculiar tenets and practices. They call themſelves *Friends*. They are remarkable for aſſerting the continuance, to the preſent time, of immediate revelation, or the communication of divine inſtruction to the mind, by the teſtimony of the ſpirit of God. This revelation they affirm to be neceſſary for the production of true faith, and that it neither does nor can contradict the outward teſtimony of the ſcriptures, or right and ſound reaſon. Their doctrine on this ſubject has been often miſunderſtood, even by theological writers; and they have in conſequence been ſubjected to much obloquy. It is, however, the principal feature in that peculiar view of Chriſtianity, which has occaſioned their ſeparation from other churches.

Origin and Hiſtory.—Before the period above mentioned, many ſerious perſons, ſatisfied with none of the modes of religion which the reformation brought forth, had withdrawn from the communion of every viſible church, to cultivate in retirement, impreſſions which they attributed to the operation of the ſpirit of Chriſt on their own minds: it is chiefly from ſuch, when brought to recognize each other by the miniſtry of an individual, that the Quakers conſider their ſociety to have been originally gathered. George Fox, the individual in queſtion, was born in 1624. He has left a journal of his own life, written with a ſimplicity of ſtyle, which proves that he has fairly laid open his own character. In this work, the peculiar principles of Quakeriſm may be ſatisfactorily explored in their early beginnings, which it may be worth while briefly to review. Fox's parents, who were pious members of the church of England, had intended him for the prieſthood, his character affording very early promiſe of fitneſs for religious ſervice; but others perſuading to the contrary, he was put under a maſter to a country buſineſs. Being engaged herein at a fair, when about the age of nineteen, a couſin of his, with another profeſſor of religion, attempted to engage him in drinking to intoxication. "The Lord had ſhewn me," ſays George, "that I might not eat or drink to make myſelf wanton, but for health, uſing the creatures in their ſervice, as ſervants in their places, to the glory of Him who created them."

Accordingly, on perceiving the deſign of his companions, he roſe up, paid for the refreſhment they had had, and departed, with emotions of virtuous indignation. Returning home, he paſſed a ſleepleſs night, walking up and down, and crying to the Lord; who, he affirms, ſaid unto him, "Thou ſeeſt how young people go together into vanity, and old people into the earth; thou muſt forſake all, young and old, keep out of all, and be as a ſtranger unto all." The reader will underſtand this, and generally all revelations profeſſed to have been received by Quakers, as conſiſting not in an outward voice, but in an internal communication to the mind. Taking the command literally, he detached himſelf from his connexions; and having ſome property of his own whereon to ſubſiſt, removed from place to place, obſerving the religion and profeſſors of the age, without engaging in cloſe fellowſhip with any. He devoted much of his time to faſting, ſolitary prayer, and reading the bible.

He became at length quite detached in his affections from the world, diſtreſſed at the ſpiritual condition of his fellow men, and in much anxiety, bordering on deſpair, about his own; yet was not without intervals of heavenly joy and comfort. Such a ſtate of mind naturally led him to ſeek for ſpiritual counſel from others, and he had conferences with many of the clergy, beginning with his own pariſh prieſt. In anſwer to a queſtion from the latter, we find him profeſſing faith in Chriſt, who, by his death as man, (for he died not as he was God,) became an offering for the ſins of the whole world. The general reſult of theſe conferences was, however, unſatisfactory to him; "for," he obſerves, "they could not reach my condition." Purſuing, therefore, his meditations on the ſubject as before, he came to be ſatisfied reſpecting ſeveral propoſitions which it involved, ſuch as the following:—that although it was ſaid that all Chriſtians are believers, both Proteſtants and Papiſts, yet that none were truly ſuch, but thoſe who were born of God, and who had paſſed from death unto life. Again, that to be bred at Oxford or Cambridge, was not enough to fit and qualify men to be miniſters of Chriſt. At this he wondered, becauſe it was the common belief that ſuch qualification was ſufficient. "At another time," he ſays, "it was opened in me, that God, who made the world, did not dwell in temples made with hands. This at firſt ſeemed ſtrange, becauſe both prieſts and people uſed to call their temples or churches dreadful places, holy ground, and the temples of God; but the Lord ſhewed me clearly that he did not dwell in thoſe temples, which men had commanded and ſet up, but in people's hearts." George Fox now ceaſed to attend the eſtabliſhed preachers; at which his relations being offended, he ſhewed them from the ſcriptures, "that there was an anointing within man to teach him, and that the Lord would teach his people himſelf."

Obſerving,

Obferving, as he thought, more of the fruits of this internal teaching among the "diffenting people," he went for a while among them; but, he continues, "as I had forfaken the priefts, fo I left the feparate preachers alfo, and thofe called the moft experienced people; for I faw there was none among them all that could fpeak to my condition. And when all my hopes in them, and in all men, were gone, fo that I had nothing outwardly to help me, nor could tell what to do, then, O then, I heard a voice, which faid, 'There is One, even Chrift Jefus, that can fpeak to thy condition.' When I heard it my heart did leap for joy. Then the Lord let me fee why there was none that could fpeak to my condition, namely, that I might give him all the glory. For all (he continues, alluding to Rom. xi. 32.) are concluded under fin, and fhut up in unbelief, as I had been, that Jefus Chrift might have the pre-eminence, who enlightens and gives grace, faith, and power."

The preceding is a fpecimen of Fox's own account of the manner in which the doctrine he afterwards preached arofe in his mind. The reader will perceive that he refers all his real edification to the means which have been already indicated, immediate revelation. He fays, "though I read the fcriptures, that fpoke of Chrift, and of God, yet I knew *Him* not but by revelation, as he who hath the key did open, and as the Father of life drew me to his Son by his Spirit." Yet that he was fenfible of the importance of the holy fcriptures, as the fource from whence, under this influence, Chriftian inftruction muft be drawn, is evident, both from his declaring that they were very precious to him, and from his having inceffantly ufed, and conftantly appealed to them, both before and after beginning to promulgate his fyftem.

Having at length attained to a view of Chriftianity in which he found peace of mind, he believed himfelf required and divinely commiffioned to become a teacher of it to others: and from the year 1647, the reader may conceive him always engaged in this office. He travelled as before, preaching firft to fmall companies of enquiring perfons, then to public congregations, fuch as upon his appearance among them were willing to hear him, and at length to large affemblies of people, convened on purpofe. This he did with the courage and perfeverance of a reformer; in the face of oppofition from the national and ftipendiary preachers, of frequent perfonal abufe from their hearers, and occafional fevere treatment by the magiftrates. In moft places where he came, he met with perfons who received his doctrines, a proportion of whom, after affociating with him for a time, became impreffed with the like apprehenfions of duty to propagate their principles; which they attempted by fimilar methods. Thus, although interrupted at different periods by imprifonment, he found himfelf, before many years had elapfed, in connection with a numerous band of fellow-labourers, and a widely diffufed and refpectable fociety of religious friends. No inconfiderable number of thefe quitted, for the fake of their principles, livings in the church, commiffions in the army, or feats as magiftrates.

When we confider that this happened in an age equally remarkable for religious zeal and political turbulence, it will appear that fome deviations from Chriftian propriety, fome fruits of the mixture of imagination with good intentions, could fcarcely fail to be exhibited among them. If the new fociety, from a regard to its principle of internal impulfes to particular duties, was flow to condemn thefe, it was careful, on the other hand, not to engraft them, by imitation on its practice. Individuals, therefore, were alone refponfible for fuch acts, and the general conduct of the members, from the period of their firft affociating together, was found in no mean degree conformable to the morality of the gofpel.

The moft ferious inftance of mifconduct occurred in the cafe of James Nayler and his followers. This fell out in 1656, and was magnified beyond its real importance by being fuffered to occupy for ten days the attention of parliament. Nayler had been an Independent, and a quarter-mafter of horfe under major-general Lambert. He was one of George Fox's earlieft converts, and for fome years an able preacher and difputant in the fame caufe. Coming to London, he found a fet of people who extolled him in his office above meafure. His friends, and George Fox among the reft, feeing his danger, gave him fuitable cautions; but flighting thefe, he became expofed to the flatteries of a train of followers, chiefly women, whom he fuffered, at length, from a delufive notion of its being done to *Chrift in him*, to addrefs him with the name and titles of the Saviour, and with acts amounting to worfhip. In particular, his entrance into Briftol was conducted, by thefe infatuated people, in imitation of the proceffion of Chrift into Jerufalem. The parties implicated in this tranfaction were committed to prifon; but Nayler alone was felected by parliament, after examination and long debates on his cafe, for punifhment as a blafphemer. Cromwell kept aloof from the proceedings, which, by their exceffive feverity, moved great commiferation in the public. The culprit was twice fcourged through the ftreets, twice pilloried, branded in the forehead, and bored through the tongue with a hot iron: all which he endured with furprifing patience and fortitude. His punifhment ended with two years' clofe imprifonment in Bridewell, during which he attained to repentance, and a founder mind. Having given proof of this by feveral public confeffions, the Quakers, who had difowned both him and his followers, received him back into their communion, in which he lived circumfpectly the fhort remainder of his life.

Quakerifm prevailed at firft chiefly in the northern counties; but many preachers having rifen up here, who travelled in different directions, it was not long in fpreading to the metropolis, and the remoter fouthern and weftern parts. Wherever its profeffors appeared, the ordeal of fuffering awaited them; for which their negative tenets commonly furnifhed the occafion. They refufed to the priefts every kind of payment, to the government military fervice, to the magiftrate oaths, and to all perfons the cuftomary, and at that time much looked for *worfhip*, of kneeling or bowing with the head uncovered. They adhered too, in every inftance, to their northern Englifh of *thou* and *thee*, judging the plural mode of addreffing one perfon to have originated, together with all empty titles, in a fpirit of flattery unbecoming Chriftians. Thefe peculiarities were a check to fuperficial converfions; fince an upright conformity to the profeffion was in moft cafes purchafed by the lofs of friends, contempt, and hardfhips. Even the privilege of meeting to worfhip, apart from the national congregations, was acquired only by perfevering in the practice, through almoft every kind and degree of coercive obftruction, down to the period of complete toleration, the revolution of 1688. Hence their hiftory confifts in great part of a detail of buffetings, imprifonments, and fpoiling of goods. So early as 1659 they ftated to parliament, that in the preceding fix years about two thoufand individuals had fuffered in perfon and eftate, for being Quakers: and this reprefentation was accompanied by one of the moft extraordinary public acts on record. One hundred and fixty-four Friends offered themfelves by name to the houfe, to be imprifoned in the places of an equal number, who from ficknefs or the hardſhips of their confinement, were conceived to be in danger of periſhing. The houſe, however, rejected this propoſal, and expreſſed ſome diſpleaſure at "the reflections on magiſtracy and miniſtry," ſaid to be contained in the memorial. It will be proper to give ſome particular inſtances of their ſufferings.

James Parnel, a youth of good parts and education, going to ſee George Fox in a dungeon at Carliſle, became a convert to his principles: and, preaching in Eſſex, was the means of raiſing many congregations of Quakers in that county. He was impriſoned in Colcheſter caſtle, and at the age of nineteen ſunk under the cruel treatment there inflicted on him. In 1656, two Quaker women arrived at Boſton, New England. They were apprehended 'ere they could land, committed to cloſe priſon, and ſearched in a brutal manner, by ſtripping them naked, leſt they might alſo be *witches;* an object to the coloniſts of equal and equally rational dread. Theſe two, with eight others who arrived afterwards, were forcibly ſent away: but the precaution was in vain, their principles entered the colony. An aged citizen, and church member of Boſton, was firſt found favourably inclined to them; he was fined, impriſoned, and baniſhed in the depth of winter. In Rhode iſland he was hoſpitably received by an Indian chief, who offered, if he would live with him, "to make him a warm houſe;" obſerving, "What a God have the Engliſh who deal ſo with one another about their God!" So far is intolerance from recommending the religion of thoſe who practiſe it. Penal laws againſt Quakeriſm ſoon followed the appearance of this people in New England. The ſcourge was firſt applied, without regard to age or ſex: mutilation, by cutting off the ears, followed: but theſe being found inſufficient, cruelty proceeded through another intermediate ſtep, baniſhment on pain of death, to its dreadful extreme; and four Quakers were hanged at Boſton. Their names were William Robinſon, Marmaduke Stevenſon, William Leddra, and Mary Dyar. Their caſes, as related by Sewel, in his "Hiſtory of the Quakers," form an intereſting piece of martyrology.

Charles II., on notice of theſe proceedings, granted a mandamus, which prevented further executions in the colonies; but he was not equally ready to reſtrain perſecution at home. The Quakers had ſeveral meeting houſes in London. When aſſembled at theſe, they were often diſperſed by ſoldiers, under the direction of the magiſtrates; theſe effected the purpoſe by ſevere beatings with their arms. One John Trowel being evidently mortally wounded in this way, a coroner's inqueſt was held, but the verdict of the jury was ſuppreſſed: and the king, on being informed of the facts, evaded interference, telling the complainants to proſecute the law againſt the ſoldiers! Similar proceedings took place at Colcheſter; where the congregation, being kept out of their houſe, met for many weeks in winter ſtanding in the ſtreet. Here they were aſſailed by ſoldiers on horſeback, who wounded many of them, and a man of ſeventy loſt his life in conſequence. On one of theſe occaſions a trooper's ſword, by violent uſing, came out of the hilt. The man he had been beating handed it up to him with theſe words, "I deſire the Lord may not lay this day's work to thy charge." In this inſtance, as in others, the patience of the ſufferers at length triumphed, and they were quietly allowed their right of meeting.

In 1665 a hundred and twenty Quakers were in Newgate, ſentenced to tranſportation, under an act recently made "to prevent and ſuppreſs ſeditious conventicles." The maſters of ſhips generally refuſing to carry them, an embargo was laid, and it was made a condition of ſailing to the Weſt Indies, that ſome Quakers ſhould be taken thither by every veſſel. A *mercenary wretch* being at length found for the ſervice, the Quakers, unwilling to be active in their own baniſhment, refuſed to walk on board, as did alſo the ſeamen to hoiſt them in. By the help of ſoldiers from the Tower, fifty-five of them were at length ſhipped. But the maſter was now in priſon for debt; and the ſhip, after ſeven months' detention, quitting the coaſt, was immediately taken by a Dutchman, and twenty-eight of the priſoners (the remainder having died of the plague) were liberated in Holland and ſent home. Other parties of Quakers were ſet on ſhore again from different veſſels, ſo that the number actually ſent to the Weſt Indies was ſmall.

The preceding inſtances may ſerve to ſhew the kind of perſecution which this ſociety endured for many years; it may be obſerved in concluſion, that the court (or rather the clergy) of Charles, in their eagerneſs to ſuppreſs the growing ſociety, actually deſcended to the meaſure of iſſuing a formal order of council for demoliſhing their meeting-houſe in Southwark, which was addreſſed to no leſs a perſon than Chriſtopher Wren, eſq. ſurveyor-general of his majeſty's works; but it was executed by the military, by whom the congregation, who had the courage to meet on the ruins, were dragooned as often as they aſſembled, for nearly three months together, without however overcoming their firmneſs.

Though the Quakers never ſent out miſſionaries, in the manner of ſome other ſocieties, we have ſeen that individuals went, under apprehenſions of religious duty, to diſtant parts. Several of theſe viſited Italy, where they did not conceal their diſlike of ſuperſtition; and one John Love, being detained at Rome on this account, died (as it ſeems a violent death) in the priſon of the inquiſition. Catharine Evans, and Sarah Cheevers, after three years' confinement, and many ſufferings in the inquiſition at Malta, were releaſed and returned to England. But the moſt extraordinary enterprize, in this way, was performed by Mary Fiſher, a maiden, and one of the two who had been ſo ill treated at Boſton. She, apprehending ſhe had a meſſage from God to ſultan Mahomet IV. actually made her way from England to his camp before Adrianople, where ſhe delivered, through his interpreters, what was on her mind, was treated with reſpect, and offered an eſcort to Conſtantinople, which ſhe declined, and returned, as ſhe had gone, alone and in perfect ſafety. A young man, named George Robinſon, went, through ſtill greater difficulties, to Jeruſalem, where, ſpeaking againſt the ſuperſtition of the pilgrimages, the friars procured him to be forced into a moſque, whence the Turks, on his refuſing to turn Mahometan, led him out to be put to death, as for wilfully violating the place: but a ſudden change taking place in their ſentiments concerning him, he alſo was permitted to return.

In 1660 the Quakers held their firſt general meeting, for the care of their poor and other concerns of the ſociety, at Skipton in Yorkſhire; within a few years after which, meetings for diſcipline were eſtabliſhed throughout England and Ireland, chiefly by the inceſſant perſonal labours and epiſtolary recommendations of George Fox. At this period the ſociety received a conſiderable acceſſion of reſpectability by the converſion of William Penn and Robert Barclay. The celebrated Apology of the latter gave the world an opportunity of fairly appreciating doctrines till then but partially known, and on this account the more decried: and the ſettlement of the Jerſeys, and ſubſequently, of Pennſylvania, under the auſpices of Penn, opened to the Quakers a new and promiſing field of increaſe, which they did not fail ſpeedily to occupy. Another perſon of confiderable learning, George Keith, after affociating with them for near thirty years, became the author of a fchifm, the circumftances of which it will be proper to notice. Keith was a native of Scotland, and educated at Aberdeen; he was imprifoned, as a Quaker, in 1664, and in 1675 affifted Barclay in a public difputation againft the ftudents at Aberdeen: he wrote much in defence of the principles of the Quakers, which he thoroughly underftood, and was employed in the education of their youth; but is thought by them to have indulged too much in curious and ufelefs fpeculations, which his brethren did not encourage. Being again repeatedly imprifoned, about 1684 he removed to America in difguft. Here, after fome previous general cenfure of his friends, he accufed feveral, in particular, of grofs error in doctrine; the pretext for which was, their holding (as he himfelf had done) that the knowledge and belief of the hiftory of Chrift is not neceffary for the falvation of thofe who have no poffible means of acquiring it. His complaints againft individuals leading to more general contention, the Friends in England interfered, and the parties were heard before the yearly meeting in London, which decided the caufe againft Keith, and he remained under the "difownment" pronounced againft him in America. He now fet up a feparate Quakers' meeting in London, attacked the principles he had formerly defended, (on which occafions the Quakers replied by quotations from his own works,) and finally entered into the church of England. He was foon after ordained prieft, and made a miffionary to America, to bring over his former brethren. But his efforts, though for a while troublefome to the Quakers, were attended with very little fuccefs: he returned to England, funk into obfcurity on a fmall living in Suffex, and his party gradually difappeared.

The jeopardy in which the Quakers almoft conftantly ftood on account of their principles, very early introduced them to an immediate intercourfe with the throne; and they thus acquired the privilege, which they ftill exercife, of prefenting public addreffes to the king, by a deputation from their body, in a manner which does not violate their confcientious fcruples. The acceffion of a new fovereign, the conclufion of a peace, or an impending war, have commonly drawn from them addreffes, in which fentiments not unworthy of their Chriftian profeffion, are conveyed in fimple but refpectful language. And very recently (1814), they availed themfelves of the prefence in this country of the emperor of Ruffia, and the king of Pruffia, to addrefs each of thefe monarchs in favour of a perfect toleration in their refpective dominions: in which they met with a favourable reception. Another great and interefting object, the abolition of the flave trade, has frequently brought them forward to government in this way. In the caufe of humanity, as it regards the oppreffed Africans, they have proved themfelves ftrenuous and indefatigable: the reproach, even of holding a fellow man in flavery, was wiped away from the members of this fociety many years before the abolition of the trade was decreed, either in England or America. This was effected by their difcipline; and it was made a part of this, in confequence of that view of Chriftianity, which regards every individual of the human race as a fit object of its benefits, and as entitled to the charitable regard which it inculcates. Much was done on the Negroes' behalf, in America, by Anthony Benezet, whofe character is well known to the world; and by John Woolman, a minifter of the fociety, whofe writings difcover a mind of uncommon purity, fimplicity, and tendernefs.

The Quakers as a body have been long relieved from actual perfecution: yet they are ftill involved by their principles in occafional trouble as individuals. The refufal to bear arms, or to pay military fines, fubjects them to legal diftraint on their goods, and if none of thefe be found, to imprifonment. Tithes and other ecclefiaftical claims, enforced upon them, likewife render diftraint a very common, and fometimes an oppreffive occurrence: and if the profecutor be more rigorous, they may be imprifoned for an indefinite time. In America they are exempt from ecclefiaftical but not from military feizures; by which, during the war for independence, many of them were impoverifhed. It is obvious that, refufing to fwear, they cannot fill any office of profit or truft under government. Except for thefe purpofes however, for ferving on juries, and in cafes of criminal profecution, their folemn affirmation before the magiftrate has the legal force of an oath.

The Quakers are difperfed over the united kingdom, and moft of the ftates of North America; from the fouthern ftates of the latter they have moftly emigrated of late to the Ohio. In America they are chiefly engaged in agriculture; and for a feries of years have been making judicious and fuccefsful efforts to introduce this, with the other arts, and the manners of civilized life, among the Indian natives. There are a few Quakers in Germany, and their principles are entertained by fome perfons in France.

In this country they are found chiefly in the middle clafs of citizens, and in trade or manufacture. Their general dereliction of agriculture feems to have refulted from the impediments offered by the tithing fyftem: a yoke which, under their fcruple, becomes doubly heavy on the farmer. There is a greater approach to equality in the civil condition of the Quakers, than obtains in almoft any other body: the children of fuch as become very rich are apt to quit the fociety, either by marrying perfons not in its communion, or for the fake of liberties which it prohibits: and the children of the poor commonly get a plain but folid education, fuperior to their condition, by means of which they rife in civil fociety to a higher level. They have feveral excellent eftablifhments for this purpofe: the principal of which, fituated at Ackworth in Yorkfhire, contains, of both fexes, three hundred children, and was founded in 1778, at the inftance of Dr. Fothergill. With provifion for mathematical and claffical learning, the Quakers, though they have fome good private fchools, are but flenderly furnifhed; and they have in confequence few accomplifhed men in thefe branches. They are by no means deficient in general information, and of late years many of them have cultivated natural philofophy with fuccefs. The fociety in its earlier ftage, including many men of regular fcholaftic education, who had joined it on principle, had of courfe the advantage, in point of theological knowledge, over the modern Friends, who chiefly inherit their profeffion, and whofe education has but of late begun to include fyftematic inftruction in the doctrines of Chriftianity at large.

In morals they are allowed to excel: their youth is watched over in this refpect with more than ordinary care; and when grown up, their difcipline prohibits, to all conditions, thofe amufements which offer to the mind the ready means of diffipating ferious impreffions. Habitual offenders againft their peculiar regulations forfeit their memberfhip, as well as thofe who violate the more obvious rules of juftice and morality: their moral character, and confiftency as a body, are thus kept up. But it is alleged, that they are not equally well guarded againft a money-getting fpirit; which is apt to grow upon thofe who intently profecute trade and commerce to the exclufion of all other purfuits. From the occafional tenor of the fociety's advices to its members, it fhould feem that this is in a certain degree true; and that it

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behoves them to feek for an adequate remedy. They are not, however, chargeable with the love of money for its own fake; no clafs of men being more beneficent, or more prompt to contribute their time and fubftance to various public inftitutions, which the fpirit of the Chriftian religion has at length raifed up, for relieving the diftreffes, promoting the comforts, and improving the moral and religious condition of mankind.

As to the minuter features of their character, the Quakers are prudent and methodical in their bufinefs; generally good economifts of time and money. Their converfation has many peculiarities; fome of which flow from their principles, others merely from their affociating chiefly among themfelves. They were early thought to be habitually crafty ("the Quaker fly," fays Pope); but there feems no other ground for this, than the extreme caution with which they incur engagements, or make profeffions and promifes. Viewed at a diftance, they appear cold, formal, and referved in their manners; and have hence been unjuftly concluded void of domeftic cheerfulnefs, and incapable of the enjoyments arifing from focial converfe, and the intercourfe of cultivated minds. They are plain in their drefs; the peculiarities obfervable in which refult, not from any regulations on the fubject, but from an indifpofition to vary with the fafhion; they have, however, flowly followed changes which have proved general and permanent, and thus become lefs confpicuoufly fingular. Mourning habits they reject on principle: and with a people whofe ordinary drefs is fo grave, the moral reafon for them feems not to exift. They are averfe to fplendour in furniture and equipage: though the rich among them, in thefe articles, and moft of their females in drefs, have contrived, without ceafing to be known as Quakers, to refine confiderably upon abfolute fimplicity.

Doctrine.—A recent publication on behalf of the fociety, entitled, "A Summary of the Hiftory, Doctrine, and Difcipline of Friends," afcribed to one of the fociety, held in high eftimation, *viz.* Mr. J. G. Bevan, who died whilft this article was in the prefs, ftates their doctrine as follows:

"We agree with other profeffors of the Chriftian name, in the belief of one eternal God, the creator and preferver of the univerfe; and in Jefus Chrift his Son, the Meffiah, and mediator of the new covenant.

"When we fpeak of the gracious difplay of the love of God to mankind, in the miraculous conception, birth, life, miracles, death, refurrection, and afcenfion of our Saviour, we prefer the ufe of fuch terms as we find in fcripture; and contented with that knowledge, which divine wifdom hath feen meet to reveal, we attempt not to explain thofe myfteries which remain under the veil; neverthelefs we acknowledge and affert the divinity of Chrift, who is the wifdom and power of God unto falvation.

"To Chrift alone we give the title of the Word of God, and not to the fcriptures; although we highly efteem thefe facred writings, in fubordination to the Spirit from which they were given forth; and we hold with the apoftle Paul, that they are able to make wife unto falvation, through faith which is in Chrift Jefus.

"We revere thofe moft excellent precepts, which are recorded in fcripture to have been delivered by our great Lord, and we firmly believe that they are practicable and binding on every Chriftian; and that in the life to come every man will be rewarded according to his works. And further it is our belief, that, in order to enable mankind to put in practice thefe facred precepts, many of which are contradictory to the unregenerate will of man, every man coming into the world, is endued with a meafure of the light, grace, or good Spirit of Chrift; by which, as it is attended to, he is enabled to diftinguifh good from evil, and to correct the diforderly paffions and corrupt propenfities of his fallen nature, which mere reafon is altogether infufficient to overcome. For all that belongs to man is fallible, and within the reach of temptation; but this divine grace, which comes by Him, who hath overcome the world, is, to thofe who humbly and fincerely feek it, an all-fufficient and prefent help in time of need. By this, the fnares of the enemy are detected, his allurements avoided, and deliverance is experienced through faith in its effectual operation: whereby the foul is tranflated out of the kingdom of darknefs, and from under the power of Satan, into the marvellous light and kingdom of the Son of God.

"Being thus perfuaded that man, without the fpirit of Chrift inwardly revealed, can do nothing to the glory of God, or to effect his own falvation; we think this influence efpecially neceffary to the performance of the higheft act of which the human mind is capable; even the worfhip of the Father of lights and of fpirits, in fpirit and in truth: therefore we confider as obftructions to pure worfhip, all forms which divert the attention of the mind from the fecret influence of this unction from the Holy One. Yet, although true worfhip is not confined to time and place, we think it incumbent on Chriftians to meet often together, in teftimony of their dependence on the heavenly Father, and for a renewal of their fpiritual ftrength: thus, 'Each not only partakes of the particular refrefhment and ftrength which comes from the good in himfelf, but is a fharer of the whole body, as being a living member of the body, having a joint fellowfhip and communion with all.' Barclay.

"Neverthelefs, in the performance of worfhip, we dare not depend, for our acceptance, on a formal repetition of the words and experiences of others; but we believe it to be our duty to lay afide the activity of the imagination, and to wait in filence to have a true fight of our condition beftowed upon us; believing even a fingle figh, arifing from fuch a fenfe of our infirmities, and of the need we have of divine help, to be more acceptable to God, than any performances, however fpecious, which originate in the will of man. If any fhould object the difficulty of laying afide the activity of the imagination, let fuch confider the following ftatement—That it is our duty to maintain a watch over our thoughts, by endeavouring to preferve our attention from being carried away by fuch as manifeftly originate in our own natural will or habits, and to wait patiently for the arifing of the life of Chrift; which by bringing every thought into fubjection, produces a true inward filence, and therein affords a true fenfe of our condition.

"From what has been faid refpecting worfhip, it follows that the miniftry we approve muft have its origin from the fame fource; for that which is needful for a man's own direction, and for his acceptance with God, muft be eminently fo to enable him to be helpful to others. Accordingly we believe, that the renewed affiftance of the light and power of Chrift is indifpenfably neceffary for all true miniftry; and that this holy influence is not at our command, or to be procured by ftudy, but is the free gift of God to chofen and devoted fervants.—Hence arifes our teftimony againft preaching for hire, in contradiction to Chrift's pofitive command, 'Freely ye have received, freely give;' and hence our confcientious refufal to fupport fuch miniftry, by tithes or other means.

"As we dare not encourage any miniftry, but that which we believe to fpring from the influence of the Holy Spirit, fo neither dare we attempt to reftrain this miniftry to perfons of any condition in life, or to the male fex alone; but,

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as male and female are one in Chrift, we hold it proper that fuch of the female fex as we believe to be endued with a right qualification for the miniftry, fhould exercife their gifts for the general edification of the church ; and this liberty we efteem a peculiar mark of the gofpel difpenfation, as foretold by the prophet Joel, and noticed by the apoftle Peter.

"Three are two ceremonies in ufe among moft profeffors of the Chriftian name, water-baptifm, and what is termed the Lord's fupper. The firft of thefe is generally efteemed the effential means of initiation into the church of Chrift ; and the latter, of maintaining communion with him. But as we have been convinced that nothing fhort of his redeeming power, inwardly revealed, can fet the foul free from the thraldom of fin ; by this power alone we believe falvation to be effected. We hold that as there is one Lord and one faith, fo his baptifm is one, in nature and operation ; that nothing fhort of it can make us living members of his myftical body ; and that the baptifm with water, adminiftered by his fore-runner John, belonged, as the latter confeffed, to an inferior and decreafing difpenfation.

"With refpect to the other rite, we believe that communion between Chrift and his church is not maintained by that, or by any other external performance, but only by a real participation of his divine nature through faith ; that this is the fupper alluded to in the Revelation, 'Behold I ftand at the door and knock : if any man hear my voice, and open the door, I will come in to him, and will fup with him, and he with me,' and that where the fubftance is attained, it is unneceffary to attend to the fhadow : which doth not confer grace, and concerning which, opinions fo different, and animofities fo violent, have arifen.

"Now, as we thus believe that the grace of God, which comes by Jefus Chrift, is alone fufficient for falvation, we can neither admit that it is conferred on a few only, whilft others are left without it ; nor, thus afferting its univerfality, can we limit its operation to a partial cleanfing of the foul from fin, even in this life. We entertain worthier notions both of the power and goodnefs of our heavenly Father, and believe that he doth vouchfafe to affift the obedient to experience a total furrender of the natural will, to the guidance of his pure unerring Spirit ; through whofe renewed affiftance they are enabled to bring forth fruits unto holinefs, and to ftand perfect in their prefent rank.

"There are not many of our tenets more generally known than our teftimony againft oaths, and againft war. With refpect to the former of thefe, we abide literally by Chrift's pofitive injunction, delivered in his fermon on the mount, 'Swear not at all.' From the fame facred collection of the moft excellent precepts of moral and religious duty, from the example of our Lord himfelf, and from the correfpondent convictions of his Spirit in our hearts, we are confirmed in the belief that wars and fightings are, in their origin and effects, utterly repugnant to the gofpel ; which ftill breathes peace and good-will to men. We alfo are clearly of the judgment, that if the benevolence of the gofpel were generally prevalent in the minds of men, it would effectually prevent them from oppreffing, much more from enflaving, their brethren (of whatever colour or complexion), for whom, as for themfelves, Chrift died ; and would even influence their conduct in their treatment of the brute creation, which would no longer groan, the victims of their avarice, or of their falfe ideas of pleafure.

"Some of our tenets have in former times, as hath been fhewn, fubjected our Friends to much fuffering from government, though to the falutary purpofes of government, our principles are a fecurity. They inculcate fubmiffion to the laws, in all cafes wherein confcience is not violated. But we hold, that as Chrift's kingdom is not of this world, it is not the bufinefs of the civil magiftrate to interfere in matters of religion, but to maintain the external peace and good order of the community. We therefore think perfecution, even in the fmalleft degree, unwarrantable. We are careful in requiring our members not to be concerned in illicit trade, nor in any manner to defraud the revenue.

"It is well known that the fociety, from its firft appearance, has difufed thofe names of the months and days, which having been given in honour of the heroes or falfe gods of the heathen, originated in their flattery or fuperftition ; and alfo the cuftom of fpeaking to a fingle perfon in the plural number, as having likewife arifen from motives of adulation. Compliments, fuperfluity of apparel, of furniture, and of provifion for the table, outward fhows of rejoicing and mourning, and the obfervation of days and times, we efteem to be incompatible with the fimplicity of a Chriftian life ; and public diverfions, gaming, and other vain amufements of the world, we cannot but condemn. They are a wafte of that time which is given us for nobler purpofes ; and divert the attention of the mind from the fober duties of life, and from the reproofs of inftruction, by which we are guided to an everlafting inheritance.

"To conclude, although we have exhibited the feveral tenets which diftinguifh our religious fociety, as objects of our belief ; yet we are fenfible that a true and living faith is not produced in the mind of man by his own effort ; but is the free gift of God in Chrift Jefus, nourifhed and increafed by the progreffive operation of his Spirit in our hearts, and our proportionate obedience. Therefore, although for the prefervation of the teftimonies given us to bear, and for the peace and good order of the fociety, we deem it neceffary that thofe who are admitted into memberfhip with us, fhould be previoufly convinced of thofe doctrines which we efteem effential ; yet we require no formal fubfcription to any articles, either as a condition of memberfhip, or a qualification for the fervice of the church. We prefer judging of men by their fruits, and depending on the aid of Him, who, by his prophet, hath promifed to be 'for a fpirit of judgment to him that fitteth in judgment.' Without this, there is a danger of receiving numbers into outward communion, without any addition to that fpiritual fheep-fold, whereof our bleffed Lord declared himfelf to be both the door and the fhepherd ; that is, fuch as know his voice, and follow him in the paths of obedience."

To this ftatement may be added the following extracts, the firft of which is from a declaration iffued on behalf of the fociety in 1693.

"We fincerely profefs faith in God by his only-begotten Son Jefus Chrift, as being our light and life, our only way to the Father, and alfo our only Mediator and Advocate with the Father ;—that God created all things, he made the worlds, by his Son Jefus Chrift, he being that powerful and living Word of God by whom all things were made ; and that the Father, the Word, and the Holy Spirit, are One, in divine Being infeparable ; One true, living, and eternal God bleffed for ever ;—yet that this Word or Son of God, in the fulnefs of time, took flefh, became perfect Man, according to the flefh defcended and came of the feed of Abraham and David, but was miraculoufly conceived by the Holy Ghoft, and born of the Virgin Mary, and alfo, farther, declared powerfully to be the Son of God, according to the Spirit of fanctification, by the refurrection from the dead ;—that, as Man, Chrift died for our fins, rofe again, and was received up into glory in the heavens ; he having, in his dying for all, been that one, great, univerfal offering and facrifice for peace, atonement, and reconciliation between God and man ; and he is the propitiation

tion not for our fins only, but for the fins of the whole world; we were reconciled by his death, but faved by his life;—that divine honour and worfhip is due to the Son of God; and that he is in true faith to be prayed unto, and the name of the Lord Jefus Chrift called upon, (as the primitive Chriftians did,) becaufe of the glorious union or onenefs of the Father and the Son." Sewel's Hiftory, p. 643.

"The doctrine of the refurrection of the dead is fo connected with the Chriftian religion, that it will be alfo proper to fay fomething on this fubject. In explaining our belief of this doctrine, we refer to the 15th chapter of the 1ft Epiftle to the Corinthians. In this chapter (verfes 40. 42. 44. 50.) is clearly laid down the refurrection of a body, though not of the fame body that dies. Here we reft our belief in this 'myftery,' without defiring to pry into it beyond what is revealed to us; remembering that 'fecret things belong unto the Lord our God, but thofe things which are revealed belong unto us and to our children.' Principles of Religion, as profeffed by the Quakers, by Henry Tuke.

Difcipline: from the "Summary," with fome abridgment.—"The purpofes which our difcipline hath chiefly in view, are, the relief of the poor, the maintenance of good order, the fupport of the teftimonies which we believe it is our duty to bear to the world, and the help and recovery of fuch as are overtaken in faults: in a few words, the promotion of piety and charity.

"In the practice of difcipline, we think it indifpenfable that the order recommended by Chrift himfelf be invariably obferved. 'If thy brother fhall trefpafs againft thee, go and tell him his fault between thee and him alone: if he fhall hear thee, thou haft gained thy brother; but if he will not hear thee, then take with thee one or two more, that in the mouth of two or three witneffes, every word may be eftablifhed; and if he fhall neglect to hear them, tell it unto the church.'

"To effect the falutary purpofes of difcipline, meetings were appointed, at an early period of the fociety, which, from the times of their being held, were called quarterly meetings. It was afterwards found expedient to divide the diftricts of thofe meetings, and to meet more frequently: from whence arofe monthly meetings, fubordinate to thofe held quarterly. At length, in 1669, a Yearly Meeting was eftablifhed, to fuperintend, affift, and provide rules for, the whole: previoufly to which, general meetings had been occafionally held.

"A monthly meeting is ufually compofed of feveral particular congregations, fituated within a convenient diftance from each other. Its bufinefs is to provide for the fubfiftence of the poor, and for the education of their offspring; to judge of the fincerity and fitnefs of perfons appearing to be convinced of the religious principles of the fociety, and defiring to be admitted into memberfhip; to excite due attention to the difcharge of religious and moral duty; and to deal with diforderly members. Monthly meetings alfo grant to fuch of their members as remove into other monthly meetings, certificates of their memberfhip and conduct; without which they cannot gain memberfhip in fuch meetings. Each monthly meeting is required to appoint certain perfons, under the name of overfeers, who are to take care that the rules of our difcipline be put in practice; and when any cafe of complaint, or diforderly conduct, comes to their knowledge, to fee that private admonition, agreeably to the gofpel rule before mentioned, be given, previoufly to its being laid before the monthly meeting.

"When a cafe is introduced, it is ufual for a fmall committee to be appointed, to vifit the offender, to endeavour to convince him of his error, and to induce him to forfake and condemn it. If they fucceed, the perfon is by minute declared to have made fatisfaction for the offence; if not, he is difowned as a member of the fociety.

"In difputes between individuals, it has long been the decided judgment of the fociety, that its members fhould not fue each other at law. It therefore enjoins all to end their differences by fpeedy and impartial arbitration, agreeably to rules laid down. If any refufe to adopt this mode, or, having adopted it, to fubmit to the award, it is the direction of the yearly meeting that fuch be difowned.

"To monthly meetings alfo belongs the allowing of marriages; for our fociety hath always fcrupled to acknowledge the exclufive authority of the priefts in the folemnization of marriage. Thofe who intend to marry, appear together, and propofe their intention to the monthly meeting; and if not attended by their parents or guardians, produce a written certificate of their confent, figned in the prefence of witneffes. The meeting then appoints a committee to inquire whether they be clear of other engagements refpecting marriage; and if, at a fubfequent meeting, no objections be reported, they have the meeting's confent to folemnize their intended marriage. This is done in a public meeting for worfhip, towards the clofe whereof the parties ftand up, and folemnly take each other for hufband and wife. A certificate of the proceedings is then publicly read, and figned by the parties, and afterwards by the relations, and others as witneffes. Of fuch marriages the monthly meeting keeps a record: as alfo of the births and burials of its members. A certificate of the date, of the name of the infant, and of its parents, figned by thofe prefent at the birth, is the fubject of one of thefe laft mentioned records; and an order for the interment, counterfigned by the grave-maker, of the other. The naming of children is without ceremony. Burials are alfo conducted in a fimple manner. The body, followed by the relations and friends, is fometimes, previoufly to interment, carried to a meeting; and at the grave a paufe is generally made; on both which occafions it frequently falls out, that one or more friends prefent have fomewhat to exprefs for the edification of thofe who attend; but no religious rite is confidered as an effential part of burial.

"Several monthly meetings compofe a quarterly meeting. At the quarterly meeting are produced written anfwers from the monthly meetings, to certain queries refpecting the conduct of their members, and the meeting's care over them. The accounts thus received, are digefted into one, which is fent, alfo in the form of anfwers to queries, by reprefentatives, to the yearly meeting. Appeals from the judgment of monthly meetings are brought to the quarterly meetings; whofe bufinefs alfo it is to affift in any difficult cafe, or where remiffnefs appears in the care of the monthly meetings over the individuals who compofe them.

"The yearly meeting has the general fuperintendence of the fociety in the country in which it is eftablifhed: and therefore, as the accounts which it receives difcover the ftate of inferior meetings, as particular exigencies require, or as the meeting is impreffed with a fenfe of duty, it gives forth its advice, makes fuch regulations as appear to be requifite, or excites to the obfervance of thofe already made; and fometimes appoints committees to vifit thofe quarterly meetings which appear to be in need of immediate advice. Appeals from the judgment of quarterly meetings are here finally determined, and a brotherly correfpondence, by epiftles, is maintained with other yearly meetings.

"There are eight yearly meetings, *viz.* 1. London, to which come reprefentatives from Ireland; 2. New England; 3. New York; 4. Pennfylvania and New Jerfey; 5. Maryland; 6. Virginia; 7. The Carolinas and Georgia; 8. Ohio.

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"In this place it is proper to add, that, as we believe women may be rightly called to the work of the miniſtry, we alſo think that to them belongs a ſhare in the ſupport of our Chriſtian diſcipline; and that ſome parts of it wherein their own ſex is concerned, devolve on them with peculiar propriety. Accordingly they have monthly, quarterly, and yearly meetings of their own ſex, held at the ſame time with thoſe of the men; but ſeparately, and without the power of making rules.

"In order that thoſe who are in the ſituation of miniſters may have the tender ſympathy and counſel of thoſe of either ſex, who, by their experience in the work of religion, are qualified for that ſervice, the monthly meetings are adviſed to ſelect ſuch, under the denomination of elders. Theſe, and miniſters approved by their monthly meetings, have meetings peculiar to themſelves, called meetings of miniſters and elders; in which they have an opportunity of exciting each other to a diſcharge of their ſeveral duties, and of extending advice to thoſe who may appear to be weak, without any needleſs expoſure. Such, it may be here obſerved, as believe themſelves required to ſpeak in meetings for worſhip, are not immediately acknowledged as miniſters by their monthly meetings; but time is taken for judgment, that the meeting may be ſatisfied of their call and qualification. It will alſo ſometimes happen, that ſuch as are not approved will obtrude themſelves as miniſters, to the grief of their brethren; but much forbearance is uſed towards theſe, before the diſapprobation of the meeting is publicly teſtified. Theſe meetings of miniſters and elders are generally held in the compaſs of each monthly, quarterly, and yearly meeting. They are conducted by rules preſcribed by the yearly meeting, and have no authority to make any alteration or addition to them. The members of them unite with their brethren in the meetings for diſcipline, and are equally accountable to the latter for their conduct.

"It is to a meeting of this kind in London, called the ſecond-day's morning meeting, that the reviſal of manuſcripts concerning our principles, previouſly to publication, is intruſted by the yearly meeting held in London: and alſo the granting, in the intervals of the yearly meeting, of certificates of approbation to ſuch miniſters as are concerned to travel in the work of the miniſtry in foreign parts; in addition to thoſe granted by their monthly and quarterly meetings.

"The yearly meeting of London, in the year 1675, appointed a meeting to be held in that city, for the purpoſe of adviſing and aſſiſting in caſes of ſuffering for conſcience-ſake, which hath continued with great uſe to the ſociety to this day. It is compoſed of friends under the name of correſpondents, choſen by the ſeveral quarterly meetings, and who reſide in or near the city. The ſame meetings alſo appoint members of their own in the country as correſpondents, who are to join their brethren in London on emergency. The names of all theſe correſpondents, previouſly to their being recorded, are ſubmitted to the approbation of the yearly meeting. Such men as are approved miniſters are alſo members of this meeting, which is called the Meeting for Sufferings; a name ariſing from its original purpoſe, and which is not yet become entirely obſolete.

"The yearly meeting has intruſted the meeting for ſufferings with the care of printing and diſtributing books, and with the management of its ſtock; and, conſidered as a ſtanding committee of the yearly meeting, it hath a general care of whatever may ariſe, during the intervals of that meeting, affecting the ſociety, and requiring immediate attention: particularly of thoſe circumſtances which may occaſion an application to government. The ſtock of the yearly meeting, juſt mentioned, is an occaſional voluntary contribution, expended in printing books,—ſalary of a clerk for keeping records,—the paſſage of miniſters who viſit their brethren beyond ſea,—and ſome ſmall incidental charges: but not, as has been falſely ſuppoſed, the reimburſement of thoſe who ſuffer diſtraint for tithes and other demands with which they ſcruple to comply." G. Fox's Journal. Sewel's Hiſtory of the Quakers. Gough's Hiſtory of the Quakers. Beſſe's Sufferings of the Quakers. Barclay's Apology. Clarkſon's Portraiture of Quakeriſm.

The editor is indebted for the hiſtorical part of the preceding article to a reſpectable member of the ſociety of Friends. Mr. Clarkſon's work, which was compoſed in conſequence of his intimate perſonal acquaintance with many of its leading members, produced by his labours for the abolition of the ſlave trade, may be conſulted for a more ample account of the manners, practices, and opinions of this ſociety.

QUAKER-TOWN, in *Geography*, a poſt-town of America, in Bucks county, Pennſylvania; 184 miles from Waſhington.

QUAKING-Bog, in *Agriculture*, a name uſually given to a ſort of ſoft pulpy, flexible, earthy depoſitions, which are formed in hollow moiſt ſituations, in conſequence of the ſtagnation of water in them in ſome manner or other. Bogs of this kind differ much in their nature, qualities, and properties, according to the difference of circumſtances and ſituations, but they have all a tremulous motion under the foot, when capable of being trodden upon. See Bog and Quagmire.

Draining is here equally neceſſary, as in all other caſes of a ſimilar kind, and may moſtly be carried into execution without any great difficulty.

Quaking-*Graſs*, in *Botany*, ſo called from the trembling of the little pendulous ſpikelets, occaſioned by their capillary zigzag ſtalks. See Briza.

Quaking-*Graſs*, in *Agriculture*, the common name of a ſort of graſs, which is ſaid to thrive and flouriſh well on moſt kinds of poor cold land, and which cattle eat in a greedy manner; but which is not much adopted for cultivation in graſs grounds, though it makes tolerably good hay. See Briza.

QUAKU, or Quaqua, in *Geography*, a diſtrict of Africa, on the Gold Coaſt.

QUALATCHE, a town of the ſtate of Georgia; 40 miles W.N.W. of Tugeloo.

QUALE Jus, in *Law*, was an ancient writ judicial, which lay where a religious perſon had judgment to recover land; before execution was made of the judgment.

This writ was iſſued forth to the eſcheator between judgment and execution, to enquire whether the religious perſon had right to recover, or whether the judgment were obtained by colluſion between the demandant and tenant; to the intent that the true lord might not be defrauded.

QUALEA, in *Botany*, a Caribbean name, uſed by Aublet, and inadvertently adopted by Schreber; poſſibly becauſe, as it appears, he ſuſpected the genus not to be ſufficiently diſtinct from *Vochy* of the ſame author, his own Cucullaria; ſee that article. Willdenow, however, has followed him; and thus one name more is added to dunghill, which ſome future botanical Hercules muſt ſweep away.—Aubl. Guian. v. 1. 5. Schreb. 7. Willd. Sp. Pl. v. 1. 18. Mart. Mill. Dict. v. 4. Juſſ. 424. Lamarck Illuſtr. t. 4.—Claſs and order, *Monandria Monogynia*. Nat. Ord. perhaps *Guttiferæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, in four very deep ovate, coriaceous, concave, unequal ſegments; the two lowermoſt largeſt, ſpreading widely. *Cor.* Petals two, unequal, inſerted into the calyx; the uppermoſt erect, roundiſh, emarginate, terminating at the baſe behind, in a ſhort, obtuſe, horn-like nectary, projecting between the upper ſegments

ments of the calyx; lowermoſt largeſt, ſloping downward. *Stam.* Filament ſolitary, ſhort, aſcending, inſerted betwixt the lower petal and the germen; anther oblong, furrowed, recurved. *Piſt.* Germen ſuperior, globoſe; ſtyle thread-ſhaped, aſcending, the length of the ſtamen; ſtigma obtuſe. *Peric.* Berry? of one cell. *Seeds* numerous, imbedded in pulp.

Obſ. The corolla is, as it were, two-lipped. This genus is akin to *Cucullaria*. *Schreb.*

Eſſ. Ch. Calyx inferior, in four deep unequal ſegments. Petals two, unequal. Berry? with many ſeeds.

1. Q. *roſea*. Aubl. Guian. t. 1. Willd. n. 1.—Lower petal undivided. Leaves elongated at the point.—Native of the woods of Guiana, flowering in September. The inhabitants call this ſpecies *Laba-laba*. A *tree*, whoſe *trunk* is ſixty feet or more in height, terminating in large ſpreading *branches*. *Wood* red, compact. *Leaves* oppoſite, in pairs croſſing each other, on ſhortiſh ſtalks, elliptical, three or four inches long, entire, ſmooth, with an elongated blunt point; their tranſverſe veins very numerous, ſtraight and parallel. *Stipulas* deciduous. *Panicles* terminal. *Flowers* numerous, two inches long, powerfully and agreeably ſcented, white on the outſide, roſe-coloured, and finally yellowiſh, within.

2. Q. *cærulea*. Aubl. Guian. t. 2. Willd. n. 2.—Petals two-lobed. Leaves with a ſhort point.—Native of the Guiana foreſts. This ſpecies flowers in October, and is known by the name of Qualé. It differs from the former in having ſmaller *flowers*, of a grey or blueiſh colour, but fragrant like thoſe of *Q. roſea*. Their *petals* are emarginate, or almoſt obcordate. Points of the *leaves* leſs elongated.

QUALIFICATION for *killing game*, for *jurors*, *juſtices*, *members of parliament*, and *electors of members*. See Game, Jury, Justices, and Parliament.

Qualifications *for a complete muſician*, required by Zarlino. This venerable theoriſt had very exalted ideas of a perfect muſician, and tells us (Inſtit. vol. ii. part iv. p. 342, et ſeq.) that it is neceſſary he ſhould have a knowledge in arithmetic, for the calculation of muſical proportions; of geometry, to meaſure them; of the monochord and harpſichord, to try experiments and effects; that he ſhould be able to tune inſtruments, in order to accuſtom the ear to diſtinguiſh and judge of intervals; that he ſhould ſing with truth and taſte, and perfectly underſtand counterpoint; that he ſhould be a grammarian, in order to write correctly, and ſet words with propriety; that he ſhould read hiſtory, to know the progreſs of his art; be a maſter of logic, to reaſon upon, and inveſtigate the more abſtruſe parts of it; and of rhetoric, to expreſs his thoughts with preciſion; and, further, that he would do well to add to theſe ſciences ſome acquaintance with natural philoſophy, and the philoſophy of ſound; that his ears being perfectly exerciſed and purified, may not be eaſily deceived. And adds, that he who aſpires at the title of perfect muſician, has occaſion for all theſe qualifications, as a deficiency in any one of them will frequently render the reſt uſeleſs. An additional qualification is now become neceſſary to be added to thoſe enumerated by Zarlino, which is a perfect knowledge of the genius and powers of all the inſtruments for which a muſician writes; otherwiſe he will not only embarraſs a performer by uſeleſs and unmeaning difficulties, but loſe opportunities of producing effects by the bow of a violin, the *coup de langue* of flutes, and a ſelection of the pureſt and beſt tones on other wind inſtruments.

Qualifications *of Land-managers*, &c. the requiſite acquirements which are proper and eſſential to them in order to the due and full performance of all the different ſorts of buſineſs in which they may be engaged or employed. In this view, a conſiderable knowledge of the principles and practices of different ſorts of farming and farm-management, ſome acquaintance and experience in ſurveying land, in mechanics, in rural architecture, and in the buſineſs of planting, are indiſpenſibly neceſſary, as well as a notion of the various mineral and other ſubſtances contained in the bowels of the earth, and a ready facility in arranging the management of different ſorts of accounts.

They ſhould at the ſame time poſſeſs mild, conciliatory diſpoſitions, exact upright principles, and ſtrict moral characters. See Land-*Reeve*, Land-*Steward*, and Office *of Eſtate*.

The duties and uſes of theſe ſorts of managers, beſides thoſe of regulating and directing the huſbandry, management, and other matters, are, the preventing all ſorts of encroachments from taking place; the ſeeing that a proper and right method of ſtocking is purſued on the commonable lands; the guarding againſt the turf or ſoil being injured by being broken up or pared off; the looking after the public and private roads, lanes, and driftways, to ſee that the fences on the ſides of them are properly cut and pruned as occaſion may require, the travellable parts of them kept free from obſtructions, and in a ſuitable ſtate of repair, and that the farm-ways are well calculated to the uſes and intentions for which they were deſigned; the duly attending to the open drains, water courſes, and common ſewers, to take care that they are kept clear and free at all times, without doing injury to any one; the conſidering the ſtate of the natural ſtreams and running waters as fit for the purpoſes of watering live-ſtock at home or in other places, thoſe of irrigating land, the turning of mills, &c.; the examining the borders of rivers, brooks, &c. to ſee that they are not carried away, or their courſes altered in any injurious manner: the taking care of plantations, and all ſorts of woodlands, as well as timber-trees and young plants, by ſeeing that they are preſerved in a proper manner, and no damages committed by cutting them down, or in any other ways; the attending to the ſituation of the fences, gateways, &c. to ſee that the live hedges, with their banks, be duly cut, weeded, pruned, and kept up, as well as the gates, ſtiles, pales, and other dead fences properly preſerved and in repair; the keeping the home buildings, farm cottages, and garden grounds, belonging to them, in proper condition, with their tenants in a full ſtate of induſtry; and laſtly, the regulating the order of the different occupiers, by preventing improper meetings of all kinds, the repreſſing of bad houſes, and all ſorts of irregularities that have a tendency to leſſen induſtry and frugality.

Beſides theſe, there are many other duties which properly belong to them, but which need not be mentioned in this place. See Bailiff.

Qualifications *of Tenants*, the neceſſary properties and circumſtances which render them fit for holding lands as farms. The importance of having perſons perfectly qualified as tenants, is very great, in the ſuperintendance and management of all landed property, being, in a great meaſure, the baſis, or principal bearing, on which its uniform and laſting proſperity depends.

The proper qualifications of a good tenant, according to the author of the "Treatiſe on Landed Property," are the having capital, ſkill, induſtry, and character. And he contends, that without a ſufficient capital, the reſt are unavailing; but that, at the ſame time, an induſtrious, frugal, good farmer will ſtrive with difficulties, and get on with leſs money than a man of contrary qualifications. But if he has not ſufficient ſtrength to work his lands, nor a ſufficiency of live-ſtock to raiſe manure, or money wherewith to purchaſe it, he muſt, under ordinary circumſtances, live in a ſtate of poverty and hard labour; and, on the firſt attack of miſfortunes, or the firſt failing ſeaſon of crops, he will probably

ſink

fink under the weight of his accumulated burden, and be ruined.

Further, that in regard to the proper ratio or proportion between the rent and capital, it depends on the exifting ftate and circumftances of the farms, and the ftyle of management in which they are intended to be conducted; as well as on the number and ftrength of the occupiers' families, and their induftry and frugality. However, in order to afford fome general notions on the matter, it may be faid that, for farms of fize, as thofe of from one to five hundred pounds a year, the occupiers fhould have at their commands from five hundred to a thoufand pounds of capital, for every hundred pounds of rent which they may pay. Yet ftill, on the greater number of farms, the firft proportion is too fmall to manage them with full advantage and profit. And, if they be farmed with fpirit, and the higher order of improvements be attempted, particularly the introduction of the beft breeds of live-ftock adopted by modern farmers, the laft will not be found too large for the purpofe.

It may be remarked, that it is conftantly the beft way for tenants to farm fomewhat within their capitals, as a few pounds kept in their pockets enables them to embrace and take the advantage of every favourable opportunity that may offer, and to fell or buy with the greateft benefit. While fuch as are ftraightened for money, are forced to take the chance of markets, and liable to make bargains of a lofing and difadvantageous nature, as well as experience many other inconveniencies of different kinds.

Notwithftanding, where there is a want of fufficient experience and fkill in the art, and different branches of practical hufbandry, tenants cannot farm or manage their lands with the moft profit, either to themfelves, or the proprietors of them. Where, however, their capitals and exertions are great, they may, by obfervation and practice, acquire fkill; and by this means be enabled to perform the bufinefs in a tolerable manner, and in fome meafure do juftice to their farms, whatever they may do for their families in the way of getting money for their benefit. But where, with a want of fkill, fcanty capitals are joined, it is not all the exertion, induftry, and frugality in the power of man, that can fave or preferve the families or the farms from injury and inconvenience.

However, without induftry, capital and fkill may be faid to be thrown away. In the management of rural bufinefs, in which fo much depends on the nature of feafons and weather, idlenefs is a vice of the darkeft caft. Every inftance of negligence is not only injurious in itfelf, but operates as a dangerous and bad example; ferving as an apology or excufe for the half induftrious, with whom every farm or eftate is incumbered in a greater or lefs degree.

In confequence of the intimate connection which neceffarily fubfifts between the proprietors and the occupiers of land, and feeing how advantageous and profitable it is to preferve good order and regularity upon farm lands, as giving thereby full liberty and freedom to the exertions of their tenantry, it becomes a matter of fome importance, in the felection of farm-tenants, to make proper and neceffary inquiries into their characters for morality, and particularly as they relate to habits of fobriety or extravagance, as well as to a peacefulnefs or quarrelfomenefs of difpofition.

And it is farther to be remarked, in refpect to the proper felecting of tenants for farms, that nothing of intereft, or any other confideration whatever, that is not intimately connected with the above qualifications, can properly warrant the choice: unlefs in particular cafes and circumftances, as in providing for the widows and orphans of deceafed tenants, &c. A farm-manager fhould not fuffer himfelf to be influenced by any fort of family connection, favour, fee or reward. Superintendants of this kind, merely as fuch, cannot have any true interefts feparate and diftinct from thofe of the farms or lands they may overlook. It, therefore, becomes a difhoneft act in any agent of this fort, to put an inferior tenant into the poffeffion of a farm, through his own intereft, even at a fair rent for the fame.

Laftly, it may be noticed, that in a diftrict which ftands forward in a prominent manner in the ranks of rural improvements, merit fhould be looked for and encouraged near home. But to advance or bring up a farm or eftate which remains in the rear of modern practices, two or more tenants of the higher claffes fhould be fought for, at a diftance, in fuch diftricts as are of a kindred nature, but in which the more modern and profitable management of farming prevails, in order to lead and direct the native tenantry of the fituation.

Thefe are fome of the principal and leading qualifications which ought in all cafes to direct and regulate the choice of farm-tenants; there are, however, many others which fhould have an influence in certain circumftances, and particular methods of farm-management, otherwife the full interefts and advantages of the proprietors of the lands may be overlooked and neglected.

QUALIFICATOR, in the *Canon Law*, a divine appointed to qualify, or declare the quality of, a propofition brought before an ecclefiaftical tribunal; chiefly before the inquifition.

The qualificators of the office are not judges; they only give their fentiments on the propofitions prefented to them. They are the inquifitors that judge.

QUALITY, Qualitas, that affection of a thing, whence it is denominated fuch; or that which occafions a thing to affect our fenfes in this or that manner, and gives it this or that denomination. Accordingly quality is faid to be an attribute, from which no fubftance is exempt. See Mode.

Thus, that power in fire, whatever it be, by which it excites in us the fenfation of heat, fince it is that whence the fire is denominated hot, is called the quality of fire.

The word quality, *qualitas*, is faid to have been firft introduced into the Latin by Cicero: till his time the Romans ftudioufly avoided ufing a term which denoted an abftract; and in lieu of it only confidered concrete, fignified by *quale*. The like is obferved of the ancient Greeks, who did not ufe ποιοτης, but ποιον.

Quality, it is to be obferved, is an ambiguous term; and has been applied to fome things which ought rather to have been looked upon as ftates of matter, or affemblages of feveral qualities; as life, health, beauty, &c.

There are, alfo, other attributes, as fize, fhape, motion, and reft, ufually reckoned among qualities, which might more conveniently be ranked among the primary modes of the parts of matter; fince, from thefe fimple attributes, all the qualities are derived.

The ancient fchool-philofophers diftinguifh quality in the general, which they call *metaphyfical* and *predicamental* quality, into *effential* and *accidental*. The moderns more ufually divide it into *fpiritual* and *corporeal*.

Qualities, *Spiritual*, or *Qualities of the Soul*, are affections of the mind, confidered as in this or that habitude or difpofition. Of thefe they make two kinds; the one belonging to the underftanding, the other to the will: of the former kind are knowledge, opinion, certainty, doubting, &c. Of the latter are all the moral virtues and vices.

Qualities, *Corporeal* or *Phyſical*, are what we chiefly conſider under this denomination, and to which the definition above laid down is accommodated.

Philoſophers are divided as to the nature of theſe qualities, or what they are in the body. The general language of the Peripatetic ſchool is, that they are things diſtinct from the bodies themſelves; and are ſuperadded to them, or flow from their ſubſtantial forms: on which principle, they hold qualities to be real, and denominate them *accidents;* ſuppoſing them to be inherent in ſubſtances, though not in the relation of parts, but to be ſuſtained by them as in a ſubject, and incapable of ſubſiſting without them. In effect, the Thomiſts define qualities to be accidents following or ariſing from the form; in the ſame manner as quality is an accident following or ariſing from the ſubſtance.

The moderns abſolutely explode the notion of qualities diſtinct from the body; and inſiſt, that the powers by which bodies excite in us the ideas of ſuch qualities, are no other than the mechanical affections of the bodies themſelves, *viz.* the figure, magnitude, motion, &c. of the parts of which they conſiſt.

The principal conſiderations inſiſted on by the retainers to real qualities are, that theſe powers may be actually ſeparated from the ſubſtances they inhere in; as we ſee in light, heat, &c. That from theſe very qualities, conſidered as ſo many determinations, there ariſes a very great diverſity in bodies; and that bodies, according to the diverſity of their qualities, affect our ſenſes very differently.

The adherents to the experimental way, on the contrary, account for all the qualities of bodies from mechanical cauſes. Thus all the phenomena of a clock, the motion of its wheels, its hands, &c. by which it ſtrikes the hour, points the minute; day, moon's age, &c. do all evidently ariſe from the ſingle ſpring; which we never imagine to have any particular powers by which it ſhould be enabled to make ſuch diſcoveries; nor any other principle but that one of elaſticity. Why, then, may we not conceive, as to ſenſible qualities, that though, by virtue of a certain congruity or incongruity in point of figure, texture, or other mechanical properties, the portions of matter they modify are enabled to produce various effects, on account of which the bodies are ſaid to be endowed with qualities; yet theſe are not, in the bodies endowed with them, any real or diſtinct entities, or differing from the matter itſelf of ſuch a determinate bigneſs, ſhape, and other mechanical modifications? Thus, though the modern goldſmiths and refiners reckon it among the moſt diſtinguiſhed qualities of gold that it is diſſoluble in aqua regia, whilſt aqua fortis will not work upon it; yet theſe attributes are not in the gold any thing diſtinct from its peculiar texture; nor is the gold we have now of any other nature than it was in Pliny's time, when aqua fortis and aqua regia were unknown.

We all know that the ſun hath a power to harden clay, ſoften wax, melt butter, thaw ice, turn water into vapour, make air expand itſelf in weather-glaſſes, contribute to blanch linen, render the white ſkin of the face ſwarthy, and mowed graſs yellow, ripen fruit, hatch the eggs of ſilk-worms, caterpillars, &c. and perform many other things, ſome of which ſeem contrary to others; yet theſe are not diſtinct powers, or faculties in the ſun, but only the production of its heat, diverſified by the different textures of the body it chances to work on, and the condition of the other ſubſtances concerned in the operation. And, therefore, whether or not the ſun, in ſome caſes, has any influence at all diſtinct from its light and heat, we ſee that all the phenomena mentioned are producible by the heat of common fire, duly applied and regulated. Some of the ancients, and particularly the Peripatetics, have diſtinguiſhed qualities into *ſenſible* and *occult.*

Qualities, *Senſible,* or *Manifeſt,* are thoſe ariſing from certain modifications of matter, and which become immediately the objects of our ſenſes. Such are all thoſe above-mentioned.

Though, in ſtrictneſs, thoſe only are ſaid to be ſenſible qualities which affect ſome one ſenſe alone; as colour does the eye, ſound the ear, &c.

Theſe are ſometimes, alſo, called *tangible* qualities, becauſe they only produce their effect, *i. e.* excite their idea in us, when contiguous, or in contact with the organ.

Qualities, *Occult,* are certain latent powers ariſing from the ſpecific forms of things, of which no rational ſolution can be given on any principles of phyſics.

Senſible qualities are uſually ſubdivided into *primary* and *ſecondary.* See Ideas.

Qualities, *Primary,* or *General,* are ſuch as are found in all bodies; or which agree to all matter, conſidered as matter, and therefore to the elements themſelves. Such are extenſion, figure, motion, reſt, ſolidity, impenetrability, and number.

Qualities, *Secondary,* or *Particular,* are ſuch as reſult from a compoſition or mixture of elements, and do not agree to body as body, but as a mixt. Such are light, heat, cold, colour, ſound, taſte, ſmell, hardneſs, ſoftneſs, fluidity, firmneſs, roughneſs, ſmoothneſs, opacity, tranſparency, &c.

According to Ariſtotle, and the Peripatetics, the primary, or elementary qualities, are thoſe of the four elements themſelves; *viz.* heat, cold, moiſture, and dryneſs.

The ſecondary qualities, according to the ſame, are all the reſt; which are combinations or aſſemblages of the former elementary ones; as colour, odour, taſte, &c.

To give an idea of Ariſtotle's method of accounting for theſe ſecondary qualities from theſe primary ones, we ſhall inſtance in his account of colour. All colours, then, ſays he, are generated of a mixture of the four elementary qualities: white, *e. gr.* is produced when the humidity ſurmounts the heat, as in old men, whoſe hair grows grey; black is produced when the humidity dries off, as in walls, ciſterns, &c. red, &c.

Among the ſchool-philoſophers we meet with other diviſions of qualities; as *active,* and *paſſive; real,* and *intentional.*

Qualities, *Active,* are thoſe by virtue of which effects and operations are actually produced on other bodies duly diſpoſed with reſpect to them. Such are the heat of fire, the moiſture of water, &c.

Qualities, *Paſſive,* are thoſe by which bodies are diſpoſed to receive the action of others. Such are inflammability in oil, &c.

Qualities, *Real,* are thoſe which remain in the ſubject, and only act on things adjacent to it. As fire in a piece of iron not ignited, &c.

Qualities, *Intentional,* are thoſe which iſſue from the ſubject, and operate at a diſtance. Such is the light emitted from the ſun, &c.

But the moderns are agreed, that either all qualities are real, or all alike intentional. So that the diſtinction is impertinent. See on the ſubject of quality, its various ſpecies, and its different properties, Harris's Philoſophical Arrangements, chap. viii.

However ignorant we may be of the nature of qualities, or of the manner of their operation, yet we know the laws of their intention and remiſſion. Dr. Keil demonſtrates, that every quality which is propagated *in orbem,* ſuch as light,

light, heat, cold, odour, &c. has its efficacy increafed, or abated, in a duplicate ratio of the diftances from the centre of radiation, or exertion of the quality, reciprocally.

Thus, let A (*Plate* XII. *Geometry*, *fig.* 1.) be a centre from whence any quality exerts itfelf round about, according to the right lines, A *e*, A *f*, &c. The efficacy of the quality, be it heat, cold, odour, &c. will be (at equal diftances from A) as the fpiffitude or denfity of the rays, A *b*, A *c*, A *d*. But the rays within the inner circle, or rather fpherical fuperficies, *bcd* H, when they come to be extended to the other fpherical furface, *efg* K, will be much lefs clofe than they were before, and that in the reciprocal proportion of the fpaces they take up; that is, if the outer furface be the double of the inner, the rays there will be but half as thick; but fince fpherical fuperficies are as the fquares of their radii, therefore the efficacy of the quality in the inner furface will be to that of the outer, as A *e* fquare to A *b* fquare. *Q. E. D.*

Sir Ifaac Newton lays it down as one of the rules of philofophizing, that thofe qualities of bodies which are incapable of being intended and remitted, and which are found to obtain in all bodies in which the experiment could ever be tried, are to be efteemed univerfal qualities of all bodies. See PHILOSOPHIZING.

QUALITIES, *Cofmical.* See COSMICAL *Qualities.*

QUALITY is alfo ufed for a kind of title, or degree of eminence given to certain perfons, in regard of their territories, fignories, or other pretenfions.

Thus the king of Great Britain ufed to take the quality of king of France; the king of Poland that of king of Sweden; the king of Sardinia that of king of Cyprus and Jerufalem; the czars of Ruffia, and kings of Spain, have whole pages of qualities. The emperor of China affumes the quality of fon of the fun.

QUALITY *of Curvature*, in *Geometry*, is ufed to fignify its form, as it is more or lefs inequable, or as it is varied more or lefs in its progrefs through different parts of the curve. Newton's Meth. of Flux. and Inf. Ser. p. 75. Maclaur. Flux. art. 369. See CURVATURE.

QUALITIES *of Trees and Plants*, in *Agriculture* and *Gardening*, are the properties which are peculiar to them, in relation to their magnitude, modes of growth, textures or confiftences, forms, colours, taftes, fmells, means of propagation, culture, ufes, and values.

In regard to the firft, as foon as the fimple conftituent fibres of plants are evolved and increafed, as far as the nature of them and the arrangement of the primary nutrient fubftances will permit, they ceafe to receive any more for their farther increafe; the primary matters merely replacing the lofs which is occafioned by the performance of the natural functions of the plants; confequently they have each a particular prefcribed increafe or meafure of growth. Some are very large, others extremely fmall. The Indian fig, in confequence of ramifications being fent off, which concrete with the primitive trunk, by infenfible degrees acquires a very confiderable bulk or thicknefs, being frequently twenty, or even thirty cubic feet in its diametric fection. And there are accounts given of particular plants, which are fcarcely vifible to the naked eye; and of fome trees, which are fo large as to cover with their branches two hundred perfons, or more.

In this country, fome trees and fhrubs of the ornamental fort are either very high, or very low: of the former kind are the horfe-chefnut, larch, cornelian cherry, fnowdrop-tree, and many others; and of the latter, the mountain-afh, hemlock, fir, Scotch rofe, butchers' broom, and many more. There are fome trees which are very broad, in proportion to their height, as the oak, Spanifh chefnut, &c.; others which are very narrow, as the larch, fpruce fir, &c. And there are ftill fome others, in which there is a medium between thefe extremes, preferved and kept up, as in the afh-leaved maple, the evergreen oak, the Virginian rafpberry, the Guelder rofe, and a number of others.

The modes or habits of growth in trees and fhrubs are alfo extremely different: fome fending out their branches in a horizontal manner, as in the oak; in others they have an upward direction, as in the Huntingdon willow; while in a few they fall downwards, as in the lime, acacia, and others. Again, there are fome which have an oblique inclination, as may be feen in the Scotch fir; or they recline, and then rife up again, as in the larch kind; and there are ftill others, in which they hang directly downwards, as in the weeping afh, weeping willow, &c. There are likewife fome fhrubby plants, which creep along the furface of the ground, as the periwinkle; others which clafp themfelves to trees, as the paffion-flower; and a few which fix and attach themfelves to buildings, walls, &c. as the ivy. Farther, there are fome trees that, in whatever way they may be placed, cut, or pruned, conftantly affume and take on one principal ftem, from which all the different branches proceed or go off, as rays from a centre, as in the fir tribe; while in others, the trunks divide themfelves into arms, or large branches, which fend out boughs or fmaller branches in an irregular manner, as in the oak and others. Some kinds of fhrubs have merely one fingle ftem, as the althæa; while other forts invariably fpread and extend along the furface of the ground, throwing or fending up a greater number, as the hypericum, and fome others.

The texture or confiftence of plants of different kinds is likewife very different, as hard, foft, membranous, carneous, fmooth, downy, thorny, &c. which are moftly obvious to the feel. Plants of the young kind are commonly mucilaginous, becoming hard as they advance in growth; though many luxuriate in the ftate of continual foftnefs, as the tremella; yet fome are fo hard as to fink in water, as the iron wood of the ifland of Ceylon, &c. Thus among trees and fhrubs, fome have a foft fmooth appearance, as the lime, the fcorpion fenna, &c.; while others have a hard, rough, firm appearance, as the evergreen oak, the holly, &c. There are fome alfo which have a fmooth, filky appearance, as the tamarifk, &c.; while others have a downy, woolly appearance, as the hoary poplar, &c. And fome appear wholly befet and covered with thorns or prickles, as the furze, hedgehog holly, &c.; while others, again, appear wholly compofed of thready fhoots, as the Portugal broom, &c. Befides thefe, there are many other forts, which furnifh different appearances from any of thefe.

The forms in the different forts and varieties are ftill equally, if not more, various; fome being apparently folid and compact, from being thick fet with branches and foliage, as in the horfe-chefnut, the Englifh elm, the lilac, the fyringa, &c.; while others are of a more light, airy, elegant form, being thin of boughs, branches, and leaves, as the afh, the hoary poplar, the bird cherry, the Canadian mefpilus, &c.; and there is a middle degree between thefe extremes, in the broad-leaved euonymus, the afh-leaved maple, and fome others. They may alfo be further diftinguifhed into thofe whofe branches begin from nearly the furface of the ground, as in the fir tribe of trees, and moft fhrubs; and into thofe which fhoot up into a ftem before their branches are begun to be fent off, as in the mountain-afh, the althæa frutex, &c. It may likewife be noticed in refpect to thofe whofe branches begin from the ground, that fome of them rife in an elegant cone, as the larch, the

 holly,

holly, &c.; others in a cone, whofe bafe is very broad, as in the cedar; or whofe bafe is very fmall, as in the upright cyprefs. There are fome which fwell out in the middle of their growth, and diminifh or contract at both ends, as in the Weymouth pine, &c.; while others are broadeft at the top, as in the rafpberry, the alpine honeyfuckle, &c.; and fome few irregular and bufhy throughout, as in the evergreen oak, the fnowball tree, &c. Among thofe which fhoot up into a ftem before their branches are fent off, there are fome which are in the fhape of flender cones, as in the deciduous cyprefs; others in thofe of broad cones, as in the balfam poplar. Still others affume a globular form, as in the mountain-afh; while many are irregular throughout, as in the Scotch elm, the acacia, and feveral others.

As to colour, it appears to depend upon the colouring principle, the proportion of vital air and light which is contained, and is proper to different parts of the fame tree or plant: hence, when exhalation is prevented, and light intercepted, the green colour is changed into white. In trees and fhrubs it is either accidental or permanent: the latter including all the different fhades of green in the fummer months; the former, the different tints of red and yellow, which are peculiar to the autumnal and vernal feafons.

There are fome of the permanent kinds of colour, which are of a dark green, as thofe in the horfe-chefnut, the yew, &c.; while others are of a light green, as thofe in the afh, the common laurel, &c.; and others, again, which are of a blueifh-green, as thofe in the Scotch fir, the bladder fenna, &c. Some trees have a green tinged with brown, as the Virginian cedar; others a green tinged with white, as the abele and the Lapland willow. Alfo, in fome trees the greens are tinged with yellow, as in the afh-leaved maple, the Chinefe arbor vitæ, &c.; in others with red, as in the fcarlet maple, &c.; and in a few with purple, as in the purple beech. There are fome greens which are fpotted with white, yellow, and red, as that in the variegated holly, privet, fycamore, box, and various others. The colours which arife from accident are almoft infinite in number, each kind of which is liable to great variation: moftly, however, it will be found that in autumn the wild cherry affumes a bright red, the birch a deep red, the beech a brownifh-red, the fcarlet oak a deep fcarlet, the hornbeam a ruffet colour, the fugar maple a rich yellow, the common oak a reddifh-yellow, the lime and afh a ftraw colour, the balfam poplar a black, the fycamore a dark brown, and others different forts of other colours.

In regard to tafte and fmell, the former depends upon the different principles which compofe and conftitute the juices or humours of the different kinds, and varies as well in the different forts, as in the different parts of the fame fort of trees or plants. The latter depends on the volatile principle, or principles, which iffue or exhale from them, and differs in its nature, according to the kinds of plants, or the parts of them, in which it chiefly refides or is prefent. There are fome trees and fhrubs which have fcarcely any fmell, as the evergreen oak, platanus, &c.; others have a moft grateful rich fragrance, as the birch, fweet-briar, honeyfuckle, &c.; fome again have a lufcious, powerful fmell, as the mezereon, the fyringa, &c.; others a difagreeable naufeous fmell, as the elder, &c.; in fome the fmell is very fweet, as in the flowering lime; in others it is deleterious, as in thofe of the walnut, the artemifia, &c. There is alfo the greateft fragrance in fome while they are in bloffom, as in the hawthorn, and in fome it is folely confined to it, as in the lilac; while in others it is equally diffufed over or throughout the whole plant, as in the fweet-briar, and many others.

These may be confidered as fome of the moft general characteriftic qualities of trees and fhrubs; but various other peculiarities incident to them prefent themfelves, on a more minute inveftigation, which equally intereft and deferve the attention of the ornamental planter and gardener, as well as the cultivator of all forts of wood and timber; and which principally relate to differences in the barks, the buds, the leaves, the flowers, and the fruits. The appearance of the bark is very different in many different forts of trees and fhrubs, as red, white, black, brown, and green, as in the dogwood, birch, oak, Guelder rofe, and holly. It differs alfo in its properties, as in fome it is firm, in others fpongy, in fome thin, in others thick, brittle, glutinous, or thready, as in the oak, the cork-tree, the beech, the Scotch fir, the hornbeam, the holly, the lime, and the elm. It varies likewife in its duration, the outer bark or coat in fome trees being thrown off annually, as in the arbutus, the birch, &c.; while in others, for the moft part, it is conftantly retained or kept on. It differs equally in refpect to its properties of tafte, being in fome aftringent in its nature, in others fweet, bitter, refinous, &c., as in the oak and bramble, lime, abele, fir, &c. In regard to buds, fome trees have none at all, as the pine and evergreen forts; in fome they are very large, in others very fmall, as in the horfe-chefnut, and the willow. In fome they are coated over with a covering of glutinous or refinous matter, as in the horfe-chefnut, &c.; in others they are overfpread with a dry film or tegument, as in the beech, &c. There are likewife fome buds which are of a red colour; others which are yellow, black, brown, or red and greenifh; as thofe in the lime, the willow, the afh, the beech, and the common fycamore, in the order in which they occur.

The variety in the leaves is ftill much greater; fome being very broad, as thofe of the common laurel; others very narrow, as thofe of the larch. And there is a medium between thefe extremes, in thofe of the willow and the almond. In fome they are entire, as in the bay; in others ferrated, as in the cherry; and pinnatifid, as in the acacia, &c. In fome again they are covered with down, as in the fea buckthorn; in others with wool, as in the hoary poplar; with prickles, as in the holly; with a glutinous matter, as in the gum ciftus, &c. They are of all the different fhades of green in the fummer feafon; and of all the different tints of red and yellow, in the autumnal and vernal feafons.

There are fome which retain their leaves and colours during or throughout the whole year, as the pine tribe, &c.; others which lofe their green colour in the autumn; but retain their leaves all the winter, as the beech, hornbeam, &c. in particular circumftances. A great number of trees, among which are the elm and the afh, drop their leaves in the autumn, and are naked all the winter. In general, the leaves have the fame properties as the barks, but in a fainter and lefs perfect degree; which are of much importance in fome points of view. Thofe of the alder, the box, &c. are refufed by moft forts of cattle; thofe of the elm, the thorn, &c. greedily devoured by them; while thofe of the fir tribe are offenfive to many forts of infects, which are liable to infeft hot-houfes, and other fimilar places.

And the flowers are much lefs various than the leaves. Thofe of fome trees being large and fhowy, as of the rofe, the honeyfuckle, &c.; while thofe of others are fmall and obfcure, as of the alaternus, &c. In fome they cover the whole plant, and quickly fade away, as thofe of the hawthorn; while in others they are but thinly diftributed, yet continue a confiderable length of time, as thofe of the paffion-flower, &c. There are fome, which come into bloffom at an early period, as thofe of the mezereon, almond, &c.;

&c.; others that are very late, as those of the sweet chesnut, the althæa frutex, &c. And there are some trees and shrubs which cease flowering before their leaves expand, as the almond; and others in which the blossom makes its appearance only when the leaves fall off, as that of the hazel.

In the fruits or seeds of trees and plants the variety is likewise considerable. There are some, in which they are brilliantly coloured and showy in their appearance, as in the clustered berries of the mountain-ash; while in others, the seed is very much hidden and obscure, as in the willow. On some trees they remain two or more years, as the cones on the fir tribe; on others but a few weeks, as the capsules of the elm. The fruits and seeds of some are used for culinary purposes, and contribute to increase and enrich the deserts of the table, as the apple, pear, walnut, &c.; while others are appropriated to and have the properties of fattening the inferior sorts of animals, as the acorn, the beech mast, &c.; and others again are poisonous, as the berries of the deadly nightshade, and those of the mezereon, &c.

Further, along with their characteristic distinctions, some trees and plants combine and comprise what may be considered particular properties.

In the roots, they are as much varied underneath the ground, as the trunks, stems, and branches are above the surface of it. There are some which spread themselves in a horizontal manner, as those of the pine, and fir tribes; others which send down perpendicular roots to a great depth, as those of the oak, the chesnut, &c.; and there are those which form a medium between these extremes, as in those of the lime, the beech, &c.

In the modes or means of propagation in trees and plants there is equal or more variety. There are some which are raised from seeds, as the most part of forest-trees, such as the oak, elm, ash, larch, &c.; others from layers, as the lime, platanus, rose, and many sorts of shrubs; still others from suckers, as the abele, gale, spirea, &c. And some are propagated by ingrafting, as the weeping ash, apple, &c.; others by inoculation, as the double-blossomed almond, the weeping cherry, &c. And some kinds, again, by the roots, as the thorn, mezereon, and others.

In respect to culture they require different kinds of soils, situations, and management; some delight in a deep, strong soil, as the oak; some in a dry gravelly one, as the beech; some in a deep moist one, as the poplar; others in a soil of the peat-earthy kind, as the erica, and various other sorts; still others are natural to a rather moist soil, as the alder, &c. And there are some trees which will grow in a soil of almost any sort, as the Scotch fir tribe; while others will scarcely grow in any, but that of their natural one, as the rhododendron, the andromeda, &c. There are some again which hardly stand in need of the aid or assistance of any sort of soil, as the ivy, &c.; while others are of the parasite kind, as the misletoe, &c.

There is likewise much variety in the situations and exposures which trees and plants naturally affect. Some kinds will endure almost every sort of exposure, with the exception of that of strong powerful sea breezes, as the larch, the Scotch fir, the mountain-ash, &c.: while some again endure and withstand the sea breezes in a much better and far superior manner to others, as the sycamore, ash, service, elder, &c.; others will not prosper except in low, or sheltered situations, as the black spruce, most sorts of American plants, &c.; while others will rise and grow under the drip and shade of others, as the Scotch elm, the Norway maple, hemlock, spruce, dogwood, box, &c.; but others again die in such situations, as the larch, the pine, the willow, and many other sorts.

In their more young growths trees and plants not only demand soils, situations, and aspects suited to their particular natures and habits, but also such methods of culture as are adapted to them. Some kinds requiring the earth and mould about their roots to be repeatedly dug up and stirred, as the lime, the lilac, &c.; others advance with equal rapidity, where the ground on the surface is preserved free and clean from other injurious vegetable productions, as the oak, the chesnut, &c.; while others again succeed in the best manner, where the surface of the land is covered with mossy matter, as the rhododendron, the erica, &c.

In regard to cutting and pruning, there are some trees which will not bear the knife, as the cherry, &c.; the wood in others is many times hurt by it, as in the pine and the fir tribes. Some again are capable of bearing it to any extent, as the hawthorn, the crab-apple, &c. However, these peculiarities are mostly applicable to trees of considerable height; as most sorts when very young endure cutting in, and pruning very well, many kinds requiring these operations to train and bring them to single stems. For instance, the silver fir, while in the nursery state, requires the side shoots of it to be cut and shortened; and young oak plants, some time after they have been finally planted out, are often cut over just above the surface of the ground, and supposed to grow up stronger by it.

A great many sorts of trees and plants stand in need of being removed or transplanted the first or second year of their growth from the seed, while in the nursery ground; and to be set out from that situation into plantations of different kinds, while under the height of four feet, or in their more early growth. There are some sorts which are little or not at all hurt by such removals, as the elm; while others are liable to die after it, as the spruce fir, the Weymouth pine, &c.; some kinds are also apt to die on being transplanted, after they are eight, ten, or more feet in height, as the pine, the fir tribes, &c.; while other sorts may be safely transplanted at nearly double such ages and sizes, as the lime, the elm, the sycamore, and various other deciduous kinds; however, a year or more before their removal is to take place, they should have their roots cut in, and their tops thinned by the pruning knife, or other means, as such precautions are highly important and necessary, and should never be omitted, in removing trees of the latter of the above heights.

In respect to the uses of trees and shrubby plants, though the latter sort are commonly set out for the purpose of ornament, variety, &c., and the former for that of timber, as well as these and other uses; there are still some other ways in which they occasionally contribute, and become of utility and importance to the planter. There are different products of some of them, which are useful in different arts and professions. For instance, the bark of some is useful in chemistry, for the making of bird-lime, as that of the holly; that of others, as of the lime, the elm, &c. for the manufacturers of mats. The leaves of some, as those of the mulberry, for the growers and raisers of silk. The blossoms of others, as those of the rose, for the apothecary, and those of the syringa for the confectioner. Those parts of the seeds of the beech which are proper, are converted into bread. And the fruits of others, as those of the pear, apple, plum, &c. are of very general utility and value. Some kinds of wood are of particular use and value for particular purposes, as the oak to ship-builders; and others might be trained for this application, as the larch, by bending down the stem when about twenty feet in height, securing it in that position, and then re-bending it again some consider-

able

able time afterwards, leaving the bole or trunk in a differently crooked ſtate. The woody parts of the fir and pine are employed by houſe-carpenters, of the crab-tree by mill-wrights, of the aſh by plough-wrights, of the beech, the walnut, the cherry, the plum, the box, the holly, the yew, and others, by the cabinet-makers. The lime is particularly uſeful to the carver, the ſycamore to the turner, the box and holly to the mathematical inſtrument-maker, and the alder and the birch to the laſt and the heel-maker. Charcoal of any of the kinds is valuable for the iron-founders; that of the dog-wood, ſallow, alder, hazel, &c. for the gunpowder manufacturers. The larch, the ſilver fir, &c. afford the coarſe turpentine and its ſpirit; the ſpruce and pine tribes, reſin, tar, pitch, lamp-black, &c. Moſt woods, but eſpecially the beech, aſh, elm, &c. afford potaſh. The ſap-juice of ſome trees, as the birch, &c. yields a vinous liquor; and that of others, as of the ſugar-maple, &c. affords ſugar.

The value of wood as timber, and for other purpoſes, differs much according to local ſituation, and other circumſtances; when near a dry-dock or ſhip-yard, oak, elm, &c. ſuited to ſhip-building, are of much higher value than when at a great diſtance in the country. The undergrowths of ſeveral ſorts of trees, as dog-wood, ſallow, willow, alder, &c. are of the moſt value when near large manufactories of gunpowder, being of little utility, except as fuel, when at a diſtance. Some ſorts of wood, however, from the generality of their application and employment, are of great value in all ſituations, as thoſe of the oak, the elm, the aſh, the beech, and perhaps the larch has ſtill more value than any of them. Others, on account of their ſcarcity, are alſo valuable in all places, as the box, the holly, the yew, &c. All the lighter products of ſome ſorts of trees, as thoſe of bird-lime, potaſh, turpentine, tar, pitch, &c. may likewiſe be conſidered of equal value in all ſituations. But a tree which would be of the greateſt value in a particular ſituation or place, may not find in it that ſort of ſoil that is ſuitable to its nature or habits of growth; in which circumſtances that which will come to the moſt perfection in it, will commonly be found of the moſt value. Such woods as may not be valuable in conſequence of local circumſtances, may be rendered a great deal more high in their value, by having them manufactured in the places where they are met with, thus leſſening the expences of conveyance, &c. In conſequence of the great improvements in roads, canals, &c. and the general promotion of them, woods and plantations for timber, muſt, in almoſt all places, be valuable, and there can be few in which the other ſorts of products will not be of great importance. In the meaſuring of ſtandard trees for the purpoſe of aſcertaining their value, though many think themſelves fully qualified by being ſimply able to meaſure them; it is only by the perfect knowledge of the uſe and application of the different ſhapes, bends, and woods of them, that a correct eſtimate can be given; as a ſmall portion of wood may be of little conſequence in one ſort of buſineſs, while it is of much in another, which is a ſecret of great intereſt and importance to the purchaſers of timber of the ſtanding kind.

In addition to theſe qualities, almoſt every tree and plant is poſſeſſed of various others, which excite emotions that have a relation to them, and which give their characters or expreſſions. For inſtance, the cypreſs is of a regular, invariable ſhape, or form, and always, in colour, of a dark green, having a ſtill, ſolemn appearance; hence it has acquired the character of melancholy. A ſimilar, but ſomewhat fainter, train of emotions, is produced in the mind by the falling branches, drooping ſpray, and yellow greeniſh colour of the weeping willow; hence it ſuits with ſcenes of ſolitude, and induces meditation. In the light, airy form of the aſh, and the bright white of the variegated holly, there are ſome traits of certain degrees of the cheerful kind; in the feſtoons of the virgin's bower, eaſe and gracefulneſs; in the myrtle, delicacy and neatneſs; and in the ſweep of the ſtem, the curve of the branches, &c. of the larch, a peculiar elegance. In the oak and the cheſnut are forms which have long given the notions of grandeur and ſublimity. Both theſe and other trees are particularly expreſſive of peculiar known characters, ariſing, in ſome degree, from their own nature, and in part from aſſociations in the mind. Thoſe of the cypreſs and yew kinds have been planted in burying grounds, and other ſimilar places; the weeping willow, as the ſhade of urns; the laurel uſed as the crown of warriors; and the cheſnut introduced in landſcapes.

Some accidental characters and expreſſions of plants are produced by novelty and ſingularity either in their natures, forms, or appearances; hence exotics are at firſt diſtinguiſhed from thoſe of the indigenous kind, and called beautiful, elegant, fanciful, ſtrange, rare, &c. according to circumſtances. The creeping aſh, the ſtone pine, &c. derive and retain their characters from their comparative ſcarcity and unuſual ſhape; while others have that of elegance and novelty in a much leſs degree, as the cedar of Libanus and the cypreſs; the hemlock ſpruce, and the ſcarlet oak, &c. Some trees and plants are common, and thought nothing of in one diſtrict or country, while, in others, they are uncommon, and thought highly of; thus, the weeping willow, the narrow-leaved elm, the acacia, &c., which abound, and are little valued, in the ſouthern parts of the iſland; are ſcarce, highly eſteemed, and termed elegant in thoſe of the north; while the arbutus, the uva urſi, the erica alba, and even the mountain-aſh, which are plentiful, unnoticed, and common in the north, are held in eſtimation, and thought highly elegant in the ſouth.

Theſe are ſome of the more particular qualities of trees and plants, which are concerned in the claſſification and arrangement of them, as the materials by which the objects of planting and ornamental gardening are to be accompliſhed, but there are others which are peculiar to them in other points of view, that it is quite unneceſſary to notice in this place, as they are fully explained in ſpeaking of them individually under their proper heads.

More ample information on the above ſubject may, however, be obtained by conſulting Mr. Loudon's work "On Forming, Improving, and Managing Country Reſidences," in which will be ſeen their particular utility, and their moſt appropriate modes of application in the buſineſs of planting and ornamenting different kinds of pleaſure grounds, under all the various circumſtances which may occur in ſo far as their nature, ſituation, ſoil, and other ſimilar particulars are concerned, as well as the pictureſque effect which will be produced.

Qualities *of Seeds, Sets, and Produce*, the properties which are eſſential to them for the production of full and beneficial crops of the ſeveral different kinds, and the moſt perfect and advantageous ſtates of growth and maturation of ſuch crops, for their being conſumed, either as food or otherwiſe. In all ſorts of ſeeds of the grain kind, thoſe which are the moſt fully bodied, bright, thinneſt in the ſkin, and the moſt ſound, without being too long kept, are the moſt ſuitable for making uſe of as ſeed. Such as are ſmall, lean, ill fed, and ſhrunk in their ſkins, or which have been in any way heated in the mow or ſtack, are moſtly quite improper for this purpoſe. Some have, however, ſuppoſed the contrary to be the caſe, but they have hitherto adduced no proofs whatever, of the fact, while the former opinion is ſupported fupported by the daily experience of the beft farmers in the country. There is another circumftance which is of fome importance in this bufinefs, which is that of the grain for this ufe being conftantly newly threfhed out from the ftraw, as fuch, for the moft part, fprouts and grows more expeditioufly, and is lefs liable to rot and perifh in unfavourable feafons and fituations.

All forts of difeafed grain, and fuch as is not perfectly free from the mixture of the feeds of weeds with it, fhould always be, as much as poffible, avoided in this intention.

In regard to the fmaller forts of feeds for raifing all kinds of plant-crops in the field, as well as thofe of the grafs fort, both natural and artificial, the principal neceffary qualities, in each, are thofe of their being of a bright, lively, fhining colour, perfectly found, and frefh, or lately collected from the plants. Such as are old, or kept more than a few months, are moftly improper for this application. The beft forts commonly flide freely over each other, without fticking or being heavy in the hand, and have a brilliant bloomy appearance.

In gardening, moft forts of feeds alfo are the beft, and require to have thefe properties and qualities as much as poffible; but there are a few which are apt to grow too luxuriantly for fruiting well, as fome of the cucumber, melon, kidney-bean, and other kinds, which are better for being kept for fome length of time, as this property is thereby in fome meafure corrected and reftrained. Moft forts of nuts and ftones, when ufed as feed, fhould, however, be employed in as frefh a ftate as poffible.

Sets are different in their nature, being of the root or plant kinds. In the former, the fets or cuttings fhould have the eyes or buds in a perfect ftate, and be of a middling fize, as both thofe which are very large and very fmall are objectionable. This is the cafe with the potatoe and fome other forts. In the latter, the plants fhould not have too large growths, but be in a fine young ftate of vegetation, fo that they can be fet out with facility, and readily take root again, having their heads or upper parts, for the production of the produce, wholly in an uninjured condition. They fhould alfo be quite newly drawn up, cut or flipped from the ftalks of the old plants, without any fort of clubbing near the roots in thofe which are drawn. Such as have rifen the moft quickly from the feed, are, in general, the beft. They fhould none of them ever be kept any great length of time after being drawn, before they are re-planted. This is equally applicable to the field and garden kinds. See SEED, SET, and SOWING.

The produce in all the white or grain crops, which are employed either for the purpofe of mealing or malting, fhould conftantly be well ripened; but where the ftraw is to be made ufe of as cattle food, the crops are better to be cut before they have reached the ftate of full maturity, as this purpofe is thereby more completely anfwered. There is much lofs in the produce of moft forts of field plant-crops, by taking them before they have formed their bulbs or heads in a perfect manner. But many of fuch like products, in the garden, are the beft and moft advantageoufly taken in fuch imperfect ftates, being tough and coarfe when full grown, and without the neceffary tendernefs. Others require to be cut or drawn early in order to have the proper degrees of fweetnefs and flavour. The fruit kind of produce is taken both before and when nearly ripe, according to the ufes for which it is intended. Some forts of vegetable produce are ufed quite in their green ftate, as food; while others are beft in a fomewhat more advanced ftate: and others, again, in both thefe ftates. And there are thofe which require to be well ripened, and kept for fome length of time before they are ufed in this way.

All forts of produce of the grafs-kind, are cut and ufed to the moft benefit, when they are taken a little before they become perfectly ripe, as they go the fartheft, whether they are to be confumed in the green ftate, or in that of hay. This is equally the cafe with the more luxuriant artificial forts, as with thofe of lefs growth, of the natural kind. This is explained more fully in fpeaking of the different plants and crops individually, and in the article HAY; which fee.

QUALO, in *Geography*, a town on the N.E. coaft of Sumatra. N. lat. 2° 45′. E. long. 99° 40′.

QUALUGA, a town of Africa, in the country of Whidah; 18 miles N.W. of Sabi.

QUAM, a town of Norway, in the diocefe of Drontheim; 68 miles N. of Drontheim.

QUAM *diu fe bene gefferit*, a claufe frequent in letters patent, or grants of offices, to fecure them fo long as the perfon they are granted to fhall not be guilty of abufing the fame.

Thus, *e. gr.* we find it in thofe given to the barons of the exchequer: where it intimates, that they fhall hold the fame as long as they fhall behave themfelves well; which is to be reftrained to matters of their offices; and fignifies no more than the law would have implied, had the office been granted exprefsly for life. See JUDGE.

A grant therefore, with this claufe, is equivalent to a grant for life.

QUAMASH, in *Botany*, a name given, by the North American Indians, to a plant called *Phalangium Quamafh*, by Mr. Purfh, in his *Flora*, v. 1. 226; who neverthelefs mentions an irregularity in the petals, that might poffibly eftablifh it as a new genus. See PHALANGIUM.

This plant was obferved by governor Lewis, about the upper part of the Miffouri, near the Rocky-mountains, flowering in June. The *bulb* is roundifh, tunicated. *Stem* none. *Leaves* radical, few, long, and linear, half an inch broad, fmooth; keeled underneath. *Flower-ftalk* folitary, naked, erect, round, fmooth, unbranched, a foot or more in height, terminating in a *fpike*, or rather *clufter*, of large, pale-blue *flowers*, each accompanied by a linear, membranous, withering *bractea*, longer than the partial ftalk. *Petals* linear-lanceolate, nearly equal in length; five of them afcending; the fixth deflexed.

The bulbs are carefully collected by the natives, and cooked between heated ftones, when they affume the appearance of baked pears, and have an agreeable fweet tafte. They form a great part of the winter ftores of thefe Indians. Though governor Lewis's party found them a pleafant fort of food, they could not be eaten, in any quantity, without caufing bowel complaints.

QUAMOCLIT, an Indian name, retained by Plumier and Tournefort as generic; but by Linnæus ufed only as the fpecific appellation of a beautiful fpecies of IPOMÆA; fee that article.

QUAMPEAGAN FALLS, in *Geography*, falls in America at the head of the tide on Newichwanock river, which joins Pifcataqua river, 10 miles from the fea; fo called by the natives, becaufe fifh were there taken with nets. At thefe falls are a fet of faw-mills and others, and alfo a landing-place, where great quantities of lumber are rafted. Here the river has the Englifh name of Salmon Falls river, from the number of falmon caught there. On many places from Quampeagan to the pond, from which it iffues, there are mills for boards and corn.

QUAM-TOM, a town of China, of the third rank, in in the province of Yun-nan; 15 miles N.E. of Tchou-hiong.

QUAN, a town of China, of the third rank, in Chan-tong; 22 miles W. of Tong-tchang.

Quan, or *Guan*, in *Ornithology*. See Penelope *Criſtata*.

QUANAMORA, in *Geography*, a town of Africa, in Upper Guinea, on the banks of the Scherbro', ſaid to contain 5000 families. N. lat. 7° 45′. W. long. 10° 15′.

QUANDROS, a name given by writers of the middle ages to a ſtone to which they attribute great virtues, and which, they ſay, is found in the head of a vulture.

QUANG-LING, in *Geography*, a town of China, of the third rank, in Chan-ſi; 15 miles W.S.W. of Ouei.

QUANG-NING, a town of China, of the third rank, in Quang-tong; 35 miles N. of Tchao-king.

QUANG-PING, a city of China, of the firſt rank, ſituated in the northern part of the province of Pe-tche-li, between the provinces of Chang-tong and Ho-nan, which has nine towns of the third claſs dependent upon it. All its plains are well watered by rivers. Among its temples, one is dedicated to thoſe men, who, as the Chineſe pretend, diſcovered the ſecret of rendering themſelves immortal; 212 miles S.S.W. of Peking. N. lat. 36° 47′. E. long. 114° 29′.

QUANG-PUNG, a town of China, of the third rank, in Pe-tche-li; 17 miles N.W. of Tay-ming.

QUANG-SI, a province of China, ſituated between thoſe of Quang-tong, Hou-quang, Koei-tcheou, Yun-nan, and the kingdom of Tong-king; about 360 miles from E. to W., and 230 from N. to S. In commerce, as well as extent, it is not equal to that of the other provinces; and yet it ſo abounds with rice, as to ſupply, for ſix months in the year, the province of Quang-tong, without which the inhabitants of this province could not ſubſiſt. The mountains with which it is covered, abound with mines of gold, ſilver, copper, and tin, and in this province is a ſingular kind of tree, containing a ſoft pulp, which yields a ſort of flour, and of this flour they make a very good bread. Beſides parroquets, hedge-hogs, and the rhinoceros, wild animals, curious birds, and uncommon inſects are found here in great number. This province contains twelve towns of the firſt claſs, and eighty of the ſecond and third. Its capital is Quei-ling. Groſſier's China, vol. i.

The population of this province is eſtimated by ſir George Staunton at 10,000,000; its extent is ſaid to comprehend 78,250 ſquare miles, or 50,080,000 acres. The revenue transferred from it to the treaſury at Peking, compriſing land, ſalt, and taxes, is ſtated at 500,000 tahels, or ounces of ſilver.

QUANG-TCHANG, a town of China, of the third rank, in the province of Chan-ſi; 28 miles S. of Ouei.

QUANG-TCHEOU, or Quang-chou-fou, a city of China, of the firſt rank, in the province of *Quang-tong*, uſually called by the Europeans *Canton*; which ſee.

QUANG-TONG, the moſt conſiderable of the ſouthern provinces of China; bounded on the N.E. by Fokien, on the N. by Kiang-ſi, on the W. by Quang-ſi, and the kingdom of Tong-king; the reſt is waſhed by the ſea. The country is diverſified with plains and mountains, and the land is ſo fertile that it produces two crops every year. Trade and the fecundity of the ſoil ſupply this province with every thing that can contribute to the pleaſures of life; it furniſhes gold, precious ſtones, ſilk, pearls, eagle-wood, tin, quickſilver, ſugar, copper, iron, ſteel, ſaltpetre, ebony, and abundance of aromatic woods, which are much valued. Beſides European and Indian fruits, it produces ſeveral that are peculiar to itſelf. All the coaſts abound with fiſh, and furniſh great quantities of oyſters, crabs, and tortoiſes of an immenſe ſize: of the ſhells of theſe the Chineſe make ſeveral pretty toys. Tame ducks are reared in this province in great numbers: the Chineſe are induſtrious in breeding them, and they hatch their eggs in ovens or dunghills, though they do not ſeem to have derived this mode of breeding them from Egypt, where it is practiſed. They carry them on barks in large flocks to feed on the ſea-ſhore, where, at low water, they find ſhrimps, oyſters, and other kinds of ſhell-fiſh. At the approach of night they are collected together by only beating on a baſin, upon which they immediately form themſelves into different flocks, and each returns to the veſſel to which it belongs. The Chineſe have a method of ſalting their meat without injuring its flavour, and they ſalt their eggs by encloſing them in a coat of clay mixed with ſalt. Theſe ſalted eggs are ſaid to be very wholeſome, and even ſick perſons are permitted to eat them. Although the climate of this province is warm, the air is pure, and the people are robuſt and healthy. They are noted for their induſtry, and for a talent of imitation, which they poſſeſs in an eminent degree. As this province is at a great diſtance from court, its government is one of the moſt important, and it is alſo one of the moſt flouriſhing in the empire. Its viceroy has alſo the command of Quang-ſi, and reſides at Cheo-king, for the convenience of expediting his orders to either of theſe provinces. This governor always has a number of troops ready, properly poſted, to check the incurſions of robbers and pirates, who might otherwiſe interrupt and injure trade: for the ſame purpoſe, a great number of fortreſſes (moſt of them being cities provided with numerous garriſons) have been built along the coaſts and in the interior parts of the country. This province is divided into 10 diſtricts, which contain 10 cities of the firſt claſs, and 84 of the ſecond and third. Groſſier.

The number of inhabitants, according to ſir George Staunton's eſtimate, is 21,000,000; its area comprehends 79,456 ſquare miles, or 50,851,840 acres. The revenue remitted to the imperial treaſury at Peking, and raiſed from land, ſalt, and taxes, amounts to 1,340,000 tahels, or ounces of ſilver. The military force is ſaid to amount to 50,000 men. Its capital is *Canton*; which ſee.

QUANG-YANG, a town of China, of the third rank, in the province of Quang-ſi; 30 miles S. of Tſuen.

QUANG-YUEN, a town of China, of the third rank, in the province of Se-tchuen, ſeated on the Kialing; 50 miles N. of Pao-king.

QUANNEFIORD, a bay on the W. coaſt of Weſt Greenland. N. lat. 62° 10′. W. long. 48° 5′.

QUANO, a town of Japan, on the iſland of Niphon, on the S. coaſt, 70 miles E. of Meaco. N. lat. 35° 58′. E. long. 136° 14′.

QUANTALLA, an iſland of Africa, at the mouth of the Zaire, celebrated for a ſilver idol, to which the neighbouring kings ſend preſents and offer ſacrifices.

QUAN-TAO, a town of China, of the third rank, in Chan-tong; 25 miles W.N.W. of Tong-tchang.

QUAN-TCHANG, a town of China, in Chan-tong; 13 miles N. of Po.

QUANTITE′, Fr. This word in muſic, like proſody, does not fix the number of notes or of ſyllables, but their relative duration. Quantity produces the rhythm, as accent produces intonation. Rhythm and intonation generate melody. Rouſſeau. See Melody.

QUANTITY, Quantitas, any thing capable of eſtimation or menſuration; or, which being compared with another

other thing of the fame kind, may be faid to be greater or lefs than it; equal, or unequal, to it.

Mathematics is the fcience or doctrine of quantity.

Quantity is a general attribute, applied in a very different manner to things of very different nature; whence it is impoffible to give any univerfal definition of it.

Quantity is applied both to things and to modes; and this either fingularly to one; or plurally, to feveral. In the firft cafe it is called *magnitude*, in the latter *multitude*.

Quantity may be reduced to four claffes; *viz.*

Quantity, *Moral*, which depends on the manners of men, and the free determination of their wills. As the prices and value of things; degrees of dignity and power, good and evil, merit and demerit, rewards and punifhments, &c.

Quantity, *Notional*, arifing from the operation of the underftanding only. Such as the largenefs or narrownefs of the capacity of the mind, and its conceptions. In *Logic*, univerfals, predicaments, &c. In *Grammar*, the quantity or meafure of fyllables, accents, tones, &c.

Quantity, *Phyfical*, or *Natural*, which is of two kinds: 1. That which nature furnifhes us with in matter, and its extenfion. And, 2. In the powers and properties of natural bodies: as gravity, motion, light, heat, cold, rarity, denfity, &c.

Quantity, *Tranfcendental*, as duration, the continuation of any being, exiftence, time, &c.

Quantity is alfo popularly diftinguifhed into *continued* and *difcrete*.

Quantity, *Continued*, or *Continuous*, is when the parts are connected together, and is commonly called *magnitude*. This, again, is of two kinds; either *fucceffive*, or *improper*, as time.

Quantity, *Difcrete*, is when the parts of which it confifts exift diftinctly, and unconnected together; which makes what we call *number* or *multitude*.

The notion of continued quantity, and its difference from difcrete, appears to fome without foundation. Mr. Machin confiders all mathematical quantity, or that for which any fymbol is put, as nothing elfe but number, with regard to fome meafure, which is confidered as one; for that we cannot know precifely how much any thing is, but by means of number. The notion of continued quantity, without regard to any meafure, is indiftinct and confufed; and though fome fpecies of fuch quantity, confidered phyfically, may be defcribed by motion, as lines by the motion of points, and furfaces by the motion of lines; yet the magnitudes, or mathematical quantities, are not made by the motion, but by numbering according to a meafure. Vide Phil. Tranf. N° 447. p. 228.

Permanent quantity is farther diftinguifhable into length, breadth, and depth.

Wolfius feems to give us a more precife notion of mathematical quantity, and its two fpecies of difcrete and continued. hatever is referred to unity in the fame manner as one right line to another, is what we call quantity; or number in general.

If, now, the thing be referred to a given unit, as 3, it is called a determinate number: if to unity in the general, or at large, it is called a quantity; which, on this principle, is the fame with indeterminate number.

Thus, *e. gr.* the breadth of a river is accounted a quantity: if, then, it be enquired how great it is; to conceive its quantity, we take fome unit at pleafure, and fee the relation of the breadth to it; and according to the different unit affumed, we exprefs the breadth of the river in a different determinate number.

The breadth of the river, therefore, is quantity confidered as referred to a vague unit, or to unity at large; but the unit being determined, the thing is underftood by a determinate number.

In this fenfe, algebra is the arithmetic of quantities. See on the fubject of quantity, Harris's Philofophical Arrangements, chap. ix.

Quantity *of Action*. See Action.

Quantity, *Impoffible*, and *Imaginary*. See Root.

Quantity *of Curvature* at any point of a curve is determined by the circle of curvature at that point, and is reciprocally proportional to its radius. Newton's Meth. of Flux. and Inf. Series, p. 60. Maclaurin's Fluxions, b. i. c. xi. See Curvature and Evolute.

Quantity *of Motion*, in *Mechanics*, is of two kinds; *viz.* of momentary motion, and of entire motion.

Quantity *of entire motion*. The Cartefians define the entire motion as the momentary one, by the factum of the mafs, or quantity of matter, into the velocity; but fince motion is a fucceffive being, and has no parts co-exifting together, its quantity ought to be eftimated by the aggregate of the feveral parts exifting fucceffively; and is therefore equal to the factum of the momenta into the time.

Quantity *of momentary motion* is the factum of the velocity into the mafs; or it is a meafure arifing from the joint confideration of the quantity of matter, and the velocity of the motion of the body; the motion of any whole being the fum or aggregate of the motion in all its feveral parts.

Hence, in a body twice as great as another, moved with an equal velocity, the quantity of motion is double; if the velocity be double alfo, the quantity of the motion will be quadruple. Hence, the quantity of momentary motion coincides with what we call the momentum, or impetus of a moving body. See Force.

In the collifion of bodies, the quantity of momentary motion, which is found by taking the fum of motions tending the fame way, or their difference, if they tend towards contrary parts, is not at all changed by any actions of the bodies on one another. See Percussion.

Quantity *of Matter* in any body, is the product of the denfity into the bulk; or a quantity arifing from the joint confideration of its magnitude and denfity.

As, if a body be twice as denfe, and take up twice as much fpace as another, it will be four times as great.

This quantity of matter is the beft difcoverable by the abfolute weight of bodies. See Matter.

Quantity, *Infinite*. See Infinite *Quantity*.

Quantities, in *Algebra*, are indeterminate numbers, or things referred to unity in general. See Number.

Quantities are properly the fubject of algebra; which is wholly converfant in the computation of fuch quantities.

Given quantities are ufed to be noted by the firft letters of the alphabet a, b, c, d, &c. the quantities fought by the laft, z, y, x, &c. See Characters.

Algebraical quantities are chiefly of two kinds; *pofitive*, and *negative*.

Quantities, *Pofitive*, or *Affirmative*, are thofe which are greater than nothing, and which are affected with the fign + prefixed; or fuppofed to be fo.

Quantities, *Negative*, or *Privative*, are thofe lefs than nothing: which are affected with the fign − prefixed.

Hence, 1. Since + is the fign of addition, and − the fign of fubtraction; a pofitive quantity is produced by adding any real quantity to nothing: *e. gr.* $0 + 3 = + 3$; and $0 + a = + a$. And a privative quantity is produced by by fubtracting any real quantity out of nothing; *e. gr.* $0 - 3 = - 3$; and $0 - a = - a$.

For an illuftration. Suppofe when you are quite deftitute of money, fomebody gives you a hundred pieces; you have then a hundred pieces more than nothing; which pieces conftitute a pofitive quantity.

On the contrary, fuppofe you have no money, yet owe a hundred pieces; you have then a hundred pieces lefs than nothing; for you muft pay a hundred pieces to have juft nothing. This debt is a negative quantity.

Thus in local motion, progrefs may be called a pofitive quantity, and regrefs a negative one; becaufe the firft increafes, and the fecond diminifhes the fpace paffed over.

And in geometry, if a line drawn towards any part be accounted an affirmative quantity, another the contrary way will be a negative one.

Privative or negative quantities, therefore, are equally real with pofitive quantities, but oppofite to each other, fo as to take away each other's effect, in any operation, when they are equal as to quantity. Thus $3 - 3 = 0$, and $a - a = 0$. However, though $+ a$, and $- a$, are equal as to quantity, we do not fuppofe in algebra, that $+ a = - a$; becaufe to infer equality in this fcience, they muft not only be equal as to quantity, but of the fame quality, that in every operation the one may have the fame effect as the other. A negative quantity is faid to be lefs than nothing, becaufe it is oppofite to the pofitive, and diminifhes it when joined to it; whereas the addition of 0 has no effect. But a negative is to be confidered no lefs as a real quantity than a pofitive. Quantities that have no fign prefixed to them are underftood to be pofitive. See NEGATIVE *Sign*.

QUANTITIES, *commenfurable*, *compound*, *exponential*, *heterogeneous*, *like*, *rational*, *fimple*, *tranfcendental*, and *variable*. See the adjectives.

QUANTITIES, *Addition of*. 1. If the quantities denoted by the fame letter be affected with the fame fign, the numbers prefixed to them are added as in common arithmetic.

2. If they be affected with different figns, the addition is changed into fubtraction; and to the remainder is prefixed the fign of the greater.

3. Quantities denoted by different letters, are added by means of the fign $+$; as in the following example:

$$\begin{array}{lcr} 4a + 2b - 2c - 5d - g & \quad & a - b \\ 5a - 2b + 6c + 2d - 3g & & c \\ \hline 9a + 4c - 3d - 4g & & a - b + c \end{array}$$

See ADDITION.

QUANTITIES, *Subtraction of*. See SUBTRACTION.

QUANTITIES, *Multiplication and Divifion of*. See MULTIPLICATION, and DIVISION.

QUANTITIES, *Combination of*. See COMBINATION.

1. If a pofitive quantity be multiplied or divided by another pofitive quantity, the refult is alfo a pofitive quantity.

2. If a negative quantity be multiplied or divided by a pofitive, the refult is a negative.

3. If a negative quantity be multiplied or divided by another negative, the refult is a pofitive.

4. If a pofitive quantity be multiplied or divided by a negative, the refult is a negative quantity. See MULTIPLICATION, in *Algebra*.

QUANTITY *of a Degree*. See DEGREE.

QUANTITY *of an Eclipfe*. See ECLIPSE.

QUANTITIES *of Seed, Sets, and Plants*, in *Agriculture*, the proportions of each, which are neceffary for raifing good crops of the different kinds. The afcertaining of the moft ufeful and beneficial quantities, in the feveral cafes, depends, in a material degree, upon a number of different circumftances, fuch as thofe of the fituation, the nature and quality of the foil, the period of fowing, the ftate of the feafon, the manner of putting them into the earth, and feveral others.

A great deal more feed, fets, and plants, are requifite in late fituations or backward feafons, heavy, wet, ftiff lands, and late fowings; than where they are more forward, more light and dry, and put in early. And far lefs quantities made ufe of in the drill and dibble methods of putting in the crops, than in that of the broadcaft, or by the hand.

In moft forts of white, or grain crops, the quantities are from two to five bufhels *per* acre, being more in barley and oats, than in thofe of the other kinds, as from three to five in general.

In thofe of the pulfe kinds, ufually from fix or feven pecks, to two, three and a half, and four bufhels, being commonly the latter, or more, in fome forts of beans.

In thofe of the fmall feed defcription, as the buck-wheat and turnip forts, from one to two and three pounds; but in the cabbage kind, only from fix ounces to half a pound, and a quarter or half a peck.

In the tap-rooted crops, as the carrot, parfnip, mangle-wurzel, &c. from two to five pounds, and fometimes fix. In lettuce crops, in the field, from three to four pounds the acre.

In different forts of plantation crops, as thofe of hemp, flax, woad, weld, teafel, &c. from two to three up to five or fix bufhels, in the three firft; but only from two to four quarts, and from one to two pecks, in the two laft.

The fets in the hop, madder, liquorice, and lavender kinds, are from fix to feven hundred, and a thoufand or more, in the firft, and two laft; but in the madder from fifteen to twenty thoufand *per* acre. In the cabbage fort, from eight hundred to a thoufand and more plants or fets to the acre. And in the potatoe the quantity of fets vary from eight to twenty or more bufhels to the acre, according to the foil and manner of their being put into the ground.

The quantities of natural grafs feeds which are generally employed upon the acre, are from two to four bufhels and upwards. And thofe of the artificial grafs kinds, in the clovers from ten to eighteen pounds; in faintfoin from three to four bufhels; in lucern from fixteen to eighteen pounds; tares from two to three bufhels; trefoil, three pottles of cleaned feed, or two bufhels of the uncleaned fort. And in chicory from eight to twelve pounds. See SEED, SET, PLANT, and SOWING.

The fubject is more fully explained in fpeaking of the culture of the different forts of crops, and the moft fuitable quantities under different circumftances put down.

QUANTITY, in *Grammar*, denotes the meafure and magnitude of the fyllables; or that which determines them to be called long, or fhort; or, it is the meafure of time requifite for the diftinct pronunciation of a fyllable.

This quantity is the object of profody; and it is the regard to this that diftinguifhes verfe from profe.

The economy and arrangement of the quantities, *i. e.* the diftribution of long and fhort fyllables, make what we call the *number*.

The quantities are ufed to be diftinguifhed among grammarians by the characters fhort and long.

The proportion between the long and fhort fyllables may be generally fixed the fame as that between the crotchet and quaver in mufic; *viz.* as two to one. See TIME.

Syllables are long or fhort, either by their nature, or by accident; that is, on account of the place where they are put

put and the letters that follow them, which is called position.

In most languages, there are some syllables whose quantities vary, as the measure requires, which are called common; as in the English rĕcōrd and rĕcŏrd.

Some authors confound the quantity with the accent; but the difference is very evident; the former being the length or shortness of a syllable, the latter the raising or falling of the voice.

From two quantities, *viz.* long and short syllables, arise all the varieties of poetic feet, which are very great. Horace alone uses no less than twenty-eight. Yet the Greeks went vastly beyond the Romans in this respect. In effect, as many ways as two quantities may be varied by composition and transposition, from two to six syllables, so many different feet have the Greek poets contrived, and that under distinct names, to the number of 124. Though it is the opinion of some of the learned, that poetical numbers may be sufficiently explained from the feet of two or three syllables, into which the rest may be resolved.

The feet, formed by the ancients of the long and short syllables immediately, are the *spondee*, consisting of two long syllables; the *pyrrhic*, of two short ones; the *trochee*, of a long and short syllable; and the *iambic*, of a short and long syllable.

Those of three syllables are the *molossus*, consisting of three long syllables; the *tribrach*, of three short ones; the *dactyl*, of one long and two short syllables; and the *anapest*, of two short and one long syllable.

The English tongue admits of no feet above two syllables, though both the Latin and Greek allow of six.

Our heroic verses consist of five long and five short syllables intermixed alternately; though not so strictly but that the order may be dispensed with. Dryden varies them with admirable beauty; frequently his heroic verse begins with a long syllable followed by two short ones.

The truth is, the quantity of the syllables is but little fixed in the modern tongues; and there is still less regard had to it in the composition of modern verses. The want of feet, or rather the shortness and uniformity of our feet, makes great difference between the numbers of the ancient and modern verse. Our poets are fettered; and their fetters are so short, consisting of but two poor links, that it is no wonder they can make no extraordinary motions.

The ancients subsisted by their quantities alone; so well were they distinguished, and such a variety and harmony did they afford! Our quantities make such poor music, that we are forced to call in the Gothic aid of rhyme to distinguish our verse from prose.

Yet have attempts been made to settle our verse on the ancient and natural footing of quantities, in exclusion of rhyme, and with such success too (witness the immortal Paradise Lost) as seems to leave the practice of rhyming inexcusable. The French have likewise attempted the same in their tongue, particularly Jodelet, and after him Pasquier, Passerat, and Rapin; but they have all failed.

On Quantity in the Greek Language.

Rules for the determination of quantity in the Greek language, chiefly relate to the doubtful vowels α, ι, υ, since ε, ο, are, by *nature*, or not affected by *position*, short; and η, ω, are, by *nature*, or not affected by *position*, long.

Position.

1. A syllable in which a short or doubtful vowel precedes two consonants or a double letter, is long in every situation; as δεινὴ δὲ κλᾱγγὴ, αὐτᾱρ ἐμῑ Ζεὺς, κατᾱ φρένα, πᾱτρὸς, τέκνον. Hom.

1. Except that a *short* vowel before two consonants, whereof the *former* is a *mute* and the *latter* a *liquid*, is common; as

'Αλλ' ἐπιλἔκτρον ἰὼν, ἄκρον δἄκτυλον καταδάκνω. Hom. βατραχ. v. 45.

Μέτρα δὲ τεῦχε θεοῖσι, το γαρ μἔτρον εστιν αριστον. Phocyl. v. 92.

Note.—1. In pastoral, elegiac, and epigrammatic verse, the syllable is more frequently short.

2. In dramatic poetry we may observe, 1st, that a short vowel before a *short* or *aspirate* mute followed by a liquid, and before a *middle* mute followed by ρ, remains short. In tragedy the syllable, if not final, is often long. 2dly A short vowel before a *middle* mute followed by λ, μ, or ν, lengthens the syllable in all dramatic poetry.

3. When the syllable is lengthened before two consonants, the vowel in pronunciation assumes one of them; as δἔκ-λαγγὴ, ἱμἔσ-Διὸς, κατᾶφ-ρένα, πᾶτ-ρὸς, τἔκ-νον. Hom When the syllable remains short the vowel concludes it; as πᾰ-τρὸς, τἕ-κνον.

2. A short vowel is sometimes made long before a single consonant, particularly before a liquid, as πολλᾱ λισσομένη, Hom.; παρᾱ ῥηγμῖνι, Hom.

Note—It is generally long before ρ, which with its aspirate appears to have been doubled in pronunciation; as παρᾶῤῥηγμῖνι. This licence is not confined to a liquid; as ἔπειδὴ, ὄφιν &c. Hom.

3. A short syllable is often made long when the next word begins with a digammated vowel, as ὃς οἱ, for Ϝοι. Hom. Μέλανος οἴνοιο for Ϝοινοιο. Hom. 'Ουδὲ ους for Ϝους. Hom.

4. When three short syllables come together, it is necessary, on account of the measure in heroic verse, that one should be made long; as ᾱθάνατοι, Πρῑαμίδης.

Note.—This takes place even where the three syllables are in different words; as δῑα μὲν, Hom.; δρῠὸς ἔλυμα, Hes.

5. A vowel before another does not suffer elision, as in Latin, at the end of a word, unless an apostrophe is substituted.

Note.—The elision of diphthongs takes place in verbs only: real instances of this are to be found only in the fragments of the new comedy.

6. A long vowel, or a diphthong, is generally shortened at the end, and sometimes at the beginning, of a word, before a vowel; as οἴκω ἐν, Hom.; ποῖεῖ, Soph.; ἡ ζῶοι εἰμὲς, Theocr.

Note.—A long vowel, or a diphthong, may be considered as consisting of two short vowels. If the latter is supposed to suffer elision, the former will of course remain short; as οἴκὸ ἐν.

Crasis, or Contraction.

7. A contracted syllable is always long; as ὄφιες, ὄφῖς; ἱερὸς, ῑρός.

8. Two successive vowels, forming two syllables, even in different words, frequently coalesce in poetry; thus θεὸς becomes a monosyllable, χρυσέῳ a dissyllable, and in ἡ λάθετ', ἡ οὐκ ἐνόησεν, Hom.; ἡ ουκ are pronounced as one syllable.

Composition and Derivation.

9. Compound and derivative words follow the quantity of their primitives; as ἄτῑμος from τῑμὴ, φῠγη from ἔφῠγον; νῑκαω from νίκη.

Note.—Grammarians have sometimes complained that "non semper huic regulæ fidendum." But Dr. S. Clarke affirms;—"Derivata pro eo, a quâ parte fluant penultimam similiter vel perpetùo corripiunt, vel perpetùo producunt. Latini habent lĕgo, lēgi, quasi contractum ex lelĕgi. Similiter sĕdeo, sēdi, indeque sēdes, sēdile. Consimili quâdam ratione, apud Græcos fit. Verba nimirum innumera sunt, quæ in præsentibus et imperfectis omnibus et in aoristis primis, activis et mediis, semper producantur: in futuris autem et aoristis secundis omnibus, semper corripiantur; ut φαίνω, ἔφαινον, εφηνα; φᾰνῶ, ἐφᾰνον, ἐφᾰνόμην, indeque φᾰσις, φᾰνερὸς, &c. Κρῖνω, ἐκρῖνον, ἔκρῖνα; κρῖνω, indeque κρῖσις, κρῖτὸς, κρῖτης, &c.

According

According to the same analogy, μαρτῦρομαι, ἐμαρτῦρόμην, and ἐμαρτῦράμην, always lengthen the antepenultimate; as in Eurip. Med. 22. 619. 1410; Aristoph. Acharn 926. Nub 495, &c. though μαρτῦρουμαι, and its derivative μαρτῦρεω, shorten that syllable; as in Aristoph. Eccl. 557, Sophocl. Antigon. 525. In the same manner, κῦρω fut κῦρω, gives rise to κῦριος and κῦρεω, &c.

10. A, privative, is short, as ἄτιμος; but long in ἀθανατος.

11. Ἀρι, ἐρι, βρι, δυς, ζα, in composition, are short; as ζάθεος.

Of the Increments of Nouns and Adjectives.

12. The penultimate increase, A, of nouns and adjectives is short; as σώματος.

1. Except nouns in αν-ᾶνος; as τιταν, τιτᾶνος.

2. And the Doric genitive; as Ατρειδᾶο, μουσᾶν for μουσαων.

3. Also, κίςαν, κίςᾶνος; κρας, κρᾶτος; ψαρ, ψᾶρος; θώραξ, θώρᾶκος; ἱέραξ, ἱέρᾶκος; κορδαξ, κορδᾶκος; νέαξ, νέᾶκος; ῥάξ, ῥᾶγος; σύρφαξ, συρφᾶκος; Φαίαξ, Φαίᾶκος; φέναξ, φέναᾶκος, are long.

13. The penultimate increase, I, of nouns and adjectives, is short; as ἔρις, ἔριδος.

1. Except in words of two terminations; as δελφιν, δελφις, δελφῖνος.

2. And monosyllables; as θις, θῖνος; but Δις, Διὸς; θρὶξ, τρῖχος; στιξ, στῖχος; τις, τινὸς, are short.

3. Also nouns making ιδος or ιθος; as κνημις, κνημῖδος; ὄρνις, ὄρνιθος.

4. Nouns in ιξ, ιγος, or ικος; as μάστιξ, μαστῖγος; φοίνιξ, φοίνῖκος.

5. Monosyllables in ιψ, ιπος; as θριψ, θρῖπος.

14. The penultimate increase, Υ, of nouns and adjectives, is short; as πῦξ, πῦρός.

1. Except in words of two terminations; as φόρκυν and φόρκυς, with κήρυξ, κήρῦκος.

2. Γρυψ, γρυπὸς; γυψ, γυπὸς; βεβρυξ, βηβρυκος; are common.

Increment of Verbs.

15. The quantity of all tenses generally remains the same, as in the tense from which they are formed; as from κρῖνω are formed ἔκρῖνον, κρῖνομαι, ἐκρῖνόμην; from κρῖνῶ are formed κέκρῖκα, κέκρῖμαι, ἐκρῖθην.

16. The *perfect* follows the quantity of the first future; as φύω, φῦσω, πέφῦκα.

17. Verbs in πτω, except ῥίπτω, ῥίπτω, and those in υπτω, shorten the penultima of the perfect.

18. In the Attic reduplication the penultima is short; as ἐρίζω, ἤρικα, ἐρήρῖκα.

19. The *perfect middle* follows the quantity of the second aorist: as ἔτυπον, τέτῦπα; except βέβρῖθα, ἔρρῖγα, κέκρᾶγα, κέκρῖγα, μέμῦκα, πέπρᾶγα, πεφρῖκα, τέτρῖγα.

20. The doubtful vowels before σι are long; as τετύφᾶσι, δεικνῦσι.

21. In the *first aorist* participle, ασα is long.

22. In the *imperative* of verbs in μι, υ is short in polysyllables; as κέκλῦθι, but long in dissyllables, as κλῦθι.

23. In the *first future*, α, ι, and υ followed by σω, are short; as θαυμάζω, θαυμᾰσω; νομίζω, νομῐσω; κλύζω, κλῠσω.

24. But ασω is long before from verbs in αω preceeded by a vowel, or in ραω, as θεάω, θεᾶσω; δράω, δρᾶσω. Ισω and υσω are long from verbs in ω pure; as τιω, τῖσω; ἰσχύω, ἰσχῦσω.

The Quantity of doubtful Vowels in the First or Middle Syllables.

25. Α, ι, υ, before vowels, are generally short; as Ἡνίοχοι βεβάωτες, ἔφεσαν ὠκέας ἵππους. Hesiod.

1. Except Α, the penultimate of nouns in άων increasing by ο, and feminine proper names in αΐς, are long; as Μαχάων, Θαΐς. Also in ἀιξ, ἀηρ, κρᾶας, λᾶος, χᾶος, πᾶος: likewise the antepenultimate of ἄατος, ἀκρᾶαντος, ἀΐσσω, Ἀχᾶικος, Ἀΐονες, Ἀαρετις, βιάομαι, βαγίαος, &c.

2. Ι, the penultimate of nouns in ιων, ιος, is long, (except comparatives); as βραχίων, Ὠρίων. Also in κρῖος, κιάζω, ἰάομαι, ἰύζω, ἰωχμος, παλίωξις, πίειρ. But the penultimate of nouns in ια are accounted common; as σοφια, καλια. Likewise ι is said to be common in these: ἰαίνω, ἵεμαι, ἱερὸς, θριαι, θεῖον, λιαν, μνιον, ὀια, πιαινω, πιον.

3. Υ is long in ἐνῦα, θύας, ἰγνῦη, μύελος, μίωψ, πληκτύαζω, ὕετος, κυανεος.

26. Α, ι, υ, before final μα in neuter nouns, are long; as θεᾶμα, μνῆμα, χῦμα.

Except κλιμα, κριμα, ἔρυμα, πλυμα, which sometimes shorten the penultimate.

27. Α before β, γ, δ, θ, κ, λ, μ, ν, π, ρ, σ, τ, φ, χ, is mostly short; as ἀλλὰ κάκως ἀφίει, κρατερὸν δ' ἐπὶ μυθον ἔτελλε. Hom. Il. α. 25.

1. Except polysyllables in ατος, if ρ or a vowel goes before; as ἀνιᾶτος, Ἀρᾶτος, ἀπλᾶτος: except ἐρατος. Likewise nouns in ατης, whether gentiles proper, or the names of stones, are usually long; as Ἀσιᾶτης, ἀχᾶτης, Εὐφρᾶτης, Γαγᾶτης, &c. Also numerals in ακοσιος.

2. Α is also long in ἄβαλε, ἄγη, ἀδολεσχος, ἄκων, ἀκέσιος, Ἀκις, ἀλοσύνη, ἀμαρακος, Ἄπις, Ἄπυα, ἀτερος, ἀτη, κᾶδηξ, δᾶγυς, δᾶλος, Δᾶμοιτας, Δᾶμων, δᾶνος, διᾶκονος, διᾶμαλεισι, δρᾶπετης, θᾶτερος, Ἰᾶπυξ, Ἰᾶσων, Ἰθᾶγενης, κᾶναβινος, κᾶρις, κᾶρος, κλᾶδος, κοᾶλεμος, κοβᾶλος, κρᾶνιον, κρᾶνον, κρᾶτηρ, κυᾶκος, λᾶδων, λᾶρος, νᾶνος, ῥᾶπυ, ῥᾶπυια, Ὀμφᾶλη, πᾶνιζω, πετρᾶκης, ῥᾶδιξ, σᾶπερδης, σπᾶλιξ, Στυμφᾶλος, σφρᾶγις, τᾶλις, τιᾶρα, τρᾶνης, φᾶλαινα, φᾶνος, φλυᾶρος, ψᾶρος, ὑρᾶκιαω, ἀᾶτης, Ἀιᾶπος, Σαρδανᾶπαλος.

3. Α is common in ἀμαω, Ἄρης, χαραδρος, ἑανὸς, καλος, κραχυς. More frequently short in ἀλαὸς, ἀλίσκω, ἄριστον, prandium, ἀτάλλω, βαλσᾶμον, δᾶπεδον, Ζάκυνθος, ναυᾶγεω, ναυᾶγιον, τᾶφος, τᾶπης, ἀπάλαμνος: and more frequently long in ἀρᾶ, θᾶκος, φᾶρος.

4. In the nominative, α in Ἀπολλων is short; in other cases, common. Ἀνηρ in the nominative is common, in other cases long.

28. Ι before β, γ, δ, θ, κ, λ, μ, ν, π, σ, τ, φ, χ, is short. But ι before or after ρ is mostly long; as Βρῖθυ, μέγα, στιβαρὸν, τῷ δάμνησι στίχας ἀνδρῶν. Hom. Il. ε. 746.

1. Except nouns in ινη, ικη, ιτη, ιτης, ιτος, which generally have their penultimate long; as δῖνη, νῖκη, Ἀφροδῖτη, Θερσῖτης, ἀδηρῖτος.

2. Also ι is long in these: Ἀγχίσης, Αἰγῖνα, ἀγῖνεω, ἀκῖνάκης, ἀκόνιτον, ἀμνῖτος, ἀμφίσος, Δῖδω, δῖφαω, ἐνιπη, Ἐνιπευς, ἶσις, Ἴδη, Ἴδος, ἰθὺς, Ἴκαρος, ἴλη, ἴλιγξ, Ἴλιον, ἶλυς, Ἴλισσος, ἵμερος, ἰνίον, Ἰνω, Ἴναχος, Ἴφιτος, ἴφθιμος, ἰχὼρ, Καμῖνος, κῖκαμον, κῖκυς, κῖχρον, κλιβανος, κλῖμαξ, κλῖτες, κνίδη, κνῖπος, κονίσαλος, κονίλη, κοχλαμῖνος, κυμῖνον, λῖμος, μαρῖλα, Μισρίγανον, παρθενοπῖπης, πεδιλον, πῖδαξ, πῖδυω, πῖλεω, Πῖσα, σατῖνον, σελῖνον, σῖγη, Σῖδων, Σῖληνος, σῖσυμβριον, σίσυφος, σῖμος, σῖφων, σκῖπων, σμῖλη, σμῖλαξ, στιβη, στῖφος, τῖλυρος, τῖφυρις, τιθωνος, τῖμαω, τῖταν, τῖφυς, φῖμος, φῖνευς, φῖτυω, χαλῖνος, χελῖδων, χῖλιοι, χῖλος, χλῖδη, ψῖλος.

3. But ι in these is common: Αἰσχίνης, ἰθύνω, ἴκελος, ἰκέτης, ἱκάνω, ἱμὰς, κινεω, κοφινος, κοτινος, λιθος, μυρικη, πιναξ,

κῆρυξ, σίδη, φίλος; and sometimes in λίσας, θαμινος, λιπαρη, ὀπωρινός, ὀρθρινός.

4. Though ι before and after ρ is generally long, yet in the compounds and derivatives of τρις it is short, τρίνακρις excepted. It is also short in ξίφος, θρίδαξ, κρίνον, κρίσις, κρίτης, κριτος, τρίβος, θρίξ, τρίχος, with their compounds. And in materials in ινος; as κέδρινος, μύρρινος, &c.

29. Υ before β, δ, θ, κ, λ, ν, π, ρ, τ, φ, is short; but before γ, μ, σ, χ, mostly long: as Ὑμεῖς μάρτυροι ἐστε, φυλάσσετε δ' ὅρκια πιστά. Hom. Il. γ. 280.

1. Except verbals in υτηρ, υτης, υτος, υτωρ, are long; as λυτηρ, μηνυτης, κωκυτος, ῥυτωρ: except a few in υτος sometimes short. Dissyllables in υλη, υνη, υνος, are long; except μύλη, γύνη, πλῦνος. Adverbs in υδον are long; as βοτρυδον, πρυδον, except ῥυδον.

2. These also have υ long: Ἄβυδος, ἄγκυρα, ἁλιμυρης, ἀτρακτυλις, αὐτη, γεφυρα, Γερυνειος, γυρος, ζυθος, θυλακος, ισχυρος, κηρυκη, κελυφος, κινδυνος, κογχυλιον, κορκυρα, κοτυλη, κολυρα, κυριος, λαφυρον, λεπυρον, Λυδος, λυπη, μυλακομαι, μυραινα, μυρος, μυριοι, μυλιαω, ὄλυρα, διζυρος, ὀνογυρις, ορκυνος, πιτυρον, πλημμυρις, πυραμις, πυρος, ρυτη, σκυτος, συριγξ, σφυρα, τυδευς, τυρος, τρυπαω, υδος. χυλος, χελυνη.

3. But υ in these is common: βοθυνος, βυθος, κεκρυφαλος, παπυρος, ρυτις, σιβυνη, συλος, σφονδυλειος, τορυνη, τρυφαω, τυροεις, ὑγρος; and sometimes in γυλιος, κορυνη, λαγυνος, ξυλον, φυταω, φυταλια, φυταλμιος.

4. Though υ, before γ, μ, σ, χ, is generally long; yet it is short in the terminations υμος and υμων; as in ἡδυμος, διασυμων; and also in δυσις, ζυγος, Ἠλυσιος, θυμαλις, θυμον, κυμινον, λυγος, λυσις, μαρμαρυγη, μυχος, πυματος, τηυσιος, τρυγη, χυσις: and υ is often short in θυσανος, ὑμην, φυσις, and θυγατηρ.

Final Syllables.

30. Α, ι, υ, final are short: as μουσᾰ, τετυφᾰ, ινᾰ, ἱπποτᾰ; μελῐ, τιθημῐ, τυπτουσῐ, ιφῐ; σῠ, δακρῠ, γλυκῠ.

1. Except nouns in δα, θα, ρα, εα, ια, and polysyllables in αια; as κεραιᾱ; with ευλακᾱ. Διᾰ, ἴᾰ, μιᾰ, ποτνια, however, are short. So are ἄγκυρᾰ, ἄκανθᾰ, γέφυρᾰ, Κερκυρᾰ, ὄλυρᾰ, σκολοπενδρᾰ, σφυρᾰ, τανάγρᾰ; compounds of μετρᾰ, as γεωμετρᾰ; ρα preceded by a diphthong, as πειρᾰ; except αὐρᾱ, λαυρᾱ, πλευρᾱ, σαυρᾱ.

2. Duals of the first declension; as μουσᾱ.

3. Adjectives in α pure, and ρα from masculines in ος; as δικαια, ἡμετερα.

4. Nouns in εια from ευω; as δουλεια from δουλευω.

5. Oxytons of the first declension; as χαρα.

6. Accusatives in α from nouns in ευς, in the Attic dialect.

7. Vocatives from proper names in ας, as Αἰνεια, Παλλα.

8. The Doric α, as ἁ παγα for ἡ πηγη, βορεα for βορεου.

9. Adverbs in τι as usually long; in ιστι, short; as ἀνιδρωτῑ, Ἑλληνιστῐ.

10. Τυ Doric for συ is long; and adverbs in υ, as μεταξῡ: but αντικρυ is common.

11. The names of letters; as ξῖ, μῦ; to which add κρῖ, γρῦ.

12. The paragoge in pronouns and adverbs; as ουτοσι, νυνι; except the dative plural; as σοισι.

13. The Attic ι for α, ε, or ο; as ταυτι for ταυτα, ὁδὶ for ὅδε, τουτι for τουτο.

14. The imperfect and second aorist of verbs in υμι, as ἔφυ.

31. Αν, ιν, υν, final are short; as ἄν, ὦ Ἀιᾰν; παλῐν, εριν; συν.

1. Except that αν is long in circumflexed words, and in oxytons masculine; as πᾶν, Τιταν.

2. These adverbs, ἀγαν, ευαν, λιαν, περαν: and the accusative of the first declension, whose nominative is long; as Αἰνειαν, φιλιαν.

3. Ιν is long in words of two terminations; as δελφιν and δελφις.

4. Ἡμῖν and ὑμῖν when circumflexed: τιν Doric for σοι. Πριν is sometimes long in Homer.

5. Nouns in ιν, ινος, as ῥηγμιν, lengthen ιν final.

6. Υν is long in words of two terminations; as φορκυν and φορκυς.

7. Accusatives from υς long; as ὀφρυν, with νυν; though νυν the enclitic is short; as τοί νυν.

8. The imperfect and second aorist of verbs in υμι; as ἐδείκνυν, ἔφυν.

32. Αρ final is short, υρ final long; as Νεκταρ, αυταρ; ψιθυρ, πυρ.

Except that γαρ and αυταρ are sometimes long in Homer.

33. Ας, ις, υς, final are short; as λαμπᾰς, μεγᾰς, πολῐς, δῐς, βαθῠς.

1. Except that ας is long in the nominatives of participles; as τυψας: in all cases of the first declension; as Αἰνειας, ταμιας, φιλιας, μουσας, except the Doric accusative; as νυμφας; in plural accusatives in ας from the long α in the accusative singular of nouns; in ευς; and in nouns in ας-αντος; as Αἴας; with ταλας.

2. Also ις is long in words of two terminations; as δελφις and δελφιν; in nouns in ις increasing long; as κνημις, ὀρνις, κις, &c.

3. And υς is long in words of two terminations; as φορκυν and φορκυς; in monosyllables, as μυς, with κάμυς; oxytons making the genitive in ος pure; as πληθυς: ιχθυς is common. And in verbs in υμι; as ἐδείκνυς, &c.

On Quantity in the Latin Language.

As the prosody of the Latin language is considered to form an essential part of a classical education, we shall, therefore, devote the more peculiar attention to this part of the subject. In the course of which some rules will be given on the quantity of syllables usually said to be long or short by *authority*; which, we believe, have never yet been collected by any writer, ancient or modern. Perhaps, therefore, in particular for this, and for such other reasons as the candour of impartial discernment shall discover, we shall not incur the censure of having been too sanguine, should we have indulged the hope of being enabled to offer the most complete system on Latin prosody that has hitherto been presented to the public.

General Rules.

A Vowel before a Vowel.

1. One vowel preceding another, in the same word, is short; as pŭer, egregĭæ.

O Melibœe, Dĕus nobis hæc otĭa fecit. Virg.

2. The same happens, though an *h* intervene; as nĭhil, ăhenus, dĕhisco.

De nĭhilo nĭhil, in nĭhilum nil posse reverti. Pers.

Note.—H is generally considered only as a note of aspiration or breathing: though some ancient grammarians considered H as a consonant, and ranked it with the semi-vowels. See Terentianus Maurus, de syll. 511.

1. Except

1. Except the *i* of ſio is long, when it is not followed by *e* and *r*; as fīam, fīebam, fīat.

Omnia jam *fient*, *fīeri* quæ poſſe negabam.	Ovid.

2. The *e* of the genitive and dative of the fifth declenſion, when it comes between double *i*, is long; as faciēi; but it is ſhort in ſpĕi, and long and ſhort in rei and fidei.

Ventum erat ad Veſtæ quarta jam parte *diēi*.	Hor.
Extingue flammas; neve te diræ *ſpĕi*.	Seneca.
Ipſius rēi rationem reddere poſſis.	Lucret. *
Curtæ neſcio quid ſemper abeſt *rĕi*.	Hor.
Ille vir haud magna cum re, ſed plenu' *fidēi*.	Enn.
Unum pectus habent, *fidĕique* immobile vinclum.	Manil.

* Lucretius furniſhes five examples of rēi; Plautus two. Theſe caſes appear to have been anciently written both e-i and ei-i, which accounts for the variation in quantity.

3. Genitives in *ius* have the *i* long in proſe, though in poetry it is common: as unīus or unĭus, illīus or illĭus: except the *i* of alīus, which (formed by craſis from aliius) is always long, and the *i* of alterĭus, moſtly ſhort.

Navibus, infandum! amiſſis, unīus ob iram.	Virg.
Parſque meæ pœnæ totius inſtar erit.	Ovid.
Tu potes *alterīus* ſtudiis hærere Minervæ.	Claud.
Mox dum *alterīus* * obligurrias bona.	Enn.

* Alterīus is three times long in Terentianus; de ſyllab. 1072, de metr. 32; and 464.

4. The penultimate is long in auraï, aulaï, and other antique genitives of the firſt declenſion, and in ſuch vocatives as Pompeï, Caï; becauſe theſe were originally written with a double *i*; thus, Pompeii, Caii.

Æthereum ſenſum, atque aurāī ſimplicis ignem.	Virg.
Accipe Pompēī, deductum carmen ab illo.	Ovid.

5. In *ohe*, in *io* (whether interjection or proper name), and in Diana, the firſt ſyllable is common.

Ohe! jam ſatis eſt, *ŏhe*, libelle!	Mart.
Rurſus, *īo*, magnos clamat tibi Roma triumphos.	Mart.
Quâque ferebatur ductor Sidonius, *ĭo*.—Conclamant.	Sil. Ital.
Īo, verſa caput, primos mugiverat annos.	Propert.
Quæ tibi cauſa fugæ? quid *Io* freta longa pererras?	Ovid.
Experta eſt numen moriens utriuſque *Dianæ*.	Mart.
Juno, Veſta, Ceres, *Diana*, Minerva, Venus, Mars.	Enn.

6. Āër, Dīus, ēheu, have the firſt ſyllable long.

Proximus eſt *āër* illi levitate, locoque.	Ovid.
Italides: quas ipſa decus ſibi *dia* Camilla.	Virg.
Ēheu, quid volui miſero mihi? floribus Auſtrum, &c.	Virg.

7. In many Greek words a vowel is long, though immediately followed by another: as Achāia, Achelōus, Lāërtes, Lāodice, and other words compounded with λαος; Latōus, Enȳo, Panchāïa, Thrēïcius, Tāÿgetus, Trōas, Trōius, Galatīa, &c.

Erubuit Mavors, averſaque riſit *Enȳo*.	Claud.

8. Thoſe words which are written in Greek with the diphthong ει, and in Latin with a ſingle *e* or *i*, have that *e* or *i* long; as Ænēas, Muſēum, Darīus, Thalīa, Clīo, Elegīa, Orēades, &c.

Et *panacēa* potens, et Theſſala *centaurēa*.	Lucan.

9. Moſt adjectives in *eus*, formed from Greek proper names, have the *e* long; and it continues ſo, when reſolved into *ei*.

Oppida ſemoto Pelopēia marte vigerent.	Claud.

Note.—1. Thoſe which contain a choree (¯ ˘) in the two ſyllables immediately preceding the penultimate, were more frequently formed, for the convenience of furniſhing a dactyl, with the penultimate ſhort; as Hectorĕus, Neſtorĕus, Agenorĕus, Antenorĕus, &c.

2. In imitation of the Greeks, we ſee in Statius, the adjective Tiberēïus.

10. Names of towns, temples, or monuments in *ea*, *ia*, or *eum*, formed in the Greek manner, from the proper names of perſons, moſt commonly have the penultimate long; as Laodicēa, Apamēa, Cæſarēa, Alexandrīa, Antiochīa, Mauſolēum.

Terrarum mediis Apameæ mœnia clara.	Priſ.

11. Academia, Chorea, Platea, Malea, have the penultimate common.

In Latium ſpretis *Academīa* migrat Athenis.	Claud.
Atque *Academīa* celebratum nomine villam.	Laur. Tul.
Puræ ſunt *platĕæ*, nihil ut meditantibus obſtet.	Hor.
Aſpice! per bifidas plebs Romula funditur *platĕas*.	Prudent.

12. Greek genitives and accuſatives from nominatives in *eus* have the penultimate ſhort, according to the common dialect, long according to the Ionic.

Tydĕos illa dies: illum fugiuntque tremuntque.	Stat.
Ilionea petit dextrâ, levâque Sereſtum.	Virg.

Of Diphthongs.

3. A diphthong is long; as āurum, fœnus, āudio, ætas, pœnitet, Æneas, lāus, Graius, Cāius, Pompeius, Proculeius, &c.

Thesāuros, ignotum argenti pondus et *āuri*.	Virg.

1. Except præ, immediately before a vowel in a compound word, is generally ſhort.

Nec tota tamen ille prior *prăeunte* carina.	Virg.

Note.—Præ, originally being prai or prae, by the eliſion of the latter vowel before a following one, the words became pră'-uſtis, pra'-eunt, &c. Statius, however, (Theb. 6. 519.) and Sidonius Apollinarius (carm. 23.) preſerve the Æ long.

2. A diphthong is once ſhort in a line of Virgil, out of compoſition; thus,

Inſulæ̆ Ionio in magno, quas dira Celæno.	Virg.

3. The *eu* of Greek proper names in *eus* (genitive *eos*) becomes a diphthong.

Parvo dilexit ſpatio Minoïda *Thesēus*.	Propert.
Conditus Inarimes æternâ mole *Typhōeus*.	Lucan.

4. *Yi* is alſo a diphthong in Greek names, ſuch as Orithȳia, Ilithȳia, Harpyia, Agyieus, &c.

Orīthȳiān amans fulvis amplectitur alis.	Ovid.
Et patrio inſontes *Harpȳias* pellere regno.	Virg.

A Vowel before two Conſonants.

4. A vowel is long by *poſition*, when it immediately precedes two conſonants, one or both of which being in the ſame word with it; as ārma, Ērrabāt sīlvâ īn magna.

Pāſcere *opōrtet* oves, *dedūctum* dicere cārmen.	Virg.

5. Alſo, a vowel is long by *poſition*, when it immediately precedes a double conſonant (X or Z), or the letter J; as āxis, patrīzo, cūjus.

At nobis, *Pāx* alma, veni, ſpicamque teneto.	Tibul.
It Sthenelus, qualem Mavortia vidit *Amāzon*.	V. Flac.
Cauſa patrocinio non bona *pējor* erit.	Ovid.

Note.—In reality the J or I makes a diphthong with the preceding vowel; *viz.* major, pejor, are from māi-or, pēi-or:—and ſo in Māi-a, Māi-us, Bāi-æ, Troi-æ, Ai-ax, āi-unt, Cāi-eta, Cāi-us, and Grāi-us, diſſyllables. Hujus and cujus were, like illius, originally triſyllables, of which the firſt two, by ſynæreſis, coaleſced into one.

Except the compounds of jugum, which have the *i* ſhort before *j*; as bĭjugus, quadrĭjugus.

Martis equi *bĭjuges*, et magni currus Achillis.	Virg.

Note.—The word which in England we pronounce jugum, is in reality i-ugum or yu-gum, as the Germans at this day pronounce it. And in the meeting of two vowels, the former is tacitly elided, leaving the words bĭūgus, quadrĭūgus.

6. If

6. If the former of two words end in a ſhort vowel, and the next begin with two conſonants or a double letter, the vowel often remains ſhort.

Tu poteras viri es pennis *hebetarĕ ſmaragdos.* Ovid.
Jam medio apparet fluctu *nemorosă Zacynthus.* Virg.

Note.—Virgil, however, who has adopted ſuch licences as fultūs Hyacintho, and qui amant, has lengthened the ſhort ſyllable but in one line; ‘ Ferte citi ferrum, date *telā*, ſcandite muros.’ Many of theſe vowels, which at the end of a word are found long before two conſonants beginning a following word, are lengthened by the cæſura; as ‘ *Occultā* ſpolia, et plures de pace triumphos.’ Juven.

Of a Vowel before a Mute and a Liquid.

7. A vowel naturally ſhort, followed by a mute and a liquid, is common, though always pronounced ſhort in proſe: as ăgris, pharĕtra.

Natum ante ora *pātris, pătremque* obtroncat ad aras. Virg.
Nox *tenēbras* profert, Phœbus fugat inde *tenĕbras.* Ovid.

Note.—1. To produce this kind of poſition, three things are requiſite. 1. That the mute precede the liquid. 2. That the mute and the liquid be both in the following ſyllable; or otherwiſe this rule cannot take place; as in ab-luo, where the two conſonants cannot be founded in the latter ſyllable. 3. That the vowel preceding the mute and liquid be ſhort by nature. Hence the *a* in ācris and mātris is always long, becauſe the *a* in ācer and māter is always long.

2. In Latin words, *l* and *r* are the only liquids preceded by a vowel and a mute; in Greek words, *l*, *r*, and alſo *m*, *n*, have the ſame effect as Cyclopes, Tecmeſſa, Daphne.

3. H is not, neither in this, nor the foregoing rule, to be deemed a conſonant. Joined with any of the conſonants, it has not the power of lengthening a preceding ſhort vowel; not even with two conſonants (*i. e.* a mute and a liquid,) in the next ſyllable; as

Illic Pellæi proles *veſană* Philippi Lucan.
Cernitur egregius lapis hic, cui nomen *ăchates.* Priſ.
Hic *Păphius* myrtos, hic purpureas *amĕthyſtos.* Ovid.
Arbŏr habet frondes, pabula *ſempĕr* humus. Ovid.

Of Craſis, or Contraction.

8. Every ſyllable formed by the contraction of two ſyllables into one, is long; as cōgo for cŏ-ăgo, the genitive alīus for aliĭus.

Tityre *cōge* pecus, tu poſt carecta latebas. Virg.
Obſcuræ ſortis patres *ambāgibus* errant. Ovid.

Note.—This is a rule of very extenſive application. We are told that the ancients expreſſed a long ſyllable by a reduplication of the vowel; thus vēēnit for the perfect vēnit. And it will be found that in many words the long ſyllable ariſes from the contraction of two vowels. Thus we write tibīcen for tibiĭcen; ambāges for ambĕāges; bīgæ, trīgæ, for bijŭgæ, trijŭgæ; jūnior for jŭvĕnior; bōbus for bŏvibus; īt for iit; mī for mihi; and mālo for măgis vŏlo.

Of Derivatives.

9. Derivatives uſually follow the quantity of their primitives; as ănimus, ănima, ănimal, ănimalis, ănimoſus, ănimare: from lĕgo; lĕgebam, lĕgerem, lĕgam, &c.: but from lēgi; lēgeram, lēgerim, lēgero, &c. tōtalis from tōtus, and tōtus from tōt.

Nec *tōta* pars, homo terraï quota *tōtius* unus. Lucret.

1. Except deſiderative verbs in *urio*, which have the *u* ſhort, although formed from the participle in *urus*, that has *u* long; as nuptŭrio from nuptūrus.

2. Frequentative verbs, formed from the ſecond ſupine of the firſt conjugation, by changing *ātu* into *ĭto*, have the *i* ſhort; as clamĭto, volĭto.

Partŭriunt montes, naſcetur ridiculus mus. Hor.
Infelix ſua tecta ſuper *volĭtaverat* alis. Virg.

3. There are other long derivatives formed from ſhort primitives, and ſhort derivatives formed from long primitives.

Note.—1. Of the former, the following is nearly an accurate liſt: cōmo from cŏma; fōmes and fōmentum from fŏveo; hūmanus from hŏmo; jūcundus and jūmentum from jŭvo; mōbilis from mŏveo; tēgula from tĕgo; rēgula from rĕgo; trāgula from trăho; vōmer from vŏmo; vox-vōcis from vŏco; dēni from dĕcem; ſuſpīcio from ſuſpĭcor; ſēcius from ſĕcus; pēnuria from pĕnus; hūmor from hŭmus; jūgerum from jŭgum; mācero from măcer; plāco from plăceo.

2. Of the latter, the following are the principal; ărena, ăriſla from āreo; dĭcax from dīco; dĭſertus from dīſſero; dux-dŭcis from dūco; fĭdes from fīdo; frăgor and frăgilis from frango; lŭcerna from lūceo; dĭtio from dis-ditis; mĭco from mīca; năto from nātu; nŏto from nōtu; pronŭbus and pronŭba from nūbo; quăſillus from quālus; rŏſa from ros-rōris; ſtăbulis from ſtābam; ſŏpor from ſōpio; ſtĭpula and ſtĭpulor from ſtīpes; ſăgax from ſāgio; vădum from vādo; ăruſpex from āra; ambĭtus, ambĭtio, ambĭtioſus, from ambītu.

3. Some of theſe anomalies have, perhaps, ariſen from the influence of craſis and ſyncope. Thus mōbilis from mŏveo, may have been mŏvibilis; mōmentum, mŏvimentum; mōtum, mŏvitum; fōtum, fŏvitum from fŏveo; jūtum, jŭvātum; and jūmentum, jŭvamentum from jŭvo. Sometimes the derivative becomes ſhort by dropping one of the conſonants which rendered the word whence it is ſuppoſed to come, long by poſition; as dĭſertus from dīſſero; mămilla from mămma; vŏlutum from vōlvo; ſŏlutum from ſōlvo; tĭgillum from tīgnum; pŏtui from pōſſum. When the primitive is neceſſarily ſhort, by one vowel's preceding another, as in hyĕms, the derivative ſometimes becomes long, by the inſertion of a conſonant, as in hībērna, hīberno, hībernacula. Liquidus is ſuppoſed to have its firſt common (as it may be derived from the deponent liquor, or from the neuter liqueo,) on the following authority.

Craſſaque conveniunt *līquidis*, et *lĭquida* craſſis. Lucret.

Compound Words.

10. Compound words have the ſame quantity as the ſimple words from which they are formed; as perlĕgo from lĕgo; perlēgi from lēgi; imprŏbus from prŏbus; perjūrus from per and jus-jūris.

11. The quantity of the primitive word is generally preſerved in the compound, notwithſtanding the alteration of a vowel in the latter; thus accĭdo from cădo, accīdo from cædo, acquīro from quæro, inīquus, oblīquus, antīquus from æquus.

Multa renaſcentur, quæ jam *cecīdere*, *cădentque.* Hor.

Except 1. The following are ſhort compounds from long primitives; nihĭlum from hīlum; dejĕro and pejĕro from jūro; cauſidĭcus, fatidĭcus, malĕdĭcus, veridĭcus, from dīco; ſemiſŏpitus from ſōpitus; cognĭtum and agnĭtum from nōtum; hŏdie from hōc die.

2. Imbēcillus from băcillus has the ſecond ſyllable long: connūbium from nūbo has the *u* common.

Porto meis, nullo dextram ſubeunte *băcillo.* Juven.
Imbēcillus, iners, ſi quid vis? adde propino— Hor.
Connūbio jungam ſtabili, propriamque dicabo. Virg.
Hectoris Andromache! Pyrrhin' *connŭbia* ſervas. Virg.

12. Prepoſitions, in compoſition, have generally the ſame quantity as out of it; thus āmitto and dēduco have the firſt long, becauſe *ā* and *dē*, as *a* final and monoſyllabic *e* are long. Ăboleo and pĕrimo have the firſt ſhort, becauſe *ăb* and *pĕr*, as *b* and *r* final, are ſhort.

Expediam, primâ repetens *ăb* origine, famam. Virg.
Nec poterit ferrum, nec edax *ăbolere* vetuſtas. Ovid.

Note.—1. A prepoſition ending in a vowel, although out of compoſition it may be long, becomes ſhort by the firſt general rule, if followed by another vowel; as dĕoſculor, prŏhibeo. And if a ſhort prepoſition end in a conſonant, and be followed by another conſonant, it becomes long, by the ſecond general rule; as ādmitto, pērcello.

2. Sometimes the prepoſition, inſtead of becoming long by poſition, loſes its final conſonant, and remains ſhort; as ŏmitto, ŏperio.

Except 1. *Di* is ſhort in dĭrimo and dĭſertus: as

Hanc Deus et melior litem natura *dĭremit.* Ovid.
Cauſas, inquis, agam Cicerone *dĭſertius* ipſo. Mart.

2. *Rĕ*

12. *Rĕ* is ſhort; as rĕmitto, rĕpello, rĕfero. But *rē* (which here is ſuppoſed to be the ablative of *res*) is long in the imperſonal verb rēfert, it *concerns*.

Propellit Boreas; æſtus et unda *rĕfert*. Ovid.
Præterea nec jam mutari pabula *rēfert*. Virg.

13. *Pro*, when uſed as a Greek prepoſition for ante, is ſhort; as prŏpheta, prŏlogus, prŏpontis: but *pro*, a Latin prepoſition, is generally long; as prōdo, prōveho, prōmitto.

Miſit in has ſiquos longa *Prŏpontis* aquas. Ovid.
Quæ tam feſta dies, ut ceſſet *prōdere* furem. Juv.

Except prŏfundus, prŏfugio, prŏfugus, prŏnepos, prŏneptis, prŏfeſtus, prŏfari, prŏfiteor, prŏfanus, prŏfectò, prŏcella, prŏtervus, and prŏpago, ſignifying lineage; but prōpago, ſignifying a vine-ſtock, is long.

Note.—Notwithſtanding ſuch diſtinctions, propago, whoſe ſignification is always radically the ſame, may be conſidered among the doubtfuls; to which claſs procumbo is likewiſe added by ſome. But when the remarkable irregularity of *pro* is conſidered, without the ſlighteſt apparent reaſon to determine *why* it ſhould be *ſhort* in one word, *long* in another, and *common* in a third, it ſeems moſt probable, that it was in reality every where common, and that we ſhould, doubtleſs, find it ſo, had we enough of the ancient poetry extant. The word being evidently borrowed from the Greek, in which it was written with an *O-micron*, we might for that reaſon expect to find it invariably ſhort; but the Latin final *o* being in other caſes more generally long, we might, on this account, as naturally expect to find *pro* uſually made long, by thoſe at leaſt who were unacquainted with Greek. The poets ſeem to have availed themſelves of this convenient ambiguity by making *pro* long or ſhort, as proved moſt ſuitable to their purpoſe.

Of the final Vowels of firſt Words in Compoſition.

14. If the firſt member of a Latin compound word end in A, that vowel is long; as trādo, trāno, quāre, quāpropter, quātenus: but in Greek compounds the A is ſometimes ſhort; as ădipſos, ſometimes long, as Neāpolis.

Quāre agite ô proprios generatim diſcite cultus. Virg.
Extinguitque ſitim pomo, cui nomen *ădipſos*. Priſ.
Ambarum medio procera *Neāpolis* arcem. Avienus.

Except eădem, unleſs it be the ablative.

Non *eădem* arboribus pendet vindemia noſtris. Virg.

15. If the firſt member of a compound word terminate in *e*, that vowel is ſhort; as in the firſt ſyllables of nĕfas, nĕfandus, nĕque, trĕdecim, trĕcenti; in the ſecond of valĕdico, madĕfacio, ſtupĕfacio, tremĕfacio; and in the third of hujuſcĕmodi, ejuſcĕmodi.

Credebant hoc grande *nĕfas*, et morte piandum. Juven.

Except 1. The E is long in words compounded of *ſe* for *ſex* or for *ſemi*; as ſēdecim, ſēmeſtris, ſēmodius; (but in ſelibra it is ſhort.)

Sēmihominis Caci facies, quam dira tegebat. Virg.
Argenti libram mittebas: facta *sĕlibra* eſt. Mart.

2. It is long alſo in nēquis, nēquicquam, nēquam, nēquitia, nēquando, vidēlicet, and venēficus.

Nēquicquam ſeros exercet noctua cantus. Virg.

3. Liquefacio, tepefacio, and patefacio, have the *e* of the ſecond ſyllable chiefly ſhort, though ſometimes long; rarefacio and rarefio have the *e* generally long.

Sic mea perpetuis *liquĕfiunt* pectora curis. Ovid.
Tabe *liquĕfactis*, tendens ad ſidera palmas. Ovid.
Et *rarēfacit* calido miſcente vapore. Lucret.
Intremuit, motuque ſinus *patĕfecit* aquarum. Ovid.
Atque patēfecit, quas ante obſederat ater— Lucret.

Note.—Voſſius obſerves that Virgil ſhortens the e in ſuch words, and that Lucretius and Catullus lengthen it, the former without cæſura. Indeed it is probable that in theſe words it was generally conſidered common.

16. If the firſt member of a compound word terminate in *i*, that vowel is ſhort; as bĭvium, trĭvium, trĭceps, sĭquidem, fatĭdicus, agrĭcola, vatĭcinium, ſignĭfico, archĭtectus, dĭmeter, trĭmeter, Iphĭgenia, &c.

Jane *biceps!* anni tacite labentis origo. Ovid.

1. Except thoſe compounds in which the *i* is changed in declining; as quīdam, quīvis, quīlibet, quantīvis, quantīcunque, tantīdem, unīcuīque, eīdem, reīpublicæ, qualīqunque.

Jure mihi invideat *quivis*, ita te quoque amicum. Hor.

2. The final *i* is long in thoſe compounds which may be ſeparated without deſtroying the ſenſe; as ludīmagiſter, or ludī magiſter; parvīpendo, or parvī pendo; lucrīfacio, or lucrī facio; sīquis, or sī quis.

3. Thoſe words which in joining undergo a craſis or ſyncope, are long; as tibīcen for tibiicen; bigæ, trigæ, &c. for bĭjŭgæ, trĭjŭgæ, &c.; īlicet for īre licet; ſcīlicet for ſcīre licet; but tubĭcen, which has ſuffered neither, is ſhort by the general rule.

Īlicet ignis edax ſumma ad faſtigia vento. Virg.

4. Īdem maſculine is long; but in the neuter it is ſhort. Identidem has the penultimate ſhort.

Omnibus *īdem* animus, ſcelerata excedere terrâ. Virg.
Invitum qui ſervat, *idem* facit occidenti. Hor.
Qui ſedens adverſus *identĭdem* te. Catul.

5. The final *i* of the former compounding word, is long in nīmirum, ubīque, utrobīque, ibīdem.

Dixi equidem et dico. Captes aſtutus *ubīque*. Hor.

6. As the *i* is common in *ubi*; ſo it is in ubicunque and ubivis.

Clamat: io matres audite *ubīcunque* Latinæ. Virg.
Servor, *ubĭcunque* eſt: uni mea grudia ſervo? Ovid.

7. The compounds of *dies* have the final *i* of the firſt word long; as bīduum, trīduum, merīdies, prīdie, poſtrīdie.

Si ſolus tibi *trīduo* legatur. Mart.

Note.—1. Pridie and poſtridie are long by exception 3, being priori die, and poſteriori die.

2. Quotidie and quotidianus are ſaid to have the *i* ſometimes ſhort; but this is not ſatiſfactorily aſcertained, ſince the lines adduced in proof may, by the figure synizeſis, be differently meaſured: thus

Conjugis in culpa flagravit *quŏtĭdĭānā*.* Catul.

* Or quŏttīd-yā-nā. It muſt be confeſſed, however, that thus read the line is harſh, and is unneceſſarily rendered ſpondaic.

3. Trīginta, trīgeſimus, trīceſimus, and trīceni, are not conſidered as compound words, in which the *tri* is ſhort, as it is in all the real compounds of *tris*, *viz.* trĭceps, trĭplex, trĭformis, trĭcuſpis, tricenties, &c. &c. for triginta cannot with propriety be called a compound word, ſince *ginta* is only a termination. At all events the *tri* in triginta, &c. is ever long.

17. If the firſt member of a compound word terminate in *o*, it is ſhort; as Argŏnauta, Arctŏphylax, areŏpagus, bibliŏtheca, philŏſophus, ſacrŏſanctus, duŏdecim, hŏdie.

Non nautas puto vos, ſed *Argŏnautas*. Mart.
Non dices *hŏdie*, quorſum hæc tam putida tandem— Hor.

1. Except words compounded with *intro*, *retro*, *contro*, and *quando*; as intrōduco, intrōmitto, retrōcedo, contrōverſus, quandōque, &c.; but quandŏquidem has the *o* ſhort.

Ipſe *retrōverſus* ſqualentia protulit ora. Ovid.

2. Alſo aliōquin, utrōque, cæterōquin, utrōbique; and

and the compounds of *quō* ; as quōmodo, quōcunque, quōminus, quōcirca, quōvis, and quōque the adjective; but quŏque, the particle, has the *o* short.

Mendosa est natura, *aliōqui* recta, velut si. Hor.

3. Those words which in Greek are written with an *o-mega*, have the *o* long; as geōmetria, geōgraphia, minōtaurus, lagōpus.

Si meus aurită gaudet *lagōpode* Flaccus. Mart.

18. U and Y terminating the first member of a compound word, are short; as in Thrasўbulus, Eurўpylus, Polўpus, dŭcenti, dŭpondium, quadrŭpes, centŭplex, Trojŭgena, cornŭpeta, Polўdorus, Polўphemus, &c.

Nam fuit hoc vitiosus: in horâ sæpe *dŭcentos*— Hor.
Nam qualis quantusque cavo *Polўphemus* in antro. Virg.

Except jūdico, which in its first syllable is, by syncope, long.

Et sapit, et mecum facit, et Jove *jūdicat*, æquo. Hor.

Of the first Syllable of Dissyllabic Preterites.

19. Preterites of two syllables have the first long; as vēni, vīdi, vīci.

Vēnit summa dies, et ineluctabile tempus. Virg.

Except bĭbi, tŭli, dĕdi, stĕti, stĭti, scĭdi from scindo, (for abscīdi is long from abscido, and abscĭdi short from abscindo,) fĭdi from findo, (for fīdi and confīdi from fīdo are long.)

Aut *scĭdit*, et medias fecit sibi littora terras. Lucan.

Of the two first Syllables of Reduplicated Preterites.

20. Preterites doubling their first syllable, have that syllable and the following both short; as tĕtĭgi, pĕpŭli, pĕpĕri, dĭdĭci, tŭtŭdi, cĕcĭdi from cado.

Si *mĕmĭni* fuerant tibi quatuor, Ælia, dentes. Mart.
Littora, quæ cornu *pĕpŭlit* Saturnus equino. Val. Flac.

Except cecīdi from cædo has the second syllable long; and likewise those preterites, in which that syllable is followed by two consonants; as fĕfēlli, mŏmōrdi, spŏpōndi.

Ebrius et petulans, qui nullum forte *cecīdit*. Juven.
..... Vatum *spŏpōndit*: nulla propter me sacro. Senec.
Quæ Deus ipse viris intermina fortibus *spŏpōndit*. Prud.

Note.—From the authorities here quoted, it is evident that *spŏpondi* is the classic orthography, not *spospondi*, which would have the first syllable long by position, before *sp*, as we may invariably observe in compound words; as rĕspuo, rĕspicio, rĕspondeo, rĕspiro, rĕspergo, &c.

Of the first Syllable of Dissyllabic Supines.

21. Supines of two syllables, and the perfect participle formed from them, have the first syllable long; as vīsum, mōtum, ēsum, flētum, vīsus, mōtus, &c.

Terribiles *vīsu* formæ, letumque, laborque. Virg.
Quos ego — sed *mōtos* præstat componere fluctus. Virg.

1. Except the first syllable is short in dătum, rătum, sătum, ĭtum, lĭtum, quĭtum, sĭtum, rŭtum, and fŭtum, from the obsolete fuo, whence we have fŭturus.

Cui *dătus* hærebam custos, cursusque regebam. Virg.

2. Cĭtum from cieo of the second conjugation has the *i* short; but cītum from cio of the fourth conjugation has it long.

Corripuit sese, et tectis *cĭtus* extulit altis. Virg.
Unde ruunt toto *concīta* pericula mundo. Lucan.

3. Statum is common: hence we find stāturus, constāturus, obstāturus, stāmen, stātus-a-um, stātus-ûs, præstitum, stătio, stătuo, stăbilis, stăbulum, stător, stătim, &c.: the former of which are said to come from sto, the latter from sisto.

Hic *stātus* in cœlo multos permansit in annos. Ovid.
Damnavit multo *stāturum* sanguine Martem. Mart.
Instĭtor imperii, caupo famosus honorum. Claud.
Non *præstĭta* sibi præstat natura sed unus. Prop.
Constātura fuit Megalensis purpura centum. Mart.

Of the first Syllable of Polysyllabic Preterites and Supines.

22. Preterites and supines of more than two syllables have the same quantity in their first syllable as the present; thus vŏcavi and vŏcatum have the first short, because the first of vŏco is short: clāmavi and clāmatum have the first long, because the first of clāmo is long.

Si *vŏcat* officium turbâ cedente vehetur. Juven.
Induit, implevitque mero, divosque *vŏcavit*. Virg.

Except pŏsui, pŏsitum from pōno; gĕnui, gĕnitum from gīgno; pŏtui from possum; sŏlutum, vŏlutum from sōlvo and vōlvo.

Sæcula? qui tanti talem *gĕnuēre* parentes. Virg.

Of the Penultimate of Polysyllabic Supines.

23. Supines of more than two syllables, in *ātum*, *ētum*, and *ūtum*, lengthen the last syllable but one; as amātum, delētum, minūtum.

24. Supines in *itum*, from preterites in *ivi*, also have the penultimate long; as cupīvi, cupītum; petīvi, petītum; quæsīvi, quæsītum; polīvi, polītum; but the compounds of *eo*, ambio excepted, have the penultimate short.

25. Supines in *itum*, from any other preterites, shorten the penultimate; as cubui, cubĭtum; monui, monĭtum; abolevi, abolĭtum; agnovi, agnĭtum; credidi, credĭtum: recensītum of recenseo is long, on account of its origin from the obsolete censio, censivi.

Namque ferunt luctu Cycnum Phaëthontis *amāti*. Virg.
Delētas Volscorum acies, cecidisse Camillam. Virg.
Sustulit *exūtas* vinclis ad sidera palmas. Virg.
Sæpe *lacessītus* probris, gladiisque *petītus*. Claud.
Cedamus Phœbo, et *monĭti* meliora sequamur. Virg.
Prisca *recensītis* evolvite sæcula fastis. Claud.

Of the Penultimate of Participles in RUS.

26. Participles in *rus* always lengthen the last syllable but one; as amatūrus, habitūrus, lectūrus, auditūrus.

Tarda venit, seris *factūra* nepotibus umbram. Virg.

Increment of Nouns.

Note.—1. If the genitive case singular do not contain a greater number of syllables than the nominative, that noun has no increment, as penna, pennæ, caro, carnis. But if the genitive contains more syllables than the nominative, the penultimate of the genitive is the increment; and whether that syllable be long or short, it preserves the same quantity in all the oblique cases singular and plural. If bŏbus or būbus be an exception, we should recollect, it is so by syncope and crasis from bŏvibus. Ausonius, contrary to the practice of better authors, has an example of bŏbus short, as if it had been formed by simple syncope without crasis. See Auson. Epig. 62.

2. Nouns seldom have more than one increase in the singular: iter, jecur, (when its genitive is jecinoris,) supellex, and the compounds of caput, ending in *ps*, have two increments. The dative and ablative of the third declension have two; of the aforementioned words, three increments. They are reckoned in the retrograde order, beginning with the penultimate, for the last syllable is never considered as an increment.

i-ti-ne-ris, (1, 2)	i-ti-ne-ri-bus. (1, 2, 3)
je-ci-no-ris,	je-ci-no-ri-bus.
supel-lec-ti-lis,	supel-lec-ti-li-bus.
an-ci-pi-tis,	an-ci-pi-ti-bus.

Of the Increments of the Singular Number.

Of the first, second, fourth, and fifth Declensions.

27. In the first, fourth, and fifth declensions, there is no increment in the singular; except the antique increment of the first declension, by the resolution of the diphthong *æ* into *ai*, in which the *a* is long; as

Dives equûm, dives *pictāi* vestis et auri. Virg.

28. The increments of the second declension are short: as puĕri, vĭri, satŭri, tenĕri.

O *puĕri*! ne tanta animis assuescite bella. Virg.

Except Iber, Ibēri, and its compounds Celtiber, Celtibēri, which lengthen the penultimate; as

Quique feros movit Sertorius exul *Ibēros*. Lucan.
Vir *Celtibēris* non tacende gentibus. Mart.

Increments of the third Declension.

29. Nouns in A shorten the genitive penultimate; as dogma-ătis.

Non quivis videt immodulata *poēmăta* judex. Hor.

30. Nouns in I, compounds of meli, shorten the genitive penultimate; as hydromeli, hydromelĭtis.

31. Nouns in O, increasing in ĭnis, shorten the genitive penultimate; as cardo, cardĭnis; imago, imagĭnis.

32. Ēnis and ōnis, from *o*, are long; as anio, aniēnis; sermo, sermōnis.

1. Except gentiles in *o* generally shorten the increment; as Macedo, Macedŏnis; Saxo, Saxŏnis. To which add Lingŏnes, Seuŏnes, Tentŏnes, Vangiŏnes, Vascŏnes. Some lengthen the penultimate; as Sueſſiōnes, Vettōnes, Burgundiōnes, Eburōnes. Juvenal shortens Britones; Martial lengthens it.

2. Nouns in *on*, from the Greek *ων*, which sometimes drop the *n*, preserve in Latin the same quantity which they have in the original; as Agamemnon or Agamemno, Agamemnŏnis; Demiphon or Demipho, Demiphōnis.

Sanguine placâstis ventos, et *virgĭne* cæsâ. Virg.
Hæc tum multiplici populos *sermōne* replebat. Virg.
Non longinqua docent domito quod *Saxŏne* Tethys. Claud.
Qua nec terribiles Cimbri, nec *Britŏnes* unquam— Juven.
Quam veteres braccæ *Britōnes* pauperis et quam— Mart.
Quo ferus injusto petiit *Agamemnŏna* ferro— Ovid.

33. Nouns in EC lengthen the genitive penultimate; as halec-ēcis.

Halēcem sed quam protinus ipsa voret. Mart.

34. Nouns in D shorten the genitive penultimate; as David, Davĭdis.

Erecto indulget *Davĭdis* origine lumen. Juven.

Note.—Ecclesiastical writers often lengthen the penultimate of David.

35. Masculines in AL shorten the genitive penultimate; as Hannibal-ălis; sal-sălis (masculine or neuter).

36. Neuters in AL lengthen ālis; as animal-ālis.

Vela dabant læti, et spumas *sălis* ære ruebant. Virg.
Pronaque cum spectent *animālia* cætera terram. Ovid.

37. SOL lengthens sōlis: and also Hebrew nouns in EL lengthen the genitive penultimate; as Daniel-ēlis.

Regia *sōlis* erat sublimibus alta columnis. Ovid.

38. All other nouns in L shorten the genitive increment: as vigil-ĭlis, consul-ŭlis, exul-ŭlis.

Aut ursum, aut *pugĭles*, his nam plebecula gaudet. Hor.

39. Nouns in EN shorten the genitive penultimate; as crimen-ĭnis, flumen-ĭnis.

Quodque magis mirum est, auctorem *crimĭnis* hujus— Mart.

40. No certain rule can be given for the quantity of the increment of nouns ending in ON. Many lengthen the genitive penultimate; as Chiron, Demiphon, Agon, Helicon, Lacon, Sicyon, Solon, Simon: many shorten it; as Actæon, Agamemnon, Amazon, Jăson, Memnon, Philæmon, Orion, Sidon, Sindon: and Ægæon has the penultimate common.

Credit, et excludit sanos *Helicōne* poëtas. Hor.
Et velut absentem certatim *Actæŏna* clamant. Ovid.
Audierat duros laxantem *Ægæŏna* nexus. Stat.
Ægæōna suis immania terga lacertis. Ovid.

41. All other nouns in N lengthen the genitive penultimate; thus Titan-ānis, Siren-ēnis, delphin-īnis, Phorcyn-ȳnis.

Concitat iratus validos *Titānos* in arma. Ovid.
Orpheus in sylvis, inter *delphīnas* Arion Virg.

42. Neuter nouns in AR lengthen the genitive in āris; as calcar-āris.

Seu spumantis equi foderet *calcāribus* armos. Virg.

But these neuters shorten ăris; bacchar, jubar, nectar-ăris. To which add par-păris, and its compounds; as impar-impăris; dispar-dispăris, &c.; also hepar-ătis.

Pugnavere *păres*; succubuere *păres*. Mart.

43. But masculine nouns in AR shorten ăris; as Cæsar-ăris, Hamilcar-ăris, lar-lăris.

Ecce Dionæi processit *Cæsăris* astrum. Virg.

Except Car and Nar; as,

Laudibus immodicis *Cāres* in astra ferant. Mart.
Sulfureas posuit spiramina *Nāris* ad undas. Enn.

44. Greek nouns in TER lengthen the increment; as crater-ēris, character-ēris, spinther-ēris; except æther-ĕris.

Indulgent vino, et vertunt *cratēras* ahenos. Virg.
Quâcumque illa levem fugiens secat *æthĕra* pennis. Virg.

45. Nouns in OR lengthen ōris; as amor-ōris; timor-ōris.

1. Except neuter nouns; as marmor, æquor-ŏris.
2. Greek nouns in OR; as Hector, rhetor-ŏris.
3. Arbor-ŏris, and memor-memŏris.
4. Ador forms adŏris or adōris, whence adōreus in Virgil, Horace, and Claudian.

Inter spem curamque, *timōres* inter et iras. Hor.
Præterea fuit in tectis de *marmŏre* templum. Virg.
Ingemit et dulci frater cum *Castŏre* Pollux. Val. Flac.
Finiet, ante gravem quæ legerit *arbŏre* solem— Hor.
Mox ador, atque *adŏris* de polline pultificum far. Auson.
Emicat in nubes ardor *adōris*. Prif.

46. The following nouns lengthen the increment; fur-fūris, ver-vēris, Recimer-Recimēris, Byzer-Byzēris, Ser-Sēris, Iber-Ibēris, (as well as Iber of the second declension.)

Velleraque ut foliis depectant tenuia *Sēres*. Virg.

47. Other nouns in R, not mentioned, shorten the penultimate; as aer, aĕris; mulier, ĕris; cadaver-ĕris; iter, itĭneris; verber, verbĕris; vultur, ŭris; murmur, ŭris; femur, robur, jecur, ebur-ŏris; martyr-ȳris.

Si nigrum obscuro comprênderit *āĕra* cornu. Virg.
Aspice, ventosi ceciderunt *murmŭris* auræ. Virg.

48. Latin nouns in AS lengthen the increment; as pietas-ātis; Mæcenas-ātis; vas, vāsis, a vessel.

Insignem *pietāte* virum tot adire labores. Virg.

Except

Except anas, anătis; mas, măris; and vas, vădis, a ſecurity.

Tyrtæuſque *măres* animos in martia bella. Hor.

49. Greek nouns in AS ſhorten ădis, ătis, and ănis; as Pallas, lampas, ădis; artocreas, ătis; Melas, ănis.

Inſtar montis equum divina *Pallădis* arte. Virg.

50. Nouns in ES ſhorten the increment; as miles, milĭtis; ſeges, ſegĕtis; præſes, præsĭdis; obſes, obsĭdis; Ceres, Cerĕris; pes, pĕdis.

Metiri ſe quemque ſuo modulo ac *pĕde*, verum eſt. Hor.

Except locuples, quies, manſues, ētis; hæres, merces, ēdis: alſo Greek nouns which have ētis; as lebes, Thales, tapes, magnes, ētis.

Aſcanium ſurgentem, et ſpes *hærēdis* Iuli. Virg.
Viginti fulvos operoſo ex ære *lebētes*. Ovid.

51. Nouns in IS ſhorten the increment; as lapis, Phyllis, ĭdis; cinis, ĕris; ſanguis, ĭnis.

Immolat et pœnam ſcelerato ex *ſanguĭne* ſumit. Virg.

1. Except glis, glīris, and vīres the plural of vis, which lengthen the increment.

Somniculoſos ille porrigit *glīres*. Mart.
Sic fatus validis ingentem *vīribus* haſtam— Virg.

2. Latin nouns which have itis, as dis, dītis; lis, lītis; Quiris, Samnis, ītis; but Charis, a Greek noun, has Charĭtis ſhort.

Inſequeris tamen hunc, et *līte* moraris iniqua. Hor.
Tres fuerant *Charĭtes*, ſed dum mea Leſbia vixit— Auſon.

3. Crenis, Crenīdis; Neſis, Nesīdis; Pſophis, Pſophīdis, lengthen the penultimate; but Pſophis ſhortens it once in Statius.

Sylvaque, quæ fixam pelago *Nesīda* coronat. Stat.
Æpytios idem arbor agros, et *Pſophĭda* celſam. Stat.
Uſque ſub Orchomenon, *Pſophīdaque* Cylleneuque. Ovid.

4. Greek nouns in *is*, which have alſo the termination *in*; as Salamis, or Salamin-īnis.

Tiburis umbra tui, Teucer *Salamīna* patremque. Hor.

52. Nouns in OS lengthen the increment; as nepos, ōtis; flos, flōris; os, ōris; cuſtos, cuſtōdis; rhinoceros, ōtis; Tros, ōis; héros, ōis.

Qui legitis *flōres*, et humi naſcentia fraga. Virg.
Egreſſi optatâ potiuntur *Trōes* arenâ. Virg.

Except bos, bŏvis; compos, impos, ŏtis; which increaſe ſhort.

Perpetui tergo *bŏvis*, et luſtralibus extis. Virg.

53. Nouns in US ſhorten the increment; as lepus, corpus, ŏris; vellus, ĕris; tripus, ŏdis.

Ut canis in vacuo *lepŏrem* cum Gallicus arvo. Ovid.

1. Except thoſe nouns which have *udis*, *uris*, or *utis*; as incus, incūdis; tellus, tellūris; ſalus, ſalūtis. But theſe are ſhort; Ligŭris, from Ligur or Ligus; pecŭdis, from the obſolete pecus; and intercŭtis, from intercus.

In medio: ſacri *tripŏdes* viridesque coronæ— Virg.
Fas et *jūra* ſinunt: rivos deducere nulla— Virg.
Non ego te *Ligŭrum* ductor fortiſſime bello— Virg.

2. Comparatives in *us* lengthen the genitive penultimate; as melius, meliōris.

Perge, decet, forſan miſeros *meliōra* ſequentur. Virg.

54. Nouns in YS ſhorten the increment y̆dis and y̆dos, and lengthens ȳnis; as chlamys, y̆dis or y̆dos; Trachys, ȳnis.

In medio, *chlamy̆de*, et pictis conſpectus in armis. Virg.
Herculeâ *Trachȳne* jube, ſub imagine regis. Ovid.

55. Nouns in S, preceded by a conſonant, ſhorten their increment; as cœlebs, ĭbis; ſtips, ſtĭpis; Lælaps, ăpis; Cecrops, Dolops, ŏpis; auceps, cŭpis; hiems, ĕmis; alſo anceps, biceps, cĭpĭtis, and ſimilar compounds of caput, in which both increments are ſhort.

Ad matres primo *ancĭpĭtes*, oculiſque malignis— Virg.
Hic *Dolŏpum* manus, hic ſævus tendebat Achilles. Virg.

Except Cyclops, ōpis; ſeps, ſēpis; gryps, y̆phis; Cecrops, ōpis; plebs, plēbis; hydrops, ōpis; and genitives long by poſition; as excors, excordis; pars, partis.

Fortunam, et mores antiquæ *plēbis*, et idem— Hor.
Antiphatæ memores immanſuetique *Cyclōpis*. Ovid.

56. Nouns in T ſhorten the penultimate of *ĭtis*; as caput, ĭtis; ſinciput, ſincipĭtis; occiput, occipĭtis.

Magna fuit quondam *capĭtis* reverentia cani. Ovid.

57. A noun in X ſhortens the vowel before *gis*; as harpax, ăgis; grex, grĕgis; aquilex, lĕgis; biturix, ĭgis; Styx, y̆gis; Allobrox, ŏgis; conjux, ŭgis; Phryx, y̆gis.

Quinque *grĕges* illi balantum, quina redibant. Virg.
Ad *Sty̆ga* Tænariâ eſt auſus deſcendere portâ. Ovid.

Except lex, lēgis; illex, exlex, lēgis; rex, rēgis; coccyx, ȳgis; maſtix, īgis; and frūgis, from the obſolete frux.

Omnia ſub *lēges* mors vocat atra ſuas. Ovid.

58. A noun in EX ſhortens *ĭcis*; as vertex, ĭcis; pontifex, ĭcis: vibex (rather vibix), īcis excepted.

Qualem virgineo demeſſum *pollĭce* florem— Virg.

59. But EX having *ecis*, lengthens the increment; as vervex, ēcis.

Vervēcum in patria, craſſoque ſub aëre naſci. Juven.

Except nex, nĕcis, vĭcis, and prĕcis, wanting nominatives; alſo fœniſex; reſex, ĕcis; and ſupellex, ectĭlis.

Quam *nĕcis* artifices arte perire ſua. Ovid.

60. And all other nouns in X generally lengthen the increment; thus nouns in *ax*; as pax, pācis; fornax, ācis.

Except abax, ſmilax, Atrax, dropax, fax, Atax, climax, panax, opoponax, ſtyrax, colax; the compounds of phylax and corax; as Arctophylax, Nomophylax, nycticorax, phalacrocorax, ăcis.

Fraternaque fidem *pācis* petiitque deditque. Ovid.
Dicite *fēlices* animæ tuque, optime vates. Virg.

61. Thus words in IX; as radix, felix, cicatrix, nutrix, victrix, altrix, perdix, coturnix, pernix, lodix, icis.

1. Except appendix, chœnix, coxendix, cilix, calix, fornix, filix, hiſtrix, larix, pix, ſalix; varix, ĭcis, and ſtrix, ſtrigis.

2. Nix, nĭvis; maſtix, ĭchis, a gum.

Ecce *coturnīces* inter ſua prælia vivunt. Ovid.
Et *filĭcem* curvis inviſam paſcit aratris. Virg.
Et *ſtrĭgis* inventæ per buſta jacentia plumæ. Propert.
Jam fatis terris *nĭvis* atque diræ. Hor.
Contritumque ſimul cum *maſtĭche* confer anethum. Seren. Samon.

62. And

62. And words in OX; as vox, vōcis; velox, ōcis. Except Cappadox; præcox, ŏcis.

Condimus et magna fupremum *vōce* ciemus. Virg.
Mancip is locuples, eget æris *Cappadŏcum* rex. Hor.

63. In UX; as lux, lūcis; Pollux, lūcis. Except dux, crux, nux, trux-ŭcis.

Reftitit Æneas, claraque in *lūce* refulfit. Virg.
Confedere *dŭces*, et vulgi ftante corona. Ovid.

64. In YX; as bombyx, ȳcis. Except onyx, ўchis; Eryx, ўcis; calyx, ўcis; Naryx, ўcis. But Sandyx and Bebryx have the increment common.

Nec fiqua Arabio lucet *bombȳce* puella. Propert.
Illaque plebeio, vel fit *fandȳcis* amictu. Propert.
Interdum Libyco fucantur *fandȳce* pinnæ. Gratius.
Bebrȳcis et Scythici procul inclementia facri. Val. Flac

Of the Increments of the Plural Number.

65. The plural increments, A, E, O, are long; as musārum, ambābus, animābas; rērum, rēbus, hōrum, quōrum, regnōrum.

Tuque, *hārum* interpres *curārum*, et confcia, Juno. Virg.
Scilicet in nobis *rērum* natura novata eft. Ovid.
Rēbus in anguftis facile eft contemnere vitam. Mart.
Projicis? O Latio caput *hōrum* et caufa *malōrum*. Virg.

66. The plural increments I and U are fhort; as quĭbus, trĭbus, montĭbus, verŭbus, lacŭbus.

Except būbus or bōbus, which, on account of its contraction from bŏvĭbus, as already explained, is long.

Necte *trĭbus* nodis ternos, Amarylli, colores. Virg.
Non *opĭbus* mentes hominum curæque levantur. Tibul.
Pars in frufta fecant, *verŭbufque* trementia figunt. Virg.
Cum faber eduxit, *lacŭbus* demittit: at illud —— Ovid.
Et totum luftret curvatis *arcŭbus* orbem. Manil.
Et Tiberis noftris advena *būbus* erat. Propert.

Increment of Verbs.

Note.—1. When any part of a verb exceeds, in the number of fyllables, the fecond perfon fingular of the indicative prefent, active, the excefs is confidered as the increment. As in nouns, the laft fyllable is never reckoned the increment; fo alfo in verbs; and, therefore, when there is only one increafe, it muft be the penultimate.

2. Thus amat, amant, ama, amem, amans, containing, like amas, only two fyllables, have no increment. A-ma(1)-mus, a-ma(1)-tis, fle(1)-tis, fci(1)-res, da(1)-mus, have one increment, becaufe they exceed, by one fyllable, amas, fles, fcis, and das. A-ma(1)-ba(2)-mus, a-ma(1)-bi(2)-mus, have two increments, becaufe they exceed amas by two fyllables. A-ma(1)-ve(2)-ri(3)-tis has three increments. Au-di(1)-e(2)-ba(3)-mi(4)-ni has four, becaufe it has four fyllables more than audis. In determining the increments of deponent verbs, an active voice may be fuppofed; thus, co-na(1)-tur has one increment; co-na(1)-ba(2)-tur, two; cn-na(1)-re(2)-mi(3)-ni, three; becaufe conas of the fictitious active voice has but two fyllables. Or their increments may alfo be regulated by other verbs of the fame conjugation and number of fyllables, which have an active voice.

67. A is long in the increments of verbs; as flābam, ftāres, properāmus, docebāmur, audiebāmini.

Serius aut citius fedem *properāmus* ad unam. Ovid.
Pugnābant armis, quæ poft *fabricāverat* ufus. Hor.
Et *cantāre* pares, et refpondere *parāti*. Virg.
Contemplātor item, cum fe nux plurima filvis. Virg.

Except that *do*, and its compounds of the firft conjugation, have *a* fhort in their firft increment; as dămus, dăbunt, dăre; fo circundămus, venundăbo, &c. But in any other increment *do*, like its compounds of the third conjugation, is long; as dăbāmus, dederātis, circundăbāmus, credāmus.

Hic lacrymis vitam *dămus*, et miferefcimus ultro. Virg.
Taurino quantum poffent *circumdăre* tergo. Virg.
Nam quod confilium, aut quæ jam fortuna *dabātur*? Virg.

68. E is long in the increments of verbs; as flēbam, rēbar, amēris, docērem, legērunt, amēmus, amarēmus, amavifsētis, regēbat, audiēbar, &c.

Sic equidem *ducēbam* animo, *rēbarque* futurum. Virg.
Neu juvenes celebret multo fermone, *cavēto*. Tibul.

Except 1. E before R is fhort in the firft increment of all the prefent and imperfect tenfes of the third conjugation: as legĕres or legĕre, the indicative prefent paffive; legĕre, the infinitive prefent active, and imperative paffive; legĕrem and legĕrer, the imperfect fubjunctive active and paffive. But rēris and rēre are long; as amarēris, amarēre; docerēris, docerēre; regerēris, regerēre; audirēris, audirēre.

Parcĕre perfonis, *dicĕre* de vitiis. Mart.
Sic flendus Peleus, fi morerētur, erat. Ovid.
Cum confternatis *diripĕrēris* equis. Ovid.
Noftra, neque ad fedes victor *vehĕrēre*. Virg.

2. Bĕris and bĕre are every where fhort; as amabĕris, amabĕre; monebĕris, monebĕre: and among the ancients, largibĕris, experibĕre of the fourth. Excepting where the *b* belongs to the termination of the prefent; as fcribēris and fcribēre of the future paffive being long by the general rule.

Sanguine Trojano et Rutulo *dotabĕre*, virgo. Virg.
Scribēris Vario fortis, et hoftium— Hor.

3. E, before *ram*, *rim*, *ro*, and the perfons formed from them, is fhort; as amavĕram, amavĕrim, amavĕro; monuĕram, monuĕrim, monuĕro; rexĕram, rexĕrim, rexĕro; ĕram, fuĕram; potĕro, potuĕro, &c.

Vincere, nec duro *potĕris* convellere ferro. Virg.

4. By fyftole, the poets fometimes fhorten *e* before *runt*; as

Obftupui *ftetĕruntque* comæ, et vox faucibus hæfit. Virg.
Dî tibi divitias *dedĕrunt*, artemque fruendi. Hor.

69. In every increment, (whether the firft, fecond, third, or fourth,) I is fhort; as amabĭmus, docebĭmĭni, regĭtur, regĭmus, audĭmĭni, audĭebamĭni.

Mora tarda mente cedat: fimul ite; *fequĭmĭni*. Catul.
Venĭmus; et latos indagine *cinxĭmus* agros. Ovid.

Note.—In fuch verbs of the fourth conjugation as have in the firft perfon plural of their prefent and perfect indicative, the fame words, in regard to fpelling, there is a diftinction by the quantity; the penultimate of the former being long, as venīmus, reperīmus; and that of the latter fhort, as venĭmus, reperĭmus.

Except 1. Thefe have *i* long; sīmus, velīmus, nolīmus, with the other perfons coming from them and their compounds; as sītis, velītis, nolītis, nolīte, nolītote; malīmus, malītis; pofsīmus, pofsītis, &c.

Ne nimium *sīmus*, ftultorum more, molefti. Mart.

2. I before *vi* in preterites is always long; as petīvi, quæsīvi, audīvi, and in its derivative perfons; as petīvifti, quæsīvit, audīvimus, &c.

Ceffi et fublato montem genitore *petīvi*. Virg.

3. The firft increment of the fourth conjugation is long; as audīmus, audītis, audītur, audīto, audīrem, fcīmus, fcīre; and in audībam, as it is fometimes contracted;

tracted; and in ībam and ībo, from eo. But when a vowel follows, *i* is short by position, as audiēbam.

Nutrībat teneris immulgens ubera labris.	Virg.
Lenībunt tacito vulnera nostra sinu.	Propert.
Tu ne cede malis; sed contra audentior *ito*.	Virg.
Jungimus hospitio dextras, et tecta *subīmus*.	Virg.
Qui non edictis, sacturi *site* fabulis.	Plaut.

Note.—Imus in every preterite, and in that of the fourth conjugation also, is short; as juvimus, vidĭmus, fecimus, venĭmus, amavimus, adolevĭmus, pepercĭmus, munivĭmus.

4. Rĭmus and rĭtis in the subjunctive preterite are short.

Egerĭmus nosti; et nimium meminisse necesse est. Virg.

5. Rimus and rĭtis in the perfect future subjunctive are common.

Quas ob res, ubi *viderīmus* nil posse creari.	Lucret.
Nec mî aurum posco, nec mî pretium *dederītis*.	Enn.
Videritis stellas illic, ubi circulus axem.	Ovid.
Dein cum millia multa *fecerimus*.	Catul.
Oderīmus magis in culpam pœnasque creatos.	Manil.
Cum maris Ionii transieritis aquas.	Ovid.

Note—We have innumerable examples to prove that *rimis* and *ritis* in the perfect future subjunctive is common; but concerning the quantity of *rimus* and *ritis* in the preterite subjunctive, grammarians are not agreed. A difficulty in this investigation arises from the similarity of the two tenses; the latter having not unfrequently been mistaken for the former, and *vice versâ*: since "the perfect of the potential seems to be both past-perfect contingent, and future-perfect contingent. The perfect future has also so great an affinity to the preterperfect potential, that often a word may, consistently with the sense, be supposed to belong to either. As these tenses are usually interpreted in English, there is a great resemblance in their structure, as well as in the ideas which they express. Both are composed of verbs in present time, the one a verb of present liberty, or the like, the other of present intention or obligation; of an infinitive denoting subsequent or dependent possession; and a participle significant of the perfection of the action denoted by the verb: thus, *I may have written*, *I shall have written*." We find by A. Gellius, 18, 2, that it was a subject of dispute at Rome, whether the tense in *rim* ought to be considered as *past* or *future*, or both. Such disputes may, perhaps, have arisen from the accessory circumstances which are implied, besides the immediate action of the verb; in the same manner as, in English, two forms, precisely the same in their structure and reference, are characterised by certain grammarians under different times, *viz. I may write*, and *I shall write*, the former being named, from the accessory idea, a present, and the latter, from the depending action, a future, while, in reality, if we apply the same criterion to them, they are both present, or both future. Indeed it has been contended that the future had the termination *rim*, as well as *ro*; so that it is reckoned not improbable that both may originally have been but one tense, which had both a past and future reference. It is evident that this is a consideration by no means irrelevant, but indispensably necessary, before we can, with certainty, determine the quantity of *rimus* and *ritis* in the subjunctive preterite. In addition to the authorities for reckoning *rimus* and *ritis* common, there is likewise sufficient example from Horace, Martial, Ovid, Seneca, Tibullus, and Plautus, to consider *ris* of the future, at least as common; and this is an argument founded on the analogy of other tenses between the quantity of the final syllable of the second person singular, and the penultimate of the first and second persons plural, for considering the following *rimus* and *ritis* also common.—*Ris*, *rimus*, and *ritis*, are usually accounted short; but it is exceedingly probable that, whether referred to the preterite or perfect future, they still might be used as common.

70. O, in the increment of verbs, is always long; as amatōte, facitōte, itōte.

Cumquè loqui poterit, matrem *facitōte* salutet. Ovid.

71. U, in the increment of verbs, is short; as sŭmus, possŭmus, volŭmus, malŭmus.

Dicite, Pierides: non omnia *possŭmus* omnes. Virg.

Note.—For U in the penultimate of the future in *rus*, see the rule.

Section II.—*On the quantity of the penultimate and antepenultimate syllables, and on the quantity of such as are usually said to be long or short by authority.*

Note.—It is very well known that the prosodial rules, hitherto extant, determine not the quantity of every syllable of the Latin language; but of such only as are more commonly ascertained from the circumstances of *position*, *derivation*, *preterites*, *supines*, *increment*, and *final syllables*. Consequently, in the greater number of instances, the inquiries of the student are at a stand until he can appeal to that *observation*, which would be more happily employed in confirming his previous acquisitions. And thus with but partial instead of complete information, he arrives at but mere intimation, the first stage of his progress, at the time when he unquestionably might achieve the second, the satisfactory and practical illustration of his previous attainments. If we depend on practice for the *first principles* of our knowledge, we lose its best and happiest effect. Practice will always evince its most prevalent efficacy, when its office is alone to rear the superstructure on the basis of regular system and theory, and not to attempt the casual and fortuitous task of laying a transitory foundation, and that too on a vacuum, the baseless texture of ignorance, not admitting that analogy and arrangement, that reciprocal and corroborative illustration, which so essentially aid the intellectual faculty with effectual and permanent impression. The part which follows is an attempt to supply this *desideratum*. It was obtained by four consecutive analyses of the language, in which every word and syllable passed under minute and decisive consideration. This investigation was undertaken in consequence of its being suspected, that since it is a general rule in the prosody of the Latin language, that a vowel before two consonants, &c. is long, that a law exists, directly the reverse of this, and of not less extensive influence; *viz.* that a vowel before a single consonant is short: though each of these general and very extensive rules, may have, in special cases, their exceptions. The result justified the expectation, and proved, that principally with the addition of another general rule, the prosodial system might become so comprehensive, as to include and provide for the whole language; and consequently, for all those syllables usually said to be long or short only by authority. The exceptions to this general principle are chiefly included in the rules for the penultimate and antepenultimate syllables. And though some of these have appeared in former treatises, yet from their enlargement, the addition of others, the general rule, and its more special exceptions, which have arisen from the repeated analysis we have undertaken, it will be easy to perceive, that we have in this part some claim to originality. In the preceding rules, and in such as shall follow on final syllables, in justice to the subject and our readers, we have felt it indispensably incumbent on us to avail ourselves of the valuable researches of preceding and contemporary prosodians. And the originality of this section places us under the obligation of devoting peculiar attention, especially to the demonstrative part, that every rule and exception, which we now first offer, might not appear to rest on our bare assertion, but on the only legitimate warrant, poetic sanction. And thus, perhaps, we have now the opportunity, for the first time, of offering the only complete collection or system which determines the quantity of every syllable, at least of pure and Augustan Latin, that has hitherto been presented to the public.

1. Masculine patronymics in *ades* or *ides* usually shorten the penultimate; as Priamĭdes, Atlantiădes.

Atque hîc *priamĭdem* laniatum corpore toto. Virg. Æn. 6. 494.

1. Except those formed from nouns in *eus*; as [1] Pelīdes.

2. Also [2] Amphiaraīdes, [3] Belīdes, [4] Japetionīdes, [5] Lycurgīdes.

1. Par sibi Pelīdes: nec inania Tartara sentit.	Ovid. Met. 12. 619.
2. *Amphiaraīdes* Naupactoo Acheloo.	Ovid. Fas. 2. 43.
3. *Belīdæ* nomen Palamedis et inclyta fama.	Virg. Æn. 2. 82.
4. *Japetionīdes* Atlas fuit. Ultima tellus.	Ovid. Met. 4. 632.
5. Quique *Lycurgīden* lethavit, et arbore natum.	Ovid. in Ib. 505.

2. Patronymics and similar words in *ais*, *eis*, and *ois*, lengthen the penultimate; as Achāis, Ptolemais, Chrysēis, Ænēis, Minōis, and Latōis.

Protinus Ægides, raptâ *Minōĭde*, Dian. Ovid. Met. 8. 174.

Except [1] Thebāis and [2] Phocāis: [3] Nerēis is common.

1. The-

1. *Thebaides* juſſis tua tempora frondibus ornant. Ovid. Met. 6. 163.
2. *Phocăis* effundit vaſtos baliſta molares. Silius Ital. 1. 334.
3. Et tibi præ invidia *Nerĭdes* increpitarent. Prop. 1. 26. 15.
4. *Nerēi*, te vereor; tua fulmine ſævior ira eſt. Ovid. Met 13.858.

3. Words ending in *acus*, *icus*, and *idus*, ſhorten the penultimate; as [1]Ægyptiăcus, [3]aromatĭcus, [4]callĭdus.

1. Quos *Ægyptiăcos* ſemper renuiſtis ab ævo— Cole.
2. Idaliæ lucos, ubi mollis *amarăcus* illum— Virg. Æn. 1. 693.
3. Vatis *fatidĭcæ*, cecinit quæ prima futuros. Virg. Æn. 8. 340.
4. Utque ſuum laqueis, quos *callĭdus* abdidit anceps. Ovid.

1. Except [1]Merācus, [2]opācus, [3]amīcus, [4]aprīcus, [5]antīcus, [6]fīcus, [7]mendīcus, [8]poſtīcus, [9]pudīcus, [10]umbilīcus, [11]vīcus.

2. Alſo [12]nīdus, [13]sīdus; [14]fīdus, infīdus: but [15]perfīdus (from *per* and *fides*), follows the general rule.

1. Ah! pereat quicunque *merācas* repperit uvas. Prop. 2. 3. 27.
2. Continui montes, niſi diſſocientur *opāca*. Hor. Epiſt. 1. 16.
3. Eſſe tibi magnus, Theleſine, videris *amīcus*— Mart. 3. 40. 3.
4. Duceret *aprīcis* in collibus uva colorem. Virg. Ecl. 9. 49.
5. Et ſuper *antīcos* in frontis imagine crines— Mill.
6. Cum me *fīcus* alit, cum paſcar dulcibus uvis. Mart. 13. 49.
7. Nec *mendīca* ferat barbati prandia nudi— Mart. 14. 81.
8. Occipiti cæco, *poſtīcæ* occurrite ſannæ. Perſ. 1. 62.
9. Perduci poterit tam frugi tamque *pudīca*. Hor. b. 2. s. 5. 77.
10. Nec *umbilīcis* quod decorus et cedro. Mart. 8. 61.
11. Et tua patricius culmina *vīcus* habet. Mart. 7. 72.
12. Ore ferunt, dulcem *nīdis* immitibus eſcam. Virg. G. 4. 17.
13. Hoc metuens, cœli menſes et *sīdera* ſerva. Virg. G. 1. 335.
14. Fortunata domus, modò ſit tibi *fīdus amīcus*. Prop. 3. 20. 9.
15. Diſſimulare etiam ſperaſti, *perfĭde* tantum. Virg. Æn. 4. 305.

4. Words ending in [1]*imus* or [2]*ymus*, ſhorten the penultimate; as finitĭmus, maxĭmus, thўmus, fortiſsĭmus.

Thus anĭmus, decĭmus, fĭmus, ocĭmum, anonўmus, callionўmus, and all adjectives and ſuperlatives in *imus* ſhorten the penultimate.

1. Entelle heroum quondam *fortiſsĭme* fruſtra. Virg. Æn. 5. 389.
2. Fervet opus, redolentque *thўmo* fragrantia mella. Virg. G. 4. 169.

1. Except [1]bīmus, [2]līmus, [3]mīmus, [4]opīmus, [5]quadrīmus, [6]sīmus, [7]trīmus.

2. And two ſuperlatives, īmus and prīmus.

1. Tum vitulos, *bīmâ* curvans, jam cornua fronte. Virg. Georg.
2. *Līmus* ut hic dureſcit, et hæc ut cera liqueſcit. Virg. Ecl. 8. 80.
3. Scribere ſi fas eſt imitantes turpia *mīmos*— Ovid. Triſt. 2. 515.
4. Aut ſpoliis ego jam raptis laudabor *opīmis*. Virg. Æn. 10. 449.
5. Deprome *quadrīmum* Sabinâ. Hor. b. 1. od. 9. 7.
6. Dum tenera attondent *sīmæ* virgulta capellæ. Virg. Ecl. 10. 7.
7. Quæ, velut latis equa *trīma* campis— Hor. b. 3. od. 11. v. 9.

Note.—The quantity of the penultimate of patrimus and matrimus is undetermined: Facciolatus, the Italian lexicographer, ſays "lis eſt inter grammaticos de quantitate eorum penultimæ, quæ adhuc eſt ſub judice, quia nihil certi afferri adhuc potuit."

5. Other vowels before final *mus* or *mum* are long; as rāmus, rēmus, pōmum, dūmus.

So amōmum, cāmus, cardamōmum, cinnamōmum, dēmum, extrēmus, fūmus, grūmus, hāmus, poſtrēmus, prōmus, racēmus, ſuprēmus, volēmum.

Sylveſtris raris ſparſit labruſca *racēmis*. Virg.

1. Except [1]atŏmus, [2]balsămum, [3]cinnămum, [4]dŏmus, [5]glŏmus, [6]hŭmus, [7]poſtŭmus, [8]thalămus, [9]tŏmus.

2. And words ending in *dromus*, from the Greek δρόμος; as epidrŏmus, hemerodrŏmus.

1. Parvarum ſerie conſtant connexa *atŏmorum*. An.
2. & 3. *Balsăma* qui ſemper, *cinnăma* ſemper olet. Mart.
4. Non unquam gravis ære *dŏmum* mihi dextra redibat. Virg.
5. Ut vinoſa *glŏmos* furtivæ Pyrrhia lanæ— Hor.
6. Spargite *hŭmum* foliis, inducite fontibus umbras. Virg.
7. Silvius, Albanum nomen, tua *poſtŭma* proles. Virg.

8. Poſt ubi jam *thalămis* ſe compoſuere, ſiletur. Virg.
9. Scriptura quanti conſiet, et *tŏmus* vilis. Mart.

6. A vowel before final [1]*le*, [2]*lis*, or [3]*les*, is long; as monīle, annālis, mōles.

So ancīle, bovīle, būle, caprīle, crināle, focāle, fœnīle, īle, incīle, mantēle, mantīle, ovīle.

And āles, anīlis, aprīlis, civīlis, carduēlis, curūlis, crudelis, conjugālis, dotalis, exīlis, fidēlis, herīlis, mīles, patruēlis, prōles, quinctīlis, ſubtīlis, ſextīlis, &c. with many others.

1. Et opportuno ſe *bovīli* condidit. Phædr.
2. At qui umbrata gerunt *civīli* tempora quercu. Virg.
3. Tota cohors. Rarus venit in cænacula *mīles*. Juven.

1. Except [1]verbal nouns or adjectives; as agĭlis, amabĭlis, facĭlis, insĭle, miſsĭlis, miſsĭle, utĭlis.

2. And all adjectives in [2]*atĭlis*; as aquatĭlis, fluviatĭlis, plicatĭlis, volatĭlis.

3. Alſo dapsĭlis, dactўlis, [5]gracĭlis, [6]humĭlis, [7]indŏles, [8]parĭlis, [9]simĭlis, [10]ſterĭlis, [11]ſubŏles.

1. Nec tibi deliciæ *facĭles*, vulgataque tantum. Ovid.
2. Paſtor agens telis, liquitque *volatĭle* ferrum. Virg.
3. *Dapsĭlis* excepit dictis, Cereremque ferentes. Faliſc.
4. Hinc pedem ſi cœperimus, edere iterum *dactўlum*. Terent.
5. Et *gracĭlis* ſtructos effugit umbra rogos. Ovid.
6. Atque *humĭles* habitare caſas, et figere cervos. Virg.
7. Quid pius Æneas tanta dabit *indŏle* dignum? Virg.
8. —— Et noctes *parĭles* agitare diebus. Lucret.
9. Stes capite obſtipo, multùm *simĭlis* metuenti. Hor.
10. Hic, *ſterĭlem* exiguus ne deſerat humor arenam. Virg.
11. Denſior hinc *ſubŏles*, hinc largi copia lactis. Virg.

7. Adjectives in *inus* derived from nouns ſignifying [1]trees, [2]plants, and ſtones; alſo from [3]adverbs of time, or from ſubſtantives ſignifying the four ſeaſons of the year, ſhorten the penultimate; as fagĭnus, hyacinthĭnus, adamantĭnus, craſtĭnus, diutĭnus, perendĭnus, chimerĭnus, annotĭnus, hornotĭnus: to which add bombycĭnus, elephantĭnus, which ſeem rather to refer to the ſilk and ivory, than to the animals themſelves.

1. Truditur e ſicco radix *oleagĭna* ligno. Virg.
2. Grandia tolluntur *cryſtallĭna*, maxima rurſus. Juven.
3. *Myrrhĭna*, deinde adamas notiſſimus. Juven.
4. Et lux cum primum terris ſe *craſtĭna* reddet. Virg.
5. Delicias et panniculus *bombycĭnus* urit. Juven.

Except [1]repentīnus, [2]matutīnus, [3]veſpertīnus.

1. Inque *repentīnos* convivia verſa tumultus. Ovid.
2. *Matutīna* parùm cautos jam frigora mordent. Hor.
3. Nec *veſpertīnus* circumgemit urſus ovile. Hor.

Note.—The penultimate of malinus, Ainſworth, as well as every Engliſh lexicographer, has, without any poetic authority, marked long. Facciolatus, however, gives it that quantity, which, as derived from malus, a tree, it certainly ſhould have.

8. All other adjectives and words ending in *īnus* lengthen the penultimate; as canīnus, bīnus, trīnus, feſtīnus, Latīnus, mediaſtīnus.

Vix primos *inopīna* quies laxaverat artus. Virg.

Except [1]asĭnus, [2]comĭnùs, [3]domĭnus, [4]emĭnùs, [5]facĭnus, [6]sĭnus, [7]termĭnus.

1. Suadebat *Asĭno* fugere, ne poſſet capi. Phædr.
2. & 4. *Comĭnus* enſe ferit; jaculo cadit *emĭnùs* ipſe. Ovid.
3. Tum caput ipſi aufert *domĭno*, truncumque relinquit. Virg.
5. Nondum Juſtitiam *facĭnus* mortale fugarat. Ovid.
6. Nunc tantum *sĭnus*, et ſtatio maleſida carinis. Virg.
7. Quicunque mundi *termĭnus* obſtitit. Hor.

9. Other vowels before final *nus* and *num* are long; as urbānus, plēnus, dōnum, mūnus.

So ahēnus, fānum, prōnus, prūnus, ſerēnus, venēnum,

num, vānus, and many others; for the nouns and adjectives compriſed by this rule are numerous.

Aut *montāna* ſedet circum caſtella ſub armis. Virg.

Except galbănus, [2]mănus, [3]oceănus, [4]platănus, [5]tympănum; [6]ebĕnus, [7]gĕnus, [8]tĕnus, [9]Vĕnus; [10]bŏnus, [11]ŏnus, [12]sŏnus, [13]tŏnus.

1. Fuſcos colores, *Galbănos* habet mores. Mart.
2. Et *mănus* in gremio languida facta jacet. Ovid.
3. Quid tantùm *oceăno* properent ſe tingere ſoles. Virg.
4. Non ſine natanti *platăno*, lentaque ſorore. Catul.
5. Hinc radios trivere rotis, hinc *tympăna* plauſtris. Virg.
6. Fert *ebĕnum*, ſolis eſt thurea virga Sabæis. Virg.
7. Idne eſt verum? Imò, id *gĕnus* eſt hominum peſſimum. Ter.
8. Eſt quōdam prodire *tĕnùs*, ſi non datur ultrà. Hor.
9. Sic *Vĕnus*; at *Vĕneris* contrà ſic filius ortus. Virg.
10. At *bŏna* pars procerum tacitâ libabit acerrâ. Perſius.
11. Tu pueris curre, Parmeno obviàm, atque his *ŏnera* adjuta. Ter.
12. Omnibus auditur. *Sŏnus* eſt, qui vivit in illâ. Ovid.
13. Tædia dulcisŏnis auferat illa *tŏnis*. Cato.

10. Words ending in *ino* or *inor* ſhorten the penultimate; as lĭno, fulmĭno, termĭno.

So sĭno, inquĭno, coinquĭno, circĭno, femĭno, grandĭno, germĭno, emĭnor, procraſtĭno, comperendĭno; the compounds of căno, as concĭno, and many others.

Nunc *sĭnite*, et placitum læti componite fœdus. Virg.

Except [1]divīno, [2]omnīno, [3]propīno, [4]ſupīno; alſo [5]clīno, and its [6]compounds, as acclīno, inclīno, proclīno, reclīno.

1. Hâc *divīnavi*, notitiamque tuli. Ovid.
2. Non impulit me, hæc nunc *omnīnò* ut crederem. Terence.
3. Nemo *propīnabit*, Calliodore, tibi. Mart.
4. Gramen, et erecto currum temone *ſupīnant*. Stat.
5. Quare etiam, atque etiam paulum *clīnare* neceſſe. Lucret.
6. *Inclīnat* curſus; et eaſdem *circĭnat* auras. Ovid.

11. Other vowels before final *no* or *nor* are long; as māno, exarēno, pōno, Jūno.

So plāno, trāno, ferēno, dōno, cōnor, and ſeveral others.

Hâc te nos fragili *dōnabimus* ante cicutâ. Virg.

Except [1]căno, [2]rĕno, [3]hŏnor, [4]sŏno, and [5]tŏno.

1. Sicelides Muſæ, paullo majora *cănamus*. Virg.
2. Sed juremus in hæc; ſimul imis ſaxa *rĕnarint*. Hor.
3. Sed cum ſummus *hŏnor* finito computet anno. Juven.
4. Te lyra pulſa manu, te carmina noſtra *sŏnabunt*. Ovid.
5. Cum *tŏnat*, exanimes primo quoque murmure cœli— Juven.

12. A vowel before final *na* is long; as lāna, vēna, ſpīna, nōna, Lūna, rāna, arēna, arvīna, carīna.

Hîc *regīna* gravem gemmis auroque popoſcit. Virg.

Except [1]advĕna, [2]buccĭna, [3]domĭna, [4]gĕna, [5]fiſcĭna, [6]fœmĭna, [7]machĭna, [8]pagĭna, [9]farcĭna, [10]tibicĭna, [11]trutĭna.

1. Non tamen hoſpes eris, nec jam potes *advĕna* dici. Mart.
2. Sed qui ſermones? Quæ fœdæ *buccĭna* famæ? Juven.
3. Concurrunt trepidæ comites, *domĭnamque* recentem— Virg.
4. Pendenteſque *gĕnas*, et tales aſpice rugas. Juven.
5. Preſſaque flammeola rumpatur *fiſcĭna* caltha. Col.
6. *Fœmĭna* palantes agit, atque hæc agmina vertit? Virg.
7. Aut hæc in noſtros fabricata eſt *machĭna* muros. Virg.
8. Quam ſibi quæ Vari præſcripſit *pagĭna* nomen. Virg.
9. Muli gravati *farcĭnis* ibant duo. Phædr.
10. Ebria nos madidis rumpit *tibicĭna* buccis. Mart.
11. Si volet, hac lege in *trutĭna* ponetur eadem. Hor.

13. A vowel before final [1]*ne*, [2]*ni*, [3]*nes*, [4]*nis*, is long; as mānè, sēni, mānes, fīnis.

So bulbīne, anemōne, confīne, pēne; bīni, lucāni, antepilāni, quīni, ſeptēni, octōni, novēni, dēni, vicēni, ducēni, and other numerals in *ēni*; ſo fūnis, acclīnis, inclīnis, inānis, commūnis, immūnis, commūnis, immūnis, &c.

1. Et quæ *mānè* refert, et quæ ſurgentibus aſtris. Virg.
2. Bis *dēnas* Italo texamus robore naves. Virg.
3. Quòd vivis: *cĭnis*, et *mānes* et fabula fies. Perſ.
4. O curas hominum! O quantum eſt in rebus *ināne*! Perſ.

Except bĕne, [2]sĭne, [3]pĕnes, [4]cănis, [5]cĭnis, [6]juvĕnis; and [7]nouns derived from μαίνομαι, as hippomănes, trichomănes.

1. Vivitur parvo *bĕne*, cui paternum— Hor.
2. Mollia cum duris, *sĭne* pondere habentia pondus. Ovid.
3. Me *pĕnes* eſt unum vaſti cuſtodia mundi. Ovid.
4. Sic *cănibus* catulos ſimiles, ſic matribus hædos. Virg.
5. For *cĭnis*, ſee verſe 3. under the above rule.
6. Clamoſus *juvĕnem* pater excitat; accipe ceras. Juven.
7. *Hippomănes*, quod ſæpè malæ legêre novercæ. Virg.

14. A vowel before final [1]*nea*, [2]*neo*, [3]*nia*, [4]*nio*, [5]*nius*, and [6]*nium*, is long; as līnea, cāneo, mūnia, pūnio, favōnius, ſcrīnium.

So arānea, gāneo, declīneo, delīneo, līneo, cicōnia, insānia, Irōnia, colōnia, alcedōnia, lacīnia, querimōnia, delēnio, exinānio, fīnio, insānio, mūnio, confīnium, patrimōnium, vadimōnium, and many others.

1. In foribus laxos ſuſpendit *arānea* caſſes. Virg.
2. Carpamus: dum manè novum, dum gramina *cānent*. Virg.
3. Sævit amor ferri, et ſcelerata *insānia* belli. Virg.
4. Oppida cœperunt *mūnire*, et ponere leges. Hor.
5. Primo reſtituent vere *Favōnii*. Hor.
6. Pullati proceres, differt *vadimōnia* prætor. Juven.

1. Except [1]caſtănea, [2]tĭnea, [3]măneo, [4]mĭneo, [5]mŏneo, [6]tĕneo.

2. Alſo [7]ignomĭnia, [8]vĕnia, [9]lĭnio, [10]lănio, [11]vĕnio.

1. *Caſtăneæ* molles, et preſſi copia lactis. Virg.
2. Aut *tĭneas* paſces taciturnus inertes. Hor.
3. Quæ finis? Aut quod me *mănet* ſtipendium. Hor.
4. Inclinata *mĭnent* in eandem prodita partem. Lucret.
5. Aliquid *mŏneat*, ut illa, quæ te ſcire credas, neſcias. Ter.
6. Utque viam *tĕneas*, nulloque errore traharis. Ovid.
7. Multa gemens, *ignomĭnium*, plagaſque ſuperbi. Virg.
8. Orantes *vĕniam*, et templum clamore petebant. Virg.
9. Neve tua Medæ *lĭniantur* cæde ſagittæ. Propert.
10. Quin *lănient* mundum; tanta eſt diſcordia fratrum. Ovid.
11. Momento cita mors *vĕnit*, aut victoria læta. Hor.

15. A vowel before final *do* is long; as vādo, cēdo, formīdo, rōdo, teſtūdo.

So rādo, crēdo, alcēdo, dulcēdo, cupīdo, crepīdo, nōdo, cūdo, lūdo, altitūdo, beatitūdo, and many others; for the nouns and verbs compriſed by this rule are very numerous.

Poſſe putes illos ſicco freta *rādere* paſſu. Ovid.

Except [1]cădo, [2]dīvĭdo, [3]trepĭdo; and [4]rŭdo[5], which is common; and [6]ĕdo, to eat; ēdo, to declare, publiſh, &c. (the prepoſition *ē* being long,) follows the above rule.

1. Multa renaſcentur, quæ jam cecidere, *cădentque*. Hor.
2. *Dividimus* muros, et mænia pandimus urbis. Virg.
3. Cùm ſubitò *trepĭdare* intus præcordia ſenſi. Ovid.
4. Findor: ut Arcadiæ pecuaria *rŭdere* credas. Perſ.
5. Incluſumque cavo ſaxo, atque inſueta *rūdentum*. Virg.
6. Ut verò eſt expulſa quies; furit ardor *ĕdendi*. Ovid.

16. E before final *rus*, *ra*, *rum*, is ſhort; as mĕrus, hedĕra, cætĕrum.

The nouns and adjectives compriſed by this rule are numerous.

Ite domum ſaturæ, venit *Heſpĕrus*, ite capellæ. Virg.
Certum eſt, in ſylvis, inter ſpelæa *fĕrarum*. Virg.

1. Except

1. Except [1]austērus, [2]galērus, [3]plērufque, [4]sērus, [5]fevērus, [6]vērus; [7]pēra, [8]cēra, and [9]fincērus, from fine cērâ.

2. And though of anthēra, œnothēra, ftatēra, there is no poetic fanction, they are long by derivation from ἀνθηρα, θηρεια, and ϛατηρα, fo panthēra (Virg. Æn. 8. 460.) from θηρ.

1. Qui volet *auftēros* arte ferire viros. Prop.
2. Bina manu, fulvofque lupi de pelle *galēros*. Virg.
3. *Plēraque* differat, et præfens in tempus omittat. Hor.
4. *Sērus* in offenfam rettuleritque pedem. Tibul.
5. Cum fit trifte habitu, vultuque et vefte *fevērum*. Juven.
6. *Vērùm*, quid facias? Ut homo eft, ita morem geras. Ter.
7. *Pēras* impofuit Jupiter nobis duas. Phædr.
8. Limus ut hîc durefcit, et hæc ut *cēra* liquefcit. Virg.
9. Enfe recidendum; ne pars *fincēra* trahatur. Ovid.

17. Other vowels before final [1]*rus*, [2]*ra*, [3]*rum*, are long; as cārus, mīrus, mōrus, mūrus; hāra, fpīra, ōra, natūra, lōrum, &c.

So āra, tiāra, īra, līra, hōra, aurōra, lōra, manticōra, prōra, captūra, figūra, cenfūra; alfo the nouns, adjectives, and participles in *rus*, &c. are very numerous.

1. Exultans rorem latè difpergit *amārum*. Virg.
2. Vela legunt focii, et *prōras* ad littora torquent. Virg.
3. Puniceo tingit pendentia *mōra* colore. Ovid.

1. Except [1]barbărus, [2]cammărus, [3]camŭrus, [4]canthărus, [5]chŏrus, [6]hellebŏrus, [7]nŭrus, [8]opipărus, [9]ovipărus, [10]fpărus, [11]Tartărus, [12]tŏrus.

2. Alfo [13]anchŏra, [14]cithăra, [15]mŏra, [16]purpŭra, [17]philўra.

3. And the following in *rum*; [18]fŏrum, [19]fuppărum, [20]gărum, [21]părùm.

4. Alfo the [22]compounds of *vŏro*, as carnivŏrus, omnivŏrus; thofe ending in [23]*phŏrus* and *phŏra*, from φερω, as amphŏra, canephŏra, echphŏra, phofphŏrus, ciftophŏrus, &c.; and the derivatives of ἄργυρος, as hydrargўrum, lithargўrus.

1. *Barbărus* hîc ego fum, quia non intelligor ulli. Ovid.
2. Sed tibi dimidio conftrictus *Cammărus* ovo. Juven.
3. Pes etiam et *camŭris* hirtæ fub cornibus aures. Virg.
4. Et gravis attritâ pendebat *canthărus* anfâ. Virg.
5. Doctus et Phœbi *chŏrus*, et Dianæ. Hor.
6. Scillamque, *hellebŏrofque* graves, nigrumque bitumen. Virg.
7. Si qua tibi *nŭrus* eft, fi qua eft tibi filia, voces. Ovid.
8. Vino ornamentis *opipărifque* opfoniis. Plaut.
9. Præpinguis teres, *ovipăra* congeftior alvo. Aufon.
10. Agreftifque manus armat *fpărus*: vertitur ipfe. Virg.
11. *Tartăra* Panthoiden iterum Orco— Hor.
12. Proximus ut viridante *tŏro* confederat herbæ. Virg.
13. *Anchŏra* jam noftram non tenet ulla ratem. Ovid.
14. Non ftudio *cithăræ*, nec Mufæ deditus ulli. Hor.
15. Troja cadet; fed erit noftri *mŏra* longa laboris. Ovid.
16. Per hoc inane *purpŭræ* decus precor. Hor.
17. Difplicent nexæ *philўrâ* coronæ. Hor.
18. Infanumque *fŏrum*, aut populi tabularia vidit. Virg.
19. *Suppăra* nudatos cingunt angufta lacertos. Lucret.
20. Preffit cella, *găro* de fuccis pifcis Iberi. Hor.
21. Matutina *părùm* cautos jam frigora mordent. Hor.
22. Mittere *carnivŏris* præberi pabula mandat. An.
23. *Phofphŏre* redde diem; quid gaudia noftra moraris? Mart.
24. *Amphŏra* non meruit tam pretiofa mori. Mart.

18. E before final *ro* or *ror* is fhort; as fĕro, gĕro, tĕro.

So tempĕro, afpĕro, blatĕro, cætĕrò, capĕro, celĕro, confidĕro, defidĕro, fcelĕro, propĕro, sĕro (to fow), quĕror, &c.

Verùm, quid facias? ut homo eft, ita morem *gĕras*. Ter.

Except [1]fpēro; [2]affevēro and [3]perfevēro from fevērus, and the adverb [4]sēro from sērus; for sĕro, to fow, is fhort.

1. *Spēret* idem, fudet multùm fruftràque laboret. Hor.
2. Profitebitur, jurabit, *affevērabit*. Scaz
3. Poft manes tumulumque *perfevēret*. Mart.
4. Verùm. Age modò hodie: *sērò* ac nequidquam voles. Ter.

19. Other vowels before final *ro* or *ror* are long; as vāro, fpīro, ōro, ūro.

So līro, tīro, inquīro, acquīro, conquīro, plōro, labōro, auctōro, ignōro, cūro, figūro, lūror, dūro, and many others.

Delicias et panniculus bombycinus *ūrit*. Juven.

1. Except [1]ăro, [2]căro, [3]fŭro, [4]hilăro, [5]infŏro, [6]mŏror, [7]păro, [8]fatŭro, [9]vŏro.

2. Alfo the [10]derivatives from genitives increafing fhort in *ŏris* or *ŭris*; as decŏro, murmŭro, from decus-ŏris, murmur-ŭris.

So memŏro from memor-ŏris; corpŏror from corpus-ŏris; robŏro from robus-ŏris; exaugŭro from augur-ŭris; fulgŭro from fulgur-ŭris; expectŏro from pectus-ŏris.

1. Littus *ărant*, Rutulofque exercent vomere colles. Virg.
2. Sed malè viva *căro* eft. Lambendo mater in artus— Ovid.
3. Quid *fŭris*? Aut quonam noftri tibi cura receffit. Virg.
4. Hos ubi facundo tua vox *hilăraverat* ore. Ovid.
5. Licetne *infŏrare*, fi incomitiare non licet? Plaut.
6. Quid vitam *mŏror* invifam, Pallante perempto. Virg.
7. Umbras, et cœlo diffundere figna *părabat*. Hor.
8. Qua *fatŭrat* Calabris culta Galefis aquis? Mart.
9. Optima fylvarum interea, pelagique *vŏrabit*. Juven.
10. Et validas auget vires, et *robŏrat* ictum. Lucret.

20. Words ending in [1]*atus*, [2]*etus*, [3]*otus*, [4]*utus*, lengthen the penultimate; as probātus, cētus, tōtus, tūtus.

So grātus, facētus, bolētus, pōtus, agrōtus, argūtus, aftūtus, brūtus, hirfūtus, mūtus, and many others; alfo participles in *ātus*, *ētus*, *ōtus*, and *ūtus*, as mandātus, decrētus, nōtus, minūtus, metūtus, conftitūtus, volūtus, &c.

1. O *fortunātos* nimium, fua fi bona norint! Virg.
2. Tu rem impeditam et perditam reftituas? hem! quo *frētus* fum. Ter.
3. Facilè omnes, cum valemus, recta confilia, *ægrotis* damus. Ter.
4. *Tūta* manent; mediis Tanaïs fumavit in undis. Ovid.

1. Except [1]cătus, [2]lătus-ĕris, [3]ftătus-ûs; [4]impĕtus, [5]mĕtus, [6]vĕtus; and [7]antidŏtus.

2. [8]Venĕtus is fhort by derivation from Venĕtiæ; [9]quŏtus from quŏt; [10]tŏtus (fo great), from tŏt, for tōtus is long; and [11]arbŭtus from arbor-arbŏris.

3. Of dicrŏtum, and automătus from automăton, there is no poetic authority.

4. Except alfo the plural genitives of nouns ending in ma-mătis; as poemătum.

5. And the participles dătus, rătus, sătus, ftătus; for which fee the rule concerning diffyllabic fupines.

1. Me plus fapere quàm vos, dederim vobis confilium *cătum*. Plaut.
2. Impulit in *lătus*, et venti, velut agmine facto— Virg.
3. Et enim verò quoniam formam cepi hujus in me et *ftătum*. Plaut.
4. Æquora; fic illam fert *impĕtus* ipfe volantem. Virg.
5. Necdum eft ille dolor, fed jam *mĕtus* incubat amens. Lucan.
6. Et *vĕtera* oblitis jura referre foris. Propert.
7. Et venditaret falfo *antidŏtum* nomine. Phædr.
8. Sic *Venĕtus* ftagnante Pado, fufóque Britannus— Lucan.
9. & 10. Nec *tŏta* pars homo terrai, *quŏta tŏtius* unus. Lucret.
11. Inferitur verò ex fœtu nucis *arbŭtus* horrida. Virg.

21. Words ending in *itus* lengthen the penultimate; as aurītus, crinītus, invītus, perītus.

Fac jam tu, præco, nunc omnem *aurītum* populum. Plaut.

1. Except

1. Except [1]anhelītus, [2]ſervītus, [3]ſpirĭtus, and [4]ſuſpirĭtus.

2. Alſo [5]all adverbs in *itùs;* as humanĭtùs, penĭtùs.

3. [6]Blĭtum is not derived from the termination *itus*, but from βλιτον, and therefore ſhortens the penultimate.

4. Alſo polyſyllabic participles in *itus*, not derived from preterites in *īvi;* as habĭtus, exercĭtus-a-um, and nouns derived from them; as habĭtus-ûs, and exercĭtus-ûs.

5. And the participles from the verb eo, and its compounds; as transĭtus-a-um, and their derivatives; as transĭtus-ûs; the participle ambītus is, however, long, and the noun ambĭtus-ûs ſhort.

1. & 4. Simul enunciato *ſuſpirĭtûs.* Vix ſuffero, hercle, *anhelĭtum.* — Plaut.
2. Apud me juſta et clemens fuerit *ſervĭtus.* — Ter.
3. Dum memor ipſe mei, dum *ſpirĭtus* hos reget artus. — Virg.
5. Inſequor, et cauſas *penĭtùs* tentare latentes. — Virg.
6. Apponunt rumicem, braſſicam, betam, *blĭtum.* — Plaut.

For the 4th and 5th exceptions, ſee the rules for polyſyllabic ſupines.

22. A vowel before final [1]*men*, [2]*mens*, [3]*mentum*, is long; as levāmen, clēmens, āmentum.

So acūmen, crīmen, flāmen, flūmen, grāmen, jurgāmen, volūmen, argūmentum, jūmentum, atrāmentum, and many others; the nouns compriſed by this rule being numerous.

1. *Flūminibus* ſalices, craſſique paludibus alni. — Virg.
2. Ego hanc *clēmentem* vitam, urbanum, atque otium. — Ter.
3. *Strāmenta* deſunt. Tollere hæc aranea. — Phædr.

1. Except [1]tămen, [2]colŭmen, [3]hўmen, [4]elĕmentum.

2. Alſo [5]alĭmentum, [6]docŭmen or docŭmentum, [7]emolŭmentum, [8]monĭmentum or monŭmentum, [9]regĭmen, [10]ſpecĭmen, [11]tegĭmen or tegŭmen and integŭmentum.

3. And ſuch verbs as frĕmo, gĕmo, &c. will naturally ſhorten the penultimate of frĕmens, gĕmens, &c.

Note.—The irregularity of ſuch words as monĭmentum, docŭmentum, &c. has been conſidered as ariſing from the ſupine of the ſecond or third conjugation; which originally, before the effect of ſyncope, is ſuppoſed to have generally been in *it m;* as moneo, monĭtum, monĭmentum; doceo, or dokeo, dokitum, and by ſyncope dok'-tum or doctum; whence dokĭmentum or docŭmentum, &c. But if theſe verbal nouns were primitively deducible from their ſupines, many of them muſt have ſubſequently aſſumed the characteriſtic of the infinitive preſent, as the *g* of regimen and tegimen will teſtify. See Salmon's Stemmata Latinitatis on the terminations *men* and *mentum*.

1. Sed *tămen* iidem olim curru ſuccedere ſueti. — Virg.
2. Bone cuſtos, ſalve; *colŭmen* verò familiæ. — Ter.
3. Vulgus *Hўmen Hўmenæe* vocat, fugit ille vocantes. — Ovid.
4. Doctores, *elĕmenta* velint ut diſcere prima. — Hor.
5. Atque ipſæ vitiis ſunt *alĭmenta* vices. — Ovid.
6. Et *docŭmenta* damus, qua ſimus origine nati. — Ovid.
7. Nullus in urbe locus, nulla *emolŭmenta* laborum. — Juven.
8. Hic dabat, hæredes *monĭmentum* ne ſequeretur. — Hor.
9. In quo conſilium vitæ, *regĭmenque* locatum eſt. — Lucret.
10. Hocc' etiam in primis *ſpecĭmen* verum eſſe videtur. — Lucret.
11. Iſtæc ego mihi ſemper habui ætati *tegŭmentum* meæ. — Plaut.

23. A vowel before final [1]*ma*, [2]*mes*, [3]*mis*, is long; as hāma, līmes, ſublīmis.

So agēma, dāma, fāma, plūma, poēma, rīma, rūma, sīma, ſquāma, ſpūma, ſtrūma, fōmes, trāmes, illīmis, cōmis, ſēmis, deplūmis, decirēmis, quadrirēmis, quinquerēmis, infāmis, and many others in each of theſe terminations.

1. Cum canibus timidæ venient ad pocula *dāmæ.* — Virg.
2. Excitat invalidas admoto *fōmite* flammas. — Lucan.
3. *Sublīmes* in equis redeunt, pacemque reportant. — Virg.

1. Except [1]cŏma, [2]cŏmes, [3]cucŭmis, [4]făme[s], [5]incolŭmis, [6]lacrўma, [7]nĭmis, [8]pyrămis.

2. Alſo the [9]derivatives[10] of anĭmus and decĭmus; as anĭma, exanĭmis, decĭma or decŭma.

3. [11]Dynămis and [12]endrŏmis have their penultimate regulated by the Greek ſhort α and ο; as δύναμις, ἐνδρομὶς.

1. *Cŏmuntur* noſtræ, matre jubente, *cŏmæ.* — Ovid.
2. Jamque *cŏmes* ſemper magnorum prima malorum. — Lucan.
4. Sæva *fămes* aderat: nulloque obſeſſus ab hoſte. — Lucan.
3. Cæruleus *cucŭmis*, tumidoque cucurbita ventre. — Propert.
5. Fecit; et *incolŭmis* lætor quòd vivit in urbe. — Hor.
6. Cogat et invitam *lacrўmas* ſiccare cadentes. — Propert.
7. Fortuna multis dat *nĭmis*, ſatis nulli. — Mart.
8. Non mihi *pyrămidum* tumulis evulſus Amaſis. — Lucan.
9. Tantùm *anĭmas*, nobis *anĭmum* quoque; mutuus ut nos. — Juven.
10. Tibi propino *decŭma* fonte: tibi tutè unde, ſi ſapis. — Plaut.
11. *Dynămin* domi habent maxumam. — Plaut.
12. Dona peregrinam mittimus *endrŏmida.* — Mart.

Note.—Ainſworth refers to Plaut. Trinum. 3. 3. 15. for colŭmis. Taubmanni edit. anno 1621, has "Columen te ſiſtere illi, et detraxe autument." The editions of Lambinus and Camerarius have alſo colŭmen, according to the moſt ancient MSS. and editions. Facciolatus conſiders colŭmis to be of doubtful authority: it cannot, therefore, be admitted as an exception to this rule. For columen, ſee rule 22, No. 2.

24. I or Y, or a vowel derived from the ſhort increment of the genitive, before final *mo* or *mor*, is ſhort; as anĭmo, æſtĭmo, decĭmo, lacrўmo, and hiĕmo from hiems-ĕmis.

Quo redit ad faſtos, et virtutem *æſtĭmet* annis. — Hor.

Except [1]līmo and [2]rīmor.

1. *Līmat* non odio obſcuro morſuque venenant. — Hor.
2. Dulcibus in ſtagnis *rīmantur* prata Caÿſtri. — Virg.

25. Other vowels before final *mo* or *mor* are long; as clāmo, nēmo, prōmo, sūmo.

So fāmo, ſquāmo, tēmo, dēmo, poſtrēmo, fūmo, irrūmo, ſpūmo, rūmor, &c.

Excutit et longe lapſum *tēmone* relinquit. — Virg.

Except [1]ămo, [2]autŭmo, [3]crĕmo, [4]dŏmo, [5]ĕmo, [6]frĕmo, [7]gĕmo, [8]hŏmo, [9]prĕmo, [10]trĕmo, [11]tŭmor, [12]vŏmo.

1. Votum in *ămante* novum; vellem, quod *ămamus* abeſſet. — Ovid.
2. Neque ſe id pigere, et deinde facturum *autŭmat.* — Ter.
3. Atque omnem ornatum, flammâ crepitante, *crĕmari.* — Virg.
4. Non anni *dŏmuere* decem, non mille carinæ. — Virg.
5. Si quis *ĕmat* citharas, emptas comportet in unum. — Hor.
6. Poſt tergum nodis, *frĕmit* horridus ore cruento. — Virg.
7. Parte flagellari *gĕmuit* ſua robora caudæ. — Ovid.
8. *Hŏmo* ſum; humani nihil à me alienum puto. — Ter.
9. Ignoſci; *prĕmit* ille graves interritus iras. — Lucan.
10. Tempeſtas concuſſa *trĕmit*, *frĕmituſque* moventur. — Lucret.
11. Cuſtodum et nullo ſepta *tŭmore*, placet. — Propert.
12. Mane ſalutantum totis *vŏmit* ædibus undam. — Virg.

Note.—Comō-ĕre follows the general rule; but cŏmo-āre, a verb *ſeldom* uſed, ſhortens the penultimate: both are derived from cŏma.

26. A vowel before final *lo* or *lor* is long; as cālo, cēlo, pīlo, sōlo.

So hālo, mālo, vēlo, sīlo, nōlo, pālor, sōlor, pecūlor, and ſeveral others.

Excipit, ac feſſos opibus *ſōlatur* amicis. — Virg.

1. Except [1]ălo, [2]călor, [3]cŏlor, dŏlo ([4]noun or [5]verb), [6]dŏlor, [7]mŏlo, [8]ventĭlo, [9]vŏlo, and [10]cŏlo-ĕre, to cultivate, but [11]cōlo-are, to filter, follows the general rule.

2. Alſo the penultimate of [12]conſŭlo is ſhort, from conſul-ŭlis; ſo [13]gĕlo from gĕlu, and [14]aſſimĭlo from ſimĭlis.

3. Except

3. Except alſo [15]verbs in *ulo* or *ulor*, which are generally derived from diminutives in *ulus*; as circŭlo, circŭlor, from circŭlus.

1. Tutius et geminos anxia mater *ălit*. Propert.
2. Et *cŏlor* extremus primo cum frigore mixtus. Lucret.
3. Mille trahens varios adverſo Sole *cŏlores*. Virg.
4. Pila manu, ſævoſque gerunt in bella *dŏlones*. Virg.
5. Materiemque *dŏlare*, levare ac radere tigna. Lucret.
6. Nulla fides damnis, veriſque *dŏloribus* adſit. Hor.
7. *Mŏlendum* uſque in piſtrino; vapulandum; habendæ compedes. Ter.
8. *Ventĭlet* æſtivum digitis ſudantibus aurum. Juven.
9. Cæpere: alternos Muſæ meminiſſe *vŏlebant*. Virg.
10. Ignem Trojanum, et Veſtam *cŏlit* Alba minorem. Juven.
11. Et *cōlare* vagos inductis retibus amnes. Manil.
12. Utrique; id oro te, in commune ut *consŭlas*. Ter.
13. Nec Pallas ſpectare poteſt: vultuſque *gĕlaſſent*. Lucan.
14. Grandia ſi parvis *aſſimĭlare* licet. Ovid.
15. Licèt ſuperbus *ambŭles* pecuniâ. Hor.

Note.—Ainſworth has bombīlo, which ſhould be bombito. See Facciolatus.

27. A vowel before final [1]*bes* and [2]*ges* is long; as nūbes, ambāges.

So lābes, tābes, pūbes, compāges, impāges, ſtrāges, frūges, &c.

1. Sub pedibus videt *nūbes* et ſidera Daphnis. Virg.
2. Jam catervatim dat *ſtrūgem* atque aggerat ipſis. Virg.

Except [1]hĕbes, [2]indĭges, [3]lĕbes, [4]sĕges, and [5]tĕges.

1. Utque *hĕbeti* pectus tantummodo contudit ictu. Ovid.
2. Dii patrii *indĭgetes* et Romule Veſtaque mater. Virg.
3. Tertia dona facit geminos ex ære *lĕbetes*. Virg.
4. Illa *sĕges* demum votis reſpondet avari. Virg.
5. Inſtitor hybernæ *tĕgetis*, niveique cadurci. Juven.

28. A vowel before final [1]*des* and [2]*pes* is ſhort; as fĭdes, tăpes.

So analectĭdes, anterĭdes, hyădes, pleiădes, sŭdes, and all maſculine patronymics, according to the firſt rule; ſo alſo ăpes, dăpes, trăpes, and the following compounds of pes, bĭpes, trĭpes, quadrŭpes, centĭpes, antipŏdes, celerĭpes, gracilĭpes, alĭpes, levĭpes, ſonĭpes, cornĭpes, ignĭpes, longĭpes, lorĭpes, palmĭpes, ſolidĭpes, caprĭpes, &c.

1. Mens bona, fama, *fĭdes*, hæc clarè, et ut audiat hoſpes. Perſ.
2. Inſtratos oſtro *alĭpedes* pictiſque *tăpetis*. Virg.

1. Except [1]clādes, [2]sēdes, [3]rūpes, [4]sēpes, and [5]ſtīpes.

2. And though we are without poetic authority for carcinōdes, caulōdes, horminōdes, yet their penultimate is evidently long from the Greek ω; ſo epōdes; as καρκινώδες, καυλώδης, ὁρμινῶδης, ἐπῳδής.

1. *Clādibus* irruimus nocituraque poſcimus arma. Lucan.
2. Ducit ad infernas per multa ſilentia *sēdes*. Ovid.
3. Ille, velut pelagi *rūpes* immota reſiſtit. Virg.
4. Texendæ *sēpes* etiam, et pecus omne tenendum eſt. Virg.
5. *Stīpitibus* duris agitur *sŭdibuſque* præuſtis. Virg.

Note.—The claſſical exiſtence of trūdes ſeems not to be ſatisfactorily proved: Ainſworth and Facciolatus cite only one authority, Tacit. Ann. 3. 46, where commentators propoſe sŭdes, as a better reading.

29. A vowel before final [1]*dex*, [2]*dix*, [3]*lex*, [4]*mex*, [5]*nix*, or [6]*rex*, is long; as cōdex, rādix, īlex, cīmex, jūnix, cārex.

So jūdex, lōdix, ſpādix, hālex, pūlex, pūmex, rāmex, tōmex, rēmex, mūrex, sōrex, &c.

1. Inde porrò ad puteum, atque ad robuſtum *cōdicem*. Plaut.
2. Pronus ab arboreâ cecidit *rādice* retentus. Ovid.
3. Procumbunt piceæ, ſonat icta ſecuribus *īlex*. Virg.
4. Cui domus et dulces latebroſo in *pūmice* nidi. Virg.
5. Quàm mox horſum ad ſtabulum *jūnix* recipiat ſe e pabulo. Plaut.
6. Et Calabrûm coxit vitiato *mūrice* vellus. Perſ.

Except [1]cŭlex, [2]sĭlex, and [3]rŭmex.

1. Tota abit hora. Mali *cŭlices*, ranæque paluſtres. Hor.
2. Spem gregis, ah! *sĭlice* in nudâ connixa reliquit. Virg.
3. Apponunt *rŭmicem*, braſſicam, betam, blitum. Plaut.

Note.—Alex, in the beſt authors and editions, is read alec, and is therefore no exception to this rule.

30. A vowel before final [1]*per* and [2]*ter* is ſhort; as sŭper, arbĭter.

So ăper, căper, ĭter, lăter, accipĭter, diamĕter, păter, Jupĭter, Dieſpĭter, and all adverbs in *ter*; as alĭter, amplĭter, acrĭter, celerĭter, and many others.

1. Dum juga montis *ăper*, fluvios dum piſcis, amabit. Virg.
2. Non locus effuſi latè maris *arbĭter*, auſert. Hor.

1. Except [1]nūper, [2]āter, [3]frāter, [4]māter, [5]crāter, [6]dēter, [7]tēter.

2. Uter-tra-trum follows the general rule; but [8]ūter-tris, a bag, lengthens the penultimate.

3. Alſo [9]sōter from σωτηρ, of which the poets give no example, except through its derivative sōteria.

1. Nunc huc remiſit *nūper* ad me epiſtolam. Plaut.
2. Calculus immitem dimittitur *āter* in urnam. Ovid.
3. Cui volet, importunus ebur; *frāter*, *pāter*, adde. Hor.
4. Cui *māter* mediâ ſeſe tulit obvia ſylvâ. Virg.
5. Tum *pāter* Anchiſes magnum *crātera* coronâ. Virg.
6. Nam *dēteriores* omnes ſumus licentiâ. Ter.
7. *Tēter* ut immundæ carnis abiret odor. Mart.
8. Mollibus in pratis unctos ſalire per *ūtres*. Virg.
9. Nam quoties ſurgis, *sōteria* poſcis amicos. Mart.

31. A vowel before final [1]*ba*, [2]*bo*, [3]*pa*, [4]*po*, is ſhort; as făba, bĭbo, săpa, nuncŭpo.

So jŭba, ſyllăba, cĭbo, prŏbo, glŏbo, cŭbo, arrhăbo, ſcăbo, nĕpa, lŭpa, pŏpa, upŭpa, alăpa, crĭpa, legicrĕpa, metŏpa, crĕpo, ſtrĕpo, căpo, occŭpo, emancĭpo, partĭcĭpo, antĭcĭpo, &c.

1. Denſa *jŭba*, et dextro jactata recumbit in armo. Virg.
2. Non auro, myrrhaque *bĭbunt*: ſed gurgite puro. Lucan.
3. Et Laletanæ nigra lagena *săpæ*. Mart.
4. Adſidet, et totum prope ſlucibus *obcŭpat* amnem. Lucret.

Except [1]glēba, [2]ſcrība, [3]ſcrībo, [4]lībo, [5]nūbo, [6]būbo, [7]cēpa, [8]rāpa, [9]ſcōpa, [10]clēpo, [11]ſtīpo.

1. Liquitur, et Zephyro putris ſe *glēba* reſolvit. Virg.
2. Linquimus, inſani ridentes præmia *ſcrībæ*. Hor.
3. Sumite materiam veſtris, qui *ſcrībitis* æquam. Hor.
4. Purpureoſque metunt flores, et flumina *lībant*. Virg.
5. Iis *nūbant*, et illos ducere eadem hæc lex jubet. Ter.
6. Solaque culminibus ferali carmine *būbo*. Virg.
7. Cædenda eſt hortis eruta *cēpa* meis. Ovid.
8. Hæc tibi brumali gaudentia frigore *rāpa*. Mart.
9. Vilibus in *ſcōpis*, in mappis, in ſcobe, quantus. Hor.
10. Qui hæc habent conſilia; ubi data occaſio eſt, rape, *clēpe*, tene, harpaga. Plaut.
11. *Stīpant*, et liquido diſtendunt nectare cellas. Virg.

Note.—Cūpa, ſtūpa, and pūpa, are ſometimes more properly ſpelled cuppa, ſtuppa, puppa; ſince this latter orthography deſignates their quantity, and is more conſiſtent with their derivation from κυββα, (French couppe,) στυππη, &c. Cōpa and cōpo ſeem corrupted readings for caupo, which the more accurate editions ſubſtitute.

32. A vowel before final *ga* is long; as ſtēga.

So aurīga, bīga, quadrīga, collēga, sāga, pȳga, rūga, ſanguiſūga, folipūga, &c.

At Novius *collēga* gradu poſt me ſedet uno. Hor.

Except [1]calĭga, [2]oſſifrăga, tŏga, and the [4]derivatives of fŭgo, as fŭga, perfŭga, lucifŭga, lucrifŭga.

1. Caſar cognomen *calīgæ* cui caſtra dederunt. Auſon.
2. Adcipitres, atque *oſſifrāgæ*, mergeique, marinis. Lucret.
3. Lis numquam, *tŏga* rara, mens quieta. Mart.
4. Quâ venti incubuere, *fŭgam* dant nubila cœlo. Virg.

33. A vowel before final *go* is long; as imāgo, orīgo, inſtīgo.

So ærūgo, rūgo, aurīgo, fulīgo, compāgo, cartilāgo, conſilīgo, calīgo, fīgo, mīgo, heſperūgo, sūgo, ſuffrāgo, &c.

Adſpirate meis, primâque ab *origine* mundi. Ovid.

1. Except [1]ĕgo, [2]fŭgo, [3]harpăgo, lĭgo ([4]noun or [5]verb), [6]rĕgo, [7]rĭgo, [8]rŏgo, [9]ſtrĭgo, [10]tĕgo.

2. Alſo [11]congrĕgo is ſhort, from grex-grĕgis; and [12]jŭgo, from jŭgum.

3. [13]Lĕgo-ere of the third conjugation ſhortens the penultimate; but [14]lēgo-are, of the firſt, lengthens it.

4. Except alſo [15]ăgo, and its [16]compounds; as nĕgo, navĭgo, litĭgo, mitĭgo, &c. It is to be obſerved, however, that when the [17]compound has been formed by ſyncope or craſis, the penultimate, according to the rule for contracted ſyllables, becomes long; as fatīgo, from fatum or affatim and ago; indāgo, from inde and ago; farrāgo, from farre and ago; vertīgo, from vertendo and ago; caſtīgo, from caſtum and ago; dēgo, from de and ago, &c.

1. & 12. Quas ĕgo non gentes, quas non face corda *jŭgavi*. Stat.
2. Trans pontum *fŭgat*, et terris immitit apricis. Virg.
3. Conſulit blandiloquentulus, *harpăgo*, mendax, cuppes, avarus. Plaut.
4. Longis purgare *lĭgonibus* arva. Ovid.
5. Diſſociata locis concordi pace *lĭgavit*. Ovid.
6. Pacatumque *rĕget* patriis virtutibus orbem. Virg.
7. Prata *rĭget* fons interdum, campiſque redundet. Lucret.
8. Sacerdos, id faciam; atque aquam hinc de proximo *rŏgabo*. Plaut.
9. Namque ubi *ſtrĭgandum* eſt, et ubi currendum, ſcio. Phædr.
10. Superba jactas, *tĕgere* quod debet pudor. Phædr.
11. Inde ea comprendunt inter ſe, conque *grĕgantur*. Lucret.
13. Qui *lĕgitis* flores, et humi naſcentia fraga. Virg.
14. Quin potiùs, quod *lēgatum* eſt tibi negotium. Plaut.
15. Et potum, paſtas *ăge*, Tityre, et inter *ăgendum*. Virg.
16. Hoc etiam ſævas paulatim *mitĭgat* iras. Ovid.
17. Conſiliis animum *fatīgas*? Hor.

34. A vowel before final [1]*gus*, [2]*gum*, or [3]*gium*, is ſhort; as pelăgus, jŭgum, navĭgium.

So aſparăgus, catalŏgus, confrăgus, naufrăgus, oſſifrăgus, dialŏgus, epilŏgus, etholŏgus, elĕgus, lucifŭgus, indĭgus, noctivăgus, măgus, rŏgus, the noun săgus or săgum; conjŭgium, elŏgium, fortilĕgium, naufrăgium, prodĭgium, diffŭgium, perfŭgium, horolŏgium, remĭgium, ſacrilĕgium, aquilĕgium, confŭgium, &c.

1. Materiæ tanto in *pelăgo*, turbâque alienâ? Lucret.
2. Robuſtus quoque jam tauris *jŭga* ſolvet arator. Virg.
3. Excipe *naufrăgium* non duro littore noſtrum. Ovid.

1. Except fāgus, [2]frāgum, [3]frīgus, [4]pāgus, and the adjective [5]sāgus.

2. Alſo [6]contāgium, [7]faſtīgium, [8]ſuffrāgium, [9]veſtīgium.

3. And [10]chorāgus, [11]chorāgium from χορηγος, χορηγιον; and [12]pædagogus from ἄγω.

1. Tityre, tu patulæ recubans ſub tegmine *fāgi*. Virg.
2. Arbuteos fœtus, montanaque *frāga* legebant. Ovid.
3. Ante focum, ſi *frīgus* erit, ſi meſſis in umbrâ. Virg.
4. Quàm ſi me toto laudet vicinia *pāgo*. Juven.
5. Ipſe nihil certum *sāgis* clangoribus æther. Stat.
6. Nec mala vicini pecoris *contāgia* lædent. Virg.
7. Ambages; ſed ſumma ſequar *faſtīgia* rerum. Virg.
8. Libera ſi dentur populo *ſuffrāgia*, quis tam, &c. Juven.
9. Pauca tamen ſuberunt priſcæ *veſtīgia* fraudis. Virg.
10. Ipſe ornamenta a *Chorāgo* hæc ſumpſit ſuo periculo. Plaut.
11. Nam hoc pœne iniquum eſt Comico *chorāgio*. Plaut.
12. Mihi *pædagōgus* fuerat, quaſi uti mihi foret. Plaut.

35. A vowel before final [1]*va*, [2]*ve*, [3]*ves*, [4]*vis*, [5]*vo*, [6]*vus*, is long; as clāva, proclīve, dīves, cīvis, pāvo, rīvus.

So cēva, convīva, dīva, gingīva, pāva, prærogatīva, ūva, æſtīva, olīva, conclāve, nēve, clāvis, ſuāvis, nāvis, rāvis, acclīvis, declīvis, proclīvis, vīvo, prāvo, rīvo, nāvo, prīvo, æſtīvo, flāvus, ignāvus, æſtīvus, dīvum, ōvum, prāvus, and all adjectives ending in *īvus*, which are numerous.

1. Duceret apricis in collibus *ūva* colorem. Virg.
2. Currere per totum pavidi *conclāve* magiſque. Hor.
3. *Dīves* agris, *dīves* poſitis in fœnere nummis. Hor.
4. Nec prohibent *clāves*, et canis ipſe tacet. Tib.
5. Ulceris os; alitur vitium, *vīvitque* tegendo. Virg.
6. Tam ficti *prāvique* tenax, quàm nuncia veri. Virg.

1. Except [1]ăvis, [2]brĕvis, [3]grăvis, [4]lĕvis, [5]ŏvis.

2. Alſo [6]căvo, [7]grăvo, [8]jŭvo, [9]lăvo, [10]lĕvo, [11]nŏvo, [12]ŏvo.

3. And [13]ăvus, [14]căvus, [15]făvus, [16]nŏvus.

1. Fiet aper, modò *ăvis*, modò ſaxum, et, cum volet, arbor. Hor.
2. Vitæ ſumma *brĕvis* ſpem nos vetat inchoare longam. Hor.
3. Reddit, ubi Æoliden ſaxum *grăve* Siſyphon urget. Ovid.
4. Ante *lĕves* ergo paſcentur in æthere cervi. Virg.
5. Inſtituit, Pan curat *ŏves*, *ŏviumque* magiſtros. Virg.
6. Dura tamen molli ſaxa *căvantur* aquâ. Ovid.
7. Unde *grăvet* pennas; ſi celſior ignis adurat. Ovid.
8. Temperie cœli, corpuſque, animuſque *jŭvantur*. Ovid.
9. Prandeo, poto, cano, ludo, *lăvo*, cœno, quieſco. Mart.
10. Cantantes ut eamus, ego hoc te faſce *lĕvabo*. Virg.
11. Nec remorantur ibei: ſic rerum ſumma *nŏvatur*. Lucret.
12. Quo nunc Turnus *ŏvat*, ſpolio gaudetque potitus. Virg.
13. Stat fortuna domus et *ăvi*, numerantur *ăvorum*. Virg.
14. Sed tùm fortè *căvâ* dum perſonat æquora conchâ. Virg.
15. Mella *făvis*, illi tiliæ atque uberrima pinus. Virg.
16. Pura *nŏvum* vati laurea mollit iter. Propert.

36. A vowel before final *ca* is long; as ſpīca, formīca, feſtūca.

So antīca, apīca, cloāca, carrūca, currūca, erīca, mīca, myrīca, lactūca, lectīca, noctilūca, rīca, rubrīca, lorīca, pīca, paſtināca, phōca, ſambūca, ſīca, urtīca, veſtīca, &c.; and ſeveral ending in *theca*, from θήκη, as apothēca, bibliothēca, oporothēca, &c.

Parvula nam exemplo eſt, magni *formīca* laboris. Hor.

Except [1]alĭca, [2]braſsĭca, [3]fulĭca, [4]mantĭca, [5]pertĭca, [6]tunĭca, [7]falarĭca or phalarĭca, [8]dĭca.

1. Nos *alĭcam*, multum poterit tibi mittere dives. Mart.
2. Me notat, et junco *braſsĭca* vincta levi. Propert.
3. In ſicco ludunt *fulĭcæ*, notaſque paludes. Virg.
4. *Mantĭca* cui lumbos onere ulceret, atque eques armos. Hor.
5. *Pertĭca* dat plenis immitia vulnere ramis. Ovid.
6. Sufficiunt *tunĭcæ* ſummis Ædilibus albæ. Juven.
7. Sed magnum ſtridens contorta *falarĭca* venit. Virg.
8. Cedò dum, en unquam injuriarum audiſti mî ſcriptam *dĭcam*. Ter.

Note.—1. Aphăca is rather aphăce-es from ἀφάκη, and therefore does not relate to this rule.

2. And ſince adjectives in *icus* ſhorten the penultimate; wherever the termination *ica* is derivable from an adjective in *icus*, though the adjective itſelf be not in uſe, the penultimate is ſhort by derivation; as,

Piratĭca from piraticus; *i. e.* ars piratæ piratĭca.
Fabrĭca from fabricus; *i. e.* officina fabri fabrĭca.
Flaminĭca from flaminicus; *i. e.* fœmina flaminis flaminĭca.
Manĭca from manus; *i. e.* veſtis manûs manĭca.
Pedĭca from pedicus; *i. e.* catena pedis pedĭca.
Lucanĭca from Lucanicus; *i. e.* eſca Lucanorum lucanĭca.
Bucolĭca from bucolicus; *i. e.* carmina βουκολιαστῶν bucolĭca.
Baſilĭca from baſilicus; *i. e.* aula βασιλέως βασιλικὴ vel baſilica.
Arithmetĭca from arithmeticus; *i. e.* τέχνη ἀριθμῶν arithmetica.
Mnemonĭca from μνημονικὸς; *i. e.* τέχνη μνήμης μνημονικὴ.

37. Words

37. Words ending in [1]*aris* or [2]*are* lengthen the penultimate; as alāris, altāre.

So agricolāris, peculiāris, nāris, alveāre, capillāre, plantāre, quāre, and many others.

1. Sufpiciens, patulis captavit *nāribus* auras. Virg.
2. Sufpicit exigui lætum *plantāribus* horti. Juv.

Except [1]hilăris, [2]bimăris, [3]canthăris, [4]cappăris, [5]măre, and [6]dăre.

1. Oderunt *hilărem* triftes, triftemque jocofi. Hor.
2. Aut Ephefum *bimărifve* Corinthi. Hor.
3. *Canthăridum* fuccos, dante parente, bibas. Ovid.
4. *Cappărin*, et putri cepas alece natantes. Mart.
5. Ante *măre* et tellus, et quod tegit omnia cœlum. Ovid.
6. See, for *dăre*, the verbal increment in *a*.

38. Words ending in [1]*elis*, [2]*elus*, [3]*ela*, [4]*elum*, [5]*osus*, [6]*udus*, [7]*ator*, *utor*, lengthen the penultimate; as fidēlis, phasēlus, fuadēla, prēlum, fumōfus, sūdus, orātor, ūtor.

So crudēlis, carduēlis, patruēlis, candēla, loquēla, querēla, corruptēla, cicindēla, clientēla, muftēla, nitēla, Philomēla, parallēlus, polymēlus, arenōfus, formōfus, luctuōfus, perniciōfus, nūdus, crūdus, lūdus, ūdus, and many others.

1. Nunquam eft *fidēlis* cum potente focietas. Phædr.
2. Et circum pictis vehitur fua rura *phasēlis*. Virg.
3. Qualis populeâ mærens *Philomēla* fub umbrâ. Virg.
4. & 5. Colaque *prēlorum fumōfis* deripe tectis. Virg.
6. Quid Nero tam fævâ, *crudāque* tyrannide fecit? Juven.
7. Hinc altâ fub rupe canet *frondātor* ad auras. Virg.
8. Nec foleas fecit; *sūtor* tamen eft fapiens. Qui?— Hor.

39. Words ending in [1]*ober*, [2]*uber*, or [3]*aver*, lengthen the penultimate; as Octōber, falūber, papāver.

So fūber, tūber, ūber, hūber, pūber, cadāver, &c.

1. Te taceo, *Octōber* fœnere ditat agros. Aufon.
2. Quique frequens herbis et fertilis *ūbere* campus. Virg.
3. Lilia purpureis mifta *papāveribus*. Prop.

Except [1]colŭber and [2]rŭber.

1. Inque pruinofo *colŭber* diftenditur arvo. Lucan.
2. Crine *rŭber*, niger ore, brevis pede, lumine læfus. Mart.

40. Adverbs in [1]*tim* lengthen the penultimate; as oppidātim, virītim, tribūtim: except [2]ftătim.

1. Et velut abfentem *certātim* Actæona clamant. Ovid.
2. Nec fpernat auris, nec tamen credat *ftătim*. Phædr.

Note.—"Noftra Lexica, Gradufque ad Parnas. Pænultimam adverbii, *affātim*, longâ apice fignant. Nec eo inficias, quin poetæ degeneris Latinitatis eam produxerint." Vide tamen Lexicon Facciolati, ubi hanc obfervationem invenies, "Annianus poeta, apud Gell. l. 7. c. 7. ita difputat de quantitate penultimæ, ut ftatuat eam effe corripiendam: innuat, autem, olim etiam productam fuiffe: quod et ab Aratore factum eft. L. 2. in Ac. Apoftol. v. 326. Verùm non eft hoc fatis, ut contra communem ufum produci poffet."

41. Words ending in final *quus* are compounded with *æquus*, and therefore lengthen the penultimate; as antīquus, inīquus, oblīquus.

Terra *antīqua*, potens armis atque ubere glebæ. Virg.

Except relĭquus, which is not derived from æquus, and is therefore excepted.

Texantur *relĭqua* tecta palude tibi. Mart.

Note.—Though the real caufe of the penultimate of inīquus, antīquus, &c. being long, is the contraction of the *æ*, of æquus, from which they are derived, into *ī*, which is therefore long, according to the rule we have given for contraction: yet fince the above may be a more obvious diftinction than a latent caufe, we have not thought it improper to add it. And fince this remark is applicable to fome other terminations and examples, noticed in this analyfis, it is fufficient here, once for all, to give this general anfwer.

42. Words ending in *pōla*, or *pōlium*, being derived from πωλέω, lengthen the vowel before *l*; as bibliopōla, œnopōlium.

So myropōla, myropōlium, propōla, pharmacopōla, &c.

1. Sed qui me vendit *Bibliopōla* putat. Plaut.
2. Nam omneis plateas perreptavi, gymnafia et *myropōlia*. Plaut.

43. Words ending in [1]*areo*, [2]*arius*, [3]*erium*, [4]*orius*, lengthen the antepenultimate; as pāreo, cibārius, acrotērium, mefsōrius.

So āreo, clāreo, hordeārius, fextārius, librārius, mercenārius, herbārius, capiftērium, dictērium, ecclefiaftērium, nicetērium, fphæriftērium, adulatōrius, cenfōrius, and many others.

1. Vim geminam fentit, *pāretque* incerta duobus. Ovid.
2. In hunc diem jam tuus fum *mercenārius*. Plaut.
3. Omnibus arrides, *dictēria* dicis in omnes. Mart.
4. Quem *censōria* cum meo fevero. Mart.

1. Except [1]căreo, [2]vărius, and [3]nectăreus, from nectar-ăris.

2. Alfo [4]defidĕrium, from defidĕro; [5]magiftĕrium, from magiftĕr; and [6]miniftĕrium, from miniftĕr.

3. And the [7]derivatives of genitives increafing in fhort *ŏris*; as æquŏreus, arbŏreus, caftŏreus, corpŏreus, ebŏreus, marmŏreus, ftercŏreus, robŏreus, from æquor-ŏris, arbor-ŏris, caftor-ŏris, corpus-ŏris, ebur-ŏris, marmor-ŏris, ftercus-ŏris, robur-ŏris.

4. Except alfo fome [8]derivatives from o (omicron), as bŏreus, antibŏreus, hyperbŏreus, from βορέας.

1. Scilicet et morbis et debilitate *cărebis*. Juven.
2. Et *vărias* ufus meditando extunderat artes. Virg.
3. Attica *nectăreum* turbatis mella falernum— Mart.
4. Roma, domufque fubit, *defidĕriumque* locorum. Ovid.
5. Virtute, id factum, tuâ, et *magiftĕrio* tuo. Plaut.
6. Feffa *miniftĕriis* mulces, reparafque labori. Ovid.
7. *Arbŏreæ* frondes auro radiante nitentes. Ovid.
8. Vita procul patria peragenda fub axe *Bŏrea*. Ovid.

44. Words ending in [1]*aceus*, [2]*aseus*, [3]*aneus*, [4]*eneus*, [5]*oneus*, lengthen the antepenultimate; as teftāceus, cāfeus, fubitāneus, ahēneus, idōneus.

So arenāceus, hederāceus, hordeāceus, refināceus, cretāceus, arāneus, conditāneus, rejectāneus, collectāneus, bipedāneus, and many others.

1. Herbas utiliores *argillācea* terra. Var.
2. Pinguis et ingratæ premeretur *cāfeus* urbi. Virg.
3. Nec nebulam noctu, neque *arānei* tenuia fila— Lucret.
4. Si rectè facies: hic murus *ahēneus* efto. Hor.
5. Opportunus ita eft fi forte et *idōneus* aër— Lucret.

1. Except caftăneus, from caftănea.

*Caftăneæ*que nuces, mea quas Amaryllis amabat. Virg.

45. Words ending in *icius*, *icium*, or *itius*, fhorten the antepenultimate; as patrĭcius, ædifĭcium, ædilĭtius.

Patrĭcios omnes opibus cùm provocet unus. Juven.

So gentilĭcius, tribunĭcius, adventĭtius, factĭtius, aufpĭcium, judĭcium, artifĭcium, arufpĭcium, malefĭcium, benefĭcium, opifĭcium, extifpĭcium, harrufpĭcium, facrifĭcium, indĭcium, offĭcium, panefĭcium, and many others.

1. Except [1]novīcius, or novītius; and thofe which come from long fupines; as effutītius, from effutio, īre, īvi, ītum.

2. Alfo [2]convīcium, [3]līcium, and [4]nutrīcium, from nutrix-īcis.

1. Jam fedet in ripa tetrumque *novīcius* horret. Juv.
2. Neve in me ftolidæ *convīcia* funnere linguæ. Ovid.
3. Et prenfos domitare boves, et *līcia* telæ. Virg.
4. Omniaque infantum mixta *nutrītia* turba— Manil.

46. Words

46. Words ending in [1] *aticus*, [2] *atilis*, [3] *etudo*, [4] *atio*, [5] *utio*, lengthen the antepenultimate; as aquāticus, aquātilis, valētudo, feſtinātio, locūtio.

So pluviātilis, plicātilis, deſuētudo, cremātio, balbūtio, and many others.

1. Calcavêre pedis, nec ſolvit *aquāticus* Auſter. — Ovid.
2. Labitur occultè, fallitque *volātilis* ætas. — Ovid.
3. Gratia, fama, *valētudo* contingat abunde. — Hor.
4. Sceleſtæ hæ ſunt ædes, impia eſt *habitātio*. — Plaut.
5. *Balbūtit* ſcaurum, pravis fultum malè talis. — Hor.

Except ſome ending in *măticus*, from neuters in *ma-ătis;* as aromăticus, from aroma-ătis; rheumăticus, from ῥεῦμα-ατος; grammăticus, from γράμμα-ατος; and hepăticus, from hepar-ătis.

Grammăticas ambire tribus, et pulpita dignor. — Hor.

47. Abilis lengthens the antepenultimate; ſo does ibilis, when from long preterites in īvi; otherwiſe it ſhortens it, as amăbilis; expetībilis, from expeto, īvi, ītum; terrĭbilis, from terreo, ŭi, ĭtum.

Accipiam, cunctiſque meum *lætābile* factum. — Ovid.
Terrĭbili ſqualore Charon; cui plurima mento— — Virg.

48. [1] Abulum, [2] aculum, [3] ecula, lengthen the antepenultimate; [4] iculum, [5] icula, ſhorten it; as pābulum, gubernāculum, apēcula, ridĭculus, aurĭcula.

1. *Pābula* parva legens, nidiſque loquacibus eſcas. — Virg.
2. Omnia transformat ſeſe in *mirācula* rerum. — Virg.
3. Aut urſum, aut pugiles; his nam *plebēcula* gaudet. — Hor.
4. Quàm ex hoc *fontĭculo* tantundem ſumere. Eò fit. — Hor.
5. Humanum genus eſt avidum nimis *aurĭcularum*. — Lucret.

Except [1] perīculum, and [2] ſome long by derivation; as hædīculus, from hædīle; redimīculum, from redimio, īvi, &c.; lorīcula, from lorīca; poſtīculum, from poſtīcus; nutrīcula, from nutrix-īcis.

1. Sed tibi vexatæ per multa *pericula* vitæ. — Prop.
2. Et tunicæ manicas et habent *redimīcula* mitræ. — Virg.

49. Words ending in [1] *ācium*, [2] *ēlia*, [3] *fāriām*, lengthen the antepenultimate; as mendācium, pittācium, contumēlia, multifāriām.

1. Impercepta pia *mendācia* fraude latebant. — Ovid.
2. Quod quum inquinâſſent omni *contumēlia*. — Phædr.
3. Ut diſpartirem obſonium hic *bifāriam*. — Plaut.

50. Numerals ending in [1] *ni*, lengthen the penultimate; in [2] *ginti*, [3] *ginta*, [4] *gies*, and [5] *ēſimus*, the antepenultimate; as bīni, sēni, vicēni, ducēni, vīginti, octōginta, nonāgies, octōgies, vigēſimus, multēſimus.

So quīni, ſeptēni, octōni, novēni, undēni, duodēni, tredēni, &c.; quadrāginta, quinquāginta, &c.; quadrāgies, quinquāgies, &c.; trigēſimus, quadragēſimus, &c.

1. Bis *dēnas* Italo texamus robore naves. — Virg.
2. *Vīginti* tauros magnorum horrentia centum. — Virg.
3. *Trīginta* magnos volvendis menſibus orbes. — Virg.
4. Phœbus *nonāgies* illuceſcet polum utrumque. — Hipponac.
5. Bis jam pene tibi conſul *trigēſimus* inſtat. — Mart.

51. Words ending in [1] *ates*, [2] *itis*, [3] *otis*, [4] *ota*, and [5] *eta*, lengthen the penultimate; as vātes, vītis, caryōtis, diōta, mēta.

So crātes, penātes, mītis, chalcītis, pleurītis, ampelītis, arthrītis, caprītis, mephītis, caryōta, ceſtrōta, bēta, crēta, coſmēta, comēta, poēta, sēta, &c.

1. Cælicolæ, clarique ſuos poſuêre *penātes*. — Ovid.
2. Contuderit *vites*, ſeamve momorderit æſtas. — Hor.
3. Et notas *caryōtidas* theatris— — Mart.
4. O Thaliarche merum *diōtā*— — Hor.
5. Quorſum abeant ſani? *crētâ* an carbone notandi?— — Hor.

Except [1] pŏtis, [2] sĭtis, [3] nŏta, [4] rŏta, [5] drapĕta.

1. Quis *pŏtis* eſt, niſi vis animæ, quæ membra gubernat. — Lucret.
2. Depoſitura *sĭtim* vicini fontis in undâ. — Ovid.
3. A quo repulſus triſtem ſuſtinuit *nŏtam*. — Phædr.
4. Hîc neque tum ſolis *rŏta* cerni, lumine largo. — Lucret.
5. Conſtant, conferunt ſermones inter ſeſe *drapĕtæ*. — Plaut.

52. Laſtly; the following final ſyllables lengthen the preceding vowel, [1] *nar*, [2] *cal*, [3] *gal*, [4] *nal*, and [5] *tal;* as lacūnar, pulvīnar, cervīcal, vectīgal, Bacchānal, minūtal, and ſome others.

1. Meâ renidet in domo *lacūnar*. — Hor.
2. Tinge caput nardi folio, *cervīcal* olebit. — Mart.
3. Jurgatur verbis: ego *vectīgalia* magna. — Hor.
4. *Bacchānal* te exercuiſſe, quom qui ſis, alium rogites? — Plaut.
5. Heſternum ſolitus medio ſervare *minūtal*. — Juven.

53. Alſo, whatever terminations are naturally derivable from any of the preceding final ſyllables, lengthen or ſhorten, according to their primitive termination, their penultimate, or antepenultimate ſyllable; as maſculines ending in *ārius*, may form feminines in *āria*, and neuters in *ārium;* ſo *ōrius*, *ōria*, *ōrium;* *ētus*, *ēta*, *ētum*, &c. as ærārius, belonging to copper or braſs; ærāria, a copper mine; ærārium, a treaſury; hence roſārium, pomārium, muſcārium, meritōrium, quercētum, roſētum, palmētum, &c.

Note.—1. And it ſhould be recollected, that ſince compounds and derivatives follow the quantity of their primitives, the compounds and derivatives of ſuch words as form exceptions to any of theſe rules, will follow the general rule for the quantity of derivative words.

2. And it may be here neceſſary, finally, to remind the young proſodiah of the ſame rule, ſince the quantity of many vowels is explicable ſolely by this law, and requires no other direction; as ædilitius from ædilis; aliēnigena from aliēnus; contrādico from contrā; aliquātenus from aliquā, &c. Hence adjectives ending in *ax-ācis* form derivatives in *ăcia*, *ăcitas;* as capax-ācis, capăcitas, audax-ācis, audăcia: in the ſame manner genitives increaſing ſhort, ſhorten the correſponding vowel of the derivative; as cartilago-gĭnis, cartilagĭneus, cartilagĭnoſus. Thus preterites and ſupines having their penultimate long, lengthen accordingly the derivative vowel; as dormīto from dormio-īvi-ītum; condītio, condītitius from condio-īvi-ītum; ſo condĭtio, condĭtus, condĭtor from condo-dĭdi-dĭtum: hence arrīſio, arrīſor, audītio, definītio, are from arrideo-riſi-rīſum, &c. Thus words ending in *ālis* may form derivatives in *ālia*, *ālitas*, *āliter*, *ālitius*, *ālicutus;* hence cereālia, æquālitas, artificiāliter, canālitius, canāliculus, ariſe from the primitive termination *ālis:* and thus nouns in *ātio* have their derivatives in *ātiuncula;* as ædificātio, ædificātiuncula, &c.

54. I [1] before or [2] after *r*, is long; as īra, ſcrīnium.

1. *Īra* furor brevis eſt. Animum rege, qui niſi paret— — Hor.
2. Mixtaque *rīdenti* colocaſia fundet acantho. — Virg.

1. Except [1] hĭrudo, [2] hĭrundo, [3] rĭgo, [4] rĭgeo, [5] trĭbus, [6] vĭreo.

2. Alſo, *ri* followed by [7] *c* is ſhort; as frĭco, Afrĭcus, fabrĭco, lubrĭco, currĭculum; yet [8] lumbrīcus, [9] rubrīca, [10] trīcæ, and its derivative [11] extrīco, and [12] rīca, follow the general rule.

3. And *ri* followed by a vowel, is ſhort by the rule "a vowel before another," &c. as penurĭa.

1. Qualis volo, vetulos duo; jam ego me convortam in *hĭrudinem*— — Plaut.
2. Pervolat, et pennis alta atria luſtrat *hĭrundo*. — Virg.
3. Omnia quæ maria, ac terras, ſparguntque, *rĭgantque*. — Lucret.
4. Sanguine et igne micant oculi, *rĭget* horrida cervix. — Ovid.
5. Et ditant Latias tertia dona *trĭbus*. — Mart.
6. Quo ſeges in campo, quo *vĭret* uva jugo. — Prop.
7. *Afrĭcus* in glaciem frigore nectit aquas. — Prop.
8. Foras, foras, *lumbrīce*, qui ſub terrâ erepſiſti modò. — Plaut.
9. Non ſecùs ac ſi oculo *rubrīcam* dirigat uno. — Perſ.
10. Litibus, neque *trīcis:* quam ob rem ego argentum numerem foras? — Plaut.
11. Mercedem aut nummos unde unde *extrīcat*, amaras— — Hor.
12. Supparum, aut ſubminiam, *rīcam*, baſilicum, aut exoticum. — Plaut.

55. Y

55. Y before or after R, is long; as Butȳrum, collȳrium, papȳrus.

1. *Collȳræ* facite ut madeant et colliphia. Plaut.
2. Succinctus patriâ quondam Crifpine *papȳro*. Juven.

1. Except [1]lachrȳma, [2]lȳra, [3]corȳlus, [4]philȳra, [5]pȳrus, [6]fatȳra, [7]zephȳrus.

2. And the derivatives of ἄϱγυϱος; as hydrargȳros, lithargȳros.

3. See the 3d exception to the laft rule.

1. Et *lacrȳmis* fpargunt rorantibus ora genafque. Lucret.
2. Sit tibi Mufa *lȳræ* folers, et cantor Apollo. Hor.
3. Neve inter vites *corȳlum* fere; neve flagella. Virg.
4. Ebrius incinctis *philȳrâ* conviva capillis. Ovid.
5. Infere nunc, Melibœe, *pȳros*, pone ordine vites. Virg.
6. Sunt quibus in *Satȳrâ* videar nimis acer, et ultra. Hor.
7. At verò *Zephȳris* cum læta vocantibus æftas— Virg.

56. U [1]before or [2]after R, is long; as lūridus, ūro, rūmor.

1. Neglectis *ūrenda* filix innafcitur agris. Hor.
2. Quæ vos ad cœlum effertis *rūmore* fecundo. Hor.

1. Except [1]cŭrulis, [2]cærŭlus, [3]fŭro and fŭror, [4]frŭtex, [5]lemŭres, [6]nŭrus, [7]querŭlus, [8]rŭdis, [9]rŭdens, [10]rŭbeo, [11]rŭtilus, [12]rŭmex, [13]tugŭrium, [14]fatŭr-ŭra-ŭrum.

2. Except alfo *ri* in [15]genitives, increafing fhort in *ŭcis* or *ŭris*, and their derivatives; as crux-crŭcis, trux-trŭcis, augur-ŭris, murmur-ŭris, fulphur-ŭris, which give crŭcio, trŭcido, murmŭro, augŭrium, fulphŭreus, and the like.

3. Alfo, [16]meditatives in *ŭrio* and *luxŭrio*; as esŭrio: [17]other verbs in *urio* follow the general rule; as ligūrio, featūrio.

4. U before final *r*, and *ru* followed by a vowel, are regulated by the rules for thofe circumftances; as augŭr, fatŭr, rŭino.

1. Prætor adeft vacuæque loco ceffere *cŭrules*. Lucan.
2. Adnixi torquent fpumas, et *cærŭla* verrunt. Virg.
3. Quid *fŭris*? Aut quonam noftri tibi cura receffit? Virg.
4. Contexit illum *frŭtice*, et admonuit fimul. Phædr.
5. Nocturnos *lemŭres* portentaque Theffala rides? Hor.
6. Cinctaque adeft virgo matrum *nŭruumque* catervâ. Ovid.
7. Et nunquam *querŭli* caufa doloris abeft. Ovid.
8. Quem dixêre Chaos; *rŭdis* indigeftaque moles. Ovid.
9. Infequitur clamorque virûm, ftridorque *rŭdentum*. Virg.
10. Purpureis invecta rotis Aurora *rŭbebat*. Virg.
11. Robora complexus *rŭtilo* curvata metallo. Lucan.
12. Apponunt *rŭmicem*, braflicam, betam, blitum. Plaut.
13. Pauperis et *tugŭri* congeftum cefpite culmen. Virg.
14. Aut intus claufos *fatŭra* ad præfepia fervant. Virg.
15. Vultus in unum me *trŭces*. Hor.
16. Græculus *esŭriens*, in cœlum jufferis, ibit. Juven.
17. Tractavit calicem manibus, dum furta *ligūrit*. Hor.

57. [1]O and [2]U, before *m* are long; as vōmer, būmaftus.

1. Ingemere, et fulco attritus fplendefcere *vōmer*. Virg.
2. Quale folet fylvis *brūmali* frigore vifcum. Virg.

1. Except, to *o* before *m*, [1]cŏmeta, [2]cŏmedo, [3]ŏmitto, [4]tŏmaclum.

2. Alfo atŏmus, dŏmus, glŏmus, tŏmus (for which fee fect. 2, rule 5); cŏma, cŏmes (for which fee fect. 2, rule 23); dŏmo, hŏmo, and vomo; (for which fee fect. 2, rule 25.)

1. Non fecus ac liquida fi quando nocte *cŏmetæ*. Virg.
2. Ut libet: hæc porcis hodie *cŏmedenda* relinques. Hor.
3. Pleraque differat, et præfens in tempus *ŏmittat*. Hor.
4. Quod fumantia qui *tŏmacla* raucus. Mart.

3. Except, to *u* before *m*, [1]crŭmena, [2]cŭmulus, [3]hŭmerus, [4]nŭmella, [5]nŭmerus, [6]sŭmus, [7]tŭmeo.

4. Alfo, colŭmen, docŭmentum, emolŭmentum, tegŭmen (for which fee fect. 2, rule 22); hŭmus, poftŭmus (for which fee fect. 2, rule 5); cucŭmis (for which fee fect. 2, rule 23); and autŭmo; (for which fee fect. 2, rule 25.)

5. For circŭmeo and circŭmago, fee the rule for *m* final.

1. Quid eum velit, homo, *crŭmenam* fibi de collo detraxit. Plaut.
2. Exhauftum in *cŭmulos* omnifque in fluctibus unda eft. Lucan
3. Ipfe fubibo *hŭmeris*: nec me labor ifte gravabit. Virg.
4. Nervos, catenas, carceres, *nŭmellas*, pedicas boias. Plaut.
5. Rari quippe boni, *nŭmero* vix funt totidem, quot— Juv.
6. Alii fimul delinquunt, cenfores *sŭmus*. Phædr.
7. Igne micant oculi, corpus *tŭmet* omne veneno. Ovid.

58. U before *c* is long; as būcula, dūco, cadūcus.

Vidi ego labentes acies, et tela *cadūca*. Prop.

1. Except [1]lŭcellum, [2]lucerna, [3]nŭcleus, [4]volŭcer.

2. And in [5]genitives increafing fhort in *ŭcis*, and their derivatives; as dux-ŭcis, crux-ŭcis, trux-ŭcis; hence crŭcio, trŭcido, &c.

1. Quid purè tranquillet; honos, an dulce *lŭcellum*— Hor.
2. Hæc ego non credam Venufina digna *lŭcernâ*. Juv.
3. Mella dari, *nŭcleo*fque jubet, dulcefque placentas. Mart.
4. Interea *volŭcer* motis conterrita pennis. Petron.
5. Abftraxitque hominem in maximam malam *crŭcem*. Plaut.

59. Syllables indifferently fpelled with one or two confonants are long; as lītteræ or litteræ, lītus or littus, cūpa or cuppa, pūpa or puppa, ftūpa or ftuppa, fcīroma or fcirroma, ftlōpus or ftloppus or fcloppus, cōliphium or colliphium, which fhould invariably retain the double confonant, fince it is by pofition alone that they are long, by the confonant, and not by the vowel, reduplication.

60. Syllables indifferently fpelled with a fingle vowel, or a diphthong, are long; as tēda or tæda, prēlum or prælum, which latter orthography, the moft expreffive of the vowel quantity, it is better to retain.

61. Vowels derived from η, ω, ει, ου, are long, as hērōus, Sīrius, mūfa, from ἥϱως, σείϱιος, μοῦσα.

Note.—Many of thefe are already comprifed under the preceding rules; the principal words referrible *alone* to this rule, are cōlon, cratēra, hēpar, hēros, lēcythus, lēthum, lichen, ōde, rhētor, fpēlæum, fpēlunca, thēfauros, thōrax, theōria. To thefe we may add near 200 words of very rare occurrence, chiefly fignifying plants, herbs, ftones, minerals, &c. &c. as anthēdon, afclēpias, afplēnon, &c. Of thefe we would here infert our manufcript lift, but fince they are principally confined to fuch authors as Pliny, Celfus, Vitruvius, and Frontinus, they are matter rather of occafional reference, than of any grammatical rule.

62. Some words alike in orthography, differ in quantity *only* according to their fignification; as

1. . . . . Pōpulus arbor
2. . . . . Eft; notat et pŏpulus
3. . . . . . . Plebem. Sic mālos eft pro
4. . . . . . . Pravo; gignit item mălum.
5. . . . . . Navis mālus; mālina mālus,
6. . . Stirpe unâ produci poffint. Māla genam vult;
7. . . . . Māla poma. Et pālus
8. . . . . . Faciens păludis; eft ferè
9. . . . . Stagnum lacufve; at non tamen fic
10. . . . . Pālus notans sūdem. Nītor, nītenfque,
11. . . . . Nĭten; creatque nĭtor et nitens sĕcŭs.
12. . . . Pro tellure sŏlum; non ita sōlus aut
13. . . . Ab eo sōlùm. Plāga notione
14. . . . Retis vel oræ corripitur; licet
15. . . . Verberis aut vice vulneris, tu
16. . . Extendas ita plāgam. Pila fic in globuli lŏco
17. . . . . . . Contrahiturque: mole
18. . . Denotata, porrige pīlam: notat atque pilus
19. . . . . . . Aciei feriem miffileque;
20. . . . . Ea pīlum quoque, mallāmque terit. Sin
21. . . . . Vice crinis pilus eft; atque pīlo dat: pĭlo
22. . . . Significat fūrāri, non fŭrĕre. Et notat cōmāre
23. . . . Cæfariem gerere; fed cŏmĕre ornare eft cŏmam.
24. . . . Cōlāre aquam nos dicimus; || fed cŏlere arva, fons.

Note.

Note.—The above verſes not only furniſh the words relating to rule 62, but alſo, to unite two objects in one, they at the ſame time afford a ſpecimen of all the Horatian metre, which, to the claſſical ſtudent, may prove a uſeful compendium. It is, probably, only the ſecond production of the kind in print. The firſt is quoted by the two editors of Horace, Cruquius and Baxter, and, had its ſubject been as eligible as the deſign, the preſent would have been ſuperſeded. For a definition of the Horatian metres compoſing this ſpecimen, the reader may conſult Lyne's Latin Primer, (edit. 4th) page 246, or VERSIFICATION, in the ſequel of this work. The following, however, are the Horatian metres, as exemplified in the above lines: 1. An Adonic; 2. A dactylic penthemimer; 3. A Pherecratian tripodia; 4. A Glyconic choriambic; 5. Dactylic tetrameter; 6. An hexameter; 7. Iambic dimeter acephalous; 8. Iambic dimeter; 9 Iambic dimeter hypercatalectic; 10. Iambic trimeter catalectic; 11. Iambic trimeter; 12. An aſclepiad; 13. A Sapphic hendecaſyllabic; 14. A great Alcaic; 15. A ſmall Alcaic; 16. Alcaic choriambic; 17. Choriambic dimeter; 18. Epichoriambic tetrameter; 19. Ionic à minori trimeter; 20. Sapphic Ionic; 21. Ionic à minori tetrameter; 22. Dactylic heptameter; 23. Firſt elegiambic Archilochian; 24. Second elegiambic Archilochian. The remaining words alluded to by rule 62, are compriſed by the following hexameters.

25. Ad mediam noctem *sērum* producere poſſis;
26. Datque *sĕrum* tibi lac. *Sōpire* facit *sŏpor* omnes.
27. Ac ſoboles *pernĭcis*, uti *pernīciter*, eandem
28. Deductam vocalem extendunt. Perque *nĕcare*
29. *Pernĭciem* proleſque tibi dant. *Ācer* acutum
30. Denotat; arborem *ăcer* vult; atqui corripiuntur
31. Amborum ſoboles. *Prŏcĕres*, faciens *prŏcĕrum*, ſit
32. Pro magnatibus; et celſo *prōcērus*. Et *lābor*
33. *Lābi*; ſed *lăbi* *facta* *lăbore*; *lăboro*, *lăbare*.
34. Rurſus, *litteræ* uti *lĭqueant* tibi, diſcere poſſis
35. Ut liceat proferre, metalla *lĭquare*, *lĭquorem*,
36. *Līqui*. *Lūteum* et in *lŭteo* *lŭto* oleſcere *lūtum*.
37. *Īdem* *ĕădem*, necnon *ĭdem*, et in ſexto fit *eādem*.
38. *Līberi* uti ſint verò *lĭberi*, iis nihil extat
39. Utilius, quàm ut ſanctus *lĭber* hiſce *lĕgendus*
40. Sit, tunc his *lĭbertatem* *lēgalis*: ibīdem
41. Ut *mōres* *mŏni* poſſint ſolŭmque ſalutem
42. Æternamque *mŏrari*; quâ, *mŏrā* pernicioſa
43. Valde eſt; utque ita *mōri* *mŏrenturque* revera,
44. Diſcent. *Dēnique* hæc, *dīco*, mentique *dĭcanda*.

General Rule.

63. A vowel before a ſingle conſonant, not affected by any preceding or following rule, is ſhort; as săpio, sĭlĭqua, grăcĭlĭtas.

1. Attamen excipias hæc paucula, ceu, crocodīlus,
2. Ālea, fūlīgo, pīrāta, abſtēmius, ōlim,
3. Ārea, sōlenniſque vēnēficus, īlicet, īco,
4. Hībernus mācūtīnuſque fălārica, nōdus,
5. Clītellæ, bālœnaque, cōram, līlia, gluten,
6. Māturus, līmax, capitōlium, anōnymus, īlia,
7. Adduntur nīdor, vendēmia, flāgito, vēlox
8. Tībia, tībīcenque acadēmia, fībula, pāla,
9. Grādīvus, Māvors, Sāturnus, Jūpiter, Īris,
10. Pȳthon, Īdōla ethnica, vel crepitacula. Rurſus
11. Āla, repāgula, sēmi, sēmis, cōpia, fīlum,
12. Vīburnum, contāmino et āles crāpula, tālus,
13. Vītupero, mausōleum, māgālia, rāpum,
14. Cālīgo, sūgillo, mūlus, mūtuus, īdus,
15. Mētīri, bālīſtaque, fēlix, dēnuo, quālus,
16. Sōlicito, prīdem, ſic prīdie, et sīmia, sēpes,
17. Lāmina, tēmētum, irrītare, monēdula, mūgil,
18. Rhīnoceros, dūdum, nāſus, prævārĭcor, adde
19. Vārĭcor; invīto ceu vīto, sōlea, dōnec,
20. Jūniperuſque. Nec ōtia dantque nĕgōtia; sōlers
21. Eurīpus, grātus, pēnūria, pōcula, rhēda,
22. Ocius Īliadem, fīli perdiſce Hŏmēri;
23. Cūleus, et vībex, imbēcilliſque. Dat hīlum,
24. Progeniemque nīhil. Quàm ſæpe, heu! ducere poſſint
25. Nūgaces, nūgas, tricaſque. Cānōpus, asīlus,
26. Glūtīre ac vēcors, sōcors, exōticus, āēr,
27. Āēris ac āio quoque āio; vīpera, crēber,
28. Vāpulo; et audīre atque ōb, obēdīre efficiuntque
29. Adduntur gnōmon, vāgīre, bonāſus, ōmāſum,
30. Dīvidere, ac idiōta, ſināpis, trāgula, jūgis;
31. Corripiunturque hæc măceo, măcer; exprime prolem
32. Mācero: et adde vōco, quod vōcem, vōciferoque
33. Vōcalem variat, formatque vocabula. Plāco;
34. Plācatus plăceo plăcidus, plācabilis, unà
35. No nāvi nātum nāto, uti nōtum nōta, vādo
36. Atque vādum, nūbo unà pronŭba ſunt varianda.
37. Sic oblīviſcor et pecūlia, sīlus, aēdon,
38. Faſtīdire hālec, marsūpia, fābula, phrāſis,
39. Sībilo anīcetum ſquālere et ephēbus, iūlus,
40. Glōcire, ōceanus, pīpire, facētia, tūber,
41. Et cōlum, lībum, conchȳlia, ſtrāgula, tābum
42. Faux dat præſōeo, ſic veſpertīlio, pūpus,
43. Sēculum et adduntur sūſes et sēria rāſis
44. Rāvire ac ūdus mūgire et bālia, nāpus
45. Brāchia fēriæ anētha et anōdyna glōria thōrax
46. *Sīdera* cœlorum *consīdera*, opes meliores
47. Terrenis necnon *desīdera*, omitte minora.

Note—1. To confine the preceding rules to limits as ſhort as poſſible, 1ſt, the preceding rules and their exceptions relate only to words of pure or Auguſtan Latin. 2. Some terms of very rare occurrence, chiefly the names of plants, herbs, ſtones, foſſils, &c. near 300 in number, are omitted, as matters of occaſional reference, rather than of conſtant attention or grammatical rule.

2. We have now, after four conſecutive analyſes of the language, for the more complete information of the ſtudent, accompliſhed a taſk, perhaps never achieved before, nor, ſo far as we are acquainted, offered to the public, in any proſodial ſyſtem. And we can venture to affirm, that any perſon well acquainted with common proſody, and the rules of this ſection, will not, within the precincts of Auguſtan Latin, find a ſingle word, except the few of rare and unfrequent occurrence mentioned above, whoſe quantity is not regulated or accounted for by the rules now given. Thus, for the firſt time, we have reduced that, the majority of Latin quantity, by all preceding proſodians referred to a courſe of obſervation and practice alone, to a regular claſſification and ſyſtem. Would our limits permit, we would here, for the ſake of exemplification, take the words compriſed by any letter of the alphabet, and account for the quantity of each by the principles and criteria we have here conſidered.

3. It is almoſt neceſſary here to add, that the quantities of ſyllables are marked with very frequent inaccuracy in moſt of our common dictionaries. The poets are the only ſatisfactory teſt.

SECTION III.—*On final Syllables.*

1. A final, in words declined by caſes, is ſhort; as famă, regnă, lampadă.

Anchoră de prora jacitur: ſtant littore puppes. — Virg.

1. Except the ablative ſingular of the firſt declenſion; as hâc muſā, hoc Æneā.

2. The vocative ſingular from Greek nouns in *as*; as O Pallā, O Atlā.

1. Proſpiciens, *ſummā* placidum caput extulit *undā*. — Virg.
2. Non hæc, O *Pallā*, dederas promiſſa parenti. — Virg.

2. A final, in words not declined by caſes, is long; as amā, ultrā, prætereā.

1. Littus *amā* et lævas ſtringat ſine palmula cautes. — Virg.
2. *Intereā* magno miſceri murmure pontum. — Virg.

1. Except ită and ejă ſhort, and poſtea common.

2. Quia is generally ſhort, but ſince Phædrus lengthens it, we may pronounce it to be common.

3. Some proſodians quote puta, with the *a* ſhort, from Perſius, 4. 9. But the beſt editions have puto, a reading evidently preferable, in point both of ſenſe and grammar.

4. Though numerals in *ginta* are ſometimes found ſhort, approved authors lengthen the *a*; yet it may be well to recollect, that the Greek termination KONTA, whence the Latin *ginta* is evidently borrowed, has the final vowel ſhort; as

Τοις δ' ἁμα τεσσαρα KONTA μελαιναι νηες ἑποντο. — Hom.
[See many other inſtances in Iliad B.]

1. . . . Ferret ad aurigeræ caput arboris, *ejă*, per ipſum. — Val. Flac.
2. Tum ſic affatur regem, atque *ită* turbidus infit. — Virg.
3. Si auctoritatem *poſteā* defugeris. — Plaut.
4. *Poſteă* mirabar, cur non ſine litibus eſſet. — Ovid.
5. Haud, (equidem credo,) *quiă* ſit divinitus illis. — Virg.
6. Ego primam tollo, nominor *quiā* leo. — Phædr.
7. *Sexagintă* teras cum limina mane ſenator. — Mart.
8. *Trigintā* toto mala ſunt epigrammata libro. — Mart.

3. E

3. E final is ſhort; as natĕ, patrĕ, currĕ, nempĕ, antĕ.

Incipĕ, parvĕ puer, riſu *cognoſcerĕ* matrem. — Virg.

1. Except that ſinal E in all caſes of the [1] firſt and [2] fifth declenſion, is long; as Calliopē, Tydidē, Anchiſē, fidē; alſo [2] famē, originally of the fifth. Thus alſo, *rē, diē,* and their [3] compounds quarē, hodiē, pridiē, poſtridiē, quotidiē.

2. Alſo in [4] all nouns wanting the ſingular; as cetē, melē, tempē, pelagē, Greek neuters plural.

3. The ſecond perſon ſingular of the imperative of the [5] ſecond conjugation, has the E long; as docē, monē; but [5] cave, [6] vale, [9] vide [10], [7] reſponde [8], and [11] ſalve [12], have *e* common.

4. [13] Monoſyllables ending in E are long; as *ē, mē, tē, ſē, nē* (leſt or not) except [13] enclitics and ſyllabic adjectives; as *quĕ, nĕ, vĕ, ptĕ, cĕ, tĕ;* as nequĕ, quoquĕ, ſuaptĕ, hujuſcĕ, tutĕ, &c.

5. [14] Adverbs in *e* coming from nouns of the ſecond declenſion are long; as placidē, pulchrē, valdē or validē, &c. Except [15] benĕ, malĕ, [16] ſupernĕ, [16] infernĕ, magĕ.

6. [17] Fermē, [18] ferē, and [19] ohē, have *e* long.

1. Hanc tua *Penelopē* lento tibi mittit, Ulyſſe. — Ovid.
2. Et quamquam ſævit pariter *rabiēque, famēque.* — Ovid.
3. Quæ mens eſt *hodiē*, cur eadem non puero fuit? — Hor.
4. At *pelagē* multa, et late ſuſtrata videmus. — Lucret.
5. Vade, *valē*, *cavĕ* ne titubes, mandataque frangas. — Hor.
6. Idque, quod ignoti faciunt, *valĕ* dicere ſaltem. — Ovid.
7. *Reſpondē*, quibus amiſſas reparare queam res. — Hor.
8. Si quando veniet? dicet; *reſpondĕ*, poëta. — Mart.
9. Quid ſis nata *vidē*, niſi te quoque decipis ipſam. — Ovid.
10. *Vidĕ*, ne dolone collum compungam tibi. — Phædr.
[See alſo Perſ. 1. 108.]
11. Lector *ſalvē*. Taces, diſſimulaſque? Vale. — Mart.
12. *Salvĕ*, Pæoniæ largitor nobilis undæ. — Claud.
13. Vera, inquit; *nequĕ* me Argolica *dē* gente negabo. — Virg.
14. *Præcipuē*, cum jam hic trabibus contextus acernis. — Virg.
15. Nil *benĕ* cum facias, facis attamen omnia belle. — Mart.
16. Tecta *ſupernē* timent: metuunt *infernē* cavernas. — Lucret.
17. Mobilis et varia eſt *fermē* natura malorum. — Juven.
18. Jamque *ferē* ſicco, ſubductæ littore puppes. — Virg.
19. Importunus amat laudari? donec *ohē!* jam. — Hor.

4. I final is long; as dominī, claſsī, fierī, docerī, audī, ī, filī.

Ollī reſpondit rex *Albāī Longāī.* — Enn.

1. Except the *i* of Greek vocatives; as Alexĭ, Amaryllĭ, Thetĭ, Parĭ, Daphnĭ; but Simŏī, or ſuch as belong to nouns having *entos* in the genitive, are long.

2. Greek datives ſingular of the third declenſion, from nouns increaſing, are varied. Minoidĭ and Tethyĭ in Catullus, and Palladĭ in Statius, are ſhort.* Thetidī in Catullus, and Paridī and Tyndaridī in Propertius, are long; but Greek datives formed by contraction are always long; as Demoſthenī, metamorphoſī; alſo thoſe which come from the firſt declenſion in Greek; as Oreſtī, Euripidī.

3. Neuters in *i* are alſo ſhort; as gummĭ, melĭ, ſinapĭ.

4. Datives and ablatives plural of Greek nouns in *ſi* (*ſin* before a vowel) are ſhort; as heroiſĭ, Troaſĭ.

5. Mihi, tibi, ſibi are common. Alſo ibi, niſi, ubi and quaſi; but theſe laſt are more frequently ſhort.

* *Note.*—Theſe may be long by poetic licence, or by poſition; for the *i* of Greek caſes is naturally ſhort. Orphēī may be conſidered as a dactyl in Virgil. Ecl. 4. 57; and by ſynæreſis it is a ſpondee in the Georgics, 4. 535 and 553.

1. O crudelis *Alexī*, nihil mea carmina curas. — Virg.
2. *Palladī* littoreæ celebrabat Scyros honorem. — Stat.
3. *Troaſĭn* invideo, quæ ſi lacrymoſa ſuorum. — Ovid.
4. Non unquam gravis ære domum *mihī* dextra redibat. — Virg.
5. Extremum hunc, Arethuſa, *mihi* concede laborem. — Virg.

5. O final is common; as quando, Cato, leo, ambo, octo, amo, doceto.

1. Arma amens *capiō*, nec ſat rationis in armis. — Virg.
2. Non *amŏ* te, Sabidi; nec poſſum dicere quare. — Mart.

1. Except [1] monoſyllables, which are long; as ō, prō, dō, ſtō, and prōh, *h* not being accounted as a letter.

2. [2] Greek feminines ending in *o* are long; as Didō, Sapphō, Cliō.

3. O final in [3] datives and ablatives of the ſecond declenſion, is long; as ſomnō; to which add another ablative, as ergō, for the ſake of, ergo therefore belonging to the rule.

4. Alſo [3] Greek caſes, written in the original with omega; as Androgeō, Athō.

5. [4] Adverbs formed from nouns have the final *o* long; as ſubitō, meritō, multō; [5] and illō, quō, eō, and their compounds. Alſo citrō, intrō, retrō, ultrō. But the [6] following are ſometimes found ſhort, denuŏ, idcircŏ, ſerŏ, profectŏ, [9] poſtremŏ, the conjunction [10] verŏ, [11] porrŏ, to which ſome add ſedulŏ, crebrŏ, and mutuŏ. [12] Modŏ (uſed adverbially,) and its compounds are ſhort; as quomodŏ, dummodŏ, poſtmodŏ.

6. Though the final *o* of verbs, occaſionally by writers of a [7] ſecondary claſs, and more rarely by thoſe of the [5] Auguſtan age, has been made ſometimes ſhort, yet its derivation from the Greek omega, and the more general practice of the principal poets, make it long: the *o* of ſcio, [6] neſcio, puto, cito, and of the imperative cedo, only, are generally ſhort.

7. The gerund in *do*, in reality, being nothing elſe than the dative or ablative of the ſecond declenſion, is, accordingly, by all authors of the Auguſtan age, made long: the [17] exceptions to this rule are very few, and only by writers of an inferior claſs.

8. [18] Ambo, duo, imo, illico, ego, generally ſhorten *o* final.

1. *Prō* molli violâ, *prō purpureō* narciſſo. — Virg.
2. *Cliōque*, et Beroë ſoror, oceanides ambæ. — Virg.
3. In foribus letum *Androgeō*: tum pendere pœnas. — Virg.
4. Adde, quod iſte tuus, tam *rarō* prælia paſſus. — Ovid.
5. Uſque *a leōne* times, quem tu facis ipſe timendum? — Lucret.
6. *Idcircŏ* gemellum vocitarunt choriambon. — Terent.
7. *Idcircō* certis dimenſum partibus orbem. — Virg.
8. Imperium tibi *ſerŏ* datum: victoria velox. — Claud.
9. Et Scauros, et Fabricios; *poſtremŏ* ſeveros. — Juven.
10. Quod petimus: ſin *verŏ* preces et dicta ſuperbus. — Val. Flac.
11. Veſter *porrŏ* labor fæcundior hiſtoriarum. — Juven.
12. Hic inter denſas corylos *modŏ* namque gemellos. — Virg.
13. Horrida Romuleum certamina *pangŏ* duellum. — Enn.
14. *Prandeŏ, potŏ*, cano, ludo, *lavŏ, cœnŏ*, quieſco. — Mart.
15. *Dixerŏ* quid ſi forte jocoſius, hoc mihi juris. — Hor.
16. Sic ubi *neſciŏ* quis Lycia de gente virorum. — Ovid.
17. Quæ noſti, *meditandŏ* velis inoleſcere menti. — Auſon.
18. Præterea *duŏ* nec tutâ mihi valle reperti. — Virg.

6. U final is long; as vultū, cornū, Panthū, dictū, diū.

Quo res ſumma loco, *Panthū?* quam prendimus arcem. — Virg.

1. Except [1] indŭ for in, and [2] nenŭ for non, both uſed by Lucretius, the former likewiſe by others, in compoſition, as indŭperator, have the *u* ſhort.

2. Alſo the *ŭ* before the elided *s*; as nunciŭ, plenŭ, for nuncius, plenus.

1. *Indū*

1. *Indŭ* manu validas potis eſt moderanter habenas. Lucret.
2. *Nenŭ* queunt rapidi contra conſtare leones. Lucret.
3. Vicimus O ſocii, et magnam *pugnavimŭ* pugnam. Enn.

7. Y final is ſhort; as Moly̆, Tiphy̆, Chely̆, Tethy̆.

Moly̆ vocant ſuperi. Ovid.

Except when *y* is a contraction, as in Tethy, inſtead of Tethyi, the dative, it is long by the general rule for craſis.

Quam *Tethȳ* longinqua dies, Glaucoque repoſtâm. Val. Flac.

8. Latin words ending in B ſhorten the preceding vowel; foreign words lengthen it, as ăb, ŏb, Jōb, Jacōb.[1]

Magnus *ăb* integro ſec'lorum naſcitur ordo. Virg.

9. Final C lengthens the preceding vowel; as āc, sīc, hīc, (adverb), dūc, illūc, &c.

Sīc oculos, *sīc* ille manus, *sīc* ora ferebat. Virg.

1. Except that nec and donec are ſhort, as alſo the imperative fac.*
2. Hic and hoc of the nominative and accuſative, are common.

* Two paſſages quoted from incorrect copies of Ovid, to prove *fac* long, in better editions appear *facito* and *face*; ſo that, according to the opinion of Alvarez, it is ſafer to conſider *fac* as ſhort.

1. Parve, *nĕc* invideo, ſine me, liber ibis in urbem. Ovid.
2. *Donĕc* eris felix, multos numerabis *amīcos*. Ovid.
3. Signa rarius, aut ſemel *făc* illud. Mart.
4. Hic vir, *hĭc* eſt, tibi quem promitti ſæpius audis. Virg.
5. Hic gladio fidens, *hīc* acer et arduus haſta. Virg.

10. Final D, in Latin words, ſhortens the preceding vowel; in foreign words it lengthens it; as quĭd, ăd, apŭd, illŭd, sĕd, Davīd.

Ipſe docet *quĭd* agam. Fas eſt et *ăb* hoſte doceri. Ovid.

11. Final L ſhortens the preceding vowel: as mĕl, fĕl, pŏl, ſimŭl, ſemĕl, nihĭl, conſŭl.

Innocui veniant: *procŭl* hinc, *procŭl* impius eſto. Ovid.

1. Except that Hebrew words are generally long; as Daniēl, Nabāl, Saūl.
2. Sāl, ſōl, and nīl, are long.

1. Non *sāl*, oxyporumve caſeuſve. Stat.
2. Omnia ſub pedibus, quâ *sōl* utrumque recurrens. Virg.
3. *Nīl* opis externæ cupiens, *nīl* indiga laudis. Claud.

12. Final M was, anciently, ſhort, and was not, as now, elided when followed by a vowel.

Inſignita ferè tum millia *militŭm* octo. Enn.

It is ſhort in *circŭm*, in compoſition with words beginning with a vowel, as [1] circŭmeo, [2] circŭmago.

1. Cujus non hederæ *circŭmiere* caput. Propert.
2. Quo te *circŭmagas?* quæ prima aut ultima ponas? Juven.

13. Final N lengthens the preceding vowel; as ēn, ſplēn, quīn, nōn, sīn, rēn, Pān, Salamīn, Oriōn, Titān.

Merſit et ardentes *Oriōn* aureus ignes. Manil.

1. Except nouns ending in [1] *en*, which have *ĭnis*, ſhort, in the genitive; as carmĕn-ĭnis, tegmĕn-ĭnis.
2. Alſo nouns in [2] *on* of the ſingular number, from the Greek *o* (omicron), and which, in Latin, are of the ſecond declenſion; as Iliŏn, Pylŏn.
3. N is ſhort in the accuſatives of Greek nouns, having the final ſyllable of their nominative ſhort; as Majăn, Æginăn, Orpheŏn, Alexĭn, Ibĭn, Chely̆n, Ity̆n.

4. Alſo ăn, ĭn, forsăn, forſităn, tamĕn, attamĕn, veruntamĕn, vidĕn', ſatĭn', have *n* ſhort.

1. Addunt et titulum; titulus breve *carmĕn* habebat. Ovid.
2. Laudabunt alii claram *Rhodŏn*, aut Mitylenen. Hor.
3. Tantaque nox animi eſt, *ităn* huc arceſſite, dixit. Ovid.
4. Mittite; *forsăn* et hæc olim meminiſſe juvabit. Virg.
5. *Forſităn* et, Priami fuerint quæ fata, requiras. Virg.
6. Educet. *Vidĕn'* ut geminæ ſtent vertice criſtæ. Virg.

14. Final R ſhortens the preceding vowel; as vĭr, puĕr, tĕr, timŏr, calcăr, Hamilcăr, amamŭr, audiuntŭr.

Tum *patĕr* omnipotens miſſo perfregit Olympum. Ovid.

1. Except [1] Greek nouns, and [2] ſuch as have *ēris*, long, in the genitive; as cratēr, ſtatēr, vēr, Recimēr, [3] Iber-ēris; but [4] Celtiber[5], the compound of Iber, has the penultimate common.
2. Alſo [6] aēr and æthēr, though they increaſe ſhort in the genitive.
3. And [7] fār, [8] lār, [9] nār, [10] cūr, [11] fūr, and [12] pār, with its [12] compounds, compār, impār, diſpār.

1. *Cratēr* auratis ſurgit cælatus ab aſtris. Manil.
2. *Vēr* erat æternum, placidique tepentibus auris. Ovid.
3. Si tibi durus *Ibēr*, aut ſi tibi terga dediſſet. Lucan.
4. Nunc *Celtibēr* in *Celtibēria* terrâ. Catul.
5. Ducit ad auriferas quod me ſalo *Celtibĕr* oras. Mart.
6. Inde mare, inde *aēr*, inde *æthēr* ignifer ipſe. Lucret.
7. *Fār* erat, et puri lucida mica ſalis. Ovid.
8. Exagitant et *Lār*, et turba Diania fures. Ovid.
9. Sulfureâ *Nār* albus aquâ, fonteſque Velini. Virg.
10. Multa quidem dixi, *cūr* excuſatus abirem. Hor.
11. Callidus effracta nummos *fūr* auferet urcâ. Mart.
12. Ludere *pār*, *impār*, equitare in arundine longa. Hor.

Note.—*Cor* long is attributed to Ovid, but the line in which it is ſaid to be thus found, is read differently in corrected editions; the ſame remark is applicable to *vir*; as

1. Molle meum levibuſque *cŏr* eſt violabile telis. Ovid.
2. De grege nunc tibi *vir*, nunc de grege natus habendus. Ovid.

Thus corrected, *vir* is long merely by poſition.

15. Words ending in AS, lengthen the final ſyllable; as mās, vās, crās, fās, amās, farās, pietās, Thomās, Muſas.

Hās autem *terrās*, Italique hanc littoris oram— Virg.

1. Greek nouns in *as* are ſhort, which make the genitive in *ados* or *adis*, as Arcas, Pallas, Lampas, Ilias: to which add the noun Anăs, and Latin nouns in *as*, formed after the manner of Greek patronymics; as Appiăs.
2. Alſo the final *as* of Greek accuſatives plural of the third declenſion is ſhort; as craterăs, lampadăs, Troăs, Cyclopăs, herŏas, heroidăs, Hectorăs, &c.

1. Bellica *Pallăs* adeſt, et protegit ægide fratrem. Ovid.
2. Et pictis *anăs* enovata pennis. Petron.
3. *Appiăs* expreſſis aëra pultat aquis. Ovid.
4. *Naidăs* his venam, quæ nunquam areſcere poſſet— Ovid.

16. Words ending in ES lengthen that ſyllable; as rēs, ſpēs, vulpēs, quiēs, hærēs, eſsēs, Anchisēs, totiēs, locuplēs.

Vulpēs ad cœnam dicitur ciconiam. Phædr.

1. [1] The nouns and vocatives plural of Greek nouns increaſing (not in εος) ſhort in the ſingular, are ſhort; as Amazonĕs, Arcadĕs, Delphinĕs, Naiadĕs, Gryphĕs, Phrygĕs.
2. To which may be added Greek vocatives ſingular in *es*, coming from nominatives in *es*, not formed from *eus* of the Doric dialect, and having their genitive in *eos*; as Demoſthenĕs, Socratĕs.

3. * *Es*, in the present tense of *sum*, and its [3] compounds, is short; as adĕs, abĕs, prodĕs, potĕs, &c.; and in the preposition penĕs.

4. [2] Latin nouns of the third declension, in *es*, increasing short in the genitive, are short in the final syllable; as hebĕs, alĕs, pedĕs, limĕs, obsĕs. [5] But *es* is long in these following; Cerēs, pariēs, ariēs, abiēs, pēs, and its [8] compounds, as bipēs, tripēs, alipēs, sonipēs; to which some add præpēs, a derivative of præpeto.

1.	*Troadĕs*; et patriæ fumantia tecta reliquunt.	Ovid.
2.	Quisquis ĕs, amissos hinc jam obliviscere Graios.	Virg.
3.	Nunc *adĕs* O cœptis, flava Minerva, meis.	Ovid.
4.	Vivitur ex rapto; non *hospĕs* ab hospite tutus.	Ovid.
5.	Flava *Cerēs* alto nequicquam spectat Olympo.	Virg.
6.	Creditur: ipse *ariēs* etiam nunc vellera siccat.	Virg.
7.	Desuper Aurigæ dexter *pēs* imminet astro.	Manil.
8.	Stat *sonipēs*, et fræna ferox spumantia mandit.	Virg.

**Note.*—1. Though *es*, in the present tense of *sum* and its compounds is short, it is not in any other tense, nor in the final syllable of *essēs*, (as has been asserted,) as

Possēs in tanto vivere flagitio?	Propert.
Essēs Ionii facta puella maris.	Propert.

2. Whenever paries, aries, and abies are found long, there happens to be a cæsura; and perhaps Ceres and pes are long by diastole: Ausonius shortens bipes and triges; and Probus observes that alipes and sonipes are likewise short: though the contrary appears in Virgil, Lucan, and Horace, yet some of the above-mentioned words could not be introduced into heroic verse without the influence of a figure to lengthen their final syllable. Præpes, which comes not from *pes*, but from πϱοπετής, is short in Virgil. (Æn. 5. 254.) Tigrēs, ascribed to Ovid, is, by the best critics, rejected.

17. IS final is short; as bĭs, ĭs, quĭs, cĭs, magĭs, turrĭs, militĭs, creditĭs, Thetĭs.

Tum *bĭs* ad occasum, bis se convertit ad ortum.	Ovid.

1. Except plural cases in *is*; as nobīs, vobīs, ([2] quīs for quibus), musīs; the plural accusatives [3] omnīs, [4] urbīs, &c.

2. The nominative in *is* is long, when the [5] genitive ends in *ītis*, *īnis*, or *ēntis* long; as līs, Samnīs, Salamīs, Simoīs.

3. *Is* is long in the adverbs [9] gratīs and forīs; in the noun glīs, and in vīs, whether noun or [8] verb.

4. All [6] second persons singular in *is* are long; when the second persons plural have *ītis* long; as cīs, fīs, sīs, īs, abīs, audīs, velīs, nolīs, possīs, &c.

5. [10] *Ris* of the perfect is commonly considered short, of the [11] future [2], common; so are the penultimates of ausĭs and faxĭs: ris and ritis of [13] ero and potero are more frequently short.

1.	Inducenda rota est: das *nōbīs* utile munus	Mart.
2.	*Quīs* ante ora patrum Trojæ sub mœnibus altis.	Virg.
3.	Non *omnīs* arbusta juvant, humilesque myricæ.	Virg.
4.	Adde tot egregias *urbīs*, operumque laborem.	Virg.
5.	Sed *līs* est mihi de tribus capellis.	Mart.
6.	*Nescīs*, heu! nescis dominæ fastidia Romæ.	Mart.
7.	Ignea convexi *vīs* et sine pondere cœli.	Ovid.
8.	Si *vīs* esse aliquis. Probitas laudatur et alget.	Juven.
9.	*Gratīs* anhelans, multa agendo, nil agens.	Phædr.
10.	*Dixerīs* egregie notum si callida verbum.	Hor.
11.	Quas gentes Italum, aut quas non *oraverĭs* urbes.	Virg.
12.	Da mihi te placidum; *dederĭs* in carmine vires.	Ovid.
13.	Fortunate puer, tu nunc *ĕris* alter ab illo.	Virg.

18. OS final is long; as rōs, vōs, nōs, mōs, flōs, trōs, arbōs, honōs, custōs, nepōs.

Ōs homini sublime dedit, cœlumque tueri.	Ovid.

1. Except [1] Greek genitives in *os*; as Arcadŏs, Tethyŏs, Tereŏs, Orpheŏs.

2. Also [2] compŏs, impŏs, and [3] ŏs-ossis, with its compounds exŏs, have the final syllable short.

3. [4] Greek nominatives and vocatives of the second declension have *os* short; as Clarŏs, Tenedŏs, Lesbŏs, Atropŏs. But those nouns of the Attic dialect, having their genitives in omega, are long, as Androgeōs, Athōs: also nouns of the same dialect, which have changed *laŏs* (λαὸς) into *leos* (λεὼς), as Peneleōs, Meneleōs.

4. Greek neuters in *os* are short; as Argŏs, epŏs, chaŏs, melŏs.

1.	Alta jacet vasti super ora *Typhoëŏs* Ætna.	Ovid.
2.	Insequere, et voti postmodo *compŏs* eris.	Ovid.
3.	*Exŏs* et exsanguis tumidos perfluctuat artus.	Lucret.
4.	Tum, cum tristis erat, defensa est *Iliŏs* armis.	Ovid.
5.	Quantus *Athōs*, aut quantus Eryx, aut ipse caruscis.	Virg.
6.	Et *Chaŏs* et Phlegethon, loca nocte silentia late—	Virg.

19. US final is short; as tenŭs, littŭs, penitŭs, intŭs, Ambobŭs, Montibŭs, Amamŭs.

Incipe: pascentes servabit *Tityrŭs* hædos.	Virg.

1. Except [1] monosyllables in *us*; as grūs, plūs, rūs, thūs, jūs.

2. Also the [2] genitives of feminine nouns in *o*; as Cliūs, Sapphūs, Mantūs.

3. Genitives singular, and nominatives, accusatives, and vocatives plural of the fourth declension, (all being contracted,) have *us* long; as fructūs, manūs.

4. Also nouns increasing long in the genitive; as palūs-ūdis, virtūs-ūtis, tellūs-ūris, Opūs-ūntis.

5. *Us* is long in the [5] compounds of πους, (forming the genitive in podis or podos,) as Tripūs, Melampūs, Œdipūs, Polypūs.

6. Also [6] those nouns which have *u* in their vocative; as Panthūs, O Panthu.

7. Finally, [7] Ιησους has the final syllable long.

1.	Romæ *rūs* optas, absentem rusticus urbem.	Hor.
2.	*Didūs* atque suum misceri sanguine sanguen.	Varro.
3.	Pars secreta *domūs* ebore et testudine cultus—	Ovid.
4.	Ridet ager; neque adhuc *virtūs* in frondibus ulla est.	Ovid.
5.	Hic *Œdipūs* Ægea tranabit freta.	Seneca.
6.	*Panthūs* Othryades, arcis Phœbique sacerdos.	Virg.
7.	Et cœlo et terris venerandum nomen *Jēsus*.	

20. YS final is short; as Capy̆s, chely̆s, chlamy̆s.

At *Capy̆s*, et quorum melior sententia menti.	Virg.

Except nouns which form the nominative in *yn* also; as Gortȳs, Phorcȳs. To these add contracted plurals; as Erynnȳs, for Erinnyēs, or Erinnyās.

21. Final T shortens the preceding vowel; as capŭt, amăt.

Verum hæc tantum alias inter; *capŭt extulĭt* urbes.	Virg.

Except when final *t* is long by crasis: as redit for rediit or redivit.

Magnus civis *obīt* et formidatus Othoni.	Juven.

22. The last syllable of every verse is considered common; that is, if the syllable be naturally long, it may be accounted short; or, if it suit the verse, *vice versâ*.

Gens inimica mihi Tyrrhenum navigat *æquŏr*.	Virg.
Crescit occulto velut arbor *ævŏ*.	Hor.

Note.—1. In the first of these examples, *ŏr*, naturally short, forms the second syllable of a spondee; in the last, a Sapphic verse, the word *ævŏ*, which is naturally a spondee, forms a trochee.

2. "The grammarians that displease Dr. Clarke, (see Clarke's Homer, Iliad A. v. 54.) by saying that the last syllable of a verse is common, only mean, that the *local* quantity supersedes the natural quantity of the syllable."

For the last principal head of prosody; see VERSIFICATION.

QUAN-TSOM, in *Geography*, a town of China, of the third rank, in Pe-tche-li; 32 miles S. of Chunte.

QUANTUM Meruit, called alfo an *affumpfit*, in *Law*, an action upon the cafe, grounded upon a neceffity to pay a ma for doing any thing fo much as it deferves or merits.

This valuation of his trouble is fubmitted to the determination of a jury; who will affefs fuch a fum in damages as they think he really merited.

Quantum *Valebat*, or an implied affumpfit, is where goods and wares fold, are delivered by a tradefman at no certain price, or to be paid for them as much as they are worth in general; then *quantum valebat*, or an action on the cafe, lies, and the plaintiff is to aver them to be worth fo much; fo where the law obliges one to furnifh another with goods or provifions, as an inn-keeper his guefts, &c.

QUANTZ, John Joachim, in *Biography*, chamber mufician to Frederic II. king of Pruffia, to whom he had been flute-mafter before his acceffion to the crown. Quantz was born at Oberfcheden, a village in the electorate of Hanover, in 1697. His father, who was a blackfmith, obliged him to work at the anvil before he was nine years old; which muft have afforded him an early opportunity of making the famous Pythagorean experiment, mentioned by Jamblichus (de Vit. Pythag.), and by all the mufical writers of antiquity. Indeed, the ear of our young Ardalus had been already formed, in his excurfions with his brother, a village mufician, who ufed to play about the country on holydays and feftivals, whom he accompanied upon thefe occafions, on the bafe-viol, when but eight years old, and without knowing a note of mufic; but this performance, bad as it was, pleafed him fo much, that he determined to choofe mufic for his profeffion; though his father, who died when he was only ten years of age, recommended to him, on his death-bed, to continue in the honourable profeffion of his anceftors.

Quantz, after lofing his father, had no other friends to depend upon for counfel and protection, than two uncles, who lived at Merfeburg in Saxony; and thefe, fending for him, gave him the choice of their feveral profeffions, the one being a taylor, and the other a *kunftpfeifer*, or town-wait.

Upon this occafion, the paffion for mufic in the young Quantz overpowered all other confiderations, and, prefering the fiddle-ftick to the anvil or fhears, he bound himfelf apprentice to his uncle, the mufician, for five years; but this uncle dying three months after, he was transferred to his fon-in-law, Fleifchhack, who was of the fame profeffion; and it was under him that he firft practifed the violin, an inftrument to which his inclination at this time impelled him, preferably to any other.

Soon after this, however, he practifed the hautbois, and the trumpet, with which inftruments, and the violin, he chiefly filled up the term of his apprenticefhip; but as a true town mufician, in Germany, is expected to play upon all kinds of inftruments, he had been obliged, occafionally, to apply himfelf, during this period, to the fackbut, cornet, bafe-viol, French horn, common flute, baffoon, viol da gamba, and the lord knows how many more. Thefe were in the way of bufinefs, but for pleafure, he now and then took leffons on the harpfichord, of the organift Kiefewetter, who was likewife his relation; by which he laid the firft foundation of his knowledge in harmony, and love for compofition.

Luckily for Quantz, his mafter, Fleifchhack, was not, like other country muficians, fond only of old, dry, ftiff, and taftelefs compofitions, but had fufficient difcernment to choofe his pieces out of the neweft and beft productions of the times, by Telemann, Melchoir, Hofmann, and Heinechen, which were publifhed at Leipfic; from the perufal, and practice of which, our young performer derived great advantage.

The duke of Merfeburg's band not being very numerous, the town-waits, at this time, were often called in, to affift at the mufical performances, both of court and chapel. Here Quantz frequently heard foreigners play and fing, in a manner far fuperior to any profeffors whom he had hitherto met with, which excited in him a ftrong defire to travel. Drefden and Berlin were at this time the moft renowned cities in Germany, for the cultivation of mufic, and the number of able muficians. He eagerly wifhed to vifit one of thofe cities, but was deftitute of the means. However, he now began to feel his ftrength, and trufting to his feet and his fiddle, he boldly fet off for Drefden.

It was in the year 1714 that he arrived in that city. His firft entrance was not aufpicious, being wholly unable to procure employment: on this account, he made an excurfion to Radeburg, where a journeyman fiddler being wanting, he entered into the fervice of the town mufician, Knoll; but alas! he was foon driven from this poft, by the fatal accident of the town being burnt down by lightning. Again reduced to the ftate of a fugitive, and a wanderer, he levied contributions round the country by the power of his violin, which was now his principal inftrument, till he reached Pirna.

Here, deftined ftill to be *fervus fervorum*, he could procure no other means of exercifing his profeffion, than by accepting the office of deputy to a fick journeyman mufician of the town. It was during this time, that he firft faw Vivaldi's concertos for the violin, which were fo congenial to his own feelings and ideas of perfection, that he made them his model as long as he continued to practife that inftrument.

Still regarding Drefden as his centre, he eagerly accepted an offer that was made to him, of being temporary affiftant there, to one of the town-waits, who was then ill; an employment which he preferred, for the opportunities it afforded him of hearing good mufic and good muficians, to the more honourable poft of being the beft of bad muficians at Berenburg, where he might have been appointed firft violin, with a good falary.

His fecond arrival at Drefden was in the year 1716, where he foon difcovered that it was not fufficient for a mufician to be able to execute the mere notes which a compofer had fet on paper; and it was now that he firft began to be fenfible of the exiftence of tafte and expreffion.

Auguftus II. was at this time king of Poland, and elector of Saxony, and the orcheftra of this prince at Drefden was in a flourifhing condition; however, the ftyle which had been introduced there, by the concert-mafter Volumier, was French; but Pifendel, who fucceeded him, introduced a mixed tafte, partly French, and partly Italian, which he afterwards brought to fuch perfection, that Quantz declares, he never heard a better band in all his future travels.

No orcheftra in Europe could now boaft of fo many able profeffors, as that of the elector of Saxony, among whom, were Pifendel and Veracini, on the violin; Pantaleone Hebenftreit, on the pantaleone; Weifs, on the lute; Richter, on the hautbois; and Buffardin, on the German flute; not to mention feveral excellent performers on the violoncello, baffoon, French horn, and double-bafe.

Upon hearing thefe great performers, Quantz was filled with fuch wonder, and poffeffed of fuch a rage for improvement, that he laboured inceffantly to render himfelf worthy of a place among fuch honourable affociates.

For, however prejudiced he may have been in favour of his own reputable calling of kunftpfeifer, he began now juft to think it poffible for him to be prevailed upon, to relinquifh that part of it, at leaft, which required him to play country dances, though in itfelf fo jovial, pleafant, and feftal an employment.

He continued, however, to be the kunftpfeifer's delegate in this city, till the death of Auguftus II.'s mother, in 1717, at which time, the general mourning profcribing the ufe of every fpecies of convivial mufic, he again, in his ufual manner, commenced traveller, and fiddled his way through Silefia, Moravia, and Auftria, to Vienna; and in the month of October, of the fame year, returned through Prague to Drefden; which journey, he thinks, contributed more to his knowledge, in practical geography, than in any other art.

The jubilee of the reformation, brought about by Dr. Luther, happening to be celebrated foon after his return, he was called upon, among others, to perform a part upon the trumpet, at church, where the chapel-mafter Schmidt having heard him, offered to prevail on the king to have him regularly taught that inftrument, in order to qualify him for the place of court trumpeter; but Quantz, however ardently he might have wifhed for an office at court, declined the acceptance of this, well knowing that the good tafte to which he afpired, was not to be learned upon that inftrument, at leaft as it was then played in Drefden.

In 1718, the Polifh or royal chapel was inftituted; it was to confift of twelve performers, eleven were already chofen, and a hautbois player, only, was now wanting, to complete the number. After undergoing the feveral trials, and giving the requifite proofs of his abilities, he had the happinefs to be invefted with that employment, by the director, baron Seyfertitz, with a falary of 150 dollars, and a lodging.

This was an important period in his life, and in the exercife of his profeffion. The violin, which had hitherto been his principal inftrument, was now laid afide for the hautbois, upon which, however, he was prevented from diftinguifhing himfelf, by the feniority of his brethren. Mortified at this circumftance, he applied himfelf ferioufly to the German flute, upon which he had formerly made fome progrefs without a mafter; but his motive now for refuming it, was the certainty of his having no rival, in the king's band, as M. Friefe, the firft flute, had no great paffion for mufic, and readily relinquifhed to him his place.

In order to work upon fure ground, Quantz took leffons at this time of the famous Buffardin, with whom, however, he only played quick movements, in which this celebrated flute-player chiefly excelled. The fcarcity of pieces, compofed exprefsly for the German flute, was fuch, at this period, that the performers upon that inftrument were obliged to adopt thofe of the hautbois, or violin, and by altering or tranfpofing, accommodate them to their purpofe, as well as they could.

This ftimulated Quantz to compofe for himfelf; he had not as yet ever received any regular inftructions in counterpoint, fo that, after he had committed his thoughts to paper, he was obliged to have recourfe to others to correct them. Schmidt, the chapel-mafter, had promifed to teach him compofition, but delayed keeping his word from time to time, and Quantz was afraid of applying to Heinichen, his colleague, for fear of offending Schmidt, as thefe mafters were upon bad terms together. In the mean time, for want of other affiftance, he diligently ftudied the fcores of great mafters, and without ftealing from them, endeavoured to imitate their manner of putting parts together, in trios, and concertos.

About this time he had the good fortune to commence a friendfhip with Pifendel, now appointed concert-mafter, in the room of Volumier. Quantz is very warm in his praifes of Pifendel, whom he calls a profound theorift, a great performer, and a truly honeft man. It was from this worthy concert-mafter that he learned to perform an adagio, and to compofe in many parts. Pifendel had in his youth been taught to fing by the famous Piftocchi, and had received inftructions, on the violin, from Torelli; however, having travelled through France and Italy, where he had acquired the peculiarities in the tafte of both countries, he fo blended them together as to form a third genus, or mixed ftyle of writing and playing, which was half French and half Italian. Influenced by his example, Quantz declares, that he always preferred this compound ftyle, to that of Italy, France, or the national ftyle of his own country.

At the marriage of the prince royal of Poland, in 1719, feveral Italian operas were performed at Drefden. Lotti, the famous Venetian maeftro di capella, together with the moft celebrated fingers of Italy, male and female, were called thither upon this occafion; thefe were the firft Italian operas which Quantz had heard, and he confeffes, that the performance of them gave him a very favourable idea of the genuine and found Italian mufic, from which he thinks later times have too much deviated.

After defcribing the talents of the fingers who will have their place in our alphabet, he informs us that this famous opera at Drefden, was broken up by a quarrel between Heinichen, the king of Poland's chapel-mafter, and Senefino, who this fame year, 1719, went to England for the firft time.

Nothing very interefting occurs in the life of Quantz from this period, till 1723, when he took a journey with Weifs, the famous lutenift, and Graun, the compofer, to Prague.

Quantz, not long after the coronation of Charles VI. at Prague, went to Italy in the fuite of count Lagnafco, with the confent of his royal mafter, the king of Poland. He left Drefden in May 1724, and, when he arrived at Rome, he found that Vivoldi had juft introduced the Lombard ftyle in that city, with which the citizens were fo captivated, that they would hear no other.

During his refidence at Rome, he took leffons in compofition of the famous Gafparini, who was at that time feventy-two years of age; and after ftudying counterpoint with him, which he calls mufic for the eye, he went to work for the ear, and compofed folos, duets, trios, and concertos; however, he confeffes, that counterpoint had its ufe in writing pieces of many parts; though he was obliged to unlearn many things, in practice, which theory had taught him, in order to avoid that dry, and ftiff ftyle, which too clofe an adherence to rules is apt to produce; upon this occafion, he very judicioufly obferves, that invention is the firft requifite in a compofer, and that it behoves him to preferve a friendfhip between harmony and melody.

In 1725 he went to Naples, where he met with his countryman Haffe, who then ftudied under Alef. Scarlatti. Haffe had not, as yet, diftinguifhed himfelf by any compofitions for the ftage; however, it was at this time, that a confiderable Neapolitan banker employed him to fet a ferenata for two voices, which he did in the prefence of Quantz; the fingers who performed in it, were Farinelli and Tefi. Haffe gained fo much reputation by this production, that it paved the way to his future fuccefs, and he was foon after appointed compofer of the great opera at the theatre royal.

Quantz intreated Haffe to introduce him to his mafter, Scarlatti, to which he readily confented; but upon mentioning him to the old compofer, he faid, "my fon, you know I hate wind inftruments, they are never in tune." However, Haffe did not ceafe importuning him, till he had obtained the permiffion he required.

In

In the vifit which he made to Scarlatti, M. Quantz fays, that he had an opportunity of hearing him play on the harpfichord, which he did in a very learned manner; but obferves, that his abilities on that inftrument were not equal to thofe of his fon.

Before his departure from Naples, M. Quantz frequently heard concerts at the duke of Lichtenftein's, in which Haffe, Farinelli, Tefi, and Francifchello, were employed.

In 1726 he was at Venice, during the performance of two rival operas, "Siface," compofed by Porpora, and "Siroe," by Vinci; the latter was moft applauded. The Cav. Nicolini, a contralto, La Romanina, a deep foprano, and the famous tenor, Paita, were the principal fingers in thefe dramas.

San Martini, the celebrated performer on the hautbois, who afterwards eftablifhed himfelf in London, was now at Venice, as was Vivaldi.

At Turin he met with Somis, under whom, Le Claire was at that time a fcholar on the violin.

From Turin he went to Paris, which, with refpect to mufic, was going from one extreme to another.

His character of French finging in the former part of the laft century, is very juft and characteriftic.

"I was difpleafed with the French tafte now," fays M. Quantz, "though I had heard it formerly with patience. The old, worn-out, fecond-hand thoughts, and paffages ill-expreffed, difgufted me now, as much as a ftale difh warmed again. The refemblance between recitative and air, with the affected and unnatural howling of the fingers, particularly the women, fhocked my ears."

M. Quantz was the firft who applied an additional key to the German flute, in order to correct its imperfections; and it was in the courfe of this year, 1726, that he made the difcovery.

In 1727 he arrived in London, where he found the opera in a very flourifhing ftate, under the direction of Handel. The drama of "Admetus" was now in run, of which, he fays, the mufic was grand and pompous. Senefino performed the firft male part, and Cuzzoni and Fauftina were the principal women.

He then gives a character of the fingers, ftate of the opera, and of mufic in general in London, very correctly.

Upon his return to Drefden, he was eftablifhed in the king's chapel, with an addition to his former falary of 250 dollars a-year. He now entirely quitted the hautbois, fuppofing it hurtful to the embouchure of the flute, which, from this time, he made his fole ftudy.

In 1728 he went to Berlin, with baron Seyfertiz, in the fuite of the king of Poland; where he was obliged, at the command of the queen of Pruffia, but with the permiffion of his royal mafter, to remain for fome months. Pifendel, Weifs, and Buffardin, were, by the fame order, called thither. After he had had the honour of playing before the queen two or three times, he was offered a place and penfion of 800 dollars a-year. He was very willing to accept of them, but the king his mafter would not grant his confent: however, this prince gave him a general permiffion to go to Berlin as often as he was defired.

This year, 1728, the prince royal of Pruffia determined to learn the German flute, and M. Quantz had the honour to teach him. On this account, he was obliged to go twice a year to Berlin, Ruppin, or Reinfberg, the feveral refidences of his royal fcholar.

After the death of the king of Poland, in 1733, his fon, Auguftus III. not choofing to difmifs M. Quantz, raifed his appointment to 800 dollars, and confirmed the permiffion which had been granted by his royal father, for his going occafionally to Berlin.

In 1734 he publifhed his firft folos; but he does not acknowledge the fonatas, which were printed under his name, in Holland, about that time.

In 1739, M. Quantz finding a great fcarcity of German flutes, undertook to bore them himfelf for the ufe of his pupils; an enterprife which, afterwards, he found to be very lucrative.

In 1741 he was again invited to Berlin, in order to enter into the fervice of his royal fcholar, then king of Pruffia, with offers of an annual penfion of 2000 dollars for life; a feparate payment for compofitions; 100 ducats for every flute he fhould deliver; and an exemption from playing in the orcheftra, or any where elfe, but in the king's chamber, as well as from dependance on any other commands than thofe of his majefty; which terms, as the king of Poland was too gracious longer to refufe his difmiffion, M. Quantz was unable to refift.

In 1752 he publifhed his "Art of Playing the German Flute;" and it was this year that he invented the new joint for the upper-piece of the flute, by which means, without drawing out the middle piece, and without hurting the tone, the inftrument may be raifed or lowered half a note.

And now, having traced our induftrious mufician through the troublefome mazes by which he arrived at the temple of fortune, we had hopes that we fhould have left him to the enjoyment of that reputable eafe, that *otium cum dignitate*, to which every artift in years afpires; but alas! this eminent mufician and worthy man died at Potzdam in lefs than a year after we had feen, heard, and converfed with him in that fummer refidence of his royal difciple and patron! A complete lift of his works is given in Gerber.

QUANUSE, in *Geography*, a town of America, in the Tenneffee government. N. lat. 35° 12′. W. long. 84° 28′.

QUAPA, a town of Louifiana, at the conflux of the Akanfas with the Miffifippi. N. lat. 33° 48′. W. long. 91° 23′.

QUAPACTOTOTL, in *Ornithology*, a name under which Nieremberg has defcribed a bird, which, he fays, imitates the human laugh. He fays its body is eight inches long, and the tail as many; the beak of a blueifh-black, and bent and crooked; the breaft grey, and the belly black; the tail of a brownifh-black; and the wings, neck, and head, of a yellowifh-brown.

This is the Cuculus ridibundus of Gmelin, the Cuculus Mexicanus of Briffon, and the Laughing cuckow of Latham. It is found in New Spain.

QUAPIZOTL, in *Zoology*, the name given by Hernandez to the Tajaçu of Marcgrave, the Pecari of Buffon, and the Mexican hog of Pennant. See Sus *Tajaffu*.

QUAPOYA, in *Botany*, Aubl. Guian. v. 2. 897. t. 343, 344, a barbarous Caribbean name. See XANTHE.

QUAR, in *Agriculture*, a term occafionally employed, in a provincial manner, to fignify a fmall fort of quarry of any kind, but more efpecially of the lime-ftone, free-ftone, flag-ftone, or flate-ftone nature. It is much ufed in fome of the more northern diftricts of the country. See QUARRY.

QUARANTAIN, in old *Law Books*, written *Quarentine*, and *Quarentena*, denotes the fpace of forty days.

"Quatuor carucatas terræ arabilis, continentes in longitudine 8 quarentenas, & 8 quarentenas in latitudine." Chart. Withlafii Reg. Merc. apud Ingulf.

"Quarentena in London. ponetur pro refpectu habend. 40 dies poft fummonitionem per breve regis, ut confulant, &c. fi fibi viderint expedire." MS. de Temp. Ed. III.

The

The term is borrowed from the French *quarentain;* and is ſometimes uſed for the time of Lent.

QUARANTAIN *of the King*, in France, denotes a truce of forty days appointed by St. Louis, during which time it was expreſsly forbidden to take any revenge of the relations or friends of people who had fought, wounded, or affronted each other in words.

QUARANTAIN, or *Quarentine*, is more particularly uſed for the term of forty days, which veſſels, coming from places ſuſpected of contagion, are obliged to wait in certain places appointed to air themſelves before they come into port.

By the ſtat. 26 Geo. II. cap. 6. explained and amended by 29 Geo. II. cap. 8. the method of performing quarentine, or forty days probation, by ſhips coming from foreign countries, is put in a much more regular and effectual order than formerly; and maſters of ſhips coming from infected places, and diſobeying the directions there given, or having the plague on board, and concealing it, are guilty of felony without benefit of clergy. The ſame penalty alſo attends perſons eſcaping from the lazarettos, and officers and watchmen neglecting their duty, and perſons conveying goods or letters from ſhips performing quarantine. Se PLAGUE.

In caſes of inſurance, before the riſk on a ſhip can be ſaid to be completely ended, ſhe muſt not only have been 24 hours moored at anchor in her port of deſtination, but ſhe muſt have been during that time in *good ſafety*, in the fulleſt ſenſe of thoſe words. If, therefore, the ſhip be obliged to perform quarantine, this does not end the voyage. The voyage only ends when the ſhip is arrived at her port of deſtination, and is there moored 24 hours in good ſafety. Accordingly, if the ſhip, before the 24 hours are expired, be ordered to the proper place for performing quarantine, the riſk continues, though ſhe do not leave her moorings till long after the 24 hours are expired. See RISK.

QUARANTAIN alſo denotes certain duties impoſed upon ſhips, for the purpoſes of quarantine.

QUARANTAIN, *Quarantine*, or *Quarentine*, *Quarentena*, in *Law*, denotes a benefit allowed by the laws of England to the widow of a man dying ſeiſed of land; by which ſhe may challenge to continue in his capital meſſuage, or chief manſion-houſe (ſo it be not a caſtle), for the ſpace of 40 days after his deceaſe; during which time her dower ſhall be aſſigned. The particular lands to be held in dower muſt be aſſigned by the heir of the huſband, or his guardian. Co. Litt. 34, 35.

If the heir, or any other perſon, attempt to eject her, ſhe may have the writ *de quarantena habenda;* which lies for a widow to enjoy her quarantain.

QUARANTAIN is alſo uſed for a meaſure or extent of land, containing 40 perches.

QUARANTARIA, in *Geography*, a high mountain between Jeruſalem and Jericho; which, as tradition ſays, is the mountain to which our bleſſed Saviour was taken by the devil, when he tempted him with the viſionary ſcene of all the kingdoms and glories of the world. This is, as St. Matthew ſtyles it, an exceeding high mountain, and not only difficult, but dangerous, of aſcent. It has a ſmall chapel at the top, and another about half-way of its aſcent, founded upon a prominent part of the rock. Near this latter are ſeveral caves and holes in the ſide of the mountain, made uſe of anciently by hermits, and by ſome in later times, for places in which they kept their Lent; in imitation of that of our bleſſed Saviour. In moſt of theſe grots Maundrell found certain Arabs quartered with fire-arms, who obſtructed his aſcent, demanding 200 dollars for leave to go up the mountain. He and his companions, ſays the traveller, departed without farther trouble, not a little glad to have ſo good an excuſe for not climbing ſo dangerous a precipice. Maundrell's Journey, &c. p. 80.

QUARANTIA, in the Venetian *Polity*, a court of judicature compoſed of forty judges.

The Venetians have an old civil quarantia, a new civil quarantia, and a criminal quarantia.

The criminal quarantia takes cognizance of all crimes except thoſe againſt the ſtate, which belongs to the council of ten. The new civil quarantia judges of appeals made from ſentences made by judges out of the city. The old civil quarantia takes cognizance of appeals from ſentences of ſubaltern judges in that city.

QUARARIBEA, in *Botany*. See MYRODIA.

QUARE *clauſum fregit*, in *Law*. See CLAUSUM *fregit*.

QUARE *ejecit infra terminum*, a writ which lieth, by the ancient law, where the wrongdoer or ejector is not himſelf in poſſeſſion of the lands, but another who claims under him. As where a man leaſeth lands to another for years, and, after, the leſſor or reverſioner entereth, and maketh a feoffment in fee, or for life, of the ſame lands to a ſtranger: now the leſſee cannot bring a writ of *ejectione firmæ*, or ejectment, againſt the feoffee; becauſe he did not eject him, but the reverſioner: neither can he have any ſuch action to recover his term againſt the reverſioner, who did ouſt him; becauſe he is not now in poſſeſſion. And upon that account this writ was deviſed, upon the equity of the ſtatute Weſtm. 2. c. 24. as in a caſe where no adequate remedy was already provided. And the action is brought againſt the feoffee for deforcing, or keeping out, the original leſſee during the continuance of his term: and herein, as in the ejectment, the plaintiff ſhall recover ſo much of the term as remains; and alſo ſhall have actual damages for that portion of it, whereof he has been unjuſtly deprived. But ſince the introduction of fictitious ouſters, whereby the title may be tried againſt any tenant in poſſeſſion, (by what means ſoever he acquired it,) and the ſubſequent recovery of damages by action of treſpaſs for meſne profits, this action is fallen into diſuſe. See EJECTIONE *Firmæ*.

QUARE *impedit*, a writ which lies for him who has purchaſed an advowſon, againſt him that diſturbs him in the right of it, by preſenting a clerk to it when the church is void.

It differs from the aſſize of darrein preſentment, *ultimæ præſentationis*, which lies where a man, or his anceſtors, formerly preſented; this other lying for him who is the purchaſer himſelf. Where a man may have the aſſiſe, he may have this writ; but not contrariwiſe.

In conteſted preſentations, upon the firſt delay or refuſal of the biſhop to admit his clerk, the patron uſually brings his writ of *quare impedit* againſt the biſhop, for the temporal injury done to his property, in diſturbing him in his preſentation. And if the delay ariſes from the biſhop alone, as upon pretence of incapacity, or the like, then he only is named in the writ; but if there be another preſentation ſet up, then the pretended patron and his clerk are alſo joined in the action; or it may be brought againſt the patron and clerk, leaving out the biſhop; or againſt the patron only. But it is moſt adviſeable to bring it againſt all three: for if the biſhop be left out, and the ſuit be not determined till the ſix months are paſt, the biſhop is entitled to preſent by lapſe; for he is not party to the ſuit: but, if he be named, no lapſe can poſſibly accrue till the right is determined. If the patron be left out, and the writ be brought only againſt the biſhop and the clerk, the ſuit is of no effect, and the writ ſhall abate; for the right of the patron is the principal queſtion in the cauſe. If the clerk be left out, and has received

ceived inftitution before the action brought, (as is fometimes the cafe,) the patron by this fuit may recover his right of patronage, but not the prefent turn; for he cannot have judgment to remove the clerk, unlefs he be made a defendant, and party to the fuit, to hear what he can allege againft it. For which reafon it is the fafer way to infert all three in the writ.

The writ of *quare impedit* commands the difturbers, the bifhop, the pfeudo-patron, and his clerk, to permit the plaintiff to prefent a proper perfon (without fpecifying the particular clerk) to fuch a vacant church, which pertains to his patronage; and which the defendants, as he alleges, do obftruct; and unlefs they fo do, then that they appear in court to fhew the reafon why they hinder him.

Immediately on the fuing out of the *quare impedit*, if the plaintiff fufpects that the bifhop will admit the defendant's or any other clerk, pending the fuit, he may have a prohibitory writ, called a *ne admittas;* which recites the contention begun in the king's courts, and forbids the bifhop to admit any clerk whatfoever till fuch contention be determined. And if the bifhop doth, after the receipt of this writ, admit any perfon, even though the patron's right may have been found in a *jure patronatus*, then the plaintiff, after he has obtained judgment in the *quare impedit*, may remove the incumbent, if the clerk of a ftranger, by writ of *fcire facias:* and fhall have a fpecial action againft the bifhop, called a *quare incumbravit;* to recover the prefentation, and alfo fatisfaction in damages for the injury done him by incumbering the church with a clerk, pending the fuit, and after the *ne admittas* received. But if the bifhop has incumbered the church by inftituting the clerk, before the *ne admittas* iffued, no *quare incumbravit* lies; for the bifhop hath no legal notice, till the writ of *ne admittas* is ferved upon him. The patron is, therefore, left to his *quare impedit* merely; which now lies (fince the ftatute of Weftm. 2.) as well upon a recent ufurpation within fix months paft, as upon a difturbance without any ufurpation had.

In the proceedings upon a *quare impedit*, the plaintiff muft fet out his title at length, and prove at leaft one prefentation in himfelf, his anceftors, or thofe under whom he claims; for he muft recover by the ftrength of his own right, and not by the weaknefs of the defendant's: and he muft alfo fhew a difturbance before the action brought. Upon this the bifhop and the clerk ufually difclaim all title: fave only, the one as ordinary, to admit and inftitute; and the other as prefentee of the patron, who is left to defend his own right. And, upon failure of the plaintiff in making out his own title, the defendant is put upon the proof of his, in order to obtain judgment for himfelf, if needful. But if the right be found for the plaintiff, on the trial, three farther points are alfo to be inquired: 1. If the church be full; and, if full, then of whofe prefentation: for if it be of the defendant's prefentation, then the clerk is removeable by writ brought in due time. 2. Of what value the living is: and this in order to affefs the damages which are directed to be given by the ftatute of Weftm. 2. 3. In cafe of plenarty upon an ufurpation, whether fix calendar months have paffed between the avoidance and the time of bringing the action: for then it would not be within the ftatute, which permits an ufurpation to be divefted by a *quare impedit*, brought *infra tempus femeftre*. So that plenarty is ftill a fufficient bar in an action of *quare impedit*, brought above fix months after the vacancy happens; as it was univerfally by the common law, however early the action was commenced.

If it be found that the plaintiff hath the right, and hath commenced his action in due time, then he fhall have judgment to recover the prefentation; and, if the church be full by inftitution of any clerk, to remove him: unlefs it were filled *pendente lite* by lapfe to the ordinary, he not being party to the fuit; in which cafe the plaintiff lofes his prefentation *pro hac vice*, but fhall recover two years' full value of the church from the defendant, the pretended patron, as a fatisfaction for the turn loft by his difturbance: or, in cafe of infolvency, the defendant fhall be imprifoned for two years. But if the church remains ftill void at the end of the fuit, then whichever party the prefentation is found to belong to, whether plaintiff or defendant, fhall have a writ directed to the bifhop *ad admittendum clericum*, reciting the judgment of the court, and ordering him to admit and inftitute the clerk of the prevailing party; and, if upon this order he does not admit him, the patron may fue the bifhop in a writ of *quare non admifit*, and recover ample fatisfaction in damages.

Befides thefe poffeffory actions, there may be alfo had a writ of *right of advowfon*, which refembles other writs of right: the only diftinguifhing advantage now attending it being, that it is more conclufive than a *quare impedit;* fince to an action of *quare impedit* a recovery had in a writ of right may be pleaded in bar.

There is no limitation with regard to the time within which any actions touching advowfons are to be brought; at leaft none later than the times of Richard I. and Henry III.: for by ftatute 1 Mar. ft. 2. c. 5. the ftatute of limitations, 32 Hen. VIII. c. 2. is declared not to extend to any writ of right of advowfon, *quare impedit*, or affife of *darrein prefentment*, or *jus patronatus*.

In a writ of *quare impedit*, which is almoft the only real action that remains in common ufe, and alfo in the affife of *darrein prefentment*, and writ of right, the patron only, and not the clerk, is allowed to fue the difturber. But, by virtue of feveral acts of parliament, there is one fpecies of prefentations, in which a remedy, to be fued in the temporal courts, is put into the hands of the clerks prefented, as well as of the owners of the advowfon. We mean the prefentation to fuch benefices, as belong to Roman Catholic patrons; which, according to their feveral counties, are vefted in and fecured to the two univerfities of this kingdom. And particularly by the ftatute of 12 Ann. ft. 2. c. 14. § 4. a new method of proceeding is provided; *viz.* that, befides the writs of *quare impedit*, which the univerfities as patrons are entitled to bring, they, or their clerks, may be at liberty to file a bill in equity againft any perfon prefenting to fuch livings, and difturbing their right of patronage, or his *ceftuy que truft*, or any other perfon whom they have caufe to fufpect; in order to compel a difcovery of any fecret trufts, for the benefit of Papifts, in evafion of thofe laws whereby this right of advowfon is vefted in thofe learned bodies: and alfo (by the ftatute 11 Geo. II. c. 17.) to compel a difcovery whether any grant or conveyance, faid to be made of fuch advowfon, were made *bona fide* to a Proteftant purchafer, for the benefit of Proteftants, and for a full confideration; without which requifites, every fuch grant and conveyance of any advowfon or avoidance is abfolutely null and void. Blackft. Com. b. iii.

Quare *incumbravit*, a writ which lies againft the bifhop, who, within fix months after the vacancy of a benefice, confers it on the clerk of any one, while two perfons are contending at law for the right of prefenting. This writ lies always depending the plea. See the preceding article, Presentation, Assise *of darrein prefentment*, &c.

Quare *non admisit*, a writ which lies against the bishop, for refusing to admit his clerk, who has recovered in a plea of advowson, on pretence of lapse, &c. See Quare *impedit*.

Quare *non permittit*, is a writ that lies for one who has a right to present for a turn against the proprietary.

Quare *obstruxit*, a writ that lies for him, who, having right to pass through his neighbour's grounds, cannot enjoy the same, because the owner has fenced it up.

QUARENTINE. See Quarantain.

QUARERA, or Quaratia. See Quarry.

QUARITZ, in *Geography*, a town of Silesia, in the principality of Glogau; 8 miles W. of Gros-Glogau.

QUARKEN, or Querken, a cluster of small islands, in the gulf of Bothnia, near the east coast. N. lat. 63° 16′. E. long. 21°.

QUARLES, Francis, in *Biography*, an English poet, born in 1592, near Rumford, in Essex, was son of James Quarles, esq. who held an office at the navy board in the reign of queen Elizabeth. The subject of this article was educated at Christ's college in Cambridge, and was afterwards entered a student in Lincoln's Inn. He obtained the place of cup-bearer to the queen of Bohemia, daughter to James I.; and upon his return, he was appointed secretary to archbishop Usher in Ireland, from which country he made his escape, on the breaking out of the rebellion in 1641, after the loss of his property. He had before distinguished himself by some works, chiefly on religious subjects, in consideration of which he had a pension from Charles I. About this time he had the post of chronologer to the city of London. On the commencement of the civil wars, he gave great offence to the parliament by a work, entitled "The Loyal Convert;" and when he actually joined the king at Oxford, he was plundered of his estates, his books, and manuscripts. These losses he did not long survive. He died at the age of 52, in 1644. Of his numerous writings, as well in prose as in verse, the most celebrated, and indeed that by which he is almost entirely known, is his "Emblems," a set of designs exhibited in prints, and elucidated by some lines attached to each. A considerable part of the work is borrowed from the "Emblems" of Hermannus Hugo, but his verses are his own. For a considerable time they excited a large portion of public admiration in the religious world. They then fell into contempt; but we believe a new edition has of late years been given to the world. Quarles is thus characterized by an able critic: "He is by no means without his beauties; and his verses, which are generally smooth, afford occasional bursts of fancy, and strokes of pathos, which shew real genius, though overrun with false taste. Mr. Jackson of Exeter, in his "Letters on various Subjects," endeavoured to recall the public attention to this neglected poet, and pointed out with much feeling some of his brilliant passages; but though curiosity may be amused by hunting for his scattered beauties, he can never regain a place among the English classical poets."

QUARLESVILLE, in *Geography*, a post-town of America, in Brunswick county, Virginia; 204 miles from Washington.

QUARNAMELA, a town of Sweden, in the province of Smaland; 23 miles S. of Wexio.

QUARNERO, or Cornero, *Gulf of*, a part of the Adriatic, between Istria and Morlachia, anciently called "Sinus Flanaticus." It is subject to sudden storms and hurricanes, which render its navigation dangerous.

QUARRE′, Fr. In old French music, B quarré was the term for B ♮. See Quadro.

Quarré *les Tombes*, in *Geography*, a town of France, in the department of the Yonne, and chief place of a canton, in the district of Avallon; 6 miles S. of Avallon. The place contains 2007, and the canton 7287 inhabitants, on a territory of 192½ kiliometres, and 9 communes.

QUARRE′E, in the old French time-table, implied a breve, or square note, equal to two semi-breves. See Time-table.

QUARREL, Querela, in *Law*. See Querela.

Quarrel seems properly to relate to personal actions, or at most to mixed ones, wherein the plaintiff is called *querens*; and in all declarations of trespass, it is said, *queritur*.

Yet if a man release all quarrels or querels, (a man's own deed being taken most strongly against himself,) quarrel includes all actions; and accordingly all actions, both real and personal, are hereby released.

Quarrels or affrays in a church or church-yard are esteemed very heinous offences, as being indignities to him to whose service those places are consecrated; therefore mere quarrelsome words, which are neither an affray nor an offence in any other place, are penal here. See Affray.

Quarrel between the French and Italian singers at Rome, in the time of Charlemagne; for which we refer to our article Charlemagne. See also Rousseau's Dict.

Quarrel, in *Armoury*, a bolt, or square-headed arrow, to shoot out of an arbalist, or cross-bow.

Quarrel *of Glass*. See Quarry.

The word is formed, by diminution, from the Latin *quadratum*, or the French *quarré*, *square*; or, perhaps, immediately from the Italian *quadrello*, *little square*.

QUARRY, in *Agriculture*, the common name of an opening, pit, drift, or shaft, which is dug into the earth or ground, and from which are to be raised ores of various kinds, different sorts of stones, slates, and other materials of similar natures. It is remarked by the writer of the work on "Landed Property," that the more useful and advantageous materials and substances that have at different times been dug and raised out of quarries in this country, are chiefly those of the iron ore kind, lime-stone, and other calcareous matters, materials for building, such as slates, flags, stones, and substances of other sorts, matters for the constructing and repairing of roads, as sand, gravel, and others of the same nature, earthy substances for the purposes of different manufactures, such as clays, &c. moulds and vegetable earthy matters, and coals, with other articles for use as fuel. There are, however, occasionally raised from openings of this nature, a few other kinds of substances, such as will be noticed below.

It has been farther supposed by the above writer, that the substances which he has here mentioned, may with truth be said to be of more real use and value to mankind than all the mines of precious metals in the world; and that the eyes of the managers of landed estates should constantly be turned towards and fixed upon the discovery of the hidden valuable treasures and productions of this nature, wherever there is a probability or likelihood of their being to be met with. It is also suggested, that it would be highly beneficial and advantageous if mineralogists, and those who are acquainted with such substances, were to turn their attention towards the appearances or accompaniments which point out such useful concealed matters; as it might greatly facilitate the search for them, and frequently lead fortuitously to their discovery. The methods which are practised in searching for and ascertaining the presence of different sorts of materials

rials of this nature, are principally thofe of boring, by means of an auger or borer made for the purpofe, into the earth, and digging into it in other ways. In fearching for moft forts of mineral fubftances, coals, and fome other matters, the ufe of the borer is conftantly firft had recourfe to, and not that of finking a fhaft, however favourable the appearances of the place may be for the purpofe, and the fuccefs of the undertaking. The ground is firft tried by this means, and a certainty of fuccefs or failure gained, as well as that of the moft proper fituation for finking the fhaft or making the opening or pit, without much expence being incurred, in cafe of the former. In trying for ochres, marles, and other fimilar articles, the fame implement is alfo in common ufe. But in raifing and providing lime-ftone, free-ftone, flags, and flates, &c. in fome cafes, digging down into and opening the ground, by fpades and other tools, is the mode employed in the firft inftance, in confequence of fuch fubftances being obvioufly prefent in fufficient quantities to be wrought with advantage. See Borer, Boring, and Auger.

The common methods of working and managing different forts of quarries, are in general, in moft places, tolerably well underftood and regulated, by fuch quarrymen as are conftantly employed in the bufinefs; but a circumftance which they commonly neglect very much, or are in a great degree inattentive to, in many cafes, is that of making good the ground below, by means of the turf or foil which is caft off from the top, or upper parts; and that of keeping the mouths of the openings fufficiently clear and free. Another common difficulty incident to them, is that of draining, and freeing their bottom parts from injurious water. This may be effected in various ways, as by the ufe of different forts of machinery worked by wind, water, and fteam, and by fome other means. See Quarries, *Pits*, &c. *Draining of.*

In many of the more fouthern diftricts of the kingdom, and ftill more in thofe towards the north, and in Wales, there are quarries, from which fubftances of fome of the following kinds are raifed and ufed in their neighbourhoods, or fent away to a diftance, in a very extenfive manner; fuch, for inftance, as thofe of the ftony kind, as iron-ftone or ore, lime-ftone, marble, chalk, granite, free-ftone, grit-ftone, flag-ftone, white, grey, purple, and blue flate-ftone, fand-ftone, fand, gravel, clay-ftone, fcythe-ftones, tile-ftones, &c.; different ochres, plumbago or black lead, calamine, gypfum, marle, pipe-clay, alum-earth, fuller's-earth, peat-earth, culm, coal, cannel, falt-rock, &c. Thefe quarries and pits are wrought, and the materials got up from them, in feveral different ways, according to circumftances and convenience, as well as the particular nature, kinds, qualities, &c. of the different articles themfelves; all of which are moftly well known, and capable of being performed by the workmen of their refpective neighbourhoods, who are commonly employed in them, and very expert in their management.

Stony fubftances which bear a great variety of different names, and which poffefs equal variety in their qualities and ufeful properties, are met with, and dug up from quarries and pits, in many different diftricts and fituations, in almoft all parts of this ifland, in order to be converted to purpofes of improvement and utility in a variety of different ways and intentions. Iron-ftones and ores abound more in the northern parts, though they are occafionally found in fome of the fouthern ones. A confiderable quantity of highly rich iron-ftone is got up and fent annually from the vicinity of Combemartin in Devonfhire, to the iron-works of Mr. Raby at Llenethy in South Wales. A large portion of it is alfo found on the borders of the Orchment river, and difperfed throughout the whole diftrict, as well as in other parts of the fame county. Iron-ftone is likewife met with in Suffex in large quantities, imbedded with lime-ftone and fand-ftone, that which rifes near to the furface being the beft, the other having a coarfer and more dull appearance, working heavier in the furnace. The very beft is frequently interfected with thin ftripes of foft marly matter. Iron-ftone, to a great extent, exifts on the eftates of lord Dudley, and many others in Staffordfhire, and contributes much to the employment and profperity of the inhabitants. But, in the northern part of Lancafhire, in the diftrict of Low Furnefs, ftone and ore of this fort are perhaps found in the largeft quantity, of the beft kind, and in the moft general manner, of any where in the kingdom. There are numbers of fhafts, quarries, and pits for raifing them from, on Lindal Moor, Whittrig Moor, and Crofs Gates, in the vicinity of Dalton, as well as in fome other places. In the former, the working is ufually effected at the depth of from twenty to forty-five feet, but it has been done at lefs as well as greater depths. The whole of their cavities are chambered with wood, and coft from a guinea to twenty-five fhillings in finking each fathom, without the wood. The ore runs in veins or feams between the rocks on the north and fouth, being in breadth from about forty to fixty yards. And it conftantly dips towards the fouth-eaft at the rate of about a foot in five or fix. The beft ore is that which has the moft greafy appearance, and it is raifed with lefs difficulty, working lefs hard, requiring lefs flux, and forming a more foft iron. It is raifed from the fhafts or pits by machinery of the gin or windlafs kind, the men employing picks, punches, and hammers in digging it up. It was formerly got, in fome places, by driving levels into the fides of the hills, and conveying it out on railways, in fmall waggons; but now the other way is moftly employed. Four men get about fourteen tons in the day, in fome fituations; but in others, double the number are required for getting the fame quantity. It is wheeled to diftant heaps, from which much of it is fent in fmall carts to the port of Old Barrow, from whence it is fhipped to different parts of England, Wales, and Scotland, at the expence of from fourteen to thirty fhillings in freight; and the reft converted into pig-iron by the furnaces in the neighbourhood. Iron-ftones and ores are alfo met with in fome other counties more to the north of the kingdom, where there are pits and quarries for raifing them from.

Lime-ftone is a very general fort of ftone raifed from quarries and pits in many different parts of this country, as in Devonfhire, Suffex, Kent, &c. towards the fouth, where it lies in vaft beds, from which it is dug for ufe; in the more midland counties, as in Gloucefterfhire, Shropfhire, Derbyfhire, Staffordfhire, and others, where it exifts and is employed to a ftill greater extent; but by far the moft extenfively in thofe farther to the north, as Lancafhire, Weftmoreland, Yorkfhire, Cumberland, and fome diftricts of Scotland. In many parts of the county of Lancafter it is dug and raifed from quarries, where it lies in a ftratified manner at no great depth from the furface, being got up without much difficulty or trouble; while in other places it is forced from the folid rock, with great labour and expence. This is likewife the cafe in many other diftricts. Wherever it is met with, it is almoft conftantly a quarry material of great value, and which affords much employment to labourers.

In the county of Kent, the banks of fome of the large rivers are fcooped out into ftone quarries in a remarkable manner, fome of them worn out and difufed, others in the ftate of being wrought. It has been obferved, that this is the neareft ftone country into which water-carriage can penetrate from the metropolis; and that the original London

was

was built, as well as the modern one chiefly paved, by materials from this diftrict, fuch as the rag-ftone, and the large pebbles gathered on the fea-fhores, before the Scotch granite came into ufe. In the neighbourhood of Maidftone there are the appearances of many abandoned and neglected quarries of this nature; but the moft confiderable ones, which were lately wrought in that vicinity, are thofe of Farleigh and Fant. In each of thefe, blocks of ftones, of different kinds, and of every form and fize, are met with, being feparated by feams, and large irregular maffes of earth of various qualities: among the reft, brick-earth of the beft quality. In fome places, the ftones are buried feveral feet under thefe earthy materials; in others, the rock rifes to the furface. After this, the quarrymen worm their way; following it, with irregular windings, leaving behind them refufe in greater quantity than the ufeful materials which they raife.

The ftony fubftances which are principally met with in them, are of two very diftinct kinds: the one hard, and of a ftrong contexture, provincially denominated *rag*, or Kentifh rag; the other of a foft crumbly nature, provincially termed *haffock*. The quarrymen are in the practice of dividing the firft fort into two kinds; what they call the *common rag*, and the *cork-ftone*, the latter being their principal object in thefe immenfe works. It has in its general appearance much refemblance to the ftrong grey lime-ftones which are found in different parts of this country; but when minutely examined by means of a glafs, its fracture and contexture have the characters of the Devonfhire marbles; except that the grain of this fort of ftone is fomewhat coarfer. In colour, too, it differs from thefe marbles, having a greater refemblance to the Yorkfhire lime-ftones. It is ufed for different purpofes; much of it is fent to the neighbourhood of London, where it is burnt into lime, for the ufe of the fugar-bakers; who, for fome reafon or other, chiefly employ lime, burnt from this material, or ftone, inftead of that of chalk. It is likewife made ufe of as a building material; and, particularly in pedeftals, for the pofts of cattle-fheds and other farm-offices. It is hewn with ftone-mafons' axes, working with tolerable freedom.

It is very durable, as fome part of the bafement of Weftminfter Abbey appears to have been built with the ftone from thefe quarries. In this cafe, it feems to have been dreffed fmooth; and the furface ftill remains with little alteration; having withftood the attacks of time with great firmnefs; it being even now difficult to detect a loofened fplinter in the work.

The common rag-ftone comprehends all the different kinds which are met with in thefe quarries, except that of the above, and that which is of the haffocky nature; though the true unmixed rag is a diftinct fort, having characters different from any of the others. In the colour, it inclines more to the red or liver colour, than that of the cork-ftone, but otherwife refembles it confiderably. Viewed with a glafs, its grain is finer, and the fracture flint-like.

Its ufes are, however, but few. Some of the beft and moft regularly-faced ftones are fometimes laid afide for paving materials; but the large pieces are moftly referved, in order to be fent by water to the diftrict of Romney Marfh, for the purpofe of forming the hard materials of the embankments and jetties, which are there made againft the fea. The fmaller forts are, in general, converted to ufe as a road material.

The haffocky ftone appears to the naked eye to be of a foft, white, fandy quality; and its fracture is the fame But under the glafs, its grain is fine, its contexture uniform, and fo thickly interfperfed with fmall feed-like granules, of a dark or black colour, as to give it a grey appearance. Sometimes bearing evident impreffions of fhells. Its texture is loofe and brittle; crumbling eafily between the fingers into a coarfe fand-like powder. It will not burn into good lime, although it is almoft wholly calcareous.

Its principal ufe is that of forming a loofe friable fort of rubbly fub-foil, in fome places, which is admirably fuited to the growth of faintfoin, and fome other crops of the plant as well as the fruit-tree kinds.

The quarries in feveral other counties contain ftony materials of thefe different kinds, which are wrought and applied to a variety of different ufes in thefe and other ways.

Quarries of marble are wrought in feveral diftricts in different parts of the country, and afford great advantages in various ways. In Suffex they have a marble, which, when cut into flabs, is ufed for ornamenting chimney-pieces, and many other purpofes. It is equal in quality and beauty to moft forts when highly polifhed. For fquare building and paving it is alfo a material fcarcely to be exceeded. By burning, it likewife affords a very valuable manure, equal, and by fome thought fuperior, to chalk, being cheaper to thofe who are near the places from which it is dug. It is found the moft perfect about Kirdford, at the depth of from ten to twenty feet underground, in flakes nine or ten inches in thicknefs, and called the Petworth marble. It was much employed in building the cathedral at Canterbury, the pillars, monuments, vaults, pavement, &c. being formed of it. And the archbifhop's chair is one entire piece of it. Marble is gotten in fome of the counties in the middle of the ifland, as Derbyfhire, Nottinghamfhire, &c. At Beacon-hill, near Newark, a blue ftone for hearths is got, which approaches to marble, and is capable of burning into lime. And in the county of Derby much good marble is raifed in different places. In Lancafhire there are quarries of fine black marble, and of ftones, which approach to, and take on the polifh of marbles. In many of the weftern and northern parts of Yorkfhire, marble of various kinds is found, fome much refembling, and others fuperior, in clofenefs of texture and diftinctnefs of colours, to that which is wrought in Derbyfhire. Alfo a ftone, which greatly refembles the marble of that county, and which is capable of receiving much fuch a polifh, and is nearly of the fame colour, mixture, and appearance. On the fide of the river Kent, near Kendall, a vein of beautiful marble has been lately difcovered in the property of D. Wilfon, efq. of Dallam-Tower; and a main quarry opened upon it. Marble has alfo been met with on the oppofite bank.

In the county of Invernefs, likewife, marble of the greateft variety of colours, and of the moft beautiful fhades, has been met with in Benevis, on the property of Mr. Camerton; and inexhauftible quarries of it lie untouched in the iflands which belong to it.

Befides, this fort of material exifts in immenfe quantities, in quarries, in many other parts of the kingdom.

Chalk is a material which is raifed from quarries and pits, moftly in the fouthern parts of the country, as in Suffex, Surrey, Kent, Effex, Berkfhire, Hertfordfhire, &c. It exifts in vaft ranges and tracts in moft of thefe diftricts, whence it is dug up from quarries, at different depths, according to circumftances, expofed in fheds to dry, when wet, and then converted into lime for various ufes, by means of fire, or employed in its broken and powdery ftate, without undergoing the above proceffes, by merely digging it out of fuch places. In fome parts, as in Kent, and the neighbouring diftricts, it is often dug and raifed from confiderable depths, from beds of very great thickneffes. And near Reading, in Berkfhire, there is a ftratum of this fubftance,

ftance, which is thirty feet in thicknefs. It is there ufed and dug out for manure, and occafionally as a building material, for the latter of which purpofes it is very durable. The remains of the abbey of Hurley, and of the ancient chapel, now the parifh church, built wholly of chalk, in the reign of William the Conqueror, are, it is remarked by the writer of the corrected Agricultural Survey of the diftrict, ftill as frefh and found as if they had been the works of the laft century. Chalk, when once indurated by the air, has a remarkable property in refifting the action of the weather.

Granite is a ftony fubftance, which is found to exift in fome of the fouthern parts of the country, as well as in thofe of the north, but it abounds much more in the latter.

In the weftern parts of Cornwall it is in great plenty in the diftricts of Penwith and Kirrier, prefenting itfelf in large flabs on all the rocky hills or tors, as well as in the wafte moors and vallies; and appearing in detached fpots, even in the fhelfy flaty tracts. It is of different colours and textures, being adapted to a great variety of ufes and purpofes, as thofe of building, and being wrought into columnar maffes, eight or ten feet in length, for fupporters to fheds, out-houfes, &c.; and as gate-pofts, and bridges over brooks, rivulets, &c.; as well as in the forming of rollers, malting, falting, and pig troughs. It is alfo an article of commerce to different parts. It is fuppofed to be exactly of the fame nature with the original granite; and there are five forts of it, which are diftinguifhed by their colours, the white, the dufky, or dove-coloured, the yellow, the red, and the black, moft of which are charged with a brown and bright filvery matter.

The county of Invernefs has a great deal of this fort of ftone, and there are numerous quarries in it for raifing and working of it. The common granite abounds in all the different diftricts of it. In many places the whole rocks are compofed of this kind, which is uncommonly ufeful for all ordinary purpofes. By natural fiffures, which run in ftraight lines, and generally at right angles, it is formed into all fized portions and fhapes, having uniformly a plain furface. And, by means of cutters or tranfverfe lines, thefe ftones are eafily quarried, and found in the greateft plenty every where. They are remarkably beautiful, being almoft as fmooth and regular as hewn ftone, and of courfe well fuited for various forts of building work. The beft buildings of the county-town are of a dark kind of granite, which is very hard and durable, but which has few or no fiffures. It is generally found in large blocks, and in many of thefe parts, there is no other material for building or adding ornament with. The manner of giving it the polifh it admits of at the quarries, is by means of fmall picks, or pick-axes, which are, in fact, hammers with fharp points at each end, in the manner of thofe employed by millers in preparing their grinding ftones. It is a very heavy, compact ftone. There is a mixed fort, denominated peafy granite, which confifts of white, black, and grey fpots, that fparkle beautifully in the fun, and is very ornamental, as well as much ufed for different purpofes, as ftairs, doors, and windows. Though this is very folid, and almoft without natural fiffures, it fplits very ftraight, by means of iron wedges, fet in a line, and ftruck alternately, with a hammer of great power.

A great deal of this kind of ftone is imported into the metropolis and other large towns, for paving the ftreets, &c. It is on the whole a very advantageous fort of quarry material in various parts of the kingdom.

Quarries of free-ftone are wrought in a great number of different places. In the more fouthern parts is found the Portland ftone, which is fo famous and ufeful in building. A fort of this kind of ftone, which much approaches to it in quality, is alfo met with in Cornwall. Some likewife exifts in Devonfhire and Gloucefterfhire. The Cotfwold quarries in the latter, afford free-ftone of an excellent quality, particularly thofe at Painfwick, Lodbury, Lockhampton-hill, &c. It abounds more, however, in Chefhire, Lancafhire, Weftmoreland, Cumberland, and fome of the ftill more northern diftricts. Several excellent quarries of free-ftone are carried on in the firft of thefe, as thofe at Runcorn, Manley, &c. where much valuable ftone of this nature is raifed. The fecond county alfo affords equally valuable quarries in many different places, from which vaft quantities of the ftone are raifed, and employed, or fent away to a diftance. Thofe about Ormfkirk, Up-Holland, and Wigan, as well as thofe on all the eaftern fide, are in general of a very good quality. And in the vicinity of Lancafter there are fome excellent ones; that on the moor or common, clofe to the town, is very extenfive, and affords a free-ftone that admits of a fine polifh. In this diftrict, this fort of ftone is met with of a whitifh-brown, yellowifh, and reddifh caft, but the firft is by much the moft efteemed. In the eaftern parts of Weftmoreland, as about Hutton Roofe, and fome other places, a good fort of free-ftone is dug up from pits and quarries formed for raifing it. This fort of ftone exifts and is quarried almoft all over the counties of Cumberland and Northumberland; and prevails occafionally in others, where it is wrought to advantage. A grit-ftone, fomewhat of this nature, is met with in fome diftricts, as in Shropfhire, &c. which is raifed from quarries, and ufed as a building material. And a fand-ftone exifts to confiderable extent in others, as in Suffex, &c. that is fometimes dug up, and made ufe of for common buildings, &c. In Chefhire, on the hills near Macclesfield, about Kerridge, a fort of fand-ftone is met with, which is particularly well fuited to the making of flags, and whetting tools, as well as fometimes to the forming of flates, for which it was formerly much employed. Near Pott-Shrigley, alfo, a fine fand-ftone is found, that admits of a good polifh. The quarry has not, however, been wrought for fome late years, as from the extreme hardnefs of the ftone, the expence of getting it is very confiderable. There are feveral other quarries of excellent free-ftone wrought in the fame neighbourhood.

There has been great abundance of free-ftone wrought, time immemorial, in the low parts of the county of Perth, and quarries of a greater or fmaller grained ftone of this fort appear almoft in every place, with the exception of the carfes. In the lowlands, and near to the eaftern fea, the pores and grain of it are greater; but as the mountains are approached, the pores are lefs, and the grain finer, by which thefe ftones admit a fmoother polifh. The quarry of Tullyalan parifh, called Long-annat, affords a ftone of a very excellent quality. It has a white colour, admits of a fmooth polifh, and refifts the influence of the weather. Some of the principal houfes in that part of the country, as well as fome of the moft magnificent public buildings in the capital of Edinburgh, as thofe of the Exchange, the Infirmary, and the Regifter-office, confift partly of this ftone, and thofe found at hand. And farther, in fome inftances it has been carried to the continent. But the quarry of Kingoodie, in the carfe of Gowrie, belonging to Mr. Mylne, of Mylnfield, is unqueftionably the fineft of this kind of any in the county. Aftonifhing blocks in great number are raifed there, fifty feet in length, fixteen feet in breadth, and three feet in thicknefs. Such is the demand for this ftone, both at home and abroad, that four veffels are employed in exporting it from this quarry. The work is, however, on the de-

 cline,

cline, occaſioned by the act of 1794, which impoſed a duty on ſtones, which, although trifling in itſelf, cauſes much grievance, vexation, delay, and trouble, in procuring coaſt-diſpatches, &c.

Flag-ſtones and quarries for the working and preparing of all ſorts of flags, are met with in all thoſe ſituations where free-ſtone is found, and where it exiſts in rather thick ſtrata, or layers of ſome depth, which are capable of being ſeparated by hammers, wedges, or other means. In many places in the ſouthern parts of the iſland, the flags raiſed from ſuch free-ſtone quarries are of an extremely good quality, being uſed in very large quantities for many different purpoſes. Thoſe of Cornwall and Devonſhire alſo, in many caſes, afford a good ſort of flags. The ſand-ſtone quarries of Shropſhire, as at Grinſell, near Shrewſbury, about Bridgnorth, and at Corndon-hill, near Biſhop's-caſtle, as well as in the Swinney mountain, &c. where alternate beds of fine white and red ſtone of this kind, of very ſuperior quality and thickneſs, exiſt; that in the firſt of theſe ſituations, being twenty yards thick, affords flags likewiſe, which are of a very uſeful nature. Free-ſtone flags too, of uſeful ſorts, are met with in the quarries of ſome of the midland counties. And they abound much in many of the free-ſtone quarries of Lancaſhire, Yorkſhire, and ſome of the other more northern diſtricts of the country.

The quarries of this kind become ſlate-ſtone, and furniſh the white, grey, and brown ſlate, wherever the ſtone lies in thin layers, or ſtrata, which are able to be raiſed and ſeparated from each other with convenience and facility. They exiſt in moſt of the above tracts, and are plentiful in ſome of them, eſpecially thoſe towards the north. The Lancaſhire and Yorkſhire quarries, in many places, ſupply the white and grey ſorts in great abundance, and of good qualities. Thoſe of Weſtmoreland, Cumberland, and Northumberland, alſo afford them in many inſtances of a valuable nature. And they are equally good in the ſtill more northern diſtricts. There are numerous quarries of different colours of them in Clydeſdale, Perthſhire, Argyleſhire, and the county of Inverneſs, from which vaſt ſupplies are conſtantly raiſed for home and other uſe. This ſort of ſlate has, however, moſtly the diſadvantages of being very porous, heavy, leſs durable, and of requiring more and ſtronger timber to ſupport it, than ſome other kinds; being only fit for expoſed climates and ſituations.

The quarries of the lighter and thinner kinds of ſlate, of the blue, green, purple, and other colours, formed from other ſorts of ſtone, only exiſt in ſome particular diſtricts, as thoſe of Wales, the northern part of Lancaſhire, and the adjoining counties, and in a few places in Scotland. The ſlate quarries of the Welſh diſtricts ſupply ſeveral kinds and colours in large quantities, and of good qualities, but the dark and lighter purples are the moſt prevalent ſorts in moſt of them. In Lancaſhire the quarries of this kind are very numerous in the part to the north of the ſands, as about Gothwaite-common, Kirby-moor, Coniſtone-hills, and Tilberthwaite-fells, &c.; and from which very large ſupplies of the blue, green, and the dark purple ſorts of ſlate are raiſed, and ſent away for exportation, or conſumed at home for different purpoſes. They are wrought, and the ſlate prepared in ſomewhat different manners in different places. The Gothwaite quarries have the ſlate dug out from the ſide of the hill, and carried away. But in ſome on Kirby-moor, a level is driven through the ground from below, the metal being conveyed away by ſmall four-wheeled waggons on iron rail-ways. Thoſe about Coniſtone are moſtly worked into the hills, and the metal raiſed and carried out from them. Some of the Tilberthwaite quarries are wrought by blaſting the ſlate-ſtone, and collecting and carrying it out of them on ſlanting roads, in ſmall carts or trucks conſtructed for the purpoſe, the levels being below the hills, but not nearly ſo low as the bottoms of the quarries. Others are wrought by draught roads from the bottoms of them. One man will raiſe eighteen or twenty hundred weight of ſlate in one day, where the metal riſes well, but leſs in other caſes. In ſome it is dug out by one ſet of men, ſplit by another, and formed into ſlates by a third, for which purpoſes, flat crow-bars, ſlate-knives, and axes are employed. The ſlate is divided and diſtinguiſhed into three ſorts, as firſts, ſeconds, and thirds, or London, country, and toms. In the firſt, or Gothwaite quarries, the ſlate has a darkiſh purple, or black caſt, and is worth from forty to forty-four ſhillings the ton. In the Coniſtone quarries it has a fine blue and green appearance, and is much thinner and lighter than the other ſort. The Tilberthwaite ſlate, in ſome inſtances, ſplits very fine, thin, and light, but does not cover ſo far as thoſe of the Gothwaite and Kirby quarries. This ſort is worth from forty-eight to fifty ſhillings the ton. In ſome quarries a ſort of rent is paid *per* ton, on the ſlate which is raiſed, as ten ſhillings for the beſt, eight ſhillings for the ſeconds, and ſixpence for the thirds. In others a certain rent only is paid for the liberty of the royalty, and not a tonnage duty. Theſe rents or duties on the workers of theſe quarries, are probably higher than they will bear, and have enabled the Welſh ſlate dealers to underſell thoſe of this county.

Weſtmoreland and Cumberland, in ſome inſtances, afford good blue and green ſlates. In the latter, ſome of an excellent quality are gotten in the quarries of Borrowdale, and inferior ſorts in ſome of the neighbouring mountains.

The county of Argyle, in Scotland, in ſome parts abounds with ſlate-quarries, as the tracts about Eſdale, from which five millions of ſlates have for ſome time been annually ſold at the rate of twenty-five ſhillings the thouſand. Quarries of the ſame kind are alſo wrought in many other parts, with great benefit to the inhabitants.

Slate-quarries are formed in many parts of the highlands of the county of Perth, but none in the low. The ſlates in ſome are of a purple colour, in others of an azure blue, and in a few of a muddy, ſandy, brown complexion along the cutters. It is well known where the different ſorts are quarried. The veins of ſlate-rock ſeem to run from Drumlane, in the pariſh of Aberfoil, in a north-eaſt direction to Dunkeld; and may be traced beyond the limits of the county both ways. The azure coloured are the beſt metal, and riſe of a greater ſize than any of the other kinds. Many of the buildings in different places are ſlated with this beautiful covering. Into the lower diſtricts of the county, ſlates are imported from Eſdale, and the other quarries on the weſt coaſt of the county of Argyle.

Quarries of grey ſlate exiſt in many different parts of the county of Inverneſs, in which the quality is very good, and well ſuited to the climate. In ſome places theſe ſlates are much preferred to blue ones, as the latter are more expenſive in procuring, and though nailed on the roofs ever ſo firmly, are apt to be looſened by high winds, unleſs bedded in lime, which circumſtance renders repairs difficult.

There are numerous quarries of ſand and gravel to be met with in almoſt every diſtrict of the kingdom, which are wrought either for the purpoſe of ſupplying domeſtic uſes, or thoſe of repairing roads, &c. Thoſe of the former ſort, which contain the fine white, red, and yellow ſands, are by far the moſt valuable, and wrought to the greateſt extent, the materials being moſtly dug out from the ſides of banks and other places, and but rarely got by ſinking the

the quarries into the more level parts of the ground, though this method is fometimes practifed. The matters are commonly raifed fimply by digging and fpades; and thrown into the carts, in many cafes, from the quarries and pits themfelves. Numerous quarries and pits of this nature exift and are wrought to a very great extent in the neighbourhoods of the metropolis, and moft other large towns, all over the kingdom, for the purpofe of fale for various domeftic ufes.

In the gravelly kinds, thofe quarries which abound with the fharp, coarfe, flinty, and pebbly forts, are the moft proper and beneficial for the making and repairing of all forts of roads and carriage-ways. They are occafionally formed by working into banks and fteep places, but more frequently by openings in the plain furface. Their depth is fometimes confiderable, the materials being raifed after being fcreened, the work, of courfe, very laborious and troublefome. In other cafes, the carts are filled from the quarries or pits without much difficulty or trouble.

Quarries of clay-ftone, ftone-tiles, fcythe-ftones, and fome other forts, are found of good qualities in different diftricts. In Gloucefterfhire they have quarries of blue clay-ftone at different depths, lying in beds of the fame coloured clay, difpofed in layers of from four to ten inches in thicknefs. The ftone in new quarries is eftimated by the effects which the atmofphere has upon it from fome expofure. The beft fort is a very ufeful material for feveral purpofes. Quarries of ftone-tiles principally exift, and thofe articles are raifed from them, in different part of the Cotfwolds. The beft are prepared about Miferdine, Beverftone, Charlton, and Hampton-field, the colour of which are yellow or grey; but another fort, which is red grit, is dug up about Iron Acton, and fome other places, but which is lefs valuable.

There are quarries of fcythe-ftones in many parts of Lancafhire, but the beft are obtained from thofe about Rainford, where they are well wrought and prepared for ufe. In feveral other diftricts, quarries of different kinds of whetting-ftones likewife exift, and are wrought to advantage.

Ochres of different kinds are met with in different places in quarries formed for the purpofe of raifing them. In the county of Devon, formerly large quantities of various fhades between red and yellow, were raifed and manufactured in thofe about Eaft-down. Umber, in the parifh of Combemartin, exifts in a pretty large body. The working and preparing of thefe are, however, now much lefs attended to than heretofore.

In Suffex there are quarries of red ochre about Graffham, and in various places contiguous to the fea, as near Chidham, &c. where much is raifed, prepared, and fent to London. Ochre quarries alfo exift in many counties more to the middle and north of the kingdom, from which great quantities of this fubftance are procured and prepared for ufe in different forts of arts and manufactures.

Quarries of plumbago, or black lead, are likewife occafionally found and wrought, in different fituations, in different diftricts of the country. This fubftance has been met with and raifed near the borders of the Bovey river, in Devonfhire, in fome quantity, and prepared to be fent to Exeter for fale. Quarries of black lead are alfo found and wrought in Borrowdale, in Cumberland, near to the town of Kefwick, to fome advantage. And they exift in fome of the middle tracts of the ifland, affording great benefit to the proprietors of them. In the county of Invernefs, there are fome appearances of black or pencil lead about Glengary, but they have not yet been turned to any ufeful account.

In fome diftricts, in the middle parts of the country, quarries of calamine, or *lapis calaminaris*, are met with, and much of this fubftance raifed from them to great profit. It abounds in the Mendip-hills, in Somerfetfhire, about Rowbarrow, Shipham, Winfcomb, and on Broadfield-down, &c. It is fometimes found within a yard of the furface, and feldom wrought deeper than thirty fathoms. In fome places its quality is excellent. It is prefent in other neighbouring mountainous tracts, and raifed with equal advantage.

Quarries of gypfum prefent themfelves in many different parts, and are wrought in fome with confiderable benefit. In the county of Devon, it lies between ftrata of red ftone, marle, and chalk rubble, about Salcombe, Branfcombe, and Beer, being ufeful for various purpofes. Gloucefterfhire and Derbyfhire have quarries of this nature, where there are fine beds of it. Thofe of Auft Cliff in the former, have it not fo good, however, as that which is met with in the latter county. In Nottinghamfhire it is of an excellent quality, efpecially that got near Newark and at Redhill. Chefhire has fome, but not turned to much account. Weftmoreland and Cumberland have good quarries of it, in fome places, where a great deal is gotten up, and made ufe of. And it abounds in different parts of the county of York, where it is raifed to advantage.

Marle is an article that is met with in pits and quarries in a variety of different fituations, and of feveral different kinds and qualities. It is found and dug up for ufe in many places in Suffex, and the counties more to the centre of the country; but it prevails in the greateft plenty in the county of Lancafter and fome others, in which it is raifed or worked out from large openings on the fides of hills, high banks, or in the plain furface, and fet thickly upon the land. The getting or digging of the material out of fuch places, is ufually performed by means of ftrong iron mattocks, crows, fpades, and wooden fpiles; large pieces being in fome cafes forced down, not without danger to the workmen, by driving in the fpiles or piles from above. This method is called *falling*. The work is extremely fevere, and commonly done by the rod. The large clods thus forced down, break into fmall pieces, and are then filled into carts for the purpofe.

Shell-marle, though it is not much attended to in any part of England, is frequently met with and dug up from various parts of Scotland, and employed on the land in great quantities, with much fuccefs. The pits and quarries of this fort are commonly wrought with much more facility than thofe of the others.

Pipe, and other kinds of fine clays, are dug and raifed from a fort of pits or quarries, in large quantities, in many different counties. Near Wear Giffard, in Devonfhire, much of the firft fort is dug and fent coaftways, though not in fuch quantities as formerly. Brown potter's-clay is alfo raifed and fent away in great abundance from the neighbourhood of Fremington. Thefe forts of clays are likewife found in much abundance in Berkfhire, and ftill more fully in fome of the midland diftricts, where the pits of them are wrought to a vaft extent. They are articles of great importance and utility in feveral forts of manufactures, and for which there is great demand in many inftances.

Alum earth is a kind of ftratified matter, which is met with and raifed from pits and quarries in a number of different fituations, and various parts of the kingdom. In fome they are wrought to very confiderable extents and advantages, but in others in far lefs degrees, and with much lefs fuccefs.

The ftrata of this earth are dug and got up in different manners

manners under different circumſtances, but moſtly by means of ſtrong crows, picks, and other tools of a ſimilar kind, being wrought in ſomewhat the ſame method as in the caſes of marle. The buſineſs is uſually executed by common labourers.

Fuller's-earth is another material of this nature, which is dug out of the ground from pits and quarries at different depths in ſeveral parts of the country. In ſome it is very abundant, and of a rich good quality, as in thoſe of the middle and more northern parts of the iſland, forming an article of great uſe and demand in ſeveral branches of buſineſs. In others it is of a much leſs valuable nature, being far leſs in requeſt. That which is found about Tillington, in Suſſex, is conſumed in the neighbouring fulling mills. The mills of this ſort in Yorkſhire, and other parts alſo, conſume immenſe quantities. The material is raiſed from the places in which it is found in much the ſame way as many other earthy ſubſtances, but it ſeldom requires ſo much digging, as it is a far leſs hard matter.

Fuller's-earth was formerly got up from pits and quarries in the neighbourhood of Maidſtone, in Kent, and much ground wrought over; but the beds of ſand by which it is covered are of ſuch depths, as to render the works of little value or importance.

Quarries and pits of mineral peat-earth are found in ſome diſtricts, and much of the material dug up from them, and made uſe of when prepared upon land. The vale of Kennet, in Berkſhire, contains vaſt quantities of it, as well as ſome other parts. It is a ſtratified ſubſtance which is dug from under the ſurface at the depth of from one to ſix feet, laying below ſtrata of ſmall ſhells and calcareous matter. In raiſing it, a peculiar kind of ſpade is made uſe of, which cuts it in long pains, ſomething like ſoap, which, when dry, are burnt into aſhes and laid on the land. This ſubſtance is found to contain the oxyd of iron, gypſum, and the muriates of ſulphur and potaſh, in the proportions of forty-eight, thirty-two, and twenty parts to that of one hundred.

It is ſuggeſted by the writer of the work on "Landed Property," that in moſt mountainous diſtricts, and many low fenny counties, immenſe collections of vegetable mould or peat-earth lie in a ſtate of neglect; even in places where they might be converted to valuable purpoſes; not only as ſources of fuel merely, but as manure, either uſing the vegetable matter in its raw ſtate, or after being reduced to aſhes. In all theſe ſituations it might be readily dug up from different places, and applied to different uſes in each of theſe ways, the pits or other ſpots containing it working in a very eaſy manner. The aſhes of it are only employed on any large ſcale in the above county.

Culm, coal, and cannel, are articles of the fuel kind, which are found in a vaſt number of places, all over the kingdom in pits, mines, or quarries, and which are of the greateſt importance in many of them. Speaking of coals, the author of the work on "Landed Property," conſiders them as riſing in the minds of moſt men, far ſuperior to moſt other productions and ſubterraneous matters, whether they are held in the light of agriculture, manufactures, or national defence. It is aſked, if it were not for the collieries of this country, how many hundred thouſand acres of its land, which are now appropriated to cultivation, would be required for the production of fuel? How many manufactories, eſpecially thoſe of iron, which are ſo very valuable to civilized ſociety, would be cramped, retarded, and ſtopped, in their progreſs and operations? And how many hardy ſeamen would be wanting to its navy? Surely, in his opinion, an indigenous production and material, on which the proſperity of the country ſo greatly depends, is entitled to the guardian care of its government; to aſcertain the preſent expenditure, and the probable ſtock which is remaining. Let us not, it is remarked, play the ſpendthrift, and, by the follies of a day, entail centuries of want on generations to come, and the curſes of millions on the memory of the preſent times.

In endeavouring to find theſe ſorts of ſubſtances in parts where pits of them have not yet been wrought, the ſearching, it is ſuppoſed by the ſame writer, ſhould, in general, be done by the land proprietors of the particular places, in a conjoint manner. There are, however, certain inſtances, in which individuals may proſecute the ſearch with propriety, and in the moſt beneficial manner. In doing which, the principal things to be guarded againſt are thoſe of misjudgment and impoſition. Hence the neceſſary prudence of endeavouring to procure perſons of ſkill and integrity for making ſuch ſearches; which are, in the firſt place, to be attempted by a cloſe inveſtigation of ſuperficial appearances, and then where thoſe are favourable in their nature, by the uſe of the boring rod or tool. It is ſuppoſed that, at preſent, there are none who are equal to ſuch undertakings, except thoſe who have been long converſant with the buſineſs of coal-works; men who have an intereſt in the exiſting collieries or works of that kind. On this account it is thought to become a matter of common prudence, in a given ſituation, to endeavour to procure an undertaker or overlooker from a diſtant work; or ſuch a one as can have no counter-intereſt to that of his employer; and then, cloſely to connect and bind them in one common intereſt. After having had different occaſions for conſidering the ſubject, and for beſtowing no ſmall thought upon it, the writer is of opinion that the moſt eligible plan of proceeding, in ſuch caſes, is that of agreeing with an overlooker, or undertaker, to pay him reaſonably, but not extravagantly, for his time, and for his actual expences in proſecuting the neceſſary ſearches; and, further, to agree to give him, in the event of ſucceſs, a reward ſufficient to call forth his beſt exertions; ſuch reward to be payable, not on finding coal, but whenever the work, to be eſtabliſhed in conſequence of the diſcovery, ſhall have cleared the amount. In this way the proprietor will feel himſelf ſecure, while the perſon employed has the moſt powerful ſtimulus to induſtry, attention, and the accompliſhment of the object of the undertaking.

Culm and coal have been met with and wrought in ſome degree, in Devonſhire, Suſſex, and ſome other of the ſouthern parts of the iſland; but they exiſt much more plentifully in the midland and more northern diſtricts, as well as in ſome places in Wales and Scotland. In Glouceſterſhire, coal abounds in moſt parts of the foreſt of Dean, and its vicinities, and probably to within a ſmall diſtance of the county-town, as at Newent and Pauntley, where pits are eſtabliſhed. Thoſe of the foreſt tracts are very numerous, but not fully wrought for want of ſufficient draining. Pits of this kind alſo exiſt in many places, in the lower vale part of the county. In this diſtrict, however, the coals are no where of the beſt quality.

In the counties of Salop and Somerſet, coals alſo prevail very much, various pits of them in both, being wrought to conſiderable extent. Thoſe in the northern part of the latter diſtrict, have ſtrata of them which form an inclination of the plane of about nine inches in the yard; and are nineteen in number. They are ſeldom wrought where leſs than fifteen inches in thickneſs, but they vary from ten inches to upwards of three feet. The working is performed at conſiderable depths, eſpecially ſince the eſtabliſhment of improved machinery, and other means for raiſing them. The coal

coal is of the firſt quality, being pure and durable in burning, and from its firmneſs, largeneſs, and ſtrength of grain, capable of being conveyed to any diſtance without injury. At preſent the quantity raiſed in theſe pits, is from fifteen hundred to two thouſand tons weekly, but much greater ſupplies could be afforded, if they were wanted. The works are twenty-ſix in number, ſome of which afford a good profit.

The pits in the ſouthern part are upon a more limited ſcale of work. In them the ſtrata of coal form an inclination of the plane of from eighteen to thirty inches in the yard; but in ſome it is deſtroyed, and they deſcend in a perpendicular manner. There are, in number, twenty-five, which are in thickneſs from ſix inches to ſeven feet, being rarely wrought under eighteen inches. The depth of working is middling, but will be increaſed. The quality of the coal not the beſt, but tolerably good. The quantity now raiſed from theſe pits is from eight hundred to a thouſand tons in the week, which might be eaſily extended. The working profits are by no means great. There are pits in other parts, but they are not many, or much wrought.

Againſt the apprehenſion of pits of this nature being exhauſted or worn out in theſe places, it is contended that more than treble the preſent quantity is capable of being raiſed from the works already carried on, and that this increaſed quantity might be ſupplied for ſeveral hundred years to come.

The works and quantities of coals contained in the counties of Stafford, Derby, and Nottingham, are likewiſe very great, and moſtly of good kinds; pits of them being carried on in many places to vaſt extent.

Cheſhire, too, is a coal diſtrict, in which a great variety of works for raiſing it are eſtabliſhed in different parts, and much of it, which is of a very good quality, gotten up. The ſtrata of coal here in many caſes are ſeveral feet in thickneſs; about Wirrall the ſeam is five or ſix feet thick, and the works extenſive under the channel of the Dee. In ſome works the beds of coal lie at the depth of from ſeventy to one hundred yards below the ſurface of the ground, and are of different thickneſſes to ten feet or more.

In Lancaſhire, coal of good ſorts is moſt abundant. The beds of it run acroſs the county in ſomewhat three different parts, as towards the ſouth, nearly in the middle, and on the north-eaſt part. Thoſe in the two firſt are of conſiderable breadths and thickneſſes in different parts, but the third is much leſs broad and very thin in many places. They all run, in ſome degree, from the north-eaſt to the ſouth-weſt, conſtantly keeping ſomewhat the ſame direction, though occaſionally branching out in a lateral manner to ſome extent. The works on each of theſe different lines of coal ſtrata, eſpecially the two moſt towards the ſouth, are very numerous, and, in different inſtances, of very conſiderable extent. There are ſome alſo eſtabliſhed on the northern line, but they are of a far more limited nature. The layers or ſtrata of the coals are of various widths, from a few yards to a very great diſtance, and their depths or thickneſſes from a few inches to ſix or ſeven feet. They lie at very different depths from the ſurface of the earth, according to circumſtances and ſituation; on the eaſtern ſide of the county they ſometimes nearly appear on the top of the ground, while in the middle, and towards the ſouth-weſt, they are often a conſiderable number of yards deep. All about moſt of the large towns in the ſouthern parts of the diſtrict very extenſive works are eſtabliſhed, where immenſe quantities of coals are raiſed for home uſe, as well as being ſent coaſtways, and, in ſome caſes, for exportation. They are a ſort of material which is of vaſt importance to the manufacturing ſtate of the county, and which contributes greatly to its proſperity. The quantity is ſo great, when conſidered as a whole, that they would ſeem to be almoſt inexhauſtible.

The cannel coal, which is a ſort that has ſome reſemblance to fine black marble, is principally found and raiſed in the tract about Haigh, near Wigan, which is not more than a few miles ſquare. It lies in pretty thick ſtrata, at the depth of from five to ſeven or eight yards from the ſurface. It is of a very fine, hard, inflammable quality, being got up by ſharp picks, often with conſiderable labour, and for which there is much demand, for domeſtic uſe, in the neighbourhood.

Coals alſo abound in the neighbouring counties of Cumberland and Northumberland, being found in many parts of the eaſtern mountains, and, with not many exceptions, all along the tract, which extends in different degrees of breadth, from Sebergham to Whitehaven, and along the coaſt to Maryport, forming and comprehending a diſtrict of about one hundred ſquare miles, in the former. And they are met with in great plenty throughout the greateſt part of the latter county, particularly in the lower diſtrict of it; being of the beſt quality, and the moſt numerous, and thickeſt ſeams, in the ſouth-eaſt quarter; whence thoſe vaſt quantities are exported which ſupply the great conſumption of the London market, as well as the coaſting and foreign trade. A trade which is the foundation of the commerce of the country, and the principal ſource of its wealth, as well as a never failing nurſery for ſome of the beſt ſeamen of the Britiſh navy. The former county has likewiſe works which ſupply prodigious quantities, both for home conſumption and the coaſtways and export trade. Cannel coal is alſo raiſed in this diſtrict in pretty large ſupplies in the neighbourhoods of Caldbeck and Bolton.

Large portions of this article are likewiſe raiſed from the works in the county of Durham, which in ſome parts are carried on with much ſpirit and enterprize.

Coals are found, and raiſed in full ſupplies, in many places, in moſt of the counties of Scotland, ſo far as Perthſhire; but they have not been met with any farther towards the north in any ſufficient quantities. Where they exiſt, to any extent, in theſe ſituations, they are generally of good kinds, and capable of being got up without any great difficulty, ſeldom lying at any very great depth below the ſurface.

It has been contended by ſome, that the coals in the pits and other places, in this country, are inexhauſtible, while others maintain the contrary to be the caſe; as the matter relates to the county of Northumberland, we have the following calculations, on the authority of the writers of the Agricultural Report of that diſtrict. And they may perhaps equally apply to others. It is ſuppoſed, that towards elucidating this point, it may be of ſome uſe to eſtimate what number of acres are wrought yearly in the county to ſupply the neceſſary conſumption. In order to accompliſh this object, the thickneſs and number of workable ſeams of coal muſt be firſt aſcertained; for which purpoſe they have been favoured with ſections, exhibiting the thickneſs and depth of the various ſtrata, in ſome of the deepeſt pits in the county, one of which has a depth of two hundred and ſeven yards, with ſixteen ſeams of coals; the other a depth of two hundred and forty yards, with fifteen ſeams; conſequently, if the medium be taken betwixt the two, it will be nearly ſix yards thick of workable coal; from which may be formed, it is thought, a calculation of the quantity of coal in an acre of ground, ſuppoſing the aggregate thickneſs of the various ſeams amount to ſix yards.

An

An acre of ground contains - 4840 fquare yards,
which, multiplied by the thicknefs 6 yards,

gives - - - 29040 cubic yards in an acre.
From which deduct ⅓ for wafte and the parts or pillars neceffary to be left in working - - 9680

there remains 19360 cubic yards to be wrought.

And as three cubic yards of coal, when wrought, afford a Newcaftle chaldron, therefore

19360 = gives 6453 Newcaftle chaldrons *per* acre,
divided by 3

The coals exported yearly from the rivers Tyne and Wear, with Hartley and Blyth, amount to about 825,000 chaldrons, which, with the home-confumption of the two counties of Northumberland and Durham, will make the quantity of coals raifed yearly about 1,000,000 chaldrons.

And the chaldrons raifed yearly divided by the chaldrons *per* acre 1,000,000 / 6453 = gives 155 acres nearly *per* year, cleared of coal fix yards thick.

And by eftimating the breadth occupied by the caking coals to be on the average eight miles broad, and twenty-five miles long in the two counties, it is found that there will be about two hundred fquare miles, or 128,000 acres of coal proper for exportation.

From Newcaftle 510,000 chaldrons.
—— Sunderland 315,000 ditto.

In all 825,000

Then the whole area divided by the yearly confumption - 128,000 / 155 = 825 years. The time before this fpace will be wrought out.

It is, however, fuggefted, that there are fome reafons to fuppofe that a thicknefs of feam equal to fix yards will not be obtained all over an extent of two hundred fquare miles, probably not more, on an average, than four yards; in which cafe the coal will be exhaufted in five hundred and fifty years. And if the aggregate thicknefs of the feams to be obtained fhould prove only three yards, then little more than four hundred will be the term of continuance; but it is probable, it is thought, that before the half of that time be elapfed, the price to the confumer will be confiderably increafed from the increafed expence of obtaining them, and the increafed length of carriage from the pits to the rivers; this laft, it is prefumed, may be reduced in fome fituations, by adopting canals inftead of waggon-ways, which, it has often been wondered at, have never yet been attempted. From this inveftigation, it is fuggefted, that the apprehenfions of exhauftion are not fo chimerical as they have been fuppofed and reprefented to be by fome perfons. When, however, the vaft extent of the working and unwrought tracts, in the different parts of the country, are confidered, there cannot be any grounds for fear, in this refpect, for a vaft length of time yet to come.

Pits, fome what of the quarry kind, are wrought in one diftrict of this country, that of Chefhire, for the raifing of rock falt, in fome of which large quantities of this material are procured, from different depths, and different thickneffes of the ftrata of it. In the getting of it different means are employed, as thofe of blafting, picking with implements, for the purpofe of roofing, the ufing of horfes, and machinery wrought by fteam, for forcing up the fubftance, and fome others. The digging, raifing, and working of this article, employs a great number of labourers, and it is of much importance to the county in many points of view.

But though this fort of material is found in feveral different parts of the county, pits, or fhafts of it, are at this time only wrought in the vicinity of the town of Northwich. This arifes from a great many different caufes, but principally from that of the want of water-carriage for the conveyance of the material from them. The number of pits or fhafts, which there are at this time in work, for the purpofe of raifing this article, are about a dozen. They are by much the moft commonly made in fomething of the fquare form, being fecured on the fides by means of ftrong timber, but they have occafionally a round form, and are walled on the fides with bricks.

The beds of this material, that are to be raifed, are wrought at various depths, the deepeft being in general the moft pure, and they vary equally in their thicknefs and directions, as fuggefted above. In fome cafes the beds are of the greateft thicknefs, the more they approach the north-eaft, decreafing in a gradual manner, in their courfe to the fouth-weft; and in fome inftances they incline from north-weft to fouth-eaft, dipping at the rate of about three feet in twenty-feven or thirty.

The ftrata, which are paffed through in getting at and working the rock-falt, lie in a very regular manner, and confift, in general, of a hard clayey fubftance and a fort of gypfeous material in mixture in various ways and proportions, that of the latter kind being the moft predominant as the pit or fhaft approaches the rocky faline fubftance. In working, the clayey matter is defignated by the name of *metal* of the feveral different colours belonging to that fort of fubftance, and the other material by that of *plaifter*. Thefe ftrata are moftly of a folid compact nature, but occafionally broken in particular places, when the metal is termed *fhaggy* by the workmen.

In the bufinefs of working the pits, and raifing the rock-falt, the rocky beds are reduced into pieces of proper fizes for the purpofe, by means of blowing them with gunpowder, and thofe of fplitting and dividing them with hammers and proper wedges for fuch ufes; a good fecure headway or roofing being conftantly provided in the firft place, to the opening from which the falt-rock is to be taken, which is effected by the ufe of fmall fharp picks, carrying on the work in a plain fimple chambering manner.

The workings are funk from thefe chamberings to different depths, as the nature of the beds of rock, and the quantity of the purer kind of rock-falt, or Pruffian rock, as the workmen term it, may direct; but commonly about fifteen feet. Occafionally the roofs or headways of the pits or fhafts are fupported by confiderable fquare pillars difpofed in a fomewhat regular manner, but in other cafes they are wrought out in a fort of long openings, according as the workmen are inclined.

In getting the rock-falt, the workmen are paid by the ton at the rate ufually of about two fhillings, they finding the gunpowder and other tools.

In raifing the falt from the pits or fhafts, horfes were formerly entirely made ufe of, but within thefe few years, recourfe has been had to the improved fteam-engine, as already noticed, though it is not yet generally employed at every pit. See Rock-salt, Rock-salt *Pits*, Salt, and Salt *Brine Springs*.

It is evident from the above account, that in whatever way they are confidered, the quarries of different kinds in this country are of very material importance to its profperity

profperity and convenience; contributing largely to the carrying on of different forts of works and improvements. Without them much ufeful labour muft be wholly at a ftand; a variety of neceffary bufineffes be incapable of being carried on; and the effects of it upon various arts and manufactures, be much too ferious to be thought upon. In fhort, the numerous fubftances of different kinds, which are taken from the bowels of the earth in this country, conftitute one great fource of our national wealth and profperity.

Quarries, *Pits*, &c. *Draining of*, the proper, moft convenient, and appropriate means of rendering all fuch forts of works dry, free from water, and in a fit ftate to be wrought with eafe and advantage. In the effectual performance of all kinds of undertakings of this nature, there is occafion for the application of the fame principles, which are fpoken of and explained in confidering the nature of draining land in general, and the particular manner which is neceffary to be purfued in the practice of fpring draining. See Draining *of Land*, and Spring-*Draining*.

There can be no doubt, indeed, but that the having recourfe to fuch principles, and the modes of practice refulting from them, will be equally expeditious, beneficial, and fuccefsful, as well as in many fituations of very material importance, in the various cafes of this fort, as in thofe which have been mentioned; by leading to and introducing the moft ready and eafy means of diminifhing the quantities of water, which are frequently met with in the courfe of working them, and which not unfrequently obftruct and hinder in a very high degree, but fometimes wholly put a ftop to the work which is carrying on in them. Such, at leaft, is very often the cafe in quarries of the free-ftone, lime-ftone, flag-ftone, marle, and other kinds, as well as in pits of the coal and other forts. The want of this fort of knowledge, of courfe, is one great caufe why fuch a number of quarries and works of that kind, in different parts, often lie altogether, or for a great length of time, in an unwrought ftate; which might otherwife be wrought to very great advantage.

As it is now well underftood, that moft fprings and fubterraneous collections of water are formed and fupplied from fuch grounds or lands as lie higher than that of the places where they are found or met with, which, on account of their being of an open or porous nature, admit that of rain and other forts of moifture to filtrate and pafs freely through them, which finking and defcending to very great depths, through fuch open materials of the rocky, fandy, gravelly, and other loofe qualities, before it becomes impeded and obftructed by fome fort of impenetrable ftratum or layer of an earthy or folid ftony nature, fuch for inftance as thofe of pure ftiff clay or compact rock; it may happen, that in many fuch cafes, in finking pits or fhafts for ftone, coal, or any other kind of fubterraneous material near the bottoms of hills or high grounds, beds of quickfand will be met with, and dug into, which are fo full of water, that to pafs through them becomes a moft troublefome, difficult, and expenfive piece of work, and fometimes impoffible to be performed, but which, from knowing that the water proceeds from the porous ground that lies above, it may often be practicable to intercept and cut off the greater part of the water, before it reaches fuch fand beds in the quarries, pits, and fhafts, by the means of boring into and tapping the water at the *tail* of the banks of this nature, provided that the ground naturally declines lower than the place where the fand is found in the quarries, pits, &c., and the whole or moft of the water be drawn off, and diverted from them at a comparatively trifling expence to that which is employed as the common remedy in fuch cafes and circumftances.

In order to accomplifh this intention, it will be neceffary, in afcending from the quarry or pit, to carefully examine and afcertain, if at any place higher on the declivity, any porous ftratum, bed of rock, fand, or gravel, *tails* out, which may conduct and convey the water contained in it to the fand bed, which is below in the works; and where any fuch bed is found, to cut or bore into it in fuch a manner as to form a drain, that is capable of carrying away the whole or the greateft part of the water, and of courfe to clear, or diminifh the quantity contained in the quarry or pit, which would otherwife have continued to defcend through fuch porous fubftrata or beds, and have continued to fill the fands, or quarries and pits.

But although this part of the bufinefs may have been accomplifhed, and the fupply of water from the higher ground entirely cut off, a fufficient quantity to injure, hinder, and inconvenience the working of the quarries or pits, may yet continue to drain and ooze from the fides of the fand beds, notwithftanding they fhould happen to *dip* towards the lower ground, in which cafes, however, that water may readily and with great eafe be commonly drawn off at fome particular point in it.

In order to effect this, and thereby remove the inconvenience of this filtrating water, in defcending from the quarries or pits along the declivity, it fhould be endeavoured to difcover and afcertain, at what particular point or place in the low ground, the fand terminates or *tails* out, which is moftly beft accomplifhed by means of proper levelling; and if there fhould be there any appearance of the waters having a natural outlet, it may, by means of making in it a deep drain, be far more readily and effectually drawn off and removed; as fprings, for the moft part, naturally pafs and flow through narrow, winding, convoluted openings, or perforations; of courfe, whenever the orifices or paffages are opened, enlarged, or made lower than before, the difcharge of water becomes greater and more expeditious. Where, however, there happens to be a deep impervious layer or covering of clay, or other matter of a fimilar nature, placed above or upon the termination or tail of the fand, the drain need only be cut down to it or a little way into it, as by means of boring through it, or the remaining portion of it, a ready and eafy outlet or paffage may be given to the whole of the water, that may be contained in the fand-bed or other porous ftratum.

This mode of draining quarries and pits may often be of great utility, advantage, and convenience, as it will alfo, in a great degree, remove, or at any rate relieve, the trouble and difficulty that would afterwards have attended the finking the quarry, pit, or fhaft; as the water thus drawn or cut off, muft of neceffity diminifh and reduce the quantity, which would have been found at a greater depth, the fame body of it probably paffing downwards from one ftratum to another, as far as they continue to be porous, or capable of admitting it. Therefore, it is of very material importance to drain and lay dry all fuch ground as is fituated higher, but contiguous to quarries, pits, or other deep fubterraneous works of the fame kind, for the above ftated reafons. And it may, in general, be accomplifhed with but little trouble, difficulty, or expence, by adopting the fame principles, and the fame means.

But in regard to the removal of the water found and contained in the bottoms of fuch quarries, pits, or deep works, it muft be drained off and got rid of in quite a different manner, as the level of the ground may probably be, or decline, nowhere lower than the mouths or openings of fuch quarries, pits,

pits, &c.; as it is folely and particularly on the fuppofition, and in fuch cafes as where the direction of the different ftrata and fand-beds have a *dipping* pofition with the natural inclination of the furface of the land, or lie nearly horizontally, that the method of proceeding which is ftated above is practicable, or capable of being employed with any fort of advantage. But fhould they, for inftance, lie in a reverfe or contrary direction, there is but little poffibility or chance of accomplifhing the object, the removal of the water, unlefs by difcovering or hitting on their terminations, fomewhere on the oppofite fides of the hills or elevations, which in fome cafes may very nearly or exactly be found out, by afcertaining the precife inclination or direction of the materials of the quarries, pits, &c. and by a careful and exact ufe of the level. But this will be much better comprehended, and a more clear, full, and perfect notion of its nature be afforded, by the fection figure in the plate on draining quarries, pits, &c. in agriculture, as given by Mr. Elkington, in his work on that fubject.

This is the manner which is to be purfued in preventing the effects of water, or cutting off that which is met with in finking the quarries, pits, fhafts, or other fimilar works, before reaching or arriving at the ftone, coal, or other fort of material that may be wanted; but that which is found in the bottoms of thefe different kinds of undertakings, or which proceeds from the rocks or their fides, or in other ways, in the courfe of working them, is commonly got quit of by means of fome fort of machinery, as that of the engine or other kind of pump, in order to affift in working of which, the water gained by cutting the drains already noticed may be particularly ufeful, efpecially where the ufual ftream for that purpofe is infufficient in faving the great expence of working fuch machinery by the power of fteam. But without the aid of a natural ftream, which is capable of being converted to this purpofe, it is rarely poffible to find, by means of drains, or in any other way, a quantity of water fufficient to drive fuch weighty machinery, in a fituation of proper height, to have the full and neceffary command of it. However, in many cafes it may be an acquifition of great utility and value. It is explained at *fig.* 2. in the fame plate.

In fome fituations, where a full and proper command of water can be had, and where the entrance to the quarry, pit, fhaft, &c. is alfo fuitable for the purpofe, the ufe to which it may be converted and applied is ftill more important and advantageous, as the driving of machinery for bringing out the various kinds of materials, and at the fame time working an engine-pump, in order to clear the works of the fubterraneous water which flows from the cavities of the rocks, which are met with in working thefe forts of pits, &c.

It has been remarked in Mr. Elkington's work on draining, in thefe cafes, that the duke of Buccleugh's coal-works, near Langholm, in the county of Dumfries, afford a ftriking example of this, as well as of the fuperior powers of water and machinery, when properly combined, where a command of the former can be had, and when the latter is conftructed on proper principles, and conducted with that care and ingenuity which are requifite in fuch difficult undertakings.

In working quarries of lime-ftone, free-ftone, and other forts of materials, it not unfrequently happens, that, at a certain depth, part of the rock or other body, which contains the water, is hit upon, by which they are foon fo filled with it, as completely to put a ftop to the work proceeding any deeper, where the beft and often the greateft part of the ftone is fituated. In all fuch cafes, the moft ufual remedies have been, either the erection of a wind-mill pump, to draw out part of the water, as the whole cannot be taken away by fuch means, or the opening of a new quarry or pit contiguous to the other, which at the fame depth moftly meets with a fimilar obftruction, or the bringing up of a very deep cut, often at great expence, under the level of the water, from the neareft declivity or hollow that can be met with. However, by the following method, all quarries of lime-ftone, free-ftone, marle, or other materials of the fame nature, which are liable to fuch fort of obftruction, may be completely and effectually cleared of the water at but little expence; while, at the fame time, the drain which is made may ferve the double purpofe of that, and the laying of the wet ground, caufed by the fpring contained in the rock, which is found contiguous to it, dry.

There commonly lies, immediately under the rock, a bed of ftrong, ftiff, retentive clay, which upholds all the water received and retained by that rocky ftratum, and which being, at the fame time, bound round on each fide by a covering of the fame fort of clayey material, or other ftiff earthy fubftance, is not able to difcharge itfelf, and of courfe conftantly remains or ftands full in the rock, fo as to prevent the working or taking out the ftone from the bottom.

In fuch cafes it is neceffary, in the firft place, to endeavour to find to what fide the rock *dips* or inclines, which, in general, may eafily be afcertained by the appearance of the furface, in examining the furrounding ground, and the aid of a proper level. When this has been difcovered and fully afcertained, a fuitable drain muft be cut through the clayey covering to the rock, by which the water will be drawn off, which, for want of a proper outlet, formerly ftood pent up in the hollows and cavities of the ftony ftratum or body. This is further and more fully explained by *figs.* 3 and 4, in the fame plate.

But, in fome cafes, this fort of evil or inconvenience may be removed and remedied in a different way. As it frequently happens that a bed or body of the fame ftone, which has a clofe, compact nature or quality, is found lying under one which has a more open porous texture, with fiffures and cracks in it, that are admiffible of water, which obftructs and keeps up the water in the upper bed or layer, in fuch a manner, that not any of it can pafs or filtrate through it to an inferior, or ftill deeper open ftratum or bed; and on finking or cutting through this compact bed of ftone, another layer is met with, which is of fo open and porous a nature, as to admit the reception of any water from the above one, which may come upon it.

And fometimes a bed of gravel or fand is found under that of the clofe ftone, which being ftill more capable of abforbing or taking up any water that may be let down to it, is far better and more properly fuited for the purpofe of clearing the upper bed of ftone from water, than a ftratum of open ftone itfelf.

Therefore, when this is difcovered and afcertained to be the cafe, and the water is *kept up* by the fecond bed of ftone, fo as to be injurious and hurtful to the working of the upper bed, and which will be equally fo in working the fecond; the work may be greatly freed and relieved by boring through the clofe bed of ftone, and letting down the water into the more porous one below, or into a ftratum or body of dry fand or gravel, fhould there be fuch a one underneath it. But in place of boring, the finking of fmall pits through the clofe ftone is a more effectual method of letting down the water, though a much more difficult one in the execution.

The methods of digging and boring, even in the bottoms of quarries, pits, and fhafts, where pumps and other machinery of the fame nature are made ufe of, as has been noticed above, may, in fome cafes, not only be practicable, but advantageous for letting down the water which they contain into an inferior open ftratum.

That

That of boring has been practifed with complete fuccefs in the cafe of a colliery in the county of York, which had been wrought many years, and in which the water was raifed about fixty yards by a fteam-engine: the proprietors of which, on boring down from the bottom of the pit next to the engine-pit, to the further depth of about ten yards, in order to afcertain the depth or thicknefs of a feam of coals, which was fuppofed to lie below thofe then wrought; the workmen, on taking out the boring rods, found that the water from the works, which ufually ran acrofs the bottom of this pit to the engine-pump, now ran down the holes they had made. And that the fteam-engine pump, on being fet to work, contained little or no water, it having efcaped through thefe holes, and continued to run through the fame ever afterwards, rendering the pump ufelefs. It is remarked, that this inftance of water at fo great a depth from the furface, finding a paffage at a further depth of ten yards, or lefs, and immediately below, is extremely fingular and ftriking in its nature. The fituation was much higher than the neareft contiguous vallies, or the level of the fea. Trials of this fort can feldom be made, therefore the cafes are rare, uncommon, and curious. But in extenfive tracts of level land, where lakes or moraffes have been formed, and which cannot be laid dry by cutting open drains, or driving levels through rocks, except at an expence for which the lands, when drained, would never compenfate, the above inftances warrant the trial of experiments with boring rods, which, if not attended with fuccefs, can be made at little expence.

In the county of Lancafter, about the town of Ormfkirk, as well as in fome other parts, ftone quarries are cleared of water exactly in the manner which has been already pointed out, but which *fig.* 5. in the plate will explain much better.

The fuccefs of the practice has likewife been farther fhewn by the late T. Eccleflon, efq. of Scarrifbrick-hall, an ingenious and extenfive proprietor of land in the fame neighbourhood, who remarks, that in ftone quarries thereabouts, wells or pits are occafionally funk to the open bed, which have proved ferviceable. This mode was practifed in a ftone delf near the above town in a very beneficial manner. But in order to lay the delf more effectually dry to a greater depth, Mr. Elkington, on viewing the furrounding ground, marked out where he thought the rock terminated, or tailed out, and at the loweft level fet out a drain to be cut and carried up to the rock, part of which work has been executed, and a very confiderable flow of water comes from it; but on account of its great depth, fixteen feet, the whole will not be finifhed before he has feen the work again. The drain he has thus laid out is about ten feet lower than the bottom of the ftone quarry, and when completed, will lay the head or body of ftone dry lower than the prefent floor. All rocks, for the moft part, where they terminate, are fucceeded by broken loofe ftones of the fame nature as the rock, and they are frequently, nay almoft always, fucceeded by fand, which, when in a thick bed, and of a running nature, fuch us quickfand, often caufe great expence in cutting through to the tail end of any rock. This is more fully explained in fpeaking of the manner of draining in hilly lands, and where the foils are of a mixed nature. See SPRING-*Draining*.

Therefore, in all fuch cafes as this, where there is any danger of meeting a quickfand, boring or finking pits through the bed of clofe ftone, is by much the moft advifeable, and at the fame time the leaft expenfive method that can be purfued.

The fituations of marle pits are for the moft part fuch, that they require very extenfive cuts to be made through fome parts of the furrounding banks or fides of them, in order to carry or convey off the fuperabundant quantity of water which prevents their being dug or wrought to advantage. This bufinefs might frequently be effected in a much lefs troublefome and expenfive manner, by the method of letting the water down by means of finking pits or openings through the retaining and upholding ftratum underneath the bed of marle, into fome abforbent porous body of materials lying ftill deeper, which is capable of receiving it. Where the fpace of ground that is occupied by the marle is of confiderable fize, feveral pits will be required, in order to effectually carry off the water; and where it is neceffary that they fhould be fo deep as to be in danger of falling in, they ought to be walled round the fides, or filled up to near the top with loofe ftones, through which the water can fettle and find its way. And any fuch crofs drains or cuts as may be neceffary for the purpofe of collecting the water muft be fo formed and conducted as to lead into the pits. But in many cafes the water may be removed and got rid of in a ftill more eafy manner, efpecially where the fituation of the ground is favourable and fuited to the purpofe. In inftances where the furrounding banks decline or fall on the oppofite fides *lower than the water*, by cutting drains into them, and boring with an horizontal auger into the tails of the ftrata containing the water, it may be drawn off and brought down to a level lower than that of the bed or body of marle. And as this water is not unfrequently fupplied by a fpring which rifes in fome part of the higher ground, and defcends into the place where the marle is found, it will be neceffary, in all fuch cafes, to cut off the fource of it, and divert the flow of water into fome other channel; as by that means the quantity of water below will be leffened, and more eafily and readily carried off by the pits or drains which may have been formed.

Mines and fhafts, for the purpofe of raifing different forts of metals, are often much impeded, or wholly prevented from being wrought by the water which is brought into them from a diftance, by various kinds of mineral ftrata. In many fuch cafes, the water flowing in this way may be intercepted, by making cuts up to the loweft banks of them, from fome neighbouring water-courfe, or other convenient outlet, and then boring or digging pits in the bottoms of fuch cuts, when the metals to fuch depths or levels will be rendered free from water, and capable of being wrought. This will, however, be more amply fhewn in confidering the manner of draining, in fome cafes of wetnefs, caufed by fprings arifing in this way. See SPRING-*Draining*.

In removing the water, or freeing the bottoms of quarries and pits from it, where machinery is required, the writer of the work on "Landed Property" has remarked, that in cafes where *fhaft-drains* are found to be impracticable, *well-drains* and pumps become neceffary, and are the moft proper; as they may be wrought by water, where ftreams can be conducted to them; or by wind in high expofed fituations; or in works of confequence, where fuel is moderately cheap, by fmall fteam-engines. However, in inftances where large bodies of water are required to be raifed and difcharged at the height of a few feet only, marfh-mills, fuch as are made ufe of in low marfh-land diftricts, are found the readieft and moft ufeful kind of machinery for the purpofe.

In fome cafes of this nature, the bottoms of quarries, pits, and mines, may be cleared from water, fimply by forming openings into them from fome parts of the neighbouring ground where it falls lower than the levels of them, at fufficiently fhort diftances, without any other more expenfive works being undertaken for the purpofe. This fhould always be fully confidered before any means are reforted to

for

for laying them dry, as it may occafionally be the faving of much labour, trouble, and money.

Quarry, in *Glaziery*, a pane, or piece of glafs, cut in a lozenge, or diamond-form.

The word feems formed by corruption, from *quarrel*, (which fee); unlefs we will fuppofe it to come immediately from the French *quarre, fquare*.

Quarries, or quarrels of glafs, are of two kinds; *viz*. fquare and long, each of which is of different fizes, expreffed by the number of pieces which make a foot of glafs; *viz*. 8ths, 10ths, 12ths, 15ths, 18ths, and 20ths; but all the fizes are cut to the fame angle, the acute angle being 77° 19′ in the fquare quarries, and 67° 22′ in the long ones.

Quarry, in *Falconry*, is the game, or fowl, which the hawk is in purfuit of, or has killed.

Quarry, among *Hunters*, is fometimes ufed for part of the vifcera of the beaft taken; given by way of reward to the hounds.

Quarry-*Cart*, a name commonly given to that fort of cart which is principally employed in the work of quarries, and which is generally of a low, compact, ftrong kind, in its nature, form, and manner of conftruction, in order to fuftain heavy weights, and receive them without difficulty, or the danger of being deftroyed. Carts for this purpofe fhould always be made of well-feafoned wood, be well put together, and have fufficient ftrength of timber in thofe parts where the main ftrefs of the load is placed. See Cart.

Some quarry counties have well-formed carts of this nature, as many of thofe towards the northern boundaries of the kingdom.

Quarry-*Waggon*, or *Truck*, a fmall carriage of the low truck kind, which is much employed in the bufinefs of quarries, efpecially thofe of the flate kinds, for the purpofe of holding and conveying the rough materials, which have been blown from the large maffy rocks, or feparated in other ways, out of or from the quarries and pits in which they are fituated and contained, to the places where they are to receive their different preparations and fhapes.

It is formed and conftructed on a frame fomewhat fimilar to that of the common barrow, and mounted on two low light iron wheels on the fore part, having two feet behind, projecting from the frame, bent fomething in the manner of the letter S, and of fufficient length to let it ftand or reft in a horizontal pofition while it is in the act of being loaded. Thefe feet are ufually made of iron, but they may be formed of other materials. A fort of inclined plain is formed from the bottoms of the quarries or pits, up which it is forced, with great eafe and facility, by the workmen, or fmall animals of the horfe kind, after being filled with thefe forts of heavy materials. It is a very ufeful and convenient machine in this application, being met with in moft of the flate quarries in the northern part of Lancafhire, as well as in thofe of many other diftricts of the kingdom.

QUARRYING, the bufinefs of directing and conducting the nature and management of finking the different kinds of quarries, pits, and fhafts, as well as of the different forts of work which are neceffary to be undertaken, carried on, and performed, in the feveral different defcriptions of them; fuch as thofe of feparating, getting up, and preparing the various forts of materials for ufe in the arts, or in other ways. It is a practice which requires confiderable knowledge and experience, to be fully mafter of it in all its different bearings and intentions. See Quarry, and Quarrying *Slates and Stones*.

Almoft every fort of quarrying-work requires a different kind of management, not only in the opening and finking the quarries and pits in the grounds at firft, but afterwards in the methods and practices of working them, and getting up the various forts of materials from them, as well as in the modes of preparing, trimming, and arranging them, after they have been raifed. They are, however, moftly well known and familiar to the quarry-men and pit-men who are ufually engaged in works of the feveral different kinds.

Quarrying *Slates and Stones*, the methods of preparing and fitting them for their different ufes and applications at the quarries and pits where they have been raifed. The former of thefe articles, particularly thofe of the blue, green, and purple or blackifh kinds, undergo feveral different forts of preparation in the quarrying, according to the purpofes to which they are to be afterwards applied. They are feparated and divided into very thin pieces or flates, where light, neat coverings are required, or in much demand; but for more ftrong and heavy coverings, in expofed fituations, or other places, they are fplit into much thicker fheets, layers, or flates, and are, of courfe, more clumfy in their appearance.

Each fort in the bufinefs of quarrying is wrought in a feparate manner, and packed up by itfelf; the different forts having appropriate names, as has been already feen.

The white or brown flates are never divided and prepared in fo fine a way as the other kinds, but feparated into much thicker flakes or laminæ, in this intention. The blue, green, and purple or darkifh forts, are, for the moft part, found capable of being fplit into very thin laminæ or fheets; but thofe of the white, or brownifh free-ftone kinds, can feldom be feparated or divided in any very thin manner, as the layers of the large maffes of the ftones are of a much thicker nature, they confequently form heavy, ftrong, thick coverings, proper for buildings in expofed climates and fituations, and of the more rough kinds, fuch as barns, ftables, and other forts of out-houfes.

In the different operations and proceffes of this fort of quarrying, flate knives, axes, bars, and wedges are chiefly made ufe of in the different intentions of fplitting and cleaning the flates, they being feparated into proper thickneffes by the axe, bar, and wedge, and afterwards chipped into their proper forms and fhapes by the knife. All the different inequalities which may appear upon any part of them, are likewife removed by this laft fort of implement.

In the quarrying of the latter forts of materials, or thofe of ftones, the work is ufually performed in fuch a manner as to fuit the different ufes for which they are intended. Where flags are to be formed, they are fplit or riven into fuitable thickneffes, and fquared to different fizes, fo as to be adapted to different applications. Thefe operations are executed in rather a rough way, as they are afterwards to be finifhed by the ftone-mafon. When for fteps, they have the proper breadths and depths given to them in a fort of fquaring manner, being left to be completed as they may be wanted for particular ufes and applications. Gate-pofts are, for the moft part, quarried fo as to have from about a foot to a foot and a half or more in the fquare. Trough-ftones have the quarrying performed fo as to be formed into various proper-fized fquares or other forms, in a rough manner, being left in thefe ftates to be afterwards hewn and hollowed out, in the intended parts, by the ftone-mafons.

Stones for building purpofes are ufually raifed and quarried out roughly into fomething of the fquare fhape, being left in that ftate for the builders, who afterwards fit them fo as to fuit their own purpofes and intentions.

In the quarrying of ftones, the quarrymen commonly make ufe of large hammers, with cutting ends on one fide, the other being formed in a plain manner; ftrong, fharp, crowbars,

bars, and broad, fharp, iron wedges; by which means thefe matters are, from the conftant practice of the men, fplit and torn into fuch forms as are wanted with great eafe and facility. See QUARRY.

QUARRYING *Tools*, the different forts of implements which are employed or made ufe of in the different works of this kind, as in the raifing and preparing the various forts of materials of this nature. They are principally fuch as thofe which have been noticed already, and different defcriptions of picks, mattocks, and jumpers, or boring implements, for the purpofe of blafting the various kinds of ftone, and other hard materials. Thefe tools are individually defcribed under their particular heads. See each of them.

QUARRYINGS, the fmall pieces which are broken or chipped off from the different forts of materials which are found and wrought in quarries, while they are undergoing their different preparations for various ufes. Thefe fubftances, where they are of the hard kind, fuch as thofe of the blue and lime-ftone, as well as fome other forts, are extremely well calculated for the purpofe of forming and repairing roads, as they are nearly, if not quite, in a ftate fit for immediate application in this way. Materials of thefe kinds ought, therefore, where they can be conveniently had, never to be neglected by thofe who have the care and management of roads, as they will fave much expence and trouble, in a great number of inftances. See ROADS.

QUART, *q. d.* fourth, in *Mufic*. See QUARTE.

QUART is particularly ufed for a diminutive meafure, containing one-fourth, or quarter, of fome other *meafure;* which fee.

The Englifh quart is a fourth of a gallon, or two pints; the Roman quart, or quartarius, was the fourth part of their congius.

The committee appointed for examining the ftandards of weights and meafures, and afcertaining thofe that fhall be ufed in this kingdom, delivered it as their opinion, in their report to the houfe of commons, A. D. 1814, that the gallon ought to contain 10 pounds of pure water, or 276.48 cubical inches; that the quart, or fourth part of the gallon, ought to contain 40 ounces of water, or 69.12 cubical inches; and that the pint, or half of the quart, ought to contain 20 ounces of water, or 34.56 cubical inches.

The French, from whom we borrow the word, befides their quart, or pot of two pints, have various other quarts, diftinguifhed by the whole of which they are quarters; as *quart de muid*, and *quart de boiffeau*. See MUID, and BUSHEL.

QUART *of Butter*, in *Rural Economy*, a name given to a lump which contains the quantity of three pounds; and which is a mode of felling it that is peculiar to fome diftricts, it being carried in this ftate to the markets.

QUART *de Soupir*, in *Fr. Mufic*, is a reft equal to a femiquaver. By a 4th part of a foupir is meant an equivalent to a double croche, or two quavers in French, and one crotchet in Englifh. See TIME-TABLE, and VALUE *of* NOTES.

QUART *de Ton*, Fr., a quarter of a tone, an interval introduced into the enharmonic genus by Ariftoxenus. We have neither ear nor harmonic calculations that can furnifh us with the exact interval or ratio of a quarter-tone; and when we confider what nice geometric operations are neceffary to fettle it on the monochord, we are very apt to fufpect that this true quarter-tone never has been nor ever will be produced exactly in tune either vocally or inftrumentally. Muficians, however, call the difference between A♯ and B♭, a quarter-tone, an interval which, though in nature, is annihilated by temperament.

This quarter-tone is pretended to be of two kinds; the enharmonic major, in the ratio of 576 to 625, which is the complement of two minor femitones to a tone major; and the enharmonic minor, in the ratio of 125 to 128, which is the complement of the fame two minor femitones to the minor tone. Rouffeau.

QUARTAN, in *Medicine*, an ague or intermittent fever, the paroxyfms of which recur every third day, leaving two intervening days without fever. This is vulgarly called a *third-day* ague; but in medical language it is termed quartan, or *fourth-day* ague, becaufe if we reckon the day on which the difeafe commences as *one*, then the fecond paroxyfm is on the *fourth* day, which again becomes *one* in relation to the fucceeding paroxyfms. See FEVER, *Quartan*, and AGUE. See alfo TERTIAN.

QUARTARIUS, a meafure among the ancients, being the fourth part of a fextary, and nearly equal to a quarter of a pint of our wine-meafure.

QUARTARO, in *Commerce*, a liquid meafure at Venice. The amphora, which is a wine-meafure, contains 4 bigoncio; a bigoncia 4 quartari, 16 feechie, or 256lb. Pefo groffo; but a bigoncia of brandy is only 14 feechie, or 56lb. Kelly's Un. Cambift.

QUARTATION, in *Metallurgy*, is the feparation of filver from gold by means of aqua fortis or nitric acid; which is an operation that has fomething fingular in it.

If filver and gold are mixed together into a mafs, and the gold is not lefs than one-third part of the mafs in weight, the beft aqua fortis poured upon it is not at all capable of diffolving the filver; but if you add more filver to this mafs, by melting it again in the fire, with fuch a neceffary addition of that metal alone as fhould bring the gold in the mafs to the proportion of lefs than one-third of the whole, and fuffer it to cool, then aqua fortis poured on it will corrode the filver from it: this is alfo by fo much the more ftrongly performed, as the quantity of gold is lefs than in the proportion of one-third of the whole mafs; but experience has taught us, that aqua fortis diffolves filver mixed with gold quickly enough when the gold conftitutes but one, and the filver three parts of a mixed mafs of them; and in this cafe, if the folution is not too impetuoufly performed, the gold ufually remains in fuch a proportion, in the fame figure that the whole mafs had before the feparation of the filver by this menftruum; fo that, in this cafe, there is no reafon to apprehend the gold's being torn into minute particles, and diffipated in fome meafure; though this can hardly be prevented when the filver exceeds the three-quarter proportion, in regard to the gold in the mafs. The artificers, therefore, always make it their ftudy to obferve very exactly this proportion of the gold being one-fourth part of the mixture; and thence it is that the operation itfelf has been called quartation.

In order to afcertain nearly the proportion of gold and filver in a mafs, the affayers rub this mafs upon a touchftone, fo as to leave a mark upon it; and they then make marks upon the ftone with fome of thofe needles, called touch-needles, the colour of which they think comes neareft to that of the mafs: by comparing the marks of thefe needles with the mark of the mafs, they difcover nearly the proportion of the gold and filver in the mafs. The mafs of gold and filver to be quartered ought previoufly to be granulated, by melting it in a crucible, and pouring it into a large veffel full of cold water, while at the fame time a rapid circular motion is given to the water by quickly ftirring it round with a ftick or broom. The veffels generally ufed for this operation are called parting-glaffes. The aqua fortis muft be purified for this purpofe, and fhould be fo ftrong as to be capable of acting fenfibly on filver when cold, but not fo ftrong as to act violently. If it be very ftrong, and the veffels well

well clofed, a fmall quantity of the gold will be diffolved along with the filver, which is to be guarded againft. Little heat ought to be applied at the beginning, the liquor being apt to fwell and rife over the veffel; but when the acid is nearly faturated, the heat may be fafely increafed. When the folution ceafes, which may be known by the difcontinuance of the effervefcence, or emiffion of air-bubbles, the liquor is to be poured off. If any grains appear entire, more aqua fortis muft be added, that all the filver may be diffolved. If the operation has been performed flowly, the remaining gold will have ftill the form of diftinct maffes, which are to receive folidity and colour by putting them into a teft under a muffle, and making them red-hot. If the operation has been performed haftily, the gold will have the appearance of a black mud or powder, which after five or fix wafhings with pure water, muft be melted. The filver is ufually recovered by precipitating it from the aqua fortis by means of copper veffels, into which the liquor is poured, or of plates of copper, which are thrown along with the liquor into glafs veffels. A confiderable heat is required to accelerate this precipitation. Dr. Lewis obferves, that when the aqua fortis has been perfectly faturated with filver, no precipitation is occafioned by plates of copper, till a drop or two of aqua fortis is added to the liquor, and then the precipitation begins, and continues as ufual. The precipitated filver muft be well wafhed in boiling water, and fufed with fome nitre, the ufe of which is to fcorify any cupreous particles which may adhere to the filver.

Here we may add, that filver and gold may be parted from one another by the vitriolic acid, as effectually, though not fo commodioufly, as by the nitrous. If the compound be reduced into grains or thin plates, and boiled in about twice its weight of oil of vitriol to drynefs, the filver will be fo far corroded, as to be eafily wafhed off by a little more of the acid: or if the mafs, after the corrofion, be melted in a crucible, the gold will feparate and fubfide, the filver forming a fcoria above it. Gold may be purified in the fame manner from feveral other metallic bodies. M. Scheffer fays, that this is the moft direct way of feparating tin from gold. Lewis's Com. Phil. Techn. 95. 149, &c. See Assaying, Depart, and Gold.

QUARTAUT, in *Commerce*, a wine meafure in fome parts of France: thus, at Blois, 3.74 quartauts are equal to 100 Englifh gallons, and each of them contains 6183 cubic inches; in Burgundy, 3.68 quartauts are equal to 100 Englifh gallons, and each contains 6275 cubic inches. Kelly's Un. Cam.

QUARTE, Fr., *Quarta*, Ital., the 4th in mufic, and the third confonance in point of perfection, according to the order in which concords are generated.

The 4th is a perfect concord; its ratio is 3 to 4. It is compofed of three diatonic degrees, formed of four founds; whence it has its name of fourth. Its interval is compofed of two tones and a half: a tone major, a tone minor, and a major femitone.

The 4th may be altered two feveral ways: 1ft, by diminifhing its interval a femitone, and then it is called the diminifhed or falfe 4th; 2dly, by augmenting it a femitone, and then it is called a *tritonus*, or fuperfluous 4th. (See Tritonus.) But the diminifhed 4th is never ufed in harmony, and only touched now and then in melody as an appoggiatura, or note of refinement.

The 4th in thorough-bafe is accompanied by the $\begin{smallmatrix}8\\5\end{smallmatrix}$, and called by fome the chord of the 11th.

Another chord is called the fuperfluous 4th, or tritonus, by the French; which is what we call the chord of the $\begin{smallmatrix}4\\2\end{smallmatrix}$, or $\begin{smallmatrix}6\\4\\2\end{smallmatrix}$, in which the difcord is in the bafe; but it is not the chord of the tritonus, unlefs the 4th is fharp. See Chord, and Accompaniment.

The fucceffion of two perfect 4ths is allowed in compofition, even in fimilar motion, provided they are accompanied by the 6th; but thefe are paffages that muft not be abufed, or pufhed too far, as they are not authorized by the fundamental bafe. The Italians call a regular fucceffion of chords of the 6th *falfo bordone;* for which fee Fourth.

QUARTEEL, in *Commerce*, a meafure for train-oil at Hamburgh: it contains 2 tonnes, or 64 ftubgen, and is reckoned at 2 centners, or 224 lbs. net weight. Kelly.

QUARTELOIS, Cartelois, or *Cortucæ*, furtouts, or upper garments, with coats of arms quartered on them, worn by the ancient knights in their military expeditions.

QUARTER, the fourth part of a whole, or integer divided into four equal portions.

In working of fractions, the quarter is expreffed by $\frac{1}{4}$; three quarters by $\frac{3}{4}$.

Quarter, as a *Weight*, is a fourth part of the quintal, or hundred-weight.

The quarter is 28 pounds avoirdupois.

Quarter is alfo a dry meafure, containing of corn eight bufhels ftriked, or two facks, being that by which corn is generally fold in the London market, and in large quantities in fome diftricts of the country; and the quarter of coals is the fourth part of a chaldron, called a vat.

"Quarterium frumenti conftat ex octo buffellis." Fleta, lib. ii. This feems to have fignified originally the fourth part of a ton in weight, or capacity. See Weight.

Quarter, in *Aftronomy*, the fourth part of the moon's period, or lunation, which is divided into four ftages, or quarters; containing each from feven to eight days.

The firft quarter is from the new moon to the quadrature; the fecond thence to the full moon, &c.

Quarter, in *Heraldry*, is fometimes ufed for an efcutcheon, or coat of arms.

In this fenfe there are fixteen quarters required to prove nobility, in companies, or orders, where none but nobles are admitted.

The word quarters, required as a proof of nobility, is derived hence, that they ufed anciently to put the coats of arms of the father, mother, grandfather, and grandmother, on the four corners of the tomb of the deceafed.

In Flanders and Germany we frequently fee tombs that have eight, fixteen, and even thirty-two quarters.

Quarter is alfo applied to the parts or members of the firft divifion of a coat that is quartered, or divided into four quarters. See Quartering.

The king of Great Britain, in the firft quarter, bears gules three lions paffant or, &c. In the fecond quarter he bears azure three fleurs-de-lis, &c.

Quarter, *Franc*, is a quarter fingle, or alone; which is to poffefs one-fourth part of the field.

This makes one of the honourable ordinaries of a coat. See Ordinary.

Quarter, in *Law*, *Quarterium Anni*, is the fourth part of a year.

Hence the days on which thofe quarters ftatedly commence, are called quarter-days.

Quarter-days are the 25th of March, called Lady-day; the 24th of June, called Midfummer-day; the 29th of September, called Michaelmas-day; and the 25th of December, or Chriftmas-day.

Quarter, Fr., in old counterpoint, was proceeding in difcant by a fucceffion of 4ths; which was called, in barbarous

barous Latin, *diateſſaronare;* of which we have inſtances in the "Micrologus" of Guido.

Quarter, in *Navigation.* A quarter of a point, wind, or rhumb, is the fourth part of a cardinal point, wind, or rhumb; or of the diſtance between two cardinal points, winds, &c.

The quarter contains an arc of 11 degrees 15 minutes.

The quarter is what Wolfius, with regard to the other diviſions, calls a ſecondary point of the ſecond order.

Quarter *of a Ship* is that part of the ſhip's ſide which lies towards the ſtern; or which is comprehended between the aftmoſt end of the main chains and the ſides of the ſtern, where it is terminated by the quarter-pieces. Although the lines by which the quarter and bow of a ſhip are determined, with reſpect to her length, are only imaginary, yet experience appears ſufficiently to have aſcertained their limits; ſo that if we were to divide the ſhip's ſides into five equal portions, the names of each ſpace would be readily enough expreſſed. Thus the firſt, from the ſtern, would be the quarter; the ſecond, abaft the midſhips; the third, the midſhips; the fourth, before the midſhips; and the fifth, the bow. Falconer.

Quarter, *On the*, in *Sea Language*, may be defined an arc of the horizon, contained between the line prolonged from the ſhip's ſtern and any diſtant object, as land, ſhips, &c. Thus if the ſhip's keel lies on an eaſt and weſt line, the ſtern being weſtward, any diſtant object, perceived in the north-weſt or ſouth-weſt, is ſaid to be on the larboard or ſtarboard quarter.

Quarter is alſo uſed for a canton, or diviſion of a city; conſiſting of ſeveral ranges of buildings, &c. ſeparated from ſome other quarter by a river, a great ſtreet, or by ſome other boundary.

Such are the twenty quarters of the city of Paris. Ancient Rome was divided ſeveral times, under its ſeveral augmentations, into quarters, which were called *regions;* as may be obſerved in the topographies of Aurelius Victor, Onuphrius Panvinius, Marillan, Pyrro Ligorio, Boiſſard, and other antiquaries.

In many cities there are commiſſaries of the quarter appointed to look to the policy of them. The prior of the Caporions accounts himſelf the chief and colonel of the fourteen regions, or quarters, of Rome. Muſcarat, p. 134.

Quarters, *Franchiſe of.* See Franchise.

Quarter, in *War*, the place allotted to certain forces to live, lodge, and encamp upon, during a ſiege, or the like. See Camp.

The general's quarter, called the head-quarters of an army, is that where the general lodges and encamps in perſon. They uſed to make lines of communication, to join the ſeveral quarters together.

Quarters *at a Siege*, are the encampments on the principal paſſes about a place; ſerving to ſtop the avenues, and to prevent relief and convoys.

Quarter is alſo uſed for any lodgment made in the field, or champaign, out of a ſiege. Thus they ſay, the general has extended his quarters a good way; the enemy coming by, made him contract his quarters.

Quarters, *Intrenched*, denote a place fortified with a ditch and parapet, to ſecure a body of troops.

Quarters, *Winter*, the place allotted troops to paſs the winter ſeaſon in. Wherein theſe differ from garriſons, ſee Garrison.

Winter quarters, when cold or moiſt, are productive of inflammatory diſorders, particularly hard coughs, with inflammations of the pleura or lungs. See Barracks.

Quarters, *Winter*, are alſo uſed for the time the troops continue in this lodgment; and for the advantage the captains make of it.

In Spain they have alſo ſummer quarters.

Quarter *of Aſſembly*, is the place of rendezvous, where the troops are to meet and draw up, to march in a body.

Quarters *of Refreſhment*, denote ſome well provided, fertile ſpot, to which troops, that have been much fatigued and haraſſed, are ſent to recover their ſtrength, or health; even during the ſeaſon of the campaign.

There are alſo quarters aſſigned for the huckſters, and their equipage.

Quarter alſo denotes the ſafety and good treatment promiſed to perſons or troops that ſurrender, and lay down their arms. Thus we ſay, the enemy begged quarter.

The phraſe took its riſe from an agreement anciently made between the Dutch and Spaniards, that the ranſom of an officer, or ſoldier, ſhould be a quarter of his pay. Hence, to beg quarter was to offer a quarter of their pay for their ſafety; and to refuſe quarter was not to accept of that compoſition for their ranſom.

On an enemy's ſubmitting, and delivering up his arms, the victor cannot with juſtice take away his life. In a battle, quarter is to be given to thoſe who lay down their arms; and at a ſiege, a garriſon offering to capitulate are never to be refuſed their lives. If ſometimes, however, in the heat of action, the ſoldier refuſes to give quarter, it is always contrary to the inclination of the officers, who eagerly interpoſe for ſaving the lives of ſuch enemies as have laid down their arms. Nevertheleſs, there is one caſe, in which life may be denied to an enemy who ſurrenders, and alſo capitulation refuſed to a place. This is when the enemy has been guilty of ſome enormous breach of the law of nations, and particularly if it be at the ſame time a violation of the laws of war. This denial of quarter is no natural conſequence of the war, but the puniſhment of his crime; a puniſhment which the injured party has a right to inflict: but that the puniſhment may be juſt, it muſt fall on the guilty. When the war is with a ſavage nation, which obſerves no rules, and never gives quarter, it may be chaſtiſed in the perſons of any that are ſeized or taken, among the guilty; ſo that by this rigour they may be brought to conform to the laws of humanity. But wherever ſeverity is not abſolutely neceſſary, clemency is to be uſed. Corinth was utterly deſtroyed, for having violated the law of nations towards the Roman ambaſſadors. However, that ſeverity has been cenſured by Cicero, and other great men. He, who has even the moſt juſt cauſe to puniſh a ſovereign as his enemy, will always incur the reproach of cruelty, if he ſhould cauſe the puniſhment to fall on the innocent people. There are other methods of chaſtiſing the ſovereign; as the depriving him of ſome of his rights, taking from him towns and provinces. The evil which a whole nation ſuffers is the participation inevitable to the members of a political ſociety. The learned Vattel expreſſes his aſtoniſhment that, in a knowing age, it could be conceived that it is lawful to puniſh with death a governor who has defended his place to the laſt extremity; or who, in a weak place, has preſumed to make a ſtand againſt a royal army. Yet, even in the 17th century, this notion was ſo common as to make an article in the law of war; and, at a later period, it is not wholly exploded. What a thought! to puniſh a brave man for having performed his duty. Very different were the principles of Alexander the Great, when he gave orders for ſparing ſome Mileſians, "on account of their courage and fidelity." It is in vain to object, that an obſtinate defence, eſpecially in a weak place, againſt a royal army, only cauſes a great effuſion of blood to no purpoſe; for this defence may ſave the ſtate, by delaying the enemy ſome days longer; and,

and, befides, courage fupplies the want of fortifications. It is urged farther, that by threatening a commander with death, you may fhorten the bloody fiege, fpare your troops, and gain a valuable opportunity. The anfwer is, fays Vattel, that a brave man will defpife your menace, or, provoked at fuch ignominious ufage, will fell his life at a dear rate, make you pay for your injuftice, and bury himfelf under the ruins of his fort. Befides, the menace of an unjuft punifhment is unjuft in itfelf; it is an infult and an injury. But to execute it, would be barbarous and horrible; and if it is not to take effect, it muft be allowed to be vain and ridiculous. Neverthelefs, juft and lawful means may be ufed for inducing a governor not obftinately to reduce himfelf to the laft extremity; and this is at prefent done by all wife and humane generals. A governor is fummoned to furrender, and in the progrefs of the fiege an honourable and advantageous capitulation is offered him, with an intimation that if he ftays too long, he will be admitted only to furrender as a prifoner of war, and at difcretion: if he perfifts, and is at length forced to furrender at difcretion, all the feverity of the law of war may be ufed, both againft him and his troops. But this right never extends fo far as to deprive an enemy of life, who lays down his arms, unlefs he has been guilty of fome proportionate crime towards the conqueror. See CAPITULATION, PRISONERS *of War*, and REPRISALS.

QUARTERS, in *Building*, thofe flight, upright pieces of timber, placed between the punchions and pofts; ufed to lath upon. They are of two kinds, fingle and double. The fingle quarters are fawn to two inches thick, and four inches broad; the double are four inches fquare.

QUARTERS in a clock, are little bells, which found the quarters of an hour.

QUARTERS, in *Sea Language*, the feveral ftations of a fhip's crew in the time of action. See QUARTERING *the Men*.

QUARTER, in the *Manege*, to work from quarter to quarter, is to ride a horfe three times upon the firft of the four lines of a fquare; then changing your hand, to ride him three times upon the fecond; and fo to the third and fourth, always changing hands and obferving the fame order.

QUARTERS *of a Saddle*, the parts or pieces of leather, or ftuff, which are made faft to the lower part of the fides, and which hang down below the faddle.

QUARTERS *of a Horfe, and other Animals*, the four principal parts of the animals; the fore-quarters confift of the fhoulders and the fore-legs; the hind-quarters, of the hips and the hind legs.

In the horfe, the fore-quarters or fhoulders fhould always fall in a neat manner backwards, where they join with the breaft, and the hind-quarters be fuitably long and well fhaped towards the rump. Something of a fimilarity of fhape fhould likewife prevail in the quarters of neat cattle, fheep, and fwine, but they fhould be much more flefhy downwards as they approach the thigh and leg parts. See LIVE-*Stock*, HORSE, SHEEP, and SWINE.

QUARTERS *of the Foot*, in horfes, are the fides of the coffin, comprehended between the toe and the heel on both fides; the inner quarters are thofe oppofite to one another, facing from one foot to the other; thofe are always weaker than the outfide quarters, which lie on the external fides of the coffin. A horfe is faid to have a *falfe* quarter, when the hoof has a kind of cleft occafioned by the cafting the quarter and getting a new one, for then the horn becomes uneven, and alfo fofter than the reft of the hoof; and the foot fhould be fhod with fome nicety. But if the cleft be confiderable, and take up a fourth of the hoof, the horfe is worth little afterwards for any purpofe.

QUARTER-*Caft*, among horfes, is when for any difeafe in the coffin-bone or joint, one of the quarters of the hoof is caft off, and when thus caft, the reproduction of a new hoof or part takes place. It is a common occurrence among fome horfes.

QUARTER-*Evil*, among domeftic animals of the neat cattle kinds, is an affection which fometimes takes place in the glands of the udders, and fometimes in different parts of the feet.

QUARTERS, in *Gardening*, the large divifions of garden grounds, or thofe parts of them which are fituated between the different walks, at a diftance from the fmall, narrow portions on the fides ufually termed borders, and which form or conftitute the principal fpaces or compartments for the cultivation and growth of the various forts of the more ufeful culinary vegetables which are raifed in large quantities; fuch as peas, beans, cabbages, cauliflowers, broccoli, early potatoes, and many others.

It is neceffary to have the quarters of garden grounds formed and laid out in fuch a manner as to favour the growth of early and late crops of the feveral different forts, as much as poffible; thofe for the former having a fouthern, or fouth-weftern expofure, and thofe for the latter, an eaftern, or north-eaftern afpect. By thefe means, early crops are, in fome meafure, rendered more forward and fine, and thofe of the more late kinds, in fome degree, prevented from being injured or burnt up and deftroyed by too full an expofure to the heat of the fun.

It is ufual during the winter feafon to have the large quarters of garden grounds laid up in high ridges, in order to be expofed to the influence and effects of froft, by which the earth may be rendered more light and mellow, and be in a more fit ftate for fowing or planting in the fpring months, on throwing them down and rendering them level for the purpofe.

The large quarters of gardens fhould likewife be kept as free and open as poffible, not being inclofed and choaked up, as is too frequently the cafe by planting fruit-trees and fhrubs on their fides, either in the manner of efpaliers or otherways, as by fuch means the growths of the plants are much promoted, and they are prevented from being drawn up in a weak manner. See GARDEN.

All forms of garden grounds are found, except that of the fquare, to derange the regularity of the quarters, and, of courfe, to render them highly troublefome in digging and cropping. Where they are very large they may be fubdivided into fuitable fizes, as one hundred feet in breadth, &c.; but their length does not fignify, as it may be varied in different ways, as by rows of trees, bufhes, or which, in many cafes, are preferable, by trodden walks and the modes of cropping.

QUARTERS *of a Garden*, the feveral divifions into which it is formed for the purpofe of cultivating the different kinds of vegetables, fruits, &c. Thus, there are parts or quarters deftined to the growth of kitchen vegetables, fruit, and other trees, forcing, &c.

QUARTERS *of a Field, or Farm*, in *Agriculture*, are the particular parts of them, which are under, fet apart, or intended for any fort of crops, or peculiar modes of cultivation and management. Farmers are frequently in the practice of dividing their lands or farms into different quarters or parts, according to the different forts of hufbandry which they are proper for, and the manner and fucceffion in which the various kinds of crops are to be grown upon them, and the fame is often the cafe with large fields; four, five, fix, and more divifions or quarters, being common in fuch inftances.

inſtances. This plan of proceeding is ſuppoſed to give caſe, facility, and diſpatch, to the work which is afterwards carried on, as well as to have ſeveral other advantages and conveniences. See FARM.

QUARTER-*Bill*, in *Sea Language*, a roll or liſt, containing the different ſtations, to which all the officers and crew of the ſhip are quartered, in the time of battle, and the names of all the perſons appointed to thoſe ſtations.

QUARTER-*Bullet*, a bullet quartered into four or eight parts.

QUARTER-*Chord*, in *Mining*, ſeven yards and a quarter, which the miner hath croſs-ways of his vein on either ſide, for liberty to lay his earth, ſtones, and rubbiſh on, and to waſh and dreſs up his ore.

QUARTERS, *Cloſe*, in a *Ship*. See CLOSE-*Quarters*.

QUARTER-*Cloths*, are long pieces of painted canvas extended on the outſide of the quarter-netting from the upper part of the gallery to the gang-way. They are generally decorated with martial inſtruments, or allegorical figures.

QUARTER-*Day*. See QUARTER.

QUARTER-*Deck* of a ſhip, is that aloft the ſteerage, reaching to the round-houſe; or that deck in ſhips of war which extends from the main-maſt to the ſtern, next above the upper-deck.

QUARTER, *Fat*, in a *Ship*, denotes the ſame with *broad*. Thus, if the truſſing in, or tuck of a ſhip's quarter under water be deep, they ſay, ſhe hath a *fat* quarter.

QUARTER-*Gallery*, a ſort of ſmall balcony, with or without balluſtrades, on the quarter of a ſhip; which generally communicates with the gallery on the ſtern, by means of a door paſſing from one to the other.

QUARTER-*Guard*. See GUARD.

QUARTER-*Gunner*, is an inferior officer under the direction of the gunner of a ſhip of war, whom he is to aſſiſt in every branch of his duty; as keeping the guns and their carriages in proper order, and duly furniſhed with whatever is neceſſary; filling the powder into cartridges; ſcaling the guns, and keeping them always in a condition ready for ſervice. The number of quarter-gunners in any ſhip is always in proportion to the number of her artillery; one quarter-gunner being allowed to every four cannon.

QUARTER-*Netting*, is a ſort of net-work, extended along the rails on the upper part of a ſhip's quarter. In a ſhip of war theſe are always double, being ſupported by iron cranes, placed at proper diſtances. The interval is ſometimes filled with cork or old ſails, but chiefly with the hammocks of the ſailors, ſo as to form a parapet to prevent the execution of the enemy's ſmall arms in an engagement.

QUARTER-*Pieces*, ſubſtantial pieces of timber, moſtly of fir, that form the outboundary of the ſtern, and connect the quarter-gallery to the ſtern and toffarel.

QUARTER-*Point of the Compaſs*. See POINT.

QUARTER-*Rails*, in a *Ship*, are narrow-moulded planks, generally of fir, reaching from the top of the ſtern to the gang-way. They are ſupported by ſtanchions, and ſerve as a fence to the quarter-deck, to prevent the men from tumbling into the ſea by the rolling of the ſhip, particularly in ſmall veſſels.

QUARTER-*Round*, in *Architecture*, is a term uſed by the workmen for any projecting moulding in general, whoſe contour is a perfect quadrant, or quarter of a circle, or which approaches near that figure.

The architects uſually call it *ovolo;* and Vitruvius, the *echinus*.

QUARTER-*Seſſions, General, Court of*. See COURT *of General Quarter-Seſſions*, and SESSIONS.

QUARTER-*Staff*, a long ſtaff, or pole, borne by foreſters, park-keepers, &c. as a badge of their office; and occaſionally uſed as a weapon.

QUARTER-*Wheeling*, or *Quarter of Converſion*, in the *Military Art*, is the motion by which the front of a body of men is turned round to where the flank was; this making the quarter of a circle.

If it be done to the right, the man in the right-hand angle keeps his ground, and faces about, while the reſt wheel; if to the left, the left-hand man keeps his place, &c.

QUARTER-*Wind*, at *Sea*, is a lateral, or ſide-wind; or a wind which does not blow in ſtern, but a little aſide of it.

Properly, the quarter-wind is that which comes in abaft the main-maſt ſhrouds, even with the quarter of the ſhip.

The quarter-wind is the beſt of all winds, as bearing into all the ſails; whereas a wind blowing full in ſtern, is kept off by the ſails of the mizen.

QUARTERA, in *Commerce*, a corn-meaſure in Spain, containing 12 cortanes: the ſalma contains 4 quarteras, or 48 cortanes; the carga, $2\frac{1}{2}$ quarteras, or 30 cortanes: $78\frac{1}{4}$ quarteras correſpond to 100 Caſtilian fanegas; and 100 quarteras Catalan to 128 Caſtilian fanegas; 39 quarteras Catalan contain 10 Engliſh quarters. The carga of wine and brandy is divided into 16 cortanes, 32 quarteras, or 128 quartillos.

At Barcelona 39.08 quarteras are equal to 10 Engliſh quarters, and a ſingle quartera contains 4401 cubic inches. Kelly's Un. Cambiſt.

QUARTERED, COUNTER. See COUNTER-QUARTERED.

QUARTERIDGE, money paid quarterly, or by the quarter.

QUARTERING *of Soldiers*, in *Military Language*, ſeems to have anciently differed very little from that now in uſe, except that they were indiſcriminately quartered upon all houſeholders, as was practiſed in England ſo late as in the rebellion of the year 1745. Rapin ſays, that William the Conqueror quartered almoſt all his troops upon the monaſteries, and obliged the monks to furniſh them with neceſſaries; by which means he maintained his army without any charge, and had ſpies in all their religious houſes, who watched the actions of the monks; theſe houſes were long after charged with finding carts and horſes for the carrying the baggage of the army; and there are ſtill extant many of the original returns from different monaſteries, ſtating the number of each they were able to furniſh for that purpoſe. About the time of Henry VII. we meet with a regulation that bears ſome reference to quarters: this is a coat and conduct-money; the firſt was a ſpecies of cloathing, probably for recruits; the money for which was advanced by the county in which they were raiſed;—conduct-money was an allowance for ſubſiſtence, to and from the army, according to the number of days which the ſoldiers had to march; a day's march being eſtimated ſometimes at 12 and ſometimes at 15 miles. Both the coat and conduct-money were occaſionally advanced by the different counties in which the troops were quartered, under the promiſe of being repaid by government. Towards the latter end of the reign of king James II. and even after the acceſſion of king William III. ſoldiers uſed to oblige the inhabitants of the towns in which they were quartered, not only to furniſh them with diet and lodging, but alſo to advance them their daily ſubſiſtence. After the revolution, by the mutiny-act, paſſed the 23d day of December, in the year 1689, other laws and regulations reſpecting quarters were enacted.

By the petition of right in the third of Charles I. it is enacted and declared, that the people of the land are not by the laws to be burthened with the ſojourning of soldiers against their wills; it is also enacted by the 31 Car. II. c. 1. that no officer, military or civil, nor any other person whatsoever, shall presume to place, quarter, or billet any soldier on any subject or inhabitant of this realm, of any degree, quality, or profession whatsoever, without his consent; and every such subject or inhabitant may refuse to sojourn or quarter any soldier, notwithstanding any command, order, warrant, or billeting whatever. The present mode of quartering our troops is settled by the Mutiny Act, renewed annually, with little or no alteration. Accordingly by the mutiny act, 49 Geo. III. c. 12. s. 41. the constables and other chief officers and magistrates of cities, towns, villages, and other places, and in their default or absence, any one justice inhabiting in or near such place, and no other, shall and may, during the continuance of this act, quarter and billet officers and soldiers in inns, livery stables, alehouses, victualling houses, and the houses of sellers of wine by retail to be drank in their own houses or places thereunto belonging, (other than person's canteens held under the authority of the commissioners for the affairs of barracks, and other than persons who keep taverns only, being free of the vintners' company in London,) and all houses of persons selling brandy, strong waters, cyder, or metheglin, by retail to be drank in houses, (other than the houses of distillers who keep places of distilling brandy and strong waters, and of shopkeepers whose principal dealings shall be more in other goods than in brandy and strong waters, and who do not permit tipling in their houses,) and no other, and in no private houses whatsoever; nor shall any more billets be ordered than there are effective soldiers; which billets when made out shall be delivered to the commanding officer present: and if any constable, or such like officer or magistrate as aforesaid, shall presume to billet any such officer or soldier in any private house without the consent of the owner or occupier, such owner or occupier shall have his remedy at law against such magistrate or officer, for damages; and if any military officer shall take upon him to quarter soldiers otherwise than by this act, or shall offer any menace or compulsion to any mayor, or other civil officer before-mentioned, tending to discourage any of them from doing their duty, he shall on conviction before any two justices by the oath of two witnesses be *ipso facto* cashiered and disabled to hold any military employment; provided the conviction be affirmed at the next quarter sessions, and a certificate thereof be transmitted to the judge advocate, who shall certify the same to the next court martial. And if any person shall be aggrieved by having more soldiers billeted than in proportion to his neighbours, on complaint thereof to one justice of the division, &c. where quartered, or if the person so billeting them be a justice, then on complaint to two justices they may relieve him.

Note.—The clause above recited, relating to shopkeepers, might as well be now omitted out of the act; for that by the 17 Geo. II. c. 17. no shopkeepers, as such, are allowed to retail any spirituous liquors, but only those who keep taverns, victualling houses, inns, coffee-houses, or alehouses.

By s. 43. No justice, having any military command, shall be concerned in quartering soldiers under his immediate command; but all things done by him therein shall be void.

By s. 50. of this act, an officer taking money for excusing the quartering, shall be cashiered.

By s. 51. If any high constable or other officer or any person whatsoever shall neglect to quarter any officers or soldiers, provided sufficient notice be given him before their arrival, or if he receive or agree for any reward in order to excuse any person from receiving such officer or soldier, or if any victualler, &c. having any officer, &c. billeted upon him, refuse to receive him, or refuse to furnish him as herein provided by this act, and shall be thereof convicted by one justice of the county, &c. where such offence was committed, on confession of the oath of one witness, he shall forfeit not more than 5*l.* nor less than 40*s.* to be levied by distress; which sum shall be applied first to satisfy such soldier for the expence thereby occasioned to him, and the remainder to the overseers of the poor of the parish where the offence was committed.

By s. 56. If any officer, military or civil, shall quarter any of the wives, children, or servants of officer or soldier, in any house, against the consent of the owner; if he be an officer, he shall on proof made thereof to the commander in chief of the army or judge advocate, be *ipso facto* cashiered; and if a civil officer, he shall forfeit to the party grieved 20*s.* on proof thereof to the next justice by distress.

By s. 53. Officers and soldiers, billeted as aforesaid, shall be received and furnished with diet and small beer, paying for the same as hereafter mentioned, out of their subsistence-money.

By s. 54. If any person shall choose rather to furnish non-commissioned officers or private men, with candles, vinegar, and salt, *gratis*, and allow them the use of fire and the necessary utensils for dressing and eating their meat, and shall give notice thereof to the commanding officer, and shall furnish the same accordingly; in such case they shall provide their own victuals and small beer, and the officer who receives their pay shall pay the sums after mentioned out of the subsistence-money for diet and small beer to them, and not to the persons on whom they are quartered.

By s. 55. Every officer receiving the pay or subsistence-money, either for a regiment, or particular troops and companies, or otherwise, shall immediately, upon each receipt of each sum, give public notice thereof to all on whom officers or soldiers are quartered; and shall also appoint such persons to repair to their quarters, at such times as they shall appoint, for the payment of the said pay or subsistence-money to the officers or soldiers, which shall be within four days at the farthest after the receipt of the same, as aforesaid; and such persons shall then and there acquaint such officer with the accounts or debts between them and the officers and soldiers quartered; which accounts the said officer is to accept of, and immediately pay the same, before any part of the pay or subsistence be distributed: provided the said accounts exceed not, for a commission officer of horse being under the degree of a captain, for such officer's diet and small beer, *per diem*, 2*s.*; nor for one commission officer of dragoons, being under the degree of a captain, for such officer's diet and small beer, *per diem*, 1*s.*; nor for one commission officer of foot, under the degree of a captain, for such officer's diet and small beer, *per diem*, 1*s.*; nor for each horse quartered under this act, for hay and straw, *per diem*, 6*d.*; nor for one light horseman's diet and small beer, *per diem*, 7*d.*; and hay and straw for his horse, *per diem*, 6*d.*; nor for one dragoon's diet and small beer, *per diem*, 7*d.*; and hay and straw for his horse, *per diem*, 6*d.*; nor for one foot soldier's diet and small beer, *per diem*, 5*d.*: and if such officer shall not so give notice and shall not immediately upon producing such account stated satisfy the same; upon complaint on oath by two witnesses, at the next quarter sessions for the county or city where such quarters were, the paymaster of the guards, garrisons, and marines, are authorized (upon certificate of the said justices before whom such oath was made, of the sum due upon such accounts and the persons

ſons to whom the ſame is owing) to pay the ſaid ſums out of the arrears due to the ſaid officer, upon pain of ſuch paymaſter forfeiting his place, and being incapacitated from holding it again. The act then ſtates what courſe is to be purſued if there be no arrears due, or no ſubſiſtence-money remitted, and is directory of the courſe to be purſued by the paymaſter.

By ſ. 49. The commanding officer may exchange any men or horſes quartered in any place with another man or horſe quartered in the ſame place, provided the number of men and horſes do not exceed the number at that time billeted on ſuch houſe.

By ſ. 47. And where any horſe or dragoon ſhall be quartered upon any perſon who hath no ſtables, upon his complaint to two juſtices of the diviſion, &c. and his making ſuch allowance as ſuch juſtices ſhall think reaſonable, they may order the men and their horſes, or the horſes only, as the caſe may be, to be removed and quartered upon ſome other perſon who hath ſtables, and may order and ſettle a proper allowance to be made by the perſon having no ſtables, in lieu of his quartering ſuch horſe or dragoons, and order payment thereof to the perſon to whom the removal is made, for or to be applied for the furniſhing of quarters for ſuch men and their horſes.

By 49 Geo. III. c. 37. It is enacted that every non-commiſſioned officer and private ſoldier who ſhall be furniſhed with diet and ſmall beer by the perſons on whom they are quartered, ſhall pay for the ſame 1*s.* 4*d.* *per* day, in like manner as by the firſt act is enacted as to the 7*d.* *per* day.

By ſ. 2. Where the innholder, &c. furniſhes certain articles in lieu of diet and ſmall beer, as in the former act mentioned, he ſhall have one halfpenny *per* day for each non-commiſſioned officer, &c.

By ſ. 3. 1*s.* 3*d.* *per* day is to be paid for each horſe, inſtead of 6*d.* *per* day.

By ſ. 4. The proviſions in the former act relating to the dieting on a march or recruiting are repealed.

By ſ. 5. All non-commiſſioned officers and ſoldiers ſhall receive their diet and ſmall beer at the above rates while on the march and on the day of arrival at the place of their final deſtination, and on the two ſubſequent days, unleſs either of the two be a market day for the place where billeted, or within two miles thereof; in which caſe the innkeeper, &c. ſhall diſcontinue on and from ſuch market-day the diet and ſmall beer, and furniſh in lieu thereof the articles in the ſaid former act ſpecified, and at the rate in this act preſcribed.

By ſ. 6. If any perſon liable to have ſoldiers quartered on him ſhall pay any ſum to any non-commiſſioned officer or ſoldier on the march in lieu of the diet and ſmall beer, he may be proceeded againſt and fined as if he had refuſed to furniſh according to the former act the things to be furniſhed to non-commiſſioned officers and ſoldiers ſo quartered as aforeſaid.

By ſ. 7. The proviſions of ſ. 5. are extended to halting on a march.

By ſ. 8. But if the halt be for longer than one day, and the day after the arrival be market-day as aforeſaid, there is to be no diſcontinuance of diet and ſmall beer.

By ſ. 9. Non-commiſſioned officers and private men employed in recruiting, and the recruits by them raiſed, ſhall, while on the march, and for two days after the day of their arrival at any recruiting ſtation, be entitled to the ſame benefits as before provided for troops on the march; but no recruit enliſted after the two days ſubſequent to the arrival of the party at their recruiting ſtation, ſhall be entitled to be ſupplied with diet and ſmall beer at the rate herein-before preſcribed, except at the option of the party where quartered. Provided that in caſe any recruiting party, with the recruits by them raiſed, ſhall remove from their ſtation, and after a time ſhall return to the ſame place, they and the recruits ſhall not be again entitled to the diet and ſmall beer for two days, unleſs the time of abſence exceeded 20 days. This act to continue to 25th March 1810.

By ſ. 52. Any juſtice within his county, &c. may command any conſtable or other officer who ſhall billet any ſoldiers, to give an account in writing to him of the number of officers and ſoldiers billeted by them, and the names of the perſons on whom quartered, and an account of the place where they dwell, and of their ſigns, if any. See Martial *Law*, and Soldiers.

But by the 50 G. III. c. 96. ſ. 1. it is enacted, that after the 25th of June 1810, every non-commiſſioned officer and private ſoldier who ſhall be furniſhed with diet and ſmall beer within the parts of the united kingdom mentioned in the 50 G. III. c. 28. by the innholders or other perſons on whom ſuch non-commiſſioned officers or private ſoldiers ſhall be quartered and billetted by virtue of the ſaid act, ſhall pay and allow for the ſame, the ſum of eight-pence *per diem* inſtead of one ſhilling and four-pence *per diem*, as in the ſaid act ſpecified; and that for ſuch allowance of eight-pence, the innkeeper or other perſon ſhall furniſh one meal; *videlicet*, a hot dinner if required in each day to each non-commiſſioned officer, trumpeter, drummer, and private ſoldier quartered and billetted on him, to conſiſt of ſuch quantities of diet and ſmall beer as ſhall be ſpecified and fixed in and by any regulations made or to be made from time to time by his majeſty in that behalf, but not to exceed one pound and a quarter of meat previous to being dreſſed, one pound of bread, one pound of potatoes or other vegetables previous to being cooked, and two pints of ſmall beer, and vinegar, ſalt, and pepper.

And by ſ. 2. of the ſame act, the mutiny act, and the ſaid 50 G. III. c. 28. ſhall be applied for the enforcing ſuch regulations as to the diet of ſoldiers and the payment of and accounting for the allowances for the ſame.

Quartering *of Traitors*, in *Law*. See Treason.

Quartering, in the *Sea Language*. When a ſhip under ſail goes at large, neither by a wind nor before a wind, but, as it were, betwixt both, ſhe is ſaid to go quartering.

The term is alſo uſed when a ſhip ſails with quarter-winds.

Quartering *the Men*, the diſpoſing of the ſhip's company at the time of an engagement in ſuch a manner, that each may readily know where his ſtation is, and what he is to do: as, ſome to the maſter, for the management of the ſails; ſome to aſſiſt the gunners to traverſe the ordnance; ſome for plying the enemy with ſmall ſhot; ſome to fill powder in the powder-room; others to carry it from thence to the gunners in cartridges, &c.

The number of men appointed to manage the artillery is always in proportion to the nature of the guns, and the number and condition of the ſhip's crew. They are in general as follow, when the ſhip is well manned, ſo as to fight both ſides at once occaſionally:

To a 42-pounder	-	15 men.	
32	-	-	13
24	-	-	11
18	-	-	9
12	-	-	7
9	-	-	6
6	-	-	5
4	-	-	4
3	-	-	3

This

This number, to which is often added a boy to bring powder to every gun, may be occafionally reduced, and the guns neverthelefs well managed.

The number of men appointed to the fmall arms, on board his majefty's fhips and floops of war by order of the admiralty, are,

Rate of the Ship.	Number of Men.
1ft - -	150
2d - -	120
3d of 80 guns -	100
— of 70 guns -	80
4th of 60 guns -	70
— of 50 guns -	60
5th - -	50
6th - -	40
floops of war -	30

The lieutenants are ufually ftationed to command the different batteries, and direct their efforts againft the enemy. The mafter fuperintends the movements of the fhip, and whatever relates to the fails. The boatfwain and a fufficient number of men are ftationed to repair the damaged rigging: and the gunner and carpenter whatever may be found neceffary, according to their refpective offices. The marines are generally quartered on the poop and forecaftle, or gangway, under the direction of their officers: although, on fome occafions, they affift at the great guns, particularly in diftant cannonading. Falconer. See Engagement.

Quartering, in *Gunnery*, is when a piece of ordnance is fo traverfed, that it will fhoot on the fame line, or on the fame point of the compafs, as the fhip's quarter bears.

Quartering, in *Heraldry*, the act of dividing a coat into four or more quarters, or quarterings, by parting, couping, &c. *i. e.* by perpendicular and horizontal lines, &c. See Quarter and Quarterly.

The king of Great Britain quarters with Great Britain, France, Ireland, Brunfwick, &c.

Colombiere reckons twelve forts of quartering; but other authors give us more—*viz.* party per pale, dividing the efcutcheons from top to bottom. See Pale.—Party per crofs, dividing it from fide to fide. See Cross.—Party of fix pieces, when the efcutcheon is divided into fix parts, or quarters.—Party of ten; of twelve; of fixteen; of twenty; and of thirty-two; when there are fo many partitions refpectively.

Others give the divifions in another manner: as—Party per crofs—per pale—per chief—per pale inclave—per bend dexter—per bend finifter—per chevron—barry bendy of eighty pieces—paleways of fix pieces—barry of fix pieces—barry of eight pieces—bendy of fix—checky—fufilly, or lozengy—pale bendy, or bendy lozengy—barry bendy lozengy, or bend lozengy—gyronny—barry lozengy counterchanged—waved of fix pieces—barry nebule of fix pieces—party per faltier—and party per pale in point. See farther under their refpective articles.

Counter-quartering a coat, is when the quarters are quartered over again, or fubdivided each into four. See Counter-quartered.

There are counter-quartered coats which have twenty or twenty-five quarters.

Quartering is alfo applied to the partitions or compartments themfelves, that is, the feveral coats borne on an efcutcheon, or the feveral divifions made in it, when the arms of feveral families are to be placed on the fame fhield, on account of intermarriages, or the like.

Colombiere obferves, that thirty-two is the greateft number ufed in France; but that the Englifh and Germans fometimes extend to forty: as a teftimony of the truth of which, he fays he faw the efcutcheon of the earl of Leicefter, ambaffador extraordinary in France in the year 1639, divided into the number of forty: and fome, he affirms, do go on to fixty-four feveral coats.

But a multitude of quarters make a confufion; and, accordingly, all the writers of armoury exclaim againft it as an abufe. The firft inftance of quartering, of which we have any account, is faid to be in the arms of Renatus, king of Sicily, &c. in the year 1435, who quartered the arms of Sicily, Arragon, Jerufalem, &c.

William Wickly obferves, that fuch quarterings are much more proper for a pedigree, to be locked up in a cheft, and occafionally produced as an evidence for the clearing or afcertaining of alliances of families, and titles to lands, &c. than to be borne as a cognizance.

In blazoning, when the quartering is performed per crofs, the two quarters a-top are numbered the firft and fecond; and thofe at the bottom the third and fourth; beginning to tell on the right fide. When the quartering is by a faltier, &c. the chief and point are the firft and fecond quarters, the right fide the third, the left the fourth.

Quartering is fometimes alfo ufed for the diftinguifhing of younger brothers from elder. See Difference.

QUARTERIZATION, Quartering, part of the punifhment of a traitor, by dividing his body into four quarters.

"Walfingham, in Ric. II. Auditum et confeffum turpiffima fcelera tractationi, fufpendio, decollationi, exenterationi, et quarterizationi adjudicavit."

QUARTERLY, in *Heraldry*, a perfon is faid to bear quarterly, when he bears arms quartered.

The king of Great Britain bears quarterly of four; in the firft quarter gules, &c. Great Britain; in the fecond, azure, &c. Ireland, &c.

QUARTER-MASTER, an officer in the army, whofe bufinefs it is to look after the quarters of the foldiers; their clothing, bread, ammunition, firing, &c. Every regiment of foot and artillery has a quarter-mafter, and every troop of horfe one, who are only warrant-officers, except in the blues. Whereof there are feveral kinds; *viz.* the

Quarter-master *General*, whofe bufinefs is to provide good quarters for the whole army.

Quarter-master *of Foot*, he who is to provide quarters for a regiment of foot.

Quarter-master *of Horfe*, he who is to provide quarters for a troop of horfe.

Quarter-master, in a *Ship*, is an inferior officer, appointed by the mafter of a fhip of war to affift the mates in their feveral duties; as ftowing the ballaft and provifions in the hold, coiling the cables on their platforms, overlooking the fteerage of the fhip, and keeping the time by the watch-glaffes.

QUARTERN, Quarteron, a diminutive of quart, fignifying a quarter of a pint, as a quart does a quarter of a gallon.

QUARTIER, in *Commerce*, a liquid meafure in Germany, which, according to a regulation of 1713, made in Hanover, muft hold 2lb. of fpring water, and the contents of which are 49 French, or $59\frac{1}{2}$ Englifh cubic inches. A fuder of wine contains 4 exhofts, 6 ahms, or 15 eimers; an ahm, 4 ankers, 40 ftubgens, 80 kannes, 160 quartiers, or 320 noffels. Hence 36 ftubgens, or 144 quartiers, = 37 Englifh wine gallons. A fafs of beer at Lubec contains 42 ftubgens, or 168 quartiers. Kelly's Un. Cambift.

QUARTILE, an afpect of the planets when they are three figns, or 90 degrees diftant from each other.

The

The quartile aſpect is marked thus □. See Aspect.

QUARTILLO, in *Commerce*, a liquid meaſure in Spain. At Barcelona, 128 quartillos are equal to 32 quarteras. (See Quartera.) A moyo of wine contains 16 arrobas; an arroba 8 azumbres, or 2 quartillos. The arroba of wine contains 34lb. of river water (Caſtilian weight), and meaſures 1237¼ Spaniſh, or 981 Engliſh cubic inches; hence four ſuch arrobas are equal to 17 Engliſh wine gallons. The arroba of oil meaſures 966⅘ Spaniſh, or 771 Engliſh cubic inches; ſo that three ſuch arrobas correſpond to 10 Engliſh gallons: this arroba is divided into 4 quartillos, or 100 quarterones, or panillas. A Spaniſh botta contains 30 arrobas of wine, or 38½ of oil; a pipe is 27 arrobas of wine, or 34½ of oil; thus the botta is = 127½ Engliſh gallons, and the pipe = 114¾. Kelly. See *Tab.* XXXII. *of* Measures.

QUARTO, or *4to.* a book whereof four leaves, or eight pages, make a ſheet.

Quarto, in *Commerce*, a money of account in Spain. See Real.

Quarto *Dell Torri*, in *Geography*, a town of Naples, in Capitanata; 12 miles W. of Salpe.

Quarto *die poſt*, in *Law*, denotes the fourth day incluſive beyond the return of a writ, in which thoſe that are ſummoned are allowed to make their appearance. See Essoign *day of term*.

QUARTO-DECIMANS, Quarto-decimani, in *Eccleſiaſtical Hiſtory*, an ancient ſect in the church, who maintained, that Eaſter was always to be celebrated, conformably to the cuſtom of the Jews, on the fourteenth day of the moon in the month of March, whenſoever that day fell out.

And hence their name Quarto-decimani, *q. d.* Fourteenthers.

The Aſiatics were mightily attached to this opinion, pretending that it was built on the authority of St. John, who was their apoſtle; and pope Victor could never bring them to obedience in this article, though he was upon the point of excommunicating them: but it is more probable he contented himſelf with menaces. See Easter.

QUARTUM *par conſtringens*, in *Anatomy*, a name given by Spigelius and ſome others to the muſcle called by Albinus and Riolanus orbicularis oris; and by Cowper and ſome others, conſtrictor labiorum.

QUARTUS *hyoidis muſculus*, a name given by Veſalius, Fabricius, and many other anatomiſts, to a muſcle now generally called the coracohyoidæus.

Quartus *oculum movens*, a name given by Veſalius to one of the muſcles of the eye, called by ſome rectus inferior, and by others humilis.

It is the depreſſor oculi of Albinus, being one of the quatuor recti oculi of that author.

QUARTZ, in *Mineralogy*. No ſubſtance in the mineral kingdom is more abundantly diſtributed than quartz. Grains of quartz generally compoſe a conſiderable part of the ſands on the ſea-ſhore, and of the ſand-ſtones of the ſecondary ſtrata. Rolled pieces of quartz, or pebbles and boulders, are widely ſcatterred over alluvial diſtricts. Quartz is diſſeminated through granite, gneiſs, mica-ſlate, and other compound rocks which conſtitute the loftieſt mountains on the globe; it alſo forms veins of vaſt extent interſecting theſe mountains, and ſometimes entire ſimple rocks are compoſed of this mineral. Quartz has a conſiderable degree of hardneſs, always ſtriking fire with ſteel when the fragments have ſufficient ſolidity to reſiſt the ſhock. Powdered quartz feels harſh, and, when rubbed on poliſhed ſteel, or on glaſs, ſcratches the ſurface. Quartz is infuſible by the common blowpipe. Theſe two qualities, hardneſs and infuſibility, are the eſſential characters of all the varieties of quartz, whatever forms or colours they may preſent, whether maſſive or cryſtallized.

Quartz has moſt commonly a conchoidal fracture, but ſometimes the fracture is undulated, foliated, or ſplintery. The luſtre is vitreous. Quartz has various degrees of tranſparency; from a perfectly pellucid colourleſs ſtate, it paſſes by different gradations to opacity: but all the varieties, except ſinople, admit light through the very minute fragments. The colours are various, owing to the impregnation or intermixture with foreign ſubſtances. The ſpecific gravity of quartz is from 2.58 to 2.65. It yields a phoſphoreſcent light when rubbed, and is not ſoluble in any of the acids except the fluoric. According to Vauquelin, powdered quartz gives a green colour to tincture of violets. Cryſtallized quartz preſents the phenomenon of double refraction, when an object is ſeen through one ſide of the pyramid that terminates the cryſtals, and the oppoſite ſide of the hexagonal priſm on which it is placed, in the moſt common variety of the ſecondary forms of theſe cryſtals.

The ſubſtances found imbedded in quartz are, ores of titanium, antimony, gold, ſilver, copper, and lead, arſenic, and micaceous iron ore, with chlorite, hornblende, felſpar, garnet, and fluat of lime. It is alſo penetrated by fibres of aſbeſtus, and by minute laminæ of mica and epidote: the latter ſubſtance is ſometimes ſo intimately diffuſed through quartz as to give it an homogeneous green colour. This variety of quartz is called praſe.

Quartz cryſtallizes diſtinctly: ſome of the cryſtals are of conſiderable ſize.

In the imperial cabinet of Vienna, there is ſaid to be a cryſtal of quartz ſeven feet in length. The forms of cryſtalline quartz are various; they have been reduced by modern mineralogiſts to ſix or ſeven principal varieties. The moſt common is a ſix-ſided priſm, terminated by a ſix-ſided pyramid, or two ſix-ſided pyramids joined at their baſes. The ſides of theſe pyramids are iſoſceles triangles, having the vertical angle 40°, and each of the angles at the baſe 70°. The ſides of the upper and lower pyramids are inclined to each other at an angle of 104°. According to Haüy, the primitive form of the cryſtal is a rhomboid, varying little from the cube, the angles being 94° and 86°. The primitive rhomboid is rarely found in nature; it occurs ſometimes in red hematite, coated with that mineral, and in chalcedony.

Bubbles containing air, water, and bitumen, are ſometimes ſeen in quartz cryſtals, and have given riſe to much ſpeculation reſpecting their formation. Siliceous earth, of which theſe cryſtals are compoſed, is inſoluble in water, by artificial means; but in the great laboratory of nature, its ſolution is effected probably by the effect of heat and compreſſion, as ſilex exiſts in the boiling fountains of Iceland and the Azores, and in the hot ſprings of Bath, Italy, and various parts of the world. It has been ſuppoſed that the ſiliceous earth was held in ſolution by ſoda; but Klaproth, who analyſed the waters from the Reikum, in Iceland, thinks the quantity of alkali too ſmall to have diſſolved the ſilex. One hundred cubic inches contained nine grains of ſilex, three of carbonate of ſoda, eight of common ſalt, and five of ſulphate of ſoda. If rock cryſtals were formed in an aqueous ſolution greatly heated and compreſſed, it would not be difficult to conceive how volatile matter might be involved in the ſubſtance of the cryſtal during its formation; but our knowledge of the ſubterranean operations of nature is at preſent too limited to enable us to aſcertain, or even to form any rational conjecture in what manner ſome of her more myſterious proceſſes are effected. Thoſe who have frequent opportunities of exploring mines, will not be diſpoſed to deny that ſiliceous ſtalactites, and cryſtals, are now forming at the common temperature of the earth, as they are obſerved

ſerved on the roofs and ſides of artificial excavations, and paſſages which have been undiſturbed for ſome years. According to Chaptal, a quartzoſe or a ſiliceous paſte is formed by tranſudation on ferruginous rocks at Chamillat, near Planches les Mines, in Franche Compté, and where this is waſhed and depoſited by water, rock cryſtals are formed. Siliceous ſtalactites have not unfrequently been ſeen coating the wood which has been left in mines.

Pſeudomorphous cryſtals of quartz, or falſe cryſtals of this mineral, are frequently found in mines; they are tarniſhed and opaque, and their edges are blunted. They aſſume the forms of cubic cryſtals of fluor, and the pyramidal and other forms of calcareous and other cryſtals. Theſe falſe cryſtals are evidently moulded in the cavities which the former have once occupied. Quartz alſo occurs filling up the cavities of ſhells in a ſimilar manner, and the pores of wood and other organic ſubſtances.

Cellular quartz with polyhedral cavities, appears to have been formed round cryſtals of other minerals which are ſubſequently decompoſed. The internal cryſtals are frequently thoſe of the metallic ſulphurets. Brongniart ſays this concluſion is founded on direct obſervation, as the remains found in theſe cavities are ſulphur, native gold, and oxyd of iron, all ſubſtances which originally formed part of the decompoſed ſulphurets. Such is the cellular quartz at Schemnitz in Hungary, and Joachimſthal in Bohemia. The cellular quartz at Berezof, in Siberia, is ſo porous that it is lighter than pumice.

Rock cryſtal, or *Mountain cryſtal*, is the pureſt variety of quartz, differing from common quartz by its tranſparency, and the more regular form of its cryſtals; the fracture is alſo more perfectly conchoidal. According to ſome analyſes, rock cryſtal contains 98 parts of ſilex, with 2 parts of water. Bergman found in one ſpecimen only

Silex	-	93
Alumine		6
Lime	-	1

Amethyſt is a purple variety of rock cryſtal. See AMETHYST.

Cairngorum ſtones are rock cryſtals, from the mountains of Cairngorum, in Scotland. They are valued by jewellers on account of their purity and colour. Clove-brown quartz cryſtals are known by the name of the ſmoke topaz. According to Karſten, the ſpecific gravity of this variety is 2.88. Coloured rock cryſtals loſe their colour, when carefully expoſed to a gentle heat, but retain their tranſparency. The yellow and orange-yellow varieties are the moſt eſteemed.

Milk quartz, called by ſome mineralogiſts roſe quartz, and by others the Bohemian ruby, as it is frequently of a beautiful roſe-red colour, which it derives from manganeſe. By expoſure to the light the intenſity of its colour is diminiſhed. It is uſed in jewellery, and takes a good poliſh; it is ſometimes ſold for the ruby, but is leſs hard, nor has it the tranſparency and brilliancy of that gem. Roſe quartz is found at Rabenſtein, in Bavaria, in conſiderable maſſes, and in a vein of manganeſe which traverſes a coarſe-grained granite. It occurs alſo in Sweden, Greenland, Saxony, in the iſland of Coll, one of the Hebrides, and in Ireland. Some varieties are of a milk-white colour, others pearl-grey.

Irideſcent quartz, *Quarz hyalin iriſé*, preſents on its ſurface, or in its interior, the various colours of the rainbow: it ſometimes derives this property from a thin pellicle of metallic oxyd which covers the ſurface, and ſometimes from minute fiſſures in the ſubſtance of the cryſtal. Theſe colours may be given to quartz by heating it and expoſing it ſuddenly to a cold temperature.

Avanturine quartz (ſee AVANTURINE) owes its brilliancy to minute particles of mica diſſeminated through it, and ſometimes to minute fractures. Avanturines may be formed artificially, in ſome varieties of quartz, by heat.

Blue quartz, *Quarz hyalin ſaphain*, has been found in Spain, Bohemia, and Bavaria.

Black quartz is found, mixed with carbonate of lime, in the department of Iſere in France, in Bohemia, and at Cappe Nuova, on the road to Sienna. Brongniart Mineralogie.

Cat's-eye, *Quarz hyalin chatoyant*, ſo called becauſe it reflects a pearly variety of colours, according as the light falls upon it in different directions: this property is owing to the fibrous texture of this mineral, which may be obſerved in the beſt characterized ſpecimens. It contains 95 parts of ſilex, and according to Brongniart is a variety of quartz, and ought not to be claſſed with felſpar. The geological ſituation of this ſtone is not known. The cut and poliſhed ſpecimens ſeen in cabinets come from Malabar and Ceylon. It is ſaid, alſo, to occur in Egypt and Arabia.

Green quartz, *Praſe*, *Quarz hyalin verd obſcur*. The colour is a leek green; it is ſeldom cryſtallized; the form of the cryſtals are thoſe of common quartz. Praſe has been ſaid to owe its colour to an intimate intermixture with actynolite, but Klaproth is of opinion that this is not well aſcertained.

Sinople is claſſed, by ſome mineralogiſts, with quartz. It is of a deep blood-red colour, and perfectly opaque, or barely tranſmits light on the edges. It reſembles red jaſper, but has a vitreous luſtre, and conchoidal fracture, and is ſometimes cryſtallized.

Ferruginous quartz conſiſts of ſmall cryſtals, or of granular quartz, intimately mixed with oxyd of iron, and has a brown ochre-yellow, or red colour. From the iron which it contains it becomes magnetic when heated. It is harder than pure quartz.

Certain properties, beſide colour, have given names to ſome varieties of quartz.

Fat quartz is ſo called becauſe it has a greaſy appearance, as if the ſurface had been rubbed with oil.

Fetid quartz differs from common quartz, by emitting an odour, when rubbed, like that of ſulphuretted hydrogen gas. When this foſſil is heated below a red heat, it loſes its fetid odour on cooling, and when plunged into water becomes tranſparent. When fetid it is nearly opaque. It is found in the vicinity of Nantes and Chantiloub, in the department of Haute Vienne, forming a conſtituent part of the granitic mountains of that diſtrict. It occurs alſo in the iſland of Elba.

Elaſtic quartz is a ſiliceous ſand-ſtone, found in the Brazils, compoſed of oblong laminæ of quartz, arranged in one direction, and ſo interlocked together as to form a kind of hinge with each other, from whence it poſſeſſes a certain degree of pliability, like that of a ſtiff piece of leather. In appearance, elaſtic quartz reſembles ſome of the ſlaty ſandſtones in the northern counties of England. According to Klaproth its conſtituent parts are

Silex	-	-	96.50
Alumine	-	-	2.50
Oxyd of iron and loſs			1

The uſe of quartz in the arts is principally confined to the manufactures of glaſs, enamels, porcelain, and earthenware. The finer cryſtallizations are employed by the jewellers, and before the diſcovery of glaſs, ornaments and veſſels of great value were made by the ancients from rock cryſtal. Stones in which quartz forms the principal ingredient, are beſt fitted for purpoſes of durable architecture, and in the economy

economy of nature this mineral gives ftability to the folid fabric of the globe, enabling thofe rocks and mountains in which it abounds to refift the decompofing effects of air and moifture, and to brave for ages the impetuous fury of the ocean. For the properties of filex, of which quartz is compofed, fee SILEX.

QUARTZ *Rock*, in *Geology*. Entire rocks and even mountains are compofed of quartz in various parts of the world, in the vicinity of granitic diftricts. The quartz is granular, and fometimes intermixed with a fmall portion of mica. Werner claffes quartz rock as a diftinct order of primary rocks, but it would be perhaps more confonant with a natural arrangement, to confider this rock as a conftituent of granite on a large fcale, certain caufes having feparated the quartz, mica, and felfpar into diftinct maffes. Entire mountains of thefe three fubftances are faid to occur in the Uralian chain, prefenting the materials of granite on a large fcale. Quartz rocks are met with in Scotland. In the highlands the fummits of fome of the mountains are formed of white quartz, and appear as if covered with fnow. The two beautiful conical mountains, called the *Sugar-loafs*, in the vicinity of Dublin, are compofed of granular quartz, of a fimilar kind to what forms veins in the gneifs and mica ftate of the furrounding mountains nearer Dublin.

QUARTZOSE, in *Mineralogy*, a term applied to thofe rocks or minerals which are principally compofed of quartz.

QUASHING, in *Law*, the overthrowing and annulling a thing. Thus, pleas in *abatement* (which fee), when the fuit is by original, conclude to the writ or declaration; by praying "judgment of the writ, or declaration, and that the fame may be quafhed," *caffetur*, made void or abated; but if the action be by bill, the plea muft pray "judgment of the bill," and not of the declaration; the bill being here the original, and the declaration only a copy of the bill. See PLEA, DILATORY *Pleas*, and CERTIORARI.

QUASI-CONTRACT, in the *Civil Law*, an act which has not the ftrict form of a contract, but yet has the force of it.

In a contract there muft be the mutual confent of both parties; whereas, in a quafi-contract, one party may be bound or obligated to the other, without having given his confent to the act by which he is obliged.

For an example: I have done your bufinefs in your abfence, without your procuration; and it has fucceeded to your advantage; I have then an action againft you for the recovery of what I have difburfed; and you an action againft me, to make me give an account of my adminiftration; which amounts to a quafi-contract. See CONTRACT.

QUASI-CRIME, or QUASI-DELICT, the action of a perfon who does damage, or evil, involuntarily.

The reparation of quafi-crimes confifts in making good the damages, with intereft.

QUASI-MODO SUNDAY, *Low Eafter-Sunday*, or the next funday after Eafter; thus called from the initial words of the introit of the mafs for the day, *Quafi modo geniti infantes*.

In the ancient deeds thefe words are fignified by *q. m. g.*

QUASS, the name of a liquor in Ruffia, which ferves the natives not only for drink, but alfo for fauce to a number of difhes; and is the bafis of the favourite cold foup of the North, which is made by adding cold meat cut in pieces, with cucumbers falted after a peculiar manner, or with onions, or garlick, to a bowl of this fubacid liquor. The common Ruffian quafs is prepared by putting into a large pot full of cold water as much rye-flower as will make a thin dough; this is then placed in an oven moderately heated, for three hours, and afterwards taken out and thrown into a tub of cold water; the mixture is worked with a machine like a chocolate mill till it froths. To this liquor are added two bafons of the grounds of old quafs, leaven, or a piece of their four bread; and the tub is covered with a cloth, and laid by till the liquor has acquired a fourifh tafte, which marks its being ready for ufe.

There is a better fort of quafs, which is prepared as follows. Take a chetverik (about 35 pounds Ruff. or 30 pounds Engl.) of barley-malt, two or three handfuls of rye-malt, and a like quantity of unbolted rye-meal; mix them all together in earthen pots, then pour boiling water upon it, and ftir the whole till it acquires the confiftence of a thin pap. The pots muft be full to within an inch of the brim. Upon this mixture muft now be poured about an inch in height of the hufks of oats, from which groats are made. Set the pots in a heated oven, in which fome glowing coals are ftill remaining, which muft be heaped about the pots. This done, clofe the oven, and leave the pots in it four-and-twenty hours. This time being elapfed, take them out; again pour boiling water in till they are brimfull, and ftir all well together. Now pour it all into a wooden veffel or tub, provided with a fpiggot and foffet, firft covering the bottom with a layer of ftraw, as is ufually done in brewing beer; then add warm water, more or lefs, according to the quantity of quafs you want; let it ftand an hour, and afterwards draw it off into veffels. In every veffel a flice of coarfe rye bread muft be put, in order to make it ferment. Set the veffels in a cellar, and after four-and-twenty hours the quafs is fit for drinking.

In making quafs, barley-malt alone may be ufed. The rye-malt is added only from neceffity, when the former, by itfelf, would be too poor, and not be fufficiently fweet. But the rye-meal is abfolutely neceffary.

From the quantity of malt and meal above ftated, is obtained about fix or feven kilderkins, or two ankers of quafs. The Ruffians in the fummer feafon put the veffels of quafs immediately in the cellar, but in the winter they let them ftand a whole night in a warm room, for the quafs to ferment.

QUASSE, in *Geography*, a town of Africa, in Benin. N. lat. 6° 20′. E. long. 3° 30′.

QUASSIA, in *Botany*, received that name from Linnæus. He called it fo in honour of Quaffi, a negro at Surinam, who difcovered the virtues of the wood of this tree, in curing the malignant fevers of that country, to which fo many Europeans fell a facrifice, and who communicated this valuable difcovery to his patron governor Dahlberg. Hence it became known in Europe; particularly by means of a differtation printed in the Amœnitates Academicæ, firft publifhed in 1763.—Linn. Gen. 212. Schreb. 288. Willd. Sp. Pl. v. 2. 567. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 42. Juff. 282. Lamarck Illuftr. t. 343. Gærtn. t. 70.—Clafs and order, *Decandria Monogynia*. Nat. Ord. *Magnoliis affine*, Juff.

Gen. Ch. *Cal.* Perianth inferior, very fhort, of five ovate, permanent leaves. *Cor.* Petals five, feffile, equal, lanceolate, elongated, oblique, converging. Nectary of five ovate villous fcales, attached to the infide of the filaments at the bafe. *Stam.* Filaments ten, thread-fhaped, equal, the length of the corolla; anthers oblong, incumbent. *Pift.* Receptacle flefhy, elevated, orbicular, broader than the germen. Germen ovate, compofed of five feparate ones; ftyle thread-fhaped, with five furrows, the length of the ftamens; ftigma with five angles. *Peric.* Drupas five, diftant, horizontal, ovate, obtufe, fplitting into two parts, all ftanding on a flefhy pentagonal receptacle. *Seeds* folitary, globofe or oval.

Obf. Some flowers have abortive germens, others imperfect anthers.

Eff. Ch.

Eff. Ch. Calyx of five leaves. Petals five. Nectary of five scales. Drupas five, distant, two-valved, single-seeded, placed on a fleshy receptacle.

1. Q. *amara*. Bitter Quassia. Linn. Sp. Pl. 553. Suppl. 235. Amoen. Acad. v. 6. 416. t. at page 429. Willd. n. 1. Ait. n. 1. Curt. Mag. t. 497. Woodv. Med. Bot. t. 77.—Flowers all perfect. Leaves pinnate; leaflets opposite, sessile; common stalk jointed, winged. Flowers racemose.—Native of Surinam. Introduced in 1790, by Mr. Alexander Anderson, to the stoves at Kew, where it flowers in June and July. A *shrub* rather than a tree, whose wood is intensely bitter. *Leaves* alternate; of two pair of *leaflets*, with an odd one, all elliptic-lanceolate, pointed, entire, veiny, very smooth, two or three inches in length, on a linear winged stalk, abrupt and jointed at the insertion of each pair. *Clusters* long, drooping one way. *Flowers* numerous, above an inch long, not much expanded, of a rich scarlet, as well as their stalks. The younger Linnæus errs in saying, in the Supplement, that the branch figured in Am. Acad. does not belong to the flowers.

This is the true original Quassia, whose wood is more powerful than that of the other species; but being very rare, and of small bulk, its place is said to be usually supplied by *Q. excelsa* hereafter described.

2. Q. *Simaruba*. Wing-leaved Quassia. Linn. Suppl. 234. Willd. n. 2. Ait. n. 2. Woodv. Med. Bot. t. 76. (Simarouba amara; Aubl. Guian. v. 2. 859. t. 331, 332.)—Flowers monoecious. Leaves pinnate; leaflets alternate, not quite sessile; common stalk naked. Clusters panicled.—Native of various parts of the West Indies, in a sandy soil, flowering in November and December. It was sent to Kew in 1787, by Mr. Alexander Anderson, but has not blossomed there. This is a tall and stout tree, whose wood is hard, white, without any peculiar flavour. *Leaves* alternate, with six, seven, or eight alternate obovate, rather narrow, entire, stalked *leaflets*, two inches long, whitish beneath; their common stalk simple, roundish. *Flowers* yellowish-white, much smaller than the preceding, either monoecious, or, as some say, dioecious, in branched or panicled clusters. The bark of the *root* is bitter, and much celebrated as a cure for the dysentery. Dr. Wright has given a full history of the plant, with a plate, in the Transactions of the Royal Society of Edinburgh, vol. ii. It is known in Jamaica by the name of Mountain Damson, Bitter Damson, and Stave-wood. In that island, according to Dr. Wright, the male flowers are never found on the same tree with the female.

3. Q. *excelsa*. Lofty Quassia. Swartz in Stockh. Trans. for 1788. 302. t. 8. Ind. Occ. v. 2. 742. Willd. n. 3.—Flowers polygamous. Stamens five. Leaves pinnate; leaflets opposite, stalked; common stalk naked.—Native of rather mountainous woods, in Jamaica and the Caribbean islands. The English commonly call it bitter wood, or bitter ash. The *tree* is lofty, with a very straight trunk; the wood whitish, moderately close-grained, very bitter; frequently sold by the druggists for the true *Quassia amara*, and found useful in intermittent fevers, debility of the stomach, worms, dropsy, and chlorosis. It is also used for making cabinets, for preserving insects, or other natural curiosities; this wood being supposed inaccessible to worms. The *leaves* are larger than the last, and composed of from four to six pair of opposite, elliptical, pointed, firm, entire, smooth leaflets, on short partial stalks. *Clusters* panicled, bearing very numerous, small, pale *flowers*, some male, the rest hermaphrodite, in the same cluster. Swartz describes the *nectary*, of five minute villous scales, contrary to the remark of Willdenow, under his *Zwingera*, Sp. Pl. v. 2. 569, where it is said to be wanting in this species of *Quassia*. The *stamens* are mostly five, rarely four or six. *Germens* from two to four.

Quassia *Amara*, bitter quassia, in the *Materia Medica*. The root, bark, and wood of this tree are all comprehended in the catalogues of the Materia Medica; and it is observed that the leaves, flowers, &c. possess similar qualities. The roots, being perfectly ligneous, may be medically considered in the same light with the wood, which is now most generally employed, and seems to differ from the bark in being less intensely bitter; so that the latter is thought to be a more powerful medicine. The wood is sent to this country from Jamaica and the Caribbean islands in billets; and is reduced to chips, or rasped by the druggists. Quassia has no sensible odour; its taste is that of a pure bitter, more intense and durable than that of any other substance. It imparts its virtues more completely to watery than to spirituous menstrua, and its infusions are not blackened by the addition of martial vitriol. When the infusion is evaporated to dryness, it leaves a brownish-yellow, somewhat transparent, brittle extract, which has been regarded as a vegetable constituent *sui generis*, and named the bitter principle. (Edinb. Phil. Transf. iii. 207.) The infusion is rendered muddy by nitrate of silver, and a soft, flaky, yellow precipitate is formed; acetate of lead occasions a copious white precipitate; and hence it has been inferred that these salts are incompatible in formula with it. The watery extract is from a sixth to a ninth of the weight of the wood; the spirituous about a twenty-fourth.

Quassia derived its name, as has been already observed, from a negro named Quassi (by Fermin written Coissi, and by Rolander, Quass), who employed it with uncommon success as a secret remedy in the malignant, endemic fevers, which frequently prevailed at Surinam. In consequence of a valuable consideration, this secret was disclosed to Daniel Rolander, a Swede, who brought specimens of the quassia-wood to Stockholm in the year 1756; and since that time the effects of this drug have been very generally tried in Europe, and numerous testimonies of its efficacy published by many respectable authors. Its antiseptic powers have been submitted to various trials, from which it has been concluded, that it has considerable influence in retarding the tendency to putrefaction; which, in professor Murray's opinion, cannot be attributed to its sensible qualities, as it possesses no astringency whatever, nor to its bitterness, as gentian is much more bitter, but less antiseptic. The medicinal virtues ascribed to quassia are those of a tonic, stomachic, antiseptic, and febrifuge: it has been found very effectual in restoring the tone of the stomach, producing appetite for food, assisting digestion, expelling flatulency, and removing habitual costiveness, produced from debility of the intestines, and common to a sedentary life. Dr. Lettsom observes, that in hysterical atony, to which the female sex is so prone, the quassia affords more vigour and relief to the system than the Peruvian bark, especially when united with the vitriolum album, and still more with the aid of some absorbent. In dyspepsia, arising from hard drinking, and also in diarrhœas, he exhibited the quassia with great success. Although he does not concur in opinion with Linnæus, who says, "me quidem judice chinchinam longè superat;" yet he has met with several instances of low remittent and nervous fevers, the symptoms of which the bark uniformly aggravated, though administered in intermissions the most favourable to its success, in which quassia, or snake-root, was successfully substituted. In such cases, he mostly observed that there was great congestion in the hepatic system, and the debility at the same time discouraged copious evacuations. And in many fevers, without evident

remissions

remiffions to warrant the ufe of the bark, whilft, at the fame time, increafing debility began to threaten the life of the patient, the doctor found that quaffia, or fnake-root, fingly or combined, upheld the vital powers, and promoted a critical intermiffion of fever, by which an opportunity was offered for the bark to effect a cure. Dr. Cullen fays, (Mat. Med. vol. ii. p. 174.) "I believe quaffia to be an excellent bitter, and that it will do all that any pure and fimple bitter can do; but our experience of it in this country does not lead us to think it will do more; and the extraordinary commendations given of it are to be afcribed to the partiality fo often fhewn to new medicines." It is faid to have been given, combined with nitric acid, with evident benefit in typhus, and alfo in fluor albus. It may be given in infufion, which is the beft form of adminiftering it; or in pills made from the watery extract. It may alfo be given in fubftance in dofes of from grs. x to ℈j three or four times a day. The officinal preparations are the "infufum quaffiæ" of the London Pharmacopeia, and the "tinctura quaffiæ" of that of Dublin. The infufion is prepared by macerating for two hours in a lightly covered veffel a fcruple of quaffia-wood, chipped, in half a pint of boiling water, and ftraining. In hyfteria, this may be combined with purgatives and tincture of valerian; in atonic gout, with aromatics; and in dyfpeptic affections, with chalybeates, fulphate of zinc, or mineral acids. The dofe is from f℥j to f℥iij, given twice or thrice a day. The tincture is prepared by digefting for feven days an ounce of chips of quaffia-wood in two pints of proof fpirit; and then ftraining. This may be ufed in the fame cafes as the infufion.

It is afferted that the brewers have, of late years, ufed quaffia-wood inftead of hops. Beer made with it certainly does not keep, fays Thomfon, but foon becomes muddy and flat, has a mawkifh tafte, and runs into the acetous fermentation. It is confequently lefs nutritious and wholefome than that which is properly hopped. Wood. Mat. Med. Thomfon's Lond. Difp.

QUASSIA *Simaruba*. See SIMARUBA.

QUATCHEOU, in *Geography*, a town of Afia, in the country of Hami; 30 miles E. of Tche-tcheou. N. lat. 40° 28′. E. long. 94° 27′.

QUATER-COUSINS, QUATRE-COUSINS, fourth coufins, or the laft degree of kindred.

Hence, when perfons are at variance, it is faid they are not quater, or cater-coufins.

QUATERNA FOLIA, among *Botanifts*. See LEAF.

QUATO, in *Zoology*. See SIMIA *Panifcus*.

QUATORZIEME, Fr., the 14th, or double octave of the 7th. It is called the 14th, becaufe 14 founds muft be formed to pafs diatonically from one of its terms to the other.

QUATOTOMOMI, in *Ornithology*, the name of an American bird of the wood pecker kind, having a red creft on its head, and two white lines running down the fides of the neck to the breaft. It is called by Nieremberg *Picus imbrifxtus*; which fee.

QUATOZTLI. See TANAGRA *Leucocephala*.

QUATRE FACARDINS, *Les*, in *Geography*, four fmall iflands in the South Pacific ocean, fo named by M. Bougainville, in the year 1768. S. lat. 18° 40′. W. long. 140° 30′.

QUATREFOIL, a decoration refembling a rofe with four leaves, which conftantly occurs in pointed architecture.

QUATRE-NATIONS, *q. d. Four Nations*, the denomination of a college founded in 1661, by cardinal Mazarin, for the education and mainteuance of fixty children, natives of the four countries conquered by Lewis XIV., *viz.* fifteen for Pignerol and Italy, fifteen for Alfatia, twenty for Flanders, and ten for Rouffillon.

QUATRICHROMA, in the *Italian Mufic*, is what we call a *demi-femi-quaver*, thirty-two of which make a bar in common time. See TIME, and TRIPLE.

QUATRO CASE, in *Geography*, a town of Italy, in the department of the Mincio; 17 miles S.E. of Mantua.

QUATROL, a fmall ifland in the gulf of Siam, near the coaft of Camboja. N. lat. 10° 13′. E. long. 103° 25′.

QUATROS, CORONADOS, *Los*, an ifland in the Pacific ocean, difcovered by Quiros in 1606. S. lat. 18° 40.

QUATTRINO, in *Commerce*, a copper coin at Florence; alfo a money of account, 60 quattrini being equal to 12 crazie, $1\frac{1}{2}$ paoli, or 2 lira. At Rome, the fcudo is divided into $3\frac{1}{3}$ teftoni, 500 quattrini, or 1000 mezzi quattrini; fo that 5 quattrini make 1 paolo, and 3 paoli 1 teftone. See SCUDO.

QUATUOR, Lat., a name given to any mufical compofition, vocal or inftrumental, in four parts, and in dialogue, or *a parte equale*, when each have folo parts alternately. The Italians fometimes call a quatuor *quartello*, but more frequently *quartto*, and the Englifh *quartet*.

A vocal quartet, fays Rouffeau, is more difficult for the poet to write, as well as for the compofer to fet, than a trio or chorus,

In the vocal quartet of a mufical drama, four diftinct characters fhould be fupported both in the words and mufic, according to the fituation and ftate of mind of the feveral perfonages who have petitions or complaints to make, or anfwers to give.

The inftrumental quartets of Haydn have been the delight of all that have performed, or heard them performed, for full 30 years, and bid fair to continue to afford delight for at leaft 30 years more.

QUATUOR *Principalia Artis Muficæ*, the title of a MS. in the Bodleian library at Oxford (Digby 90.), which has been afcribed to feveral authors. Anthony Wood gives it to Tewkefbury, to whom it is likewife afcribed in the Oxford Catalogue of MSS., with very little foundation. Bifhop Tanner has honoured Dr. John Hambois with this production, a writer on mufic, who flourifhed more than a century after this MS. was finifhed, as appears from the teftimony of the fcribe himfelf.

There is, however, at Oxford, among the MSS. another volume of Mufical Tracts (Bodl. 515.), which had not been fufficiently examined by any of the catalographers who have mentioned it: for, on a careful perufal and collation, we found in it, befides two other tracts by Simon Tunftede, or Tuftede, a duplicate of the Quatuor Principalia; and as no doubt has been thrown upon Tunftede having been the author of the two firft tracts in the volume, it feems as if we might venture, without doubt or hefitation, to affign to him this ample, and, for the time when it was written, excellent treatife. That Simon Tunftede was a man of fcience, and an able mufician, as well as a doctor of divinity, appears at the end of MS. Digby 90. After faying that the book was finifhed in 1351, we have the following paffage: "Ille autem anno regens erat inter minores Oxoniæ fratres, Simon de Tunftede, doctor facræ theologiæ, qui in mufica pollebat, et eciam in feptem liberalibus artibus." Pits, Bale, Tanner, and all our biographical writers, fpeak of him as a learned mufician; and Pits enumerates the Quatuor Principalia among his writings. (De illuft. Angl. Script.) Simon Tunftede, a Francifcan friar, born at Norwich, was in fuch favour for his learning and piety, as to be unanimouſly choſen provincial maſter of all England. He died at Bruzard, in Suffolk, in 1369.

The title of the tracts in the Oxford Catalogue of MSS. has occaſioned the great diverſity of opinions about the writer of the Quatuor Principalia; for N° 515 is entitled "De Muſica continua et diſcreta, cum Diagrammatibus, per Simonem Tunſtede, A.D. 1351." However, in the beginning of the volume, the author propoſes to treat "De quatuor Principalibus in quibus tocius Muſica radices conſiſtunt," &c. which exactly agrees with the other MS.; and there is no difference from the beginning to the end, except in the omiſſion of a kind of prologue, or argument to the work, which appears in the tract aſcribed to Tewkeſbury (Digby 90.), beginning "Quemadmodum inter Triticum," and is omitted in that to which the name of Tunſtede is prefixed. Bodl. 515.

What the author calls the "Four Principals of Muſic," will beſt appear from his own manner of dividing the work. In the firſt part or principal, conſiſting of nineteen chapters, he treats of muſic in general, its conſtituent parts and diviſions. II. Of its invention, intervals, and proportions, twenty-four chapters. III. Of plain chant, and the eccleſiaſtical modes, fifty-eight chapters. IV. Of meaſured muſic, or time; of diſcant, and their ſeveral diviſions. This laſt principal is divided into two ſections, of which the firſt contains forty-one chapters, and the ſecond forty-nine. The whole treatiſe fills a hundred and twenty-four folio pages; the diagrams, which are very numerous, are beautifully written, and illuminated with different coloured inks; and it ſeems to be in all reſpects the moſt ample and complete work of the kind which the fourteenth century can boaſt.

Quatuor *Hominis Prepoſiti*. See Prepositi.

Quatuor-Vir, in *Antiquity*, frequently written iiii. vir, a Roman magiſtrate, who had three colleagues joined with him in the ſame adminiſtration.

To the quatuor-vir was committed the charge of conducting and ſettling the colonies ſent into the provinces.

Upon unlucky accidents, and other dangerous affairs, it was uſual to create quatuor-viri, with commiſſion to take care *ne quid detrimenti reſpublica caperet, that the republic were not prejudiced.*

There were alſo quatuor-viri appointed to inſpect and take care of repairs, &c.

QUAUCHOCHOPITLI, in *Ornithology*. See Picus *Tricolor*.

QUAVER, in *Muſic*, a meaſure of time, equal to one-half of the crotchet, or one-eighth of the ſemi-breve.

The quaver is marked by the character

The Engliſh quaver makes what the French call *crochue*, crotchet, becauſe of the hook at bottom. See Crotchet.

The quaver is divided into two ſemiquavers, noted and four demiſemiquavers, marked. See Characters.

QUAVERING, the act of trilling, or ſhaking; or the running a diviſion with the voice.

QUAUHAYOHUATLI, in *Botany*, a name by which ſome authors have called the tree, whoſe fruit is the caſſia fiſtula of the ſhops. Hern. p. 87.

QUAUHCILUI, in *Ornithology*. See Merops *Cinereus*.

QUAUHIOYAMATL, in *Zoology*. See Sus *Tajaſſu*.

QUAUHTECALLOTLQUAPACHTLI. See Sciurus *Variegatus*.

QUAUHTECHALOTT-THLITTIC. See Sciurus *Niger*.

QUAUHTLA-COYMATL. See Sus *Tajaſſu*.

QUAUHTZONECOLIN, in *Ornithology*, the American name for a bird called by moſt a quail, but eſteemed by Nieremberg a ſpecies of partridge.

It is of the ſize of the European partridge, and of a browniſh colour, and ornamented with a creſt upon its head.

There are alſo in America two other ſpecies of partridge much allied to this: the one with a yellow body, and black and white head; the other ſmall and brown, and without a creſt. See Tetrao *Criſtatus*.

QUAUHYAC Oculensium, in *Botany*, the name of a very large Indian tree, bearing leaves reſembling thoſe of the citron. The bark is aſtringent, heating, drying, and of a ſtrong ſmell: it reſtrains a diarrhœa, and excites a ſweat. The juice, ſnuffed up the noſe, cauſes ſneezing, purges the head, and thus removes fevers, and pains in the head: for which reaſons, it is preſerved in families as a popular remedy. Nieremberg.

QUAVITL, a name given by ſome authors to the cocoa-tree. Hern. p. 79.

QUAUTOTOPOTLI, in *Ornithology*. See Picus *Canadenſis*.

QUAY, Kay, a ſpace of ground paved on the ſhore of a river, or port, deſtined for the loading and unloading of merchandize. See Kay and Wharf.

QUEAGA, in *Geography*, a town of Pegu, on the Ava; 18 miles S. of Lundſey.

QUEBEC, a city of America, the capital of the lower province of Canada, as Niagara is of the upper, was founded by the French in the year 1608, and is ſituated on a very lofty point of land, on the N.W. ſide of the river St. Lawrence, at its confluence with the river St. Charles, about 320 miles from the ſea. Nearly facing it, on the oppoſite ſhore, there is another point; and between the two the river is contracted to the breadth of three-quarters of a mile; but after paſſing through this ſtrait, it expands to the breadth of five or ſix miles, taking a great ſweep behind that point on which Quebec ſtands. The city derives its name from the word Qūebec, or Quebeio, which, in the Algonquin tongue, ſignifies a ſudden contraction of a river. The wide part of the river, immediately before the town, is called "the Baſon," and it is ſufficiently deep and ſpacious to float upwards of 100 ſail of the line. Quebec is divided into two parts, called the upper and the lower towns. The upper town is ſituated on a rock of limeſtone, on the top of the point; and the lower town, built round the bottom of the point, cloſe to the water, on land which has been gradually gained from the river. The rock on which the upper town ſtands riſes, in ſome places towards the water, nearly perpendicularly, ſo as to be totally inacceſſible; in other places it is not ſo ſteep as to prevent a communication between the two towns, by means of ſtreets winding up the ſide of it; though here the aſcent is ſo great, that there are long flights at one ſide of the ſtreets, for the accommodation of foot-paſſengers. The lower town lies very much expoſed to an enemy, being defended merely by a ſmall battery towards the baſon, which, at the time of high tides, is nearly on a level with the water; and by barriers towards the river, in which guns may be planted, when there is any danger of an attack.

The upper town is a place of immenſe ſtrength. Towards the water it is ſo ſtrongly guarded by nature, that ſlight

ſlight walls are a ſufficient defence; and in ſome places, where the rock is inacceſſible, no walls are neceſſary. Here, however, are ſeveral redoubts and batteries. The principal battery, which points towards the baſon, conſiſts of twenty-two 24-pounders, two French 36-pounders, and two large iron mortars: this battery is flanked by another of ſix guns, that commands the paſſes from the lower town. On the land ſide the fortifications are ſtupendous. When general Wolfe attacked this place, he thought it a vain attempt to make an aſſault on the ſide of the town which lies towards the water, where the rock is ſo ſteep, and ſo eaſily defended. In order to carry on the attack on the land ſide, he firſt attempted to land his troops ſome miles below the town, near the Falls of Montmorenci; but here he was repulſed by a large diviſion of the French forces with loſs. Foiled in his firſt attempt to get on ſhore, the brave Wolfe formed the bold deſign of aſcending to the top of the banks above Quebec, commonly called the Heights of Abraham. After previous preparation, the ſoldiers clambered up the heights with great difficulty, and the guns were hauled up by means of ropes and pullies fixed round the trees, with which the banks are covered from top to bottom. At the top the plain commences, and extends cloſe under the walls of the city. Here the memorable battle was fought, in which the much lamented general fell, at the moment when all his noble exertions were about to be crowned with the ſucceſs which they ſo eminently merited. The ſpot where the illuſtrious hero breathed his laſt is marked with a large ſtone, on which a true meridional line is drawn. Although the great Wolfe found it ſo difficult a taſk to gain poſſeſſion of Quebec, and it has been rendered much ſtronger ſince his time, the people of the United States imagine, that, in caſe of a rupture with Great Britain, it might be eaſily taken; and yet at the cloſe of the year 1775, and the commencement of 1776, an attempt was made by American troops, under the command of Arnold and Montgomery, without ſucceſs. On this occaſion Montgomery fell, and Arnold's attempt, on the practicability and ſucceſs of which he had previouſly boaſted, proved fruitleſs. St. John's gate, which he endeavoured to force, and the adjoining walls, are ſtupendous; and the mere ſight of them may convince any perſon, that an attempt to ſtorm them muſt be altogether ineffectual, without the aid of heavy artillery, with which the Americans were not provided.

Independently of its fortifications, and ſituation on the ſummit of a rock, Quebec owes much of its ſtrength and ſecurity to the long duration and extreme ſeverity of the winter; as in that ſeaſon it is wholly impracticable for a beſieging army either to carry on any works, or to blockade the town. Mr. Weld ſays, that 5000 ſoldiers are neceſſary to man the works at Quebec completely. A large garriſon is always kept in it, and abundance of ſtores of every deſcription. The troops are lodged partly in barracks, partly in block-houſes near Cape Diamond, which is the moſt elevated part of the point, and is reckoned to be upwards of 1000 feet above the level of the river. The Cape is ſtrongly fortified, and may be conſidered as the citadel of Quebec: it commands the town in every direction, and alſo the plains on the outſide of the walls. The evening and morning guns, and all ſalutes and ſignals, are fired from hence. Notwithſtanding the great height of the rock above the river, water may be readily obtained even at the very top of it, by ſinking wells of a moderate depth; and in ſome particular places, at the ſides of the rock, it guſhes out in large ſtreams; and the water is of a very good quality. It is ſuppoſed, ſays Mr. Weld, that including the upper and lower towns and ſuburbs, there are at leaſt 2000 dwellings; and the number of inhabitants, allowing ſix to a houſe, may be eſtimated at 12,000. Mr. Heriot ſays, that, in 1806, the number of inhabitants amounted to 15,000; and if this ſtatement be correct, the increaſe muſt have been very rapid, for, in the year 1784, Quebec contained only 6472 inhabitants. About two-thirds of the inhabitants are of French extraction. The ſociety is agreeable, and very extenſive for a place of its ſize, which is owing to its being the capital of the lower province, and therefore the reſidence of the governor, different civil officers, principal lawyers, &c. The large garriſon always maintained in it contributes to make it gay and lively.

The lower town is moſtly inhabited by the traders who are concerned with the ſhipping, and it is a very diſagreeable place. The ſtreets are narrow and dirty, and, on account of the height of the houſes in moſt of them, the air is much confined; and in the ſtreets next the water, there is an intolerable ſtench from the ſhore when the tide is out. The upper town, on the contrary, is extremely agreeable; from its elevated ſituation, the air is very pure, and the inhabitants are never oppreſſed with heat in ſummer; it is, however, far from being well laid out, the ſtreets being narrow and very irregular. The houſes are generally built of ſtone, and, except ſome few, built of late years, ſmall and inconvenient. The chateau, in which the governor reſides, is a plain building of common ſtone, ſituated in an open place, the houſes round which form three ſides of an oblong ſquare. It conſiſts of two parts. The old and the new are ſeparated from each other by a ſpacious court. The former ſtands juſt on the verge of an inacceſſible part of the rock; behind it, on the outſide, there is a long gallery, from whence, if a pebble were let drop, it would fall at leaſt ſixty feet perpendicularly. This old part is chiefly taken up with the public offices, and all the apartments in it are ſmall and ill contrived; but in the new part, which ſtands in front of the other, facing the ſquare, they are ſpacious, and tolerably well finiſhed, but none of them can be called elegant. This part is inhabited by the governor's family. The chateau is built without any regularity of deſign, neither the old nor the new part having even an uniform front. It is not a place of ſtrength, as commonly repreſented. In the garden adjoining to it is merely a parapet wall along the edge of the rock, with embraſures, in which a few ſmall guns are planted, commanding a part of the lower town. Every evening during ſummer, when the weather is fine, one of the regiments of the garriſon parades in the open place before the chateau, and the band plays for an hour or two, at which time the place becomes the reſort of numbers of the moſt genteel people of the town, and has a very gay appearance.

Oppoſite to the chateau there is a monaſtery belonging to the Recollets, or Franciſcan friars; a very few only of the order are now left. Contiguous to this building is the college belonging to the Jeſuits, whoſe numbers have diminiſhed even ſtill faſter than that of the Recollets.

The nunneries are three in number, and as there is no reſtriction upon the female religious orders, they are all well filled. The largeſt of them, called L'Hoſpital General, ſtands in the ſuburbs, outſide of the walls; another, of the order of St. Urſule, is not far diſtant from the chateau.

The engineer's drawing-room, in which is kept a variety of models, together with plans of the fortifications of Quebec and other fortreſſes in Canada, is an old building, near the principal battery. Adjoining to it ſtands the

 houſe

houfe where the legiflative council and affembly of reprefentatives meet, which is alfo an old building, that has been plainly fitted up to accommodate the legiflature.

The armoury is fituated near the artillery barrack, in another part of the town. About ten thoufand ftand of arms are kept in it, arranged in a fimilar manner with the arms in the Tower of London, but, if poffible, with greater neatnefs and more fancy.

The artillery barracks are capable of containing about five hundred men, but the principal barracks are calculated to contain a much larger number; they ftand in the market-place, not far diftant from the fquare in which the chateau is fituated, but more in the heart of the town.

The market of Quebec is extremely well fupplied with provifions of every kind, which may be purchafed at a much more moderate price than in any town vifited by Mr. Weld in the United States. It is a matter of curiofity to a ftranger to fee the number of dogs yoked in little carts, that are brought into this market by the people who attend it. The Canadian dogs are found extremely ufeful in drawing burthens, and there is fcarcely a family in Quebec or Montreal, that does not keep one or more of them for that purpofe. They are fomewhat fimilar to the Newfoundland breed, but broader acrofs the loins, and have fhorter and thicker legs; in general they are handfome, and wonderfully docile and fagacious; their ftrength is prodigious. A fingle dog will draw a man for a confiderable diftance, that could not weigh lefs than ten ftone. People, during the winter feafon, frequently perform long journeys on the fnow with half a dozen or more of thefe animals yoked in a cariole or fledge.

An attempt was made in 1711 by the Englifh and Americans, under the command of brigadier Hill, to furprife Quebec; but it proved abortive. In 1759 it was taken by the Englifh, under the command of the valiant Wolfe, who facrificed his life in the engagement; and by the peace, in 1763, it was ceded, with the reft of Canada, to the conquerors, in whofe poffeffion it has fince continued.

The fcenery that is exhibited to the view from various parts of the upper town of Quebec, furpaffes for grandeur, beauty, and diverfity, any other, as Mr. Weld fays, that he has feen, either in America, or in any other part of the globe. In the variegated expanfe that is laid open before you, ftupendous rocks, immenfe rivers, tracklefs forefts, and cultivated plains, mountains, lakes, towns, and villages, in turn ftrike the attention, and the fenfes are almoft bewildered in contemplating the vaftnefs of the fcene. Nature is here feen on the grandeft fcale; and it is fcarcely poffible for the imagination to paint to itfelf any thing more fublime than are the feveral profpects prefented to the fight of the delighted fpectator. From cape Diamond, fituated one thoufand feet above the level of the river, and the loftieft part of the rock on which the city is built, the profpect is confidered by many as fuperior to that of any other fpot. A greater extent of country opens upon you, and the eye is here enabled to take in more at once, than at any other place; but it appeared to Mr. Weld, that the view from the cape is by no means fo fine as that, for inftance, from the battery; for in furveying the different objects below you from fuch a ftupendous height, their magnitude is in a great meafure loft, and it feems as if you were looking at a draft of the country, more than at the country itfelf. It is the upper battery that Mr. Weld alludes to, facing the bafon, and is about three hundred feet above the level of the water. Here, if you ftand but a few yards from the edge of the precipice, you may look down at once upon the river, the veffels upon which, as they fail up to the wharfs before the lower town, appear as if they were coming under your very feet. The river itfelf, which is between five and fix miles wide, and vifible as far as the diftant end of the ifland of Orleans, where it lofes itfelf amidft the mountains that bound it on each fide, is one of the moft beautiful objects in nature, and on a fine ftill fummer's evening it often wears the appearance of a vaft mirror, where the varied rich tints of the fky, as well as the images of the different objects of the banks, are feen reflected with inconceivable luftre. The fouthern bank of the river, indented fancifully with bays and promontories, remains nearly in a ftate of nature, cloathed with lofty trees; but the oppofite fhore is thickly covered with houfes, extending as along other parts of the river already mentioned, in one uninterrupted village, feemingly, as far as the eye can reach. On this fide the profpect is terminated by an extenfive range of mountains, the flat lands fituated between and the villages on the banks not being vifible to a fpectator at Quebec, it feems as if the mountains rofe directly out of the water, and the houfes were built on their fteep and rugged fides.

Beautiful as the environs of the city appear when feen at a diftance, they do not appear lefs fo on a more clofe infpection; and in paffing through them the eye is entertained with a moft pleafing variety of fine landfcapes, whilft the mind is equally gratified with the appearance of content and happinefs that reigns in the countenances of the inhabitants. Indeed, if a country as fruitful as it is picturefque, a genial and healthy climate, and a tolerable fhare of civil and religious liberty, can make people happy, none ought to appear more fo than the Canadians. There are, however, in the vicinity of Canada two fcenes, more particularly deferving of attention than any others: thefe are the falls or cataracts of the rivers *Chaudiere* and *Montmorency;* which fee refpectively. N. lat. 46° 48′ 38″. W. long. 71° 5′ 29″. Weld's Travels, vol. i.

QUEBITEA, in *Botany*, a name which feems to have been whimfically extracted by Aublet, from the Caribbean appellation of this plant, *Daquejoabite*. Aubl. Guian. v. 2. 838. t. 327. This has many creeping *roots*, and a twifted, decumbent, hairy *ftem*, with alternate, elliptical, broad, entire, hairy *leaves*, three or four inches long, on hairy *footftalks*. *Flowers* minute, in fhort, denfe, axillary, ftalked *fpikes*, with a fmall fcale at the bafe of the ftalks. Aublet did not inveftigate the ftructure of thefe flowers, but he fufpects the plant to be nearly akin to *Dracontium*, under which genus it is accordingly noticed by Juffieu. The roots, when chewed, are very acrid. The bruifed herb is ufed externally, to cure the bite of ferpents. It grows on the banks of rivulets in Guiana.

QUEBRANTAHUESSOS, in *Ornithology*. See PROCELLARIA *Gigantea*.

QUEÇALA, in *Geography*, a town of Mexico, in the province of Mechoacan; 105 miles S.S.E. of St. Luis de Potofi.

QUECHUA, in *Literary Hiftory*. See PERU.

QUEDA, a fea-port city on the W. coaft of the peninfula of Malacca, the capital of a kingdom, tributary to Siam, with a good harbour at the mouth of a river that will admit a veffel drawing 12 or 14 feet water on the fprings over the bar, which is gravel and mud. The town contains about 400 houfes, inhabited by Chinefe and Malays. The environs are agreeable and fertile; the woods abound in elephants and other animals, and in fome places are mines of lead, which fupply large quantities of thofe metals for exportation to Hindooftan, Arabia, and Perfia. The government is monarchical, under a Malay Mahomedan prince, who, like many other Malay princes, engroffes almoft the whole foreign trade of the port, excepting that of an annual Chinefe junk, which pays a certain fum only as duty, and then has leave to trade freely with the inhabitants. This junk imports immenfe quantities of coarfe China-ware, thin iron pans, and many other articles from that country, and exports biche de mer, called fwallow, fharks' fins, edible bird's nefts, rattans, tin, rice, dammer, tortoife-fhell, deer's fkins and finews, bullocks and buffalos' hides and horns, jerked beef, and many other coarfe articles. At Queda there is great plenty of rice, bullocks, buffalos, and poultry; but not fuch abundance of fruit and vegetables as at Acheen. The territory of Queda is a flat country, favourable for the cultivation of rice; a hill north of the town and inland, called the Elephant, favours the navigator's approach; alfo the fmall iflands called Peers, 20 miles weft of the bar, covered with trees, and good regular mud foundings, a great way off, even by night, indicate the diftance to the mariner; 300 miles E.N.E of Acheen. N. lat. 6° 20′. E. long. 100° 18′.

QUEDENAU, a town of Pruffia, in Samland; three miles N. of Königfberg.

QUEDLINBURG, a town of Weftphalia, in the principality of Halberftadt, on the Boda, which divides it into the Old and New Towns. It has feveral churches, a hofpital, and a college. Near this town is a princely abbey, fituated on a hill: it was founded by king Henry I. between the years 932 and 936, and fince enriched by various endowments. In 1539 it embraced Lutheranifm, and obliged itfelf, by folemn oaths, to maintain that form of religion. It lately confifted of four dignitaries, *viz.* of the lady abbefs and three others, diftinguifhed by the titles of provoft, dean, and canon. In 1802, the abbey and its revenues were voted to the king of Pruffia, as an indemnity; and by the treaty of Tilfit, transferred to the kingdom of Weftphalia. The town of Quedlinburg is feven miles S.S.E. of Halberftadt. N. lat. 51° 48′. E. long. 11° 20′.

QUEDLITZ, a town of Pruffia, in the province of Ermeland; four miles S. of Wartenburg.

QUEECE, in *Agriculture*, a term fometimes provincially applied to the wood-pigeon, or birds of that kind.

QUEECHY, in *Geography*, a river of Vermont, which runs into the Connecticut at Hartland.

QUEEN, Regina, a woman who holds the crown of a realm fingly, and by right of blood.

The word queen is derived from the Saxon *cwen*, *uxor*, *the wife of any one*, but applied, by way of excellency, to the wife of the king only; whence fhe was anciently called the *king's queen;* the Weft Saxons having no other name for a queen but the *king's wife*. (Affer de Ælfred, rebus, &c.) She was alfo called *lady*, in Saxon *wlæfdig;* juft as *madame*, *mademoifelle*, were ufed in France, for the wife and daughter of the duke of Orleans.

The name queen is alfo given, by way of courtefy, to her that is married to the king; called, by way of diftinction, *queen confort*. In refpect of whom the former is called *queen regnant*, or regent.

The widow of a king is alfo called queen, but with the addition of *dowager*.

In the firft fenfe, queen is, in all conftruction, the fame with king; and has the fame powers, prerogatives, rights, dignities, and duties that the king has. This is exprefsly declared by ftatute 1 Mar. I. ft. 3. c. 1.

The *queen confort* is inferior, and a perfon diftinct from, and a fubject of, the king. In England, though fhe be a feme-covert, yet may fhe fue, and be fued, in her own name; and may make leafes, and grants, &c. as a feme-fole.

She has feveral other prerogatives. Though an alien, fhe may purchafe lands in fee-fimple, without either naturalization, or denization; fhe may prefent to a benefice; nor is plenarty a bar againft her more than againft the king. She is alfo capable of taking a grant from the king, which no other wife can do from her hufband; and fhe may have a feparate property in goods as well as lands, and has a right to difpofe of them by will. She pays no toll, and fhall not be amerced, if fhe be nonfuited in any action; and may not be impleaded till firft petitioned.

To confpire her death, or violate her chaftity, is high treafon. She has an ancient peculiar revenue, called *queen-gold;* befides a very large dower, with a royal court, and officers, diftinct from the king's; and her attorney and folicitor-general are entitled to a place within the bar of his majefty's courts, together with the king's counfel.

Another ancient perquifite belonging to the queen confort, mentioned by all our old writers, and, on this account only, worthy of notice, is this, that on the taking of a whale on the coafts, which is a royal fifh, it fhall be divided between the king and queen; the head only being the king's property, and the tail of it the queen's. One reafon of this whimfical divifion, as affigned by our ancient records, was to furnifh the queen's wardrobe with whalebone.

The *queen dowager*, as the widow of the king, enjoys moft of the privileges belonging to her as queen confort. But it is not high treafon to confpire her death; or to violate her chaftity, becaufe the fucceffion to the crown is not thereby endangered. Yet ftill, *pro dignitate regali*, no man can marry a queen dowager without fpecial licence from the king, on pain of forfeiting his lands and goods. She has alfo this particular, that fhe lofes not her dignity, though fhe marry a private gentleman; as peereffes dowager do their peerage, when they marry commoners. Thus queen Catherine, widow of Henry V. being married to Owen ap Tudor, efq. maintained an action as queen of England. Much lefs does a queen regnant follow her hufband's condition, or is fubject to other queens; but fhe is fovereign to her own hufband, as queen Mary was to king Philip, and queen Anne to prince George of Denmark; unlefs it be otherwife appointed by parliament. The hufband may be guilty of high treafon againft her; but in the inftance of conjugal infidelity, he is not fubject to the fame penal reftrictions. For which the reafon feems to be, that if a queen confort is unfaithful to the royal bed, this may debafe or baftardize the heirs to the crown; but no fuch danger can be confequent in the infidelity of a hufband to a queen regnant.

Queen Caroline, in *Biography*, when princefs of Wales, is told in the dedication of the opera of Julius Cæfar to her royal highnefs, that the firft mufical founds which her highnefs heard, were thofe produced by the voice of the celebrated Piftocio, the father of good tafte, then in the fervice of his illuftrious fire, at the court of Anfpach.

Mufic doubtlefs was a ferious part of her majefty's education, as it is, and has ever been, of all the princes and princeffes of Germany; who have likewife frequent opportunities of hearing great performers and fplendid performances; yet we do not recollect having heard that her majefty was a performer herfelf, or even an admirer or patronefs of the art. This princefs died in November 1737.

Queen Mary. (See Mary.) During the fhort reign of this bigoted and intolerant princefs, ecclefiaftical mufic was again

again transferred to Latin words and the mafs, both of which had been excommunicated during the reign of her brother, Edward VI. But metrical pfalmody had not yet been generally received in our parochial churches. Mary was herfelf a performer on the virginal and lute, as appears by a letter fent to her by her mother, queen Katherine, after her feparation from the king, in which " fhe encourages her to fuffer chearfully, to truft to God, and keep her heart clean. She charged her in all things to obey the king's commands, except in matters of religion. She fent her two Latin books, the one 'De Vita Chrifti,' and the other the 'Epiftles of St. Jerom;' in them, (fays the queen,) I truft you fhall fee good things. And fometimes, for your recreation, ufe your virginals or lute, if you have any."

Fuller tells us, that " eight weeks and upwards paffed between the proclaiming of queen Mary and her affembling the parliament; during which time two religions were together fet on foot, *Proteftantifme* and *Poperie;* the former hoping to be continued, the latter labouring to be reftored; —and during this interim the churches and chapels in England had a mongrel celebration of their divine fervices betwixt reformation and fuperftition. For the obfequies for king Edward were held by the queen in the Tower, Auguft 7th, 1553, with the dirige fung in Latin, and on the morrow a maffe of requiem, and on the fame day his corps were buried at Weftminfter with a fermon fervice, and communion in Englifh."

In October following the laws of her predeceffor, Edward, concerning religion, were all repealed. And in November 1554, bifhop Bonner " fet up the old worfhip at Paul's, on St. Katherine's day; and it being the cuftom, that on fome holydays, the quire went up to the fteeple to fing the anthems, that fell on that night:—and the next day, being St. Andrew's, he did officiate himfelf, and had a folemn proceffion."

After this period, during the fubfequent years of Mary's reign, the public fervice was every where performed in the Roman Catholic manner, throughout the kingdom; and we may imagine that the numerous compofitions to Latin words, which have been preferved of Dr. Tye, White, Tallis, Bird, and the reft of our moft eminent harmonifts, were produced and performed at this time, while the Romifh religion had the afcendant. And indeed it appears by a record, now in the poffeffion of the Antiquarian Society, that the lift of Mary's chapel eftablifhment contains nearly the fame names as that of her brother Edward.

Queen Elizabeth. (See Elizabeth.) In fpeaking of mufic during the long and profperous reign of queen Elizabeth, our nation's honour feems to require a more diffufe detail than at any other time: for perhaps we never had fo juft a claim to equality with the reft of Europe, where mufic was the moft fuccefsfully cultivated, as at this period; when indeed there was but little melody any where. Yet, with refpect to harmony, canon, fugue, and fuch laboured and learned contrivances as were then chiefly ftudied and admired, we can produce fuch proofs of great abilities in the compofitions of our countrymen, as candid judges of their merit muft allow to abound in every kind of excellence that was then known or expected.

Elizabeth, as well as the reft of Henry VIII.'s children, and indeed all the princes of Europe at that time, had been taught mufic early in life. For Camden, in giving an account of her ftudies, fays, that " fhe underftood well the Latin, French, and Italian tongues, and was) indifferently well feen in the Greek. Neither did fhe neglect muficke, fo far forthe as might become a princeffe, being able to fing and play on the lute prettily and fweetly."

There is reafon to conclude, that fhe continued to amufe herfelf with mufic many years after fhe afcended the throne. Sir James Melvil gives an account of a curious converfation which he had with this princefs, to whom he was fent on an embaffy by Mary, queen of Scots, in 1564. After her majefty had afked him how his queen dreffed? What was the colour of her hair? Whether that or her's was beft? Which of them two was faireft? And which of them was higheft in ftature? " Then fhe afked, what kind of exercifes fhe ufed?" I anfwered, fays Melvil, " that when I received my difpatch, the queen was lately come from the Highland hunting: that when her more ferious affairs permitted, fhe was taken up with reading of hiftories: that fometimes fhe recreated herfelf in playing upon the lute and virginals. She afked if fhe played well? I faid, reafonably for a queen."

" The fame day, after dinner, my lord of Hunfden drew me up to a quiet gallery, that I might hear fome mufic, (but he faid, that he durft not avow it,) where I might hear the queen play upon her virginals. After I had hearkened a while, I took by the tapeftry that hung before the door of the chamber, and feeing her back was toward the door, I entered within the chamber, and ftood a pretty fpace hearing her play excellently well. But fhe left off immediately, fo foon as fhe turned about and faw me. She appeared to be furprifed to fee me, and came forward, feeming to ftrike me with her hand; alleging, fhe ufed not to play before men, but when fhe was folitary, to fhun melancholy. She afked how I came there? I anfwered, as I was walking with my lord Hunfden, as we paffed by the chamber door, I heard fuch a melody as ravifhed me, whereby I was drawn in ere I knew how; excufing my fault of homelinefs, as being brought up in the court of France, where fuch freedom was allowed; declaring myfelf willing to endure what kind of punifhment her majefty fhould be pleafed to inflict upon me for fo great offence. Then fhe fate down low upon a cufhion, and I upon my knees by her; but with her own hand fhe gave me a cufhion, to lay under my knee; which at firft I refufed, but fhe compelled me to take it. She enquired whether my queen or fhe played beft. In that I found myfelf obliged to give her the praife."

If her majefty was ever able to execute any of the pieces that are preferved in a MS. which goes under the name of " Queen Elizabeth's Virginal Book," fhe muft have been a very great player: as fome of thefe pieces, which were compofed by Tallis, Bird, Giles, Farnaby, Dr. Bull, and others, are fo difficult, that it would be hardly poffible to find a mafter in Europe, who would undertake to play one of them at the end of a month's practice.

Befides the lute and virginals, Elizabeth was a performer on the violin, and on an inftrument fomething like a lute, but ftrung with wire, and called the *poliphant.* A violin of a fingular conftruction, with the arms of England, and the creft of Dudley, earl of Leicefter, this queen's favourite, engraved upon it, was purchafed at the fale of the late duke of Dorfet's effects. The date of its make, 1578. It is very curioufly carved; but the feveral parts are fo thick and loaded with ornaments, that it has not more tone than a mute, or violin with a fordine; and the neck, which is too thick for the grafp of the hand, has a hole cut in it for the thumb of the player, by which the hand is fo confined, as to be rendered incapable of fhifting, fo that nothing can be performed upon this inftrument, but what lies within the reach of the hand in its firft pofition. Playford tells

tells us, that "Queen Elizabeth was not only a lover of this divine ſcience (muſic), but a good proficient therein; and I have been informed, (ſays he,) by an ancient muſician, and her ſervant, that ſhe did often recreate herſelf on an excellent inſtrument, called the *poliphant*, not much unlike a lute, but ſtrung with wire."

Among the Sloane MSS. in the Britiſh Muſeum, No 1520, there is a liſt of the officers of the court of revenue in this reign; in which is included the muſical eſtabliſhment of her majeſty's houſehold, about the year 1587.

Muſytyons.

		£	s.	d.
The ſervant - -	Fee	24	6	8
Trompeters ſixteen. Fee to every of them		24	6	8
Lutes, harps, and ſingers.				
Chief luter - -	Fee	40	0	0
Chief harper - -		20	0	0
Reſt of the luters - -		19	0	0
The other of the harps - -		9	0	0
And - - -		8	0	0
Bagpiper - -	Fee	12	13	4
Minſtrels nine, whereof ſeven at -		18	5	0
every of them; one at - -		24	6	0
and thother at - -		66	0	8
Six children to ſing				
Rebeck two - -	Fee	28	6	6
Sackbutt ſix, whereof five having -		24	6	8
by the year, and one at - -		36	10	0
Vialls eight, whereof ſix at -		30	8	4
one at - - -		20	0	0
and thother at - -		10	0	0
Players on the virginalls three, one at -		50	0	0
and thother two at - -		30	0	0
a piece.				
Muſitions ſtraungers ſeven, whereof ſix have		30	10	0
and one - - -		38	0	0
Drumſleds three, every of them -		18	5	0
Players on the flute two, at -		18	5	0
a piece.				
Makers of inſtruments: Regall-makers -		20	0	0
Players of enterludes eight, every of them p. ann.		66	0	8
Organ-maker - -		20	0	0

Her majeſty's chapel eſtabliſhment was nearly the ſame, in number and ſalaries, as that of her brother and ſiſter, Edward and Mary. Indeed, it ſeems as if the religious ſcruples of muſicians had been conſiderably diminiſhed by the ſeverity with which Teſtwood had been treated in the time of Henry VIII., and the peril into which Marbeck's zeal for reformation had involved him. For in comparing the chapel eſtabliſhments of Edward, Mary, and Elizabeth, we find, that however the creeds of theſe monarchs differed, their muſicians had conſtantly tuned their conſciences to the court pitch: *i. e.* in perfect uniſon with the orders of their ſovereign, the ſupreme head of the church.

Camden ſays, that "the Romiſh religion remained a full moneth and more after the death of queen Mary, in the ſame ſtate as before." For Elizabeth, who began her reign November 17th, 1558, had a ſolemn ſervice performed for her ſiſter Mary at Weſtminſter, December 5th, and another December 20th, for the emperor Charles V.; and theſe, as well as her own coronation, were celebrated in the Romiſh manner.

Burnet ſays, that "Elizabeth had been bred up from her infancy with a hatred of the Papacy, and a love to the Reformation; but yet as her firſt impreſſions in her father's reign were in favour of ſuch old rites as he had ſtill retained; ſo in her own nature ſhe loved ſtate, and ſome magnificence, in religion as well as in every thing elſe."

We have no other muſic printed expreſsly for the cathedral ſervice to Engliſh words during the reign of Edward VI. than that of Marbeck, which was mere canto fermo, without counterpoint; but the year after the publication of the Engliſh Liturgy by queen Elizabeth, the following choral work appeared: "Certaine notes ſet forth in foure and thre partes, to be ſong at the Morning Communion, and Evening Praier, very neceſſarie for the Churcheof Chriſte to be frequented and uſed: and unto them be added divers Godly Praiers and Pſalmes, in the like forme, to the honour and praiſe of God. Imprinted at London, over Alderſgate, beneath St. Martins, by John Day, 1560." The authors of theſe compoſitions were Tallis, Cawſton, Johnſon, Oakland, Shepherd, and Taverner.

In 1565, our eccleſiaſtical compoſers, encouraged probably by the reception of the former publication, and favour of the queen, printed another collection of offices, with muſical notes, under the following title: "Morning and Evening Prayer and Communion, ſet forthe in foure partes, to be ſong in Churches, both for Men and Children, with dyvers other Godly Prayers and Anthems, of ſundry Mens doynges."

The muſicians who contributed to this collection were Thomas Cawſton, Heath, Robert Haſleton Knight, Johnſon, Tallis, Oakland, and Shepherd.

Theſe two publications by John Day, fixed, for near a century, the ſtyle of our choral muſic; of which the movement was grave, the harmony grateful, and the contrivance frequently ingenious.

The great muſicians of queen Elizabeth's reign were Dr. Tye, John White, Thomas Tallis, William Bird, Dr. Bull, and Thomas Morley. And theſe, as eccleſiaſtical compoſers, were perhaps equal in learning and genius to the greateſt contemporary contrapuntiſts on the continent of Europe.

We muſt not terminate our account of the cultivation and progreſs of muſic by queen Elizabeth and her ſubjects, without making honourable mention of her majeſty's "Virginal Book," and referring for a ſummary account of its contents to BIRD, WILLIAM. In all our enquiries after muſical curioſities throughout Europe, we have met with no pieces ſo elaborate and difficult for the harpſichord, as thoſe by our ingenious countrymen.

This book, equally valuable for its antiquity and contents, was purchaſed by Bremner at Dr. Pepuſch's ſale, 1762, whoſe property it was to the time of his death. After which it paſſed into the hands of viſcount Fitzwilliams, in whoſe poſſeſſion, we believe, it ſtill continues.

It is a magnificent folio MS. curiouſly bound in red Morocco, with gilt leaves. There are nearly 70 pieces by Dr. Bull in this volume. The writing is ſmall, but uncommonly neat, upon ſix lines. The compoſitions are in general extremely elaborate and difficult; particularly thoſe by Bird, Dr. Bull, and Giles Farnabie, who have all contributed largely to the furniſhing of this volume, which contains near three hundred pieces. The firſt movement in the book is an old Engliſh tune, called "Walſingham," beginning in C natural, and ending in A major, which Dr. Bull has varied in a moſt full and complicated ſtyle, thirty different ways. Signora Margarita, the wife of Dr. Pepuſch, when ſhe quitted the Opera ſtage, applied cloſely to the practice of the harpſichord; upon which inſtrument ſhe became a great proficient. However, with all her own diligence and talents, aſſiſted by the ſcience and experience of of her husband, she was never able to vanquish the difficulties of this piece, by Dr. Bull. And several of Dr. Pepusch's friends and pupils, who went frequently to his apartments at the Charter-house, have assured us, that though this manuscript was constantly open upon her harpsichord desk, she never advanced to the end of the variations; as seems likewise manifest from the colour, as well as wear and tear, of the leaves, which are much more clean and entire in every other part of the book, than at the first strains of this composition.

Queen Mary II. joint sovereign with William III., seems to have done little more for music, than patronise Mrs. Arabella Hunt, and the old Scots tune of "Cold and raw the wind doth blow." See Mary.

Queen Anne, in *Geography*, a post-town of America, in Prince George county, Maryland, situated on the W. side of Patuxent river, across which is a wooden bridge. This small town is laid out on a regular plan, at the foot of a hill. It contains a few stores, and warehouses for the inspection of tobacco; 25 miles E.N.E. of Washington.

Queen Anne's, a county of Maryland, bounded W. by Chesapeak bay, and N. by Kent county; containing 16,648 inhabitants. Its chief town is Centerville. Belonging to this county is Kent island, 14 miles long from N. to S. and $6\frac{1}{2}$ broad from E. to W. It is low, but the land is fertile, and its eastern side is bordered with salt marsh.

Queen Catherine's *Foreland*, the northernmost point of Terra del Fuego, at the east entrance into the straits of Magellan, discovered by Frobisher in 1576.

Queen Charlotte's *Foreland*, the S.E. extremity of New Caledonia. N. lat. 22° 15'. E. long. 167° 14'.—Also, the S.W. point of New Hanover, in the East Indian sea, so called in 1767 by Capt. Carteret. The land about it is remarkable for a number of little hummocke, or hills. S. lat. 2° 29'. E. long. 148° 27'.

Queen Charlotte's *Island*, an island in the Pacific ocean, about six miles long, and one broad, discovered in the year 1767, by captain Wallis. It is described as sandy and level, full of trees, without underwood, and abounding with scurvy-grass. The canoes of this island appeared to be about 30 feet long, 4 feet broad, and $3\frac{1}{2}$ deep. The inhabitants were of a middle stature, and dark complexion, with long black hair, hanging loose over their shoulders. The men were well made, and the women handsome. Their garments were a kind of coarse matting, fastened about their middle, and capable of being brought round their shoulders. The men who landed saw no appearance of any kind of metal, but observed several tools made of shells and stones, sharpened and fitted into handles, like adzes, chissels, and awls. They saw several repositories of the dead, in which bodies were left to putrefy, under canopies, and not deposited in the ground. The island was taken possession of by captain Wallis and his crew, in the name of his Britannic majesty. They also left some hatchets, nails, glass bottles, beads, shillings, sixpences, and halfpence, as presents to the natives. S. lat. 19° 18'. W. long. 138° 4'.

Queen Charlotte's *Islands*, a group of islands, discovered in 1767 by Capt. Carteret, consisting of Egmont's island or New Guernsey, Lord Howe's island or New Jersey, and several others. A quarrel having occurred in consequence of the imprudent conduct of the master of Capt. Carteret's ship, between the crew and the natives, several of the latter were killed, and four of the former died in consequence of their wounds. This unfortunate event prevented any intercourse with the inhabitants of these islands. *Egmont island*, says Capt. Carteret, who called it by this name in honour of the earl, is the same with the *Santa Cruz* of the Spaniards; and the place in which the ship had lain he called *Swallow bay*; about ten miles W. from this bay is a small island, near the coast, called *Portland's island*; and to the bay farther west, where the ship's cutter had been attacked by the Indians, he gave the name of *Bloody bay*. In this bay is a small rivulet of fresh water, and here were seen many houses, and near the water-side, one much longer than any of the rest, which seemed to be a kind of common hall, or council-house, and was neatly built and thatched. The sides and the floor of this edifice were covered with a kind of fine matting, and bundles of arrows were hung up in it ready for use. At this place there were also many fine gardens and plantations, inclosed by a fence of stone, and planted with cocoa-nut trees, bananas, plantains, yams, and other vegetables. About three miles W. of this town was another of considerable extent, in the front of which, near the water, was a breast-work of stone, about four feet six inches high, angularly formed like a fortification; from which, and from other circumstances, there is reason to believe that the natives have frequent wars among themselves. At the distance of two or three miles farther westward was found a small bight, receiving a river, which was called *Granville's river*, and westward of it is a point, to which was given the name of *Ferrar's point*. From this point the land forms a large bay, near which is a town of great extent, and apparently very populous. About seven miles W. of Ferrar's point is another, that was called *Carteret's point*, from which a reef of rocks, that appears above water, runs out to the distance of about a cable's length. To the W. of this was another large town, fronted like the last, and the people who thronged to the beach while the ship was passing, performed the same kind of circular dance with those of the former place. They were furnished with a number of canoes of different sizes. The inhabitants of Egmont island are extremely nimble, vigorous, and active, and seem as well qualified to live on the water as on the land, for they were in and out of their canoes almost every minute. With their bows and arrows they do execution at an incredible distance. Their arrows were pointed with flint, nor was there seen among them any appearance of metal. The country, in general, is woody and mountainous, intermixed with many vallies; several small rivers flow from the interior part of the country into the sea, and upon the coast there are many harbours. S. lat. 9° 50' to 11° 20'. E. long. 163° 30' to 165° 10'. Hawkesworth's Voyages, vol. i. p. 349, &c.

Queen Charlotte's *Islands*, called by Capt. Gray, of the United States, who visited them in 1789, and by American navigators, "Washington islands," a group of islands on the N.W. coast of America. See *Queen* Charlotte's *Island*.

Queen Charlotte's *Sound*. See *Queen* Charlotte's *Sound*. Mr. Anderson, who visited this sound four times, has made the following remarks on the country near it. The land is every where uncommonly mountainous, rising immediately from the sea into large hills, with blunted tops. At considerable distances are vallies, or rather impressions on the sides of the hills, which are not deep, each terminating towards the sea in a small cove, with a pebbly or sandy beach, behind which are small flats, where the natives generally build their huts, at the same time landing their canoes upon the beaches. The bases of these mountains, at least towards the shore, are constituted of a brittle, yellowish sand-stone, which acquires a blueish cast, where the sea washes it. It runs, in some places, in horizontal, and, at other places, in oblique strata; being frequently divided, at small distances, by thin veins of coarse quartz. The mould, or soil, which covers this, is of a yellowish cast, not unlike marle, and is commonly

monly from a foot to two or more in thicknefs. The quality of this foil is beft indicated by the luxuriant growth of its productions: the hills being one continued foreft of trees, owing the ftrength of their vegetation partly to the foil, and partly alfo to the agreeable temperature of the climate. In February, correfponding to our Auguft, the thermometer was not higher than 66°; and in June, correfponding to our December, the mercury never fell lower than 48°. The weather is, in general, good; but fometimes windy, with heavy rain, which, however, never lafts above a day; nor is it ever exceffive. Among the trees, which covered the hills, and which are of two forts, one fupplied the place of fpruce in making beer, for which purpofe a ftrong decoction of its leaves was fermented with treacle or fugar. The other fort of tree refembled a maple, and its wood ferved for fuel. On the fmall flat fpots behind there is a great variety of trees. Among other plants that were ufeful, may be reckoned the wild celery, which grows plentifully almoft in every cove, and one that was called fcurvy-grafs, though very different from the plant to which we give that name. Both forts were boiled every morning, with wheat ground in a mill, and with portable foup for the people's breakfaft, and amongft their peafe-foup for dinner. Sometimes they were ufed as fallad, or dreffed as greens. There is another plant, which produces a fine filky flax, of which the natives make their garments. A fpecies of long pepper is alfo found in great plenty. The birds are almoft entirely peculiar to the place. The principal fifh caught with the feine were mullets and elephant-fifh, with a few foles and flounders; but thofe which the natives moftly fupplied were a fort of fea-bream, of a filver colour, with a black fpot on the neck, large conger-eels, and a fifh in fhape like the bream, but fo large as to weigh five, fix, or feven pounds, and called "Mogge" by the natives. Of all the forts of fifh, which are here numerous, the mogge, fmall falmon, and colour fifh, as the feamen called it, though different from ours, are fuperior to the reft. The rocks furnifh a great variety of fhell-fifh. Infects are very rare. In this extenfive land there are not even traces of any quadruped, excepting only a few rats, and a fort of fox-dog, which is a domeftic animal with the natives. Neither is there any mineral worth notice, but a green jafper or ferpent-ftone, of which the New Zealanders make their tools and ornaments.

The natives do not exceed the common ftature of Europeans, and, in general, are not fo well made. Their colour is of different cafts, from a deep black to a yellowifh or olive tinge; and their features are alfo various, fome refembling Europeans. But in general their faces are round, with their lips full, and alfo their nofes towards the point; though the firft are not uncommonly thick, nor the laft flat. Their teeth are generally broad, white, and well fet; and their eyes large, with a very free motion, which feems the effect of habit; their hair is black, ftraight, and ftrong; commonly cut fhort on the hind part, with the reft tied on the crown of the head; but fome have it curling, and of a brown colour. In the young, the countenance is generally free or open; but in many of the men it has a ferious caft, and fometimes a fullennefs or referve, efpecially if they are ftrangers. The women are in general fmaller than the men; but have few peculiar graces. The drefs of both fexes is alike; and confifts of an oblong garment, about five feet long and four broad, and made of the filky flax before mentioned. This feems to be their moft material and complex manufacture, and is executed by knotting; and their work is often ornamented with pieces of dog-fkin, or chequered at the corners. They bring two corners of this garment over their fhoulders, and faften it on the breaft, with the other part which covers the body; and about the belly it is again tied with a girdle made of mat. Sometimes they cover it with large feathers of birds, (which feem to be wrought into the piece of cloth when it is made,) or with dog-fkin; and that alone fometimes worn as a covering. Over this garment many of them wear mats, which reach from their fhoulders to their heels. But the moft common outer covering is a quantity of fedge-plant, badly dreffed, which they faften on a ftring to a confiderable length, and throwing it about the fhoulders, let it fall down on all fides, as far as the middle of the thighs. By way of ornament, they fix in their heads feathers, or combs of bone or wood, adorned with pearl-fhell, or the thin inner fkin of fome leaf; and in the ears both of men and women, which are pierced, or rather flit, are hung fmall pieces of jafper, bits of cloth, or beads, when they can get them. A few alfo have the feptum of the nofe bored in the lower part. They wear long beards, but are fond of having them fhaved. Some are punctured or ftained in the face, with curious fpiral and other figures, of a black or deep blue colour; but it is doubtful whether this be ornamental, or intended as a mark of peculiar diftinction: and the women who are marked fo, have the puncture only on their lips, or a fmall fpot on their chins. Both fexes often befmear their faces and heads with a red paint, which feems to be a martial ochre, mixed with greafe; and the women fometimes wear necklaces of fhark's teeth, or bunches of long beads, which feem to be made of the leg-bones of fmall birds, or a particular fhell. They live in fmall coves, in companies of forty or fifty, or more; and fometimes in fingle families, building their huts contiguous to each other; which are in general miferable lodging places. The beft was about thirty feet long, fixteen broad, and fix high; built exactly in the manner of an Englifh barn. They feemed to have no other furniture than a few fmall bafkets or bags, in which they put their fifhing-hooks and other trifles. They live chiefly by fifhing, making ufe either of nets of different kinds, or of wooden fifh-hooks, pointed with bone; but fo oddly made, that a ftranger would be at a lofs to know how they can anfwer fuch a purpofe. Their boats are well built of planks, raifed upon each other, and faftened with ftrong withes, which alfo bind a long narrow piece on the outfide of the feams, to prevent their leaking. Some are fifty feet long, and fo broad as to be able to fail without an outrigger; but the fmaller fort commonly have one; and they often faften two together by rafters, forming a double canoe. They carry from five to thirty men, or more; and often have a large head, ingenioufly carved, and painted with a figure at the point, which feems intended to reprefent a man with his features diftorted by rage. Their paddles are about four or five feet long, narrow, and pointed; with which, when they keep time, the boat is pufhed along pretty fwiftly. Their fail, which is feldom ufed, is made of a mat of a triangular fhape, having the broadeft part above. Their method of feeding correfponds with the naftinefs of their perfons, which often fmell difagreeably, from the quantity of greafe about them, and their clothes never being wafhed. We have feen them eat the vermin with which their heads are plentifully ftocked. They alfo ufed to devour with the greateft eagernefs large quantities of ftinking train oil, and blubber of feals, which we were melting at the tent, and had kept near two months; and on board the fhips they were not fatisfied with emptying the lamps, but actually fwallowed the cotton and fragrant wick with equal voracity. Thefe people manifeft as much ingenuity, both in invention and execution, as any uncivilized nations under fimilar circumftances. For, without the ufe of any metal tools, they make every thing by which they procure their fubfiftence, clothing, and warlike

 weapons,

weapons, with a degree of neatneſs, ſtrength, and convenience for accompliſhing their ſeveral purpoſes. Their chief mechanical tool is formed exactly after the manner of our adzes, and is made, as are alſo the chiſſel and goudge, of the jaſper already mentioned, or of a black, ſmooth, and very ſolid ſtone. But their maſter-piece ſeems to be carving, which they uſe for various purpoſes, even the moſt trivial. Their ſubſtitute for a knife is a ſhell, a bit of flint or jaſper: and as an auger, they fix a ſhark's tooth in the end of a ſmall piece of wood. They have alſo a ſmall ſaw made of ſome jagged fiſhes' teeth, fixed on the convex edge of a piece of wood, nicely carved: but this, they ſay, is only uſed to cut up the bodies of their enemies whom they kill in battle. No people have a quicker ſenſe of injury done to them, and none are more ready to reſent it. Their temper is ſuſpicious and miſtruſtful; and they are ſo diſhoneſt, that they ſteal every thing upon which they can lay their hands. Such conduct may be expected, where little ſubordination exiſts, and where no man's authority ſeems to extend further than his own family. Their public contentions are frequent, or rather perpetual, and it appears, from their number of weapons, and dexterity in uſing them, that war is their principal profeſſion. Theſe weapons are ſpears, patoos, and halberts, or ſometimes ſtones. The firſt are made of hard wood, pointed, from five to twenty, or even thirty feet in length. The ſhort ones are uſed for throwing as darts. The "patoo," or "emeete," is of an elliptical ſhape, about eighteen inches long, with a handle made of wood, ſtone, the bones of ſome ſea animal, or green jaſper, and ſeems to be their principal dependence in battle. The halbert, or long club, is about five or ſix feet long, tapering at one end with a carved head, and at the other broad or flat, with ſharp edges. Before they begin the onſet, they join in a war-ſong, to which they all keep the exacteſt time, and ſome raiſe their paſſion to a degree of frantic fury, attended with the moſt horrid diſtortion of thier eyes, mouths, and tongues, to ſtrike terror into their enemies: which, to thoſe who have not been accuſtomed to ſuch a practice, makes them appear more like demons than men, and would almoſt chill the boldeſt with fear. To this ſucceeds a circumſtance, almoſt foretold in their fierce demeanour, horrid, cruel, and diſgraceful to human nature; which is, cutting in pieces, even before they are perfectly dead, the bodies of their enemies, and, after dreſſing them on a fire, devouring the fleſh, not only without reluctance, but with peculiar ſatisfaction. And yet theſe ſavages lament the loſs of their friends, with a violence of expreſſion, which indicates the moſt tender remembrance of them. The children are initiated, at a very early age, into all the practices, good and bad, of their fathers. They not only join in the war-ſong, but they likewiſe ſing, with ſome degree of melody, the traditions of their forefathers, their actions in war, and other indifferent ſubjects; of all which they are immoderately fond, and ſpend much of their time in theſe amuſements, and in playing on a ſort of flute. Their language is far from being harſh or diſagreeable, though the pronunciation is frequently guttural; and whatever qualities are requiſite in any other language to make it muſical, certainly obtain to a conſiderable degree here, if we may judge from the melody of ſome ſorts of their ſongs. It is alſo ſufficiently comprehenſive, though, in many reſpects, deficient, if compared with our European languages, which owe their perfection to long improvement. Mr. Anderſon has given a ſpecimen of it. (Cook's Third Voyage, vol. i.) In the year 1770 Capt. Cook left among the inhabitants a boar and two ſows, with ſome vegetables for cultivation. In 1773 he ſaw one of the ſows, and underſtood that the other and the boar were both living. The ſheep and goats did not ſucceed; the latter having been killed by one of the natives, and the ram having ran into the ſea.

QUEEN's, the middle county of Long iſland, New York, about 30 miles long, and 12 broad, containing ſix townſhips, and 19,336 inhabitants. Jamaica, Newtown, Hampſtead, in which is a handſome court-houſe, and Oyſter bay, are the principal towns in this county.

QUEEN's, a county of Nova Scotia, comprehending a part of the lands on the cape, on the S. ſide of the bay of Fundy. The ſettlements are as follow; *viz.* Argyle, on the S. ſide of the bay of Fundy, where a few Scots and Arcadians reſide: next to this is Yarmouth, ſettled chiefly by emigrants from New England; Barrington, within the iſland, called cape Sable, ſettled originally by Quakers from Nantucket. Beſides theſe are Port Raiſoir, ſo called by the French, and originally ſettled by the North Iriſh; Liverpool and Roſeway, ſettled and inhabited by emigrants from New England.

QUEEN's *County*, a county of Ireland, eſtabliſhed in the reign of the firſt Mary, which comprehended the old diſtrict of Leix. Both the county and chief town, Maryborough, received their names in compliment to the ſovereign. It is ſituated on the S.W. of Kildare, from which it is partly divided by the river Barrow, and is of a very compact form, being 25 Iriſh (nearly 32 Engliſh) miles in length, and as many in breadth. The ſuperficial contents are about 235,300 acres, or 367 ſquare miles, equal to 378,023 acres, or about 590 ſquare miles Engliſh. There are 50 pariſhes, 26 only of which have churches, and a population of 82,000 according to Dr. Beaufort, and about 90,000 as the medium of various calculations. The high and ſteep mountains of Sliebh-bloom (called alſo Ard-na-Erin, which in the Iriſh language ſignifies the height of Ireland) form ſo impracticable a barrier between the King's and Queen's counties, that in a range of fourteen miles they afford but one, and that a very difficult and narrow paſs into the King's county, called the "Gap of Glandine." In this great ridge are the ſources of the Barrow and the Nore; the Barrow running N.E. to Monaſterevan, where it changes its direction to the S., and the Nore croſſing the Queen's county by a ſouthern courſe into Kilkenny. The Dyſart hills in the eaſtern diviſion are conſpicuous and pictureſque, ſtanding rather ſingly than connected. From theſe eminences, through the viſtas formed by their particular ſituation, is commanded the view of a fine and beautiful country, highly adorned with rich plantations and magnificent demeſnes. The reſt of the county is rather flat, but lies high. The whole is watered with rivers and numerous mountain ſtreams, and according to ſir Charles Coote, its ſuperficial appropriations may be thus eſtimated.

	Acres.
Arable lands, paſture, and meadow	210,000
Woods and plantations -	1,300
Water - - -	1,000
Bog, mountain, and waſte -	21,000
Roads - - -	2,000
	235,300

The map belonging to the grand jury, reckons 244,938 acres, and of theſe 60,000 bog and mountain.

Almoſt every deſcription of ſoil is found in this county, and it varies from a very ſtiff clay to a ſandy loam, which, though light, is yet fertile; a ſtrong gravelly ſoil, very favourable to corn, is alſo prevalent. Lime-ſtone is ſo common, that there are rich quarries of it in almoſt every townland. The ſoil foil of the Sliebh-bloom mountains is variable, the furface inclining to a black and alternately yellow ftiff clay, of unequal depths, covering a loofe, rotten rock, or a gritty gravel, with occafionally a little appearance of lime-ftone. The weftern fide, more generally, inclines to a ftrong red clay, not unlike the nature of the foil in fome of th northern counties in Ireland, where oats and potatoes only are fown; but it generally is, throughout, fpongy, wet, and boggy to the fummit, and very rocky. Through the whole of the county, except in the fouth-eaftern corner, near Carlow, where the collieries are extenfive, bog is well interfperfed, and is the general fuel. The depth of thefe bogs is various, and in fome parts undifcovered, the beft fuel lying in fome a few fpades depth below the furface, in others very deep. The moors are a fhallow bog, with a ftratum of gravel or clay, under one or two fpades depth; this particular kind is eafily reclaimed, and becomes the beft and fureft land in the county, and the coft is here but trifling, indeed often repaid in one year, having all the materials within themfelves.

Amongft the mineral productions of this county, fir Charles Coote, the author of the Statiftical Survey, enumerates "coal, iron, copper, manganefe, mica, lime-ftone, marble, free-ftone, ochre, marle, fuller's-earth, and a great variety of clays valuable in every branch of pottery." Such an enumeration is of little ufe; being recommended neither by detail of facts and places, nor by accuracy of information. The coal diftrict is in another part of the fame work more fully noticed; but the reader who wifhes for information, is more likely to find it in the report of Mr. Griffith, mining engineer of the Dublin Society, which is fhortly to be publifhed. The coal is of that defcription called *ftone coal*, the *glance-coal* of Jamefon, and beft known by the name of Kilkenny coal. The Queen's county collieries feem to have laboured under many difadvantages, from want of capital or of proper exertion; but a profpect is opening upon us of more attention to this fource of wealth. There is a very fmall quantity of old timber in the Queen's county. There are, indeed, leafes ftill in exiftence, by which the tenant was obliged to cut, burn, or deftroy fo many acres of wood, to clear the land for the plough; a fyftem which, if neceffary to the eftablifhment of order in the county, was the caufe of reducing it to the bare ftate with refpect to timber, with which the Englifh traveller is fo often ftruck. The Barrow and the Nore are the principal rivers which water this county. The latter is not navigable, though, being a fine deep and fpacious river, it might be eafily rendered fo, by levelling the numerous weirs, that are of great detriment to the adjoining lands, and throw up a confiderable quantity of back water.

The Barrow is navigable throughout from Portarlington, near which it beautifully expands and winds through extenfive and fertile banks. There are no lakes which deferve notice. Maryborough is the county town, near which, as well as Mountmelich and Mountrath, there was a confiderable woollen manufacture of ftuffs, &c. which has declined. For any particulars refpecting the towns, the reader is referred to the refpective articles. Befides thofe mentioned, Portarlington is a place of fome importance, and Stradbelly a neat town. The county is reprefented in parliament by two knights of the fhire, and by one member for the borough of Portarlington. Maryborough and Ballynekill were disfranchifed at the union. Sir C. Coote's Statiftical Survey. Beaufort's Memoir.

QUEEN'*s Creek*, a river of America, in North Carolina, which runs into the Atlantic, N. lat. 34° 37′. W. long. 77° 28′.

QUEEN'S *River*, a river of the ifland of Dominica, which runs into the fea near Rofeau.

QUEEN-*Bee*, a term given by late writers to what ufed to be called the *king-bee*, or king of the bees; a large and long-bodied bee, of which kind there is only one found in every fwarm, and which is always treated with the greateft refpect by the reft.

It is well known that the generation and whole economy of bees principally depend upon this female fovereign, and that her prefence is abfolutely neceffary to the profperity and fafety of the whole community; infomuch that the lofs of the queen proves the certain and total deftruction of the fwarm or hive, unlefs the owner fupplies them in time with another ruler. Without her prefence and direction, the other bees will do no manner of work; they will gather neither wax, nor honey, nor any other materials; nor can they breed and propagate their kind without her. A ftock deprived of its queen, would yield to robbers, or elfe languifh and pine away, fo that the whole fociety would perifh. But as foon as a languifhing ftock is fupplied with a queen, pleafure and activity are apparent through the whole hive; the prefence of the fovereign reftores vigour and exertion, and her voice commands univerfal refpect and obedience: of fuch importance is the queen to the exiftence and profperity of the other members of this community. As the parent and fovereign of every fwarm is a female, the whole government is vefted in one; fo that where there happen to be more, as there fometimes are, and efpecially in fwarms that are united, confufion and difcord prevail, until all, except one, are expelled and flain.

As in forming artificial fwarms, and for other purpofes, it will be neceffary to diftinguifh the queen from the other bees, we fhall obferve, that fhe may be known by her fize, which is much larger than that of the common working-bees, and longer than that of the drones; by the form and fhape of her body, efpecially of the hinder part of it, which is more taper, and terminates in a much fharper point than the bodies of the other bees, in order the more readily to reach the bottom of the cells, where the eggs are depofited for the propagation of the fpecies (fee *Generation of* BEES): and alfo by her colour; her upper parts being fcarcely at all different in this refpect from the honey-bees, but her belly and legs are of a very deep yellow, refembling the pureft and the richeft gold. It is faid that fhe may alfo be diftinguifhed by the note of her voice, which is an octave; and by her being one of the laft which falls with her belly upwards, when the bees of a fingle ftock are dropped into an empty hive, in order to be united with thofe of another ftock.

Naturalifts have obferved, that the queen-bees are produced in a manner peculiar to themfelves, and different from the drones and working-bees. Some have fuppofed that the eggs laid by the queen in a hive, and deftined for the production of queen-bees, are of a peculiar kind; but though this is not the cafe, as M. Schirach has lately difcovered, yet there are particular cells appropriated for this purpofe. Thefe cells are generally near the edges, and at the bottom of the combs, and fometimes on the fides of a honey-comb; they are of an oblong orbicular form, and very ftrong; and are more or lefs numerous in different hives, as occafion feems to require. It has been alfo fuppofed, that the matter with which they are nourifhed is of a different kind and quality from that employed for the nourifhment of the other bees; that which has been collected out of the royal cells being of a gummy glutinous nature, of a deep tranfparent red, and diffolving in the fire rather than crumbling to powder.

It has been generally fuppofed, that the queen-bee is the only female contained in the hive; that the drones are the males by which fhe is fecundated; and that the working-bees are neutral, or of neither fex. But M. Schirach has lately eftablifhed a different doctrine, which has been alfo confirmed by the later obfervations of Mr. Debraw. According to this writer, all the working or common bees are females in difguife; and the queen-bee lays only two kinds of eggs, *viz.* thofe which are to produce the drones, and thofe from which the working-bees are to proceed; and from any one or more of thefe, one or more queens may be produced; fo that every worm of the latter or common kind, which has been hatched about three days, is capable, under certain circumftances, of becoming the queen, or mother of a hive. In proof of this doctrine, new and fingular as it may feem, he alleges a number of fatisfactory and decifive experiments, which have been fince verified by thofe of Mr. Debraw. For the proof of this doctrine by Schirach and Debraw, and the objections of Mr. Hunter, we refer to the article *Generation of* BEES.

From this doctrine we may juftly infer, that the kingdom of the bees is not, if the expreffion may be ufed, a *jure divino*, or hereditary monarchy, but an elective kingdom; in which the choice of their future ruler is made by the body of the people, while fhe is yet in the cradle, or in embryo; and who are determined by motives of preference which will perhaps for ever elude the penetration of the moft fagacious naturalifts.

The conclufions drawn by M. Schirach, from experiments of the preceding kind, very often repeated by himfelf and others with the fame fuccefs, are, that all the common or working bees were originally of the female fex; but that when they have undergone their laft metamorphofis, they are condemned to a ftate of perpetual virginity, and the organs of generation are obliterated; merely becaufe they have not been lodged, fed, and brought up in a particular manner, while they were in the worm ftate. He fuppofes, that the worm defigned by the community to be a queen, or mother, owes its metamorphofis into a queen, partly to the extraordinary fize of its cell, and its peculiar pofition in it; but principally to a certain appropriate nourifhment found there and carefully adminiftered to it by the working bees, while it was in the worm ftate; by which, and poffibly other means unknown, the developement and extenfion of the germ of the female organs, previoufly exifting in the embryo, is effected; and thofe differences in its form and fize are produced, which afterwards fo remarkably diftinguifh it from the common working bees. Schirach's Hiftoire Nat. de la Reine des Abeilles, &c. 8vo. 1772. Or, for an abftract, Monthly Review, vol. xlviii. p. 564, &c. Phil. Tranf. vol. lxvii. part i. p. 29, &c. See *Generation* and *Sex of* BEES.

This difcovery is capable of being applied towards forming artificial fwarms, or new colonies of bees, by which means the number of thefe ufeful infects might be increafed, and their produce in honey and wax proportionably augmented. M. Schirach, as well as M. Haftorff, feem, however, to have been miftaken, when they affert, that the artificial queens, formed and reared in a community confifting *only* of working bees, proceed almoft immediately to lay eggs, and to people the hive, without having had any communications with the drones, and at a time when, as they fuppofe, there were no drones in being. It is not neceffary to admit the idea of the prolific quality of a virgin queen-bee; as nature has provided drones of different fizes, for the purpofe of impregnating the eggs laid by the female, and continuing the fpecies, adapted to different occafions and circumftances. See DRONE.

QUEEN'*s Bench.* See KING'*s Bench*, &c.

QUEEN'*s Gilliflower*, or *Violet*, in *Botany*. See HESPERIS.

QUEEN *Gold, aurum regina*, an ancient royal revenue, belonging to the queen of England, during her marriage to the king; and payable by divers perfons (upon feveral grants of the king) by way of oblation out of fines, amounting to ten marks, or upwards; *viz.* one full tenth part above the entire fine, or ten pounds for every hundred pounds fine, on pardons and contracts or agreements.

This becomes a real debt to the queen, by the name of *aurum reginæ*, upon the party's bare agreement with the king for a fine, and recording it without any farther promife, or contract, for this tenth part extraordinary.

QUEEN *of the Meadows*, in *Botany*. See SPIRÆA.

QUEEN'*s Ware.* See POTTERY.

QUEEN'*s Theatre* in the Haymarket, now the Opera-houfe, was built in queen Anne's time by fir John Vanburgh, and not finifhed till the fummer of 1705, at which time there were only two theatres open; Drury Lane, and Lincoln's-Inn-Fields. Betterton, who was at the head of the Lincoln's-Inn-Fields company, removed to the new theatre in the Haymarket, April 9th, 1705; when it was opened with a new prologue, written by fir Samuel Garth, and fpoken by Mrs. Bracegirdle. The play was Dryden's "Indian Emperor," with finging by the Italian boy. April 23d, "The Merry Wives of Windfor," Falftaff by Betterton, with dancing by Mad. de la Val. And on the 24th, a new farce called "The Confultation;" after which was performed an Indian paftoral, called the "Loves of Ergafto," fet to mufic by Giacomo Greber, the German mufician, who had brought over from Italy Margarita de l'Epine; the part of Licoris by the Italian boy. And this was the firft attempt at dramatic mufic in the Opera-houfe. The company continued acting plays here till the end of June, when there were three reprefentations of "Love for Love," acted all by women. July 20th, according to the Daily Courant, Betterton and his company returned to the theatre in Lincoln's-Inn-Fields, where they continued to act till the Queen's theatre was entirely finifhed. We are the more minute about the performances in this theatre, as Cibber's account, which has been generally followed by others, is very inaccurate. October 30th, Betterton and his company quitted Lincoln's-Inn-Fields a fecond time, and returning to the Haymarket, opened that theatre, not with an opera, but with fir John Vanburgh's comedy of the "Confederacy," which was now acted for the firft time. This excellent comedy, though the parts were very ftrongly caft (Leigh, Dogget, and Booth, being among the men, and Mrs. Barry, Mrs. Porter, and Mrs. Bracegirdle, among the women,) ran but fix nights fucceffively, though the performance of M. des Barques, a dancer juft arrived from France, was added to the entertainment. It was, indeed, repeated once in November, and twice in December, this year; but it was generally found neceffary, even in a new theatre, and with fo ftrong a company, to fortify the beft plays with dances or mufic, and often with both. Sometimes there was finging in Italian and Englifh, by fignora Maria, as lately taught by fignor N. Haym: and fometimes mufic compofed by fignor Bononcini, and fongs by fignora Lovicini, &c. Daily Courant.

QUEENBOROUGH, in *Geography*, a borough and market-town in the liberty of the ifle of Shepey, lathe of Scray, and county of Kent, England, is fituated about three miles fouth from Sheernefs, and forty-five eaft by fouth from London. It was anciently called Cyningburgh, from belonging

longing to the Saxon kings, who had a caſtle here, near the weſtern entrance of the Swale, which, after the conqueſt, was denominated the caſtle of Shepey. This fortreſs being totally demoliſhed in the reign of Edward III., that monarch commenced, in 1360, a more extenſive and magnificent one, which was finiſhed in the period of ſix years, under the ſuperintendance of the celebrated William of Wykeham, afterwards biſhop of Wincheſter. When the caſtle was completed, Edward came and reſided in it ſeveral days, during which time he conſtituted the then village a free borough, and ordered it to be called Queenborough, in honour of his conſort Philippa of Hainault. By the charter of incorporation, which bears date in 1366, he conferred ſundry privileges upon the burgeſſes, and empowered them to elect a mayor, two bailiffs, four jurats, a town ſerjeant, and a water bailiff, who were to take their oath of allegiance before the conſtable of the caſtle, and to act as juſtices of the peace within the liberty of the corporation. This charter was confirmed, with additional privileges, by king Charles I.

Queenborough conſiſts chiefly of one ſtreet, which is very wide, and is formed moſtly of modern buildings. According to the parliamentary returns of 1811, the borough, which coincides in extent with the pariſh, contains 163 houſes and 805 inhabitants, who are principally fiſhermen and oyſter dredgers. The market days are Monday and Thurſday weekly, and there is a well-attended fair on the 5th of Auguſt. This town ſends two members to parliament, who are elected by the mayor, jurats, bailiffs, and burgeſſes, about 150 in number, though by the laſt deciſion of the houſe of commons in 1729, the elective franchiſe was declared to reſide only in the mayor, jurats, and common council. The mayor is the returning officer, and the patronage is in the admiralty and board of ordnance.

Of the caſtle built by king Edward, no traces remain except the moat by which it was ſurrounded, and a well, by which it was ſupplied with water, as the town ſtill is. Though a large and maſſive ſtructure, and erected, as the letters patent expreſs it, "for the ſtrength of the realm, and for the refuge of the inhabitants of this iſle," it does not appear to have ever been of any particular uſe, at leaſt it is never mentioned in hiſtory as having been beſieged, or occupied as an important military poſt. It was nevertheleſs ſeveral times repaired; firſt by Richard II., and again in the time of Henry VIII. Queen Elizabeth alſo ſeems to have contributed to its preſervation and embelliſhment, as her arms were diſplayed on the cieling of the great hall, ſurrounded by thoſe of the nobility, and principal gentry of the county, with the date 1593, affixed to ſome panegyrical verſes in honour of that princeſs. The church here was originally built as a chapel to Minſter, a village ſituated about two miles from the town, and deriving its name from the minſtre, or nunnery founded there by Sexburga, widow of Ercombert, king of Kent, about the year 673. That princeſs placed ſeventy-ſeven nuns in her new inſtitution, and took upon herſelf the office of abbeſs; which ſhe afterwards reſigned to her daughter Ermenilda, and retired to Ely, where her ſiſter Etheldred preſided. During the incurſions of the Danes, this nunnery was deſerted and nearly deſtroyed; but when their invaſions ceaſed, it was again tenanted by a few nuns, and continued to exiſt, though in a very mean ſtate, till the year 1130, when the buildings were re-edified by Corbel, archbiſhop of Canterbury, and filled with nuns of the order of St. Benedict. At the diſſolution their number was limited to a prioreſs and ten nuns, whoſe eſtates were eſtimated at 129*l.* 7*s.* 10½*d.* annual rent. Theſe, with the ſeite of the ſuppreſſed monaſtery, were then granted to ſir Thomas Cheyney, lord warden and treaſurer of the houſehold to king Henry VIII. Of the buildings, a gate-houſe, and part of the church, are the only remains. The latter conſiſts of two aiſles, a chancel, and a neat chapel, with the lower diviſion of a ſquare tower at the weſt end. In conformity with the date of its erection, ſome of the arches are ſemicircular in form, but moſt of them are in the early pointed ſtyle. In the ſouth wall of the chancel, under a range of cinquefoil arches, is the effigy of a knight templar, ſaid to repreſent and commemorate ſir Robert de Shurland, lord of Shurland, who was created a knight banneret by Edward I., for his gallant conduct at the ſiege of Carlaverock, in Scotland. Behind the figure, towards the back of the receſs, is the repreſentation of a horſe's head in the act of ſwimming, which has given riſe to much enquiry among antiquaries, and to many fabulous and ſuperſtitious ſtories among the vulgar. On the pavement are ſeveral braſſes of knights and their ladies; and under the arch ſeparating the chancel from the chapel, is a gorgeous altar-tomb in honour of ſir Thomas Cheyney, above-mentioned. Another altar-tomb, near it, bears the recumbent figure of a Spaniſh general, or admiral taken priſoner by ſir Francis Drake, on the defeat of the "Invincible Armada." From an entry in the pariſh regiſter, he appears to have died on board a ſhip at the Nore in 1591. Beauties of England and Wales, vol. vii. by E. W. Brayley.

QUEENSBURY, a townſhip of America, in Waſhington county, New York, bounded eaſterly by Weſtfield and Kingſbury; 35 miles N.E. of Albany.

QUEENSFERRY, South, a royal burgh and ſea-port town in the county of Linlithgow, Scotland, is ſituated on the ſouthern ſhore of the Frith of Forth, at the diſtance of nine miles W.N.W. from Edinburgh, on the great road to the north. It is firſt mentioned in the charters of king Malcolm IV. by the deſignation of "Paſſagium Reginæ," as is generally ſuppoſed from the frequent uſe of the ferry here by his great grandmother Margaret, queen to Malcolm Canmore, a princeſs highly celebrated in Scottiſh hiſtory for her charitable and beneficent qualities. At that period, however, it was only a village and port, endowed with ſome trifling privileges: indeed, its conſtitution as a royal burgh did not take place till about the year 1556, when its elevation to that rank was ſtrenuouſly oppoſed by the corporation of Linlithgow. It is now governed by a provoſt, one land baillie, two ſea baillies, a dean of guild, and a town council, who, like moſt other counſellors in royal boroughs, are ſelf-elected. Formerly this port enjoyed a conſiderable trade, and even ſo late as the year 1640, it was frequented by above twenty ſhips belonging to reſident owners; but its traffic is at preſent confined to the importation of coal, for the conſumption of the inhabitants, and of the materials uſed in the manufacture of brown ſoap, which, with the fiſhery and the buſineſs of the ferry, conſtitute the chief ſupport of the town. The harbour is in good repair, and is frequently reſorted to as a place of retreat in hard gales, by the ſmaller veſſels navigating the Forth. The paſſage here does not exceed two miles in breadth, and, except in very boiſterous weather, may be croſſed at all times with ſafety and expedition. Much obſcurity prevails relative to the founding of this ferry. The right of it is private property, and ſeems originally to have been attached to the lands of Murie Hall, which lie in the vicinity of the town, and are traditionally ſaid to have been appropriated for "upholding the paſſage." The preſent proprietors are ſeveral gentlemen poſſeſſing land on either ſide of the Forth, who let the paſſage yearly by public auction. As all the northern mails, and moſt carriage travellers, paſs at this ferry, the intercourſe between its ſhores is conſtant and regular. Cattle alſo are tranſported

ported over in great numbers, as well as carts and waggons; but the difficulty and danger of effecting these objects, have induced cattle-drivers and carriers to go round by the bridge at Stirling.

The parish of Queensferry is of small extent, being confined entirely to the royalty. In ecclesiastical matters it forms part of the presbytery of Linlithgow, and synod of Lothian and Tweedale; and, according to the population returns of 1811, contains 77 houses and 558 inhabitants.

On the summit of the ridge rising from the shore here, stands Hopetoun-house, the seat of the earl of Hopetoun, which is perhaps equal in magnificence of aspect to any palace or residence in Great Britain. The mansion is seated on a noble lawn, forming a kind of terrace along the Forth for more than a mile in front, and only terminated by the Frith, which winds round it, and appears like a wide and extensive lake, interspersed with islands and enlivened with a variety of shipping. Behind the house the ground is more various, breaking into hills, vallies, and promontories, which shoot into the Forth. All the grounds, to a considerable distance, are planted and adorned; and the house is judiciously flanked with a thick wood, to protect it against the violence of the northern winds. On this side the Forth assumes, at different points, different appearances, sometimes putting on the semblance of a lake, and sometimes that of a river. The house is a very noble display of architectural magnificence. It was begun by the celebrated architect sir William Bruce, and finished by Mr. Adam, who is believed to have added the wings. It is much to be regretted, that the interior of this princely mansion does not correspond with the grand scale of the exterior, in the size and decorations of the apartments. Beauties of Scotland by Robert Forsyth, vol. iii. Carlisle's Topographical Dictionary of Scotland, 4to. 1813.

QUEENSFERRY, *North*, a small sea-port town in the district and parish of Dunfermline, Scotland, is situated on the northern shore of the Frith of Forth, opposite to the royal burgh of South Queensferry, described in the preceding article. The principal export is whin-stone for paving, which is found in vast abundance in the extensive "whinstone quarries" adjoining. Of that material a large proportion is conveyed to London, and many towns on the eastern coast of England. A hamlet, called St. Margaret, between this village and the head-land, which forms the western boundary of Inverkiething bay, is noted as the landing place of prince Edgar Atheling, and his sister Margaret, afterwards queen of Scotland, when they fled from England to avoid the effects of the conqueror's jealousy of Edgar's claim to the English crown. By an act of parliament, lately passed, the ferry has been placed under excellent regulations; and the harbour on each side, but particularly on the north side, has been much enlarged and improved. A signal house here contains apartments for the accommodation of the trustees, the superintendant, and boatmen. Carlisle's Topographical Dictionary of Scotland, 4to. 1813.

QUEEN'S-HOPE, or EAST-HOPE, a town in the parish of Estyn, or Hope, cwmwd of Merffordd, cantref of Uwch, Nant, (now called the hundred of Mold,) and county of Flint, North Wales, is situated near the river Alun, at the distance of six miles N.W. from Wrexham. Together with the adjoining castle and hamlet of Caer-Gwrle, it constitutes a burgh, both by prescription, and in virtue of a charter granted by Edward the Black Prince in 1351. That deed orders that the constable of the castle shall be mayor, *ex officio*, and shall nominate two bailiffs, to govern under him, from among the burgesses. This place obtained the appellation of Queen's-Hope, after the year 1282, from the circumstance of its having been then bestowed by Edward I. on his beloved and heroic consort Eleanor; or, as some affirm, from her majesty having lodged here, when on her way to Caernarvon to give the Welsh a ruler born within their own territories. The etymology of its ancient name, "Caergawr-lle," (the camp of the gigantic legion,) seems to indicate that it was once occupied by the Romans; and in confirmation of this conjecture we may observe, that a Roman hypocaust has lately been discovered here, some of the tiles used in the construction of which were inscribed "Legio XX." Pennant supposes that it was an outpost to the grand station Deva, and notices the remains of two roads. The ruins of the castle of Caergwrle are seated on a lofty rock isolated from the surrounding land, and, on one side, extremely precipitous. At what time, or by whom it was originally built, is unknown; but in the reign of Owen Gwynnedd, it formed part of the possessions of a chieftain named Gryffydd Maelor. Edward I. made a grant of it to prince David, and afterwards, as above-mentioned, to queen Eleanor, at whose death both castle and manor were given to John de Cromwell, on condition that he repaired the former, which had been set fire to, and considerably damaged, as was supposed by design, while the king and queen were resident in it. All that remains of this once magnificent fortress, are a circular tower, and a few fragments of walls, together with the deep fosse, by which it was defended. This fosse is excavated from the solid rock, which is composed of brescia, or an excessively coarse grit.

The conjoint borough of Queen's-Hope and Caergwrle, is contributary with the town of Flint in the election of a representative to the British parliament. It formerly had the privileges of a market and fairs, but these are now discontinued. The parish is divided into two districts, called Hope and Kinnerton, and contains, according to the parliamentary returns of 1811, 547 houses and 2617 inhabitants. Of these a large proportion reside in the town, which consists of three broad parallel streets, intersected at right angles by three others of less breadth, the whole placed on the side of a rising ground, gently sloping to the river. The principal building is the church, which contains two mural monuments, one decorated with kneeling figures, but without any inscription; and the other commemorating sir John Trevor, knt. secretary to the earl of Nottingham, the conqueror of the boasted invincible armada.

Some objects in the vicinity of the place claim notice. On a hill, opposite to that of Caergwrle, is the British encampment of Caer-Estyn, which is formed by a single ditch and rampart. The adjacent summits consist chiefly of limestone, and display on their surface numerous organic examples of the fossil remains called entrochi and astroites. The uncommon species of the latter, usually denominated the arborescent sea-star, has been found here. At Rhyddyn are two springs strongly impregnated with muriate of soda, the waters of which are found highly serviceable in such chronic disorders as elephantiasis and scrophula. At this place is a fine old bridge over the river Alun. On the road to Mould, about two miles from Queen's-Hope, is Plas-Teg, the seat of the Trevor family. The house is a very noble building, and is generally believed to have been the work of Inigo Jones. Beyond this is Harts-Heath Hall, the property of Guillwn Lloyd Wardle, esq. It is a large modern mansion, forming a square, with three fronts, and is surrounded by fine plantations. Carlisle's Topographical Dictionary of Wales, 4to. 1812. Pennant's Tour in Wales.

QUEEN-

QUEENSTADT, a town of Weſtphalia, in the principality of Halberſtadt; three miles N.E. of Halberſtadt.

QUEENSTOWN, a poſt-town of America, in Queen Anne's county, Maryland, on the E. ſide of Cheſter river; ſix miles S.W. of Centerville, and 65 from Waſhington.

QUEENSTOWN, a town or village of Upper Canada, which lies on the W. ſide of the ſtraits of Niagara, near fort Niagara, and ſeven miles below the Falls. It is at the head of navigation for ſhips; and the portage occaſioned by the Falls of Niagara commences here. From the ſudden change in the face of the country in the neighbourhood of Queenſtown, and the equally ſudden change in the river with reſpect to its breadth, depth, and current, it has been conjectured, that the great falls of the river muſt originally have been ſituated at the ſpot where the waves are ſo abruptly contracted between the hills; and moreover it is a fact well aſcertained, that the falls have receded very conſiderably ſince they were firſt viſited by Europeans, and that they are ſtill receding every year. See Weld's Travels, vol. ii. p. 130.

QUEE-SAN ISLANDS. See CHUSAN.

QUE ESTATE, in *Law*, a plea whereby a man entitling himſelf to land, &c. ſaith, that the ſame eſtate which another had, he now has from him.

Thus, *e.gr.* the plaintiff alleges that ſuch four perſons were ſeiſed of lands whereunto the advowſon in queſtion belonged in fee, and who did preſent it; and that afterwards the church was vacant; *que eſtate*, i. e. *which eſtate* he now has; and, by virtue thereof, he preſents, &c. See PRESCRIPTION.

QUE EST MEME, a term uſed in actions of treſpaſs, &c. for a direct juſtification of the very act complained of by the plaintiff as a wrong.

Thus, in an action upon the caſe, the plaintiff ſaying the lord threatened his tenants at will in ſuch ſort, as he forced them to give up their lands; the lord in his defence pleads, that he ſaid to them if they would not depart, he would ſue them at law. *Que eſt meme, i. e.* this being the ſame threatening that he uſed, the defence is good.

QUEGASCA HARBOUR, in *Geography*, a bay on the S. coaſt of Labrador. N. lat. 50° 7′. W. long. 61° 22′.

QUEI, in *Natural Hiſtory*, a name given by the Chineſe to a peculiar earth found in many parts of the Eaſt.

It is of the nature of an indurated clay, and in ſome degree approaches to the talcs, as our ſteatites and the galactites do. It is very white and abſterſive, uſed by the women of China, to take off ſpots from the ſkin, and render it ſoft and ſmooth, as the Italian ladies uſe talc of Venice. They ſometimes uſe the fine powder of this ſtone dry, rubbing it on the hands and face after waſhing; ſometimes they mix it with pomatum.

QUEICH, in *Geography*, a river of France, which paſſes by Landau, and runs into the Rhine, near Germerſheim.

QUEI-CHUN, a city of China, of the ſecond rank, in the province of Quang-ſi. N. lat. 23° 22′. E. long. 106° 44′.

QUEIGE, a town of France, in the department of Mont Blanc; four miles N.E. of Conflans.

QUEIGNE, a town of Africa, in the kingdom of Bambouk.

QUEI-LING, a city of China, and capital of the province of Quang-ſi, derives its name from a flower called "quei," which grows on a tree reſembling a laurel; it exhales ſo ſweet and agreeable an odour, that the whole country around is perfumed with it. This city is ſituated on the banks of a river, which throws itſelf into the Ta-ho; but it flows with ſuch rapidity, and amidſt narrow vallies, that it is neither navigable nor of any utility to commerce. Quei-ling is a large city, and the whole of it is built almoſt after the model of our ancient fortreſſes; but it is much inferior to moſt of the capitals of the other provinces. Birds are found in great numbers in the territories belonging to it, the colours of which are ſo bright and variegated, that the artiſts of this country, in order to give additional luſtre to their ſilks, interweave with them ſome of their feathers, which have a ſplendour and beauty that cannot be imitated. Quei-ling has under its juriſdiction two cities of the ſecond claſs, and ſeven of the third. N. lat. 25° 12′. E. long. 109° 51′.

QUEIOS, a river of Spain, in Navarre, which runs into the Ebro, near Tudella.

QUEIRA, a town of Africa, in Ludamar; eight miles S. of Benowm.

QUEIS, a river of Sileſia, which riſes in the principality of Jauer, paſſes by Friedberg, Grieſſenberg, &c. and joins the Bober, between Sprottau and Sagan.

QUEI-TE, a city of China, of the ſecond rank, in Quang-ſi. N. lat. 23° 18′. E. long. 107° 4′.

QUELAINES, a town of France, in the department of the Mayenne; eight miles S. of Laval.

QUELEA, in *Ornithology*, a ſpecies of *Emberiza*; which ſee.

QUELINES, in *Geography*, mountains of Mexico, between the provinces of Guaxaca and Chiapa.

QUELLINUS, ERASMUS, in *Biography*, called the Old, born at Antwerp in 1607, was a pupil of Rubens, and became a painter of hiſtory of very conſiderable reputation. He lived to the age of 71, and left a ſon John Eraſmus Quellinus, who alſo became a painter, but who left the Flemiſh for the Venetian ſtyle of art, which he practiſed at Antwerp, his native city, till he arrived at the advanced age of 85, having been born in 1630.

QUELPAERT, in *Geography*, an iſland in the ſea of Corea, on which a Dutch veſſel, called the Sparrow-hawk, was wrecked in the year 1635, then ſubject to the king of Corea. No iſland preſents a finer aſpect; the middle of the iſland is occupied by a peak of about 800 toiſes, viſible at the diſtance of about 18 or 20 leagues, and the land gradually ſlopes towards the ſea, ſo that the habitations reſemble an amphitheatre. The ſoil to a great height ſeems to be well cultivated. It belongs, however, to a people who are forbidden to hold any intercourſe with ſtrangers, and who detain in ſlavery unfortunate perſons who are wrecked on the coaſts. Some Dutchmen of the Sparrow-hawk, after a captivity of eighteen years, during which they received many baſtinadoes, found means to take away a bark, and to croſs to Japan, from which they arrived at Batavia. N. lat. of the ſouth point 33° 14′. E. long. 126° 35′.

QUELUSIA, in *Botany*, a name given by Vandelli to the beautiful *Fuchſia coccinea*, now ſo common in gardens. The author ſuppoſed it a new genus, and meant thus to honour a royal villa near Liſbon, called *Quelus*, where he firſt ſaw this plant in bloom.

QUEM *redditum reddit*, in *Law*, an old writ which lay where a rent-charge, or other rent, which was not rent-ſervice, was granted by fine holding of the grantor. If the tenant would not attorn, then the grantee might have had this writ.

QUEMARY, in *Geography*, a town of Bootan; 20 miles E. of Beyhar.

QUEMENES, a ſmall iſland in the Engliſh channel, near the coaſt of France. N. lat. 48° 22′. W. long. 4° 48′.

QUEMI, in *Botany*, a name ufed by fome authors for the nigella, or geth.

QUEMIGNY, in *Geography*, a town of France, in the department of the Côte d'Or; nine miles S.W. of Dijon.

QUENDAL Bay, a bay at the S. extremity of the ifland of Shetland. N. lat. 59° 49'. W. long. 1° 40'.

QUENDON *Water-Barrow*, in *Rural Economy*, a contrivance of the barrow kind, much employed in the neighbourhood of the little village of Quendon, in Effex, and from which it takes its name, for the purpofe of conveying water, wafh, and other liquid matters, to live ftock of different kinds, as fattening cattle, hogs, horfes, and other animals, as well as for fome other ufes. It is a fimple and excellent invention for all fuch intentions, as very great facility is given to its motion by means of the wheels, and it is, on the whole, very compact in its general formation, which gives it a fuperiority over many other contrivances of a fimilar nature, as being capable of being put in motion, when full, without any great difficulty, or the application of any extraordinary power or force.

It is reprefented at *figs*. 6 and 7, in *Plate Agriculture*, fhewing the methods of clearing quarries, pits, &c. from water. *Fig*. 6. explains the plan, in which *a b*, *a b*, are the wheels, that faften on to the fide-beams *c d*, *c d*, which are about four feet in length, and have their ends *c*, *c*, formed in fuch a manner as to ferve for handles. E is an oval tub about thirty inches in depth, twenty-four in length, and eighteen in breadth, which is fupported on the beams by two gudgeons, which play in femicircular boxes fixed near the ends of the beams: a crofs piece connects the two beams at *ff*, as does another at *g g*, to which two little curved pieces come, parallel to the form of the tub. The wheels are about four feet in height, and carry the tub fufpended between them; for the gudgeons play almoft over the two fhort axles, which fquare into the beams. Two flight legs are fixed underneath the barrow at *i i*, to keep it in an upright pofition, but they are not at all effential, for the tub would remain in a ftate of equipoife between the wheels even without fuch aid. It muft be noticed, that the tub is funk rather more than one-half below the gudgeons.

Fig. 7. difplays the profile of the vehicle; the dotted line fhews the fize and place of the tub, which is made oval, for the purpofe of confining the breadth between the wheels, fo as to pafs in at narrow door-ways, &c.

It is probable that it might be fomewhat improved by having the axles hooked within, fo as to bear upon two loops in one of the iron hoops, and by this means render the ufe of gudgeons and boxes wholly unneceffary. The tub would lift off and on, as eafily as at prefent, while it would hang in a more precife and perfectly centrical manner. And ftill further, it would be a great convenience, if the upper part of the tub were furnifhed with a proper fpout in the front, in order to pour water or other liquid materials through between the pales, &c. for the fupplying of cattle, &c. This would be more eafily accomplifhed, if the tub were allowed to fwing in a free manner, as it might in that cafe be tilted up with great facility, fo as to favour its being done, as fhewn by the dotted line in *fig*. 2. About the little town noticed above, it is a great deal employed in carrying water for houfe ufe as well as that of farms. It is defcribed in the Agricultural Magazine. Many other forms of water-barrows are made ufe of in different places. See Water-*Barrow*.

QUENEG, or Quenena, in *Geography*, a diftrict of Africa, in the country of Sugulmeffa, near mount Atlas.

QUENOY, Le, a town of France, in the department of the North; five miles N.N.W. of Lille.

QUENTIN, in *Commerce*, a fmall weight ufed in Germany; the ounce contains two lochs, or eight quentins.

Quentin, *St.*, in *Geography*. See St. Quintin.

QUEPO, a town of Mexico, in the province of Cofta Rica, on the Eftrella; 70 miles S S.W. of Carthage.

QUERA, a town of Italy, in the Trevifan; 15 miles W. of Ceneda.

QUERALOS, a town of Spain, in Catalonia; 24 miles E. of Urgel.

QUERCERA, in *Medicine*. See Epialos.

QUERCETO, in *Geography*, a town of Etruria; nine miles S.S.W. of Volterra.

QUERCUS, in *Botany*, the Oak, an ancient Latin name, whofe etymology has been confidered as very uncertain, if not quite inexplicable. So it well might feem to thofe who looked no further than the Greek or Latin languages; for though fome have deduced the word from χοιρος, *a pig*, becaufe pigs feed on acorns, this explanation has not proved fatisfactory. De Theis, on the authority of Lepelletier, has found a much better etymology for *Quercus*, in the Celtic *quer*, fine, and *cuez*, a tree; and this appellation is fuppofed to have been appropriated to the oak, not only for the beauty of the tree, but becaufe it bore the facred plant, mifeltoe. This tree was alfo called in the Celtic tongue *derw*, whence came the word *druid*, or prieft of the oak, and even the Greek δρυς, *an oak*, vulgarly fuppofed the original of druid. (See Druids.)—Linn. Gen. 495. Schreb. 646. Willd. Sp. Pl. v. 4. 423. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 1025. Ait. Hort. Kew. v. 5. 287. Juff. 410. Tourn. t. 349. Lamarck Illuftr. t. 779. Gærtn. t. 37. (Ilex; Tourn. t. 350. Suber; ejufd.)—Clafs and order, *Monoecia Polyandria*. Nat. Ord. *Amentaceæ*, Linn. Juff.

Gen. Ch. Male, in a loofe catkin, *Cal*. Perianth of one leaf, bell fhaped, membranous, with about five fmall, fharp, often cloven fegments. *Cor*. none. *Stam*. Filaments from four to ten, capillary, fhort; anthers large, of two round lobes.

Female, from a bud ufually on the fame tree, *Cal*. Perianth of one leaf, inferior, coriaceous, hemifpherical, rough, entire, very fmall in the flower, permanent. *Cor*. none. *Pift*. Germen fuperior, ovate, very fmall; ftyle fimple, divided above into from two to five fegments, longer than the calyx: ftigmas fimple, permanent. *Peric*. none. *Seed* an oval or roundifh coriaceous nut, of one valve, fmooth, attached by its fcarred bafe to the bottom of the fhortifh, hardened, permanent, cup-like calyx.

Eff. Ch. Male, Calyx bell-fhaped, membranous, lobed. Corolla none. Stamens from five to ten.

Female, Calyx bell-fhaped, coriaceous, entire, rough. Corolla none. Style one. Stigmas from two to five. Nut coriaceous, embraced at the bafe by the hardened calyx.

This genus, fo diftinct in its botanical characters, andfo valuable for its economical ufes, confifts, in the *Species Plantarum* of Linnæus, of no more than thirteen fpecies. The difcoveries of Thunberg, but efpecially thofe of American travellers, aided by the more accurate enquiries of botanifts, have fo greatly enriched the fubject, that Willdenow, who has ftudied it well, enumerates feventy-fix kinds of *Quercus*, and even thefe are not all that we have to defcribe. The importance of many fpecies requires that they fhould all be particularized. Two or three of the Eaft Indian ones, now for the firft time defcribed, offer fome exceptions to the generic character of the calyx.

Section 1.—*Adult leaves undivided and entire*.

1. Q. *Phellos*. Deciduous Willow-leaved Oak. Linn. Sp. Pl. 1412. Willd. n. 1. Ait. n. 1. Purfh n. 1. Sm. in

in Abbot's Insects of Georgia, v. 2. 181. t. 91. Michaux Querc. n. 7. t. 12. (Q. virginiana, salicis longiore folio, fructu minimo; Pluk. Amalth. 180. t. 441. f. 7.)—Leaves membranaceous, linear-lanceolate, tapering at each end, entire, smooth, with a small point. Nut roundish.—Native of North America; in low swampy forests, near the sea-coast, from New Jersey to Florida, flowering in May. *Pursh.* It is said by Mr. Aiton, on the authority of Knowlton's MSS., to have been cultivated in England by Mr. Fairchild, before the year 1723; and indeed, by the collection at Bulstrode, this tree appears to have been planted there much earlier, among those introduced by the first earl of Portland. It rises in its native country, as well as in England, to the height of fifty or sixty feet. The *bark* is smooth; the *wood* is good, and much in use, but of slow growth. *Leaves* scattered, on short stalks, four or five inches long, and not an inch wide, smooth, thin and pliant, of a fine green, with a willow-like aspect, deciduous, their edges slightly wavy. *Acorns* in pairs, roundish, scarcely above half an inch long, with a thin, tuberculated, or tessellated cup. The *leaves* of the young plant are somewhat angular, or toothed at each side. There is said to be a dwarf straggling variety, with shorter *leaves*, which Catesby has figured in his vol. 1. t. 22. Michaux has two supposed varieties, which other botanists esteem distinct species; see the two following. The specific name, chosen by Linnæus, is not a good one, φελλος being the cork-tree.

2. Q. *maritima.* Ever-green Willow-leaved Oak. Willd. n. 2. Pursh n. 2. (Q. Phellos maritima; Michaux Querc. n. 7. var. 2. t. 13. f. 3.)—Leaves coriaceous, elliptic-lanceolate, entire, smooth, with a small point. Nut roundish.—Found on the sea-coast of Virginia and Carolina, flowering in May and June. This differs from the foregoing in its low shrubby habit, and firm evergreen *leaves*, which are more elliptical in shape, and not above two inches long. The whole plant is from three to eight feet only in height. It appears by the accounts of authors to be distinct from the above-mentioned variety of *Phellos.*

3. Q. *sericea.* Silky Willow-leaved Oak. Willd. n. 3. Pursh n. 3. (Q. Phellos; Sm. in Abb. Ins. v. 2. 101. t. 51. Q. Phellos pumila; Michaux Querc. n. 7. var. 3. t. 13. f. 1, 2.)—Leaves lanceolate-oblong, somewhat wavy; obtuse at the base; rather dilated upwards; silky beneath. Nut almost globular.—Native of the sea-coast, from Carolina to Florida, flowering in May. It is perhaps the most humble of the whole genus, scarcely ever exceeding two feet in height, and throwing out creeping scyons, whence it has obtained the name of the Running Oak. The silkiness of the *leaves* beneath gives them a glaucous appearance.

4. Q. *myrtifolia.* Myrtle-leaved Oak. Willd. n. 4. Pursh n. 4.—"Leaves coriaceous, oblong, entire, smooth, acute at each end."—Native of Carolina, according to Willdenow, who alone has noticed this species, and from whom Pursh has admitted it into his work. The *branches* are round, brown. *Leaves* an inch, or rather more, in length, coriaceous, evergreen, oblong, somewhat acute at the base; entire and slightly revolute at the margin; shining above; opaque, but smooth, beneath; on short *footstalks.* The form of the *leaves* is much like the common broad-leaved myrtle. The *flowers* and *fruit* are unknown. *Willd.*

5. Q. *virens.* Live Oak. Ait. Hort. Kew. ed. 1. v. 3. 356. ed. 2. n. 2. Willd. n. 5. Pursh n. 5. Michaux Querc. n. 6. t. 10, 11. (Q. Phellos β; Linn. Sp. 1412. Q. sempervirens; Walt. Card. 234.)—Leaves coriaceous, elliptic-oblong, revolute, entire, pointless; obtuse at the base; clothed with starry down beneath. Fruit stalked. Nut oblong.—Found near the sea-coast of North America, in a soil of sand upon clay, from Virginia to Florida and Missisippi, flowering in May. Miller cultivated it at Chelsea in 1739, but we know not that this species is still preserved, or, at least, distinguished from *Q. Ilex*, in our gardens or plantations. It is one of the most valuable American trees, growing to the height of forty or fifty feet, and extending its *branches*, in open situations, to a great extent; whence it serves, by its dense evergreen *leaves*, to shelter cattle from the summer's heat and winter's cold. The *wood* is the finest and most durable ship timber. It is felled towards the end of autumn, and kept three months before it is used. Michaux recommends this tree to the notice of the French and Spaniards, as likely to thrive well on the sandy coasts of the Mediterranean, and of the western ocean. By his account it succeeds best where there is a basis of clay under the sand, to fix the larger roots. The aspect of the *leaves* is not unlike our European *Q. Ilex*, but they are, except when very young, more uniformly entire, and more shining; their under side less densely pubescent; and their short *footstalks*, as well as the mid-rib, reddish. The foliage of seedling plants, and of vigorous young shoots, is, indeed, strongly toothed. The adult *leaves* are scarcely more than two inches long, somewhat oval, or obovate and bluntish, without any terminal bristle; silky in the spring; subsequently of a dark but shining green, and downy, with starry pubescence, beneath. The *stamens* are but four or five. *Stalks* of the fruit an inch long. *Acorn* cylindrical, an inch long, with a tessellated, but not rugged or tuberculated, cup. The acorns are said to be greedily devoured by hogs, and several wild animals; and to afford an oil, which the savages of Florida mix with their food.

6. Q. *cinerea.* Ash-coloured Silky-leaved Oak. Willd. n. 6. Ait. n. 3. Pursh n. 6. Michaux Querc. n. 8. t. 14. (Q. humilis; Walt. Carol. 234. Q. Phellos β, sericea; Ait. Hort. Kew. ed. 1. v. 3. 354. Q. Phellos γ; Linn. Sp. Pl. 1412.)—Leaves coriaceous, elliptic-lanceolate, revolute, entire, bluntish with a small point; clothed with starry down beneath. Fruit sessile. Nut nearly globose.—Native of dry barren situations, and pine forests, from Virginia to Georgia, flowering in May. Michaux says it springs up chiefly on land that, after having been cultivated, becomes abandoned on account of the bad quality of the soil. The form of the *tree* is unsightly, and its size very variable, from four to twenty feet in height. The *wood* is of no use but for firing. *Leaves* longer than in the preceding; the young ones dilated at the top, with three points. *Fruit* nearly or quite sessile, almost globular, and not much above half an inch long.

7. Q. *microphylla.* Small-leaved Dwarf Oak. Willd. n. 7. Nee in Annal. Scient. Nat. v. 3. 264. Fisch. Misc. Hisp. v. 1. 99. *Willd.*—"Leaves lanceolate, pointed, entire, villous; downy beneath. Calyx of the fruit villous. Nut roundish."—Found by Louis Nee, on the hills of Arambaro, in New Spain. A *shrub*, from three to five feet high, with a rough ash-coloured bark. *Leaves* on short stalks, scattered, numerous, from four to six lines long, scarcely two lines broad, veiny, revolute, wavy, pointed, reddish-grey; villous above; densely downy beneath; those about the extremities of the branches opposite. *Stipulas* awl-shaped, falling off at the close of summer. *Acorns* in axillary pairs, about the ends of the branches, ovate, the size of a large pea, half covered by the villous cup, which is invested with unequal scales. *Nee.*

8. Q. *salicifolia.* Mexican Willow Oak. Willd. n. 8. Nee in Annal. Scient. Nat. v. 3. 265. Fisch. Misc. Hisp. v. 1. 101. *Willd.*—"Leaves oblong-lanceolate, entire, smooth; the forks of the veins villous and brown beneath. Nut oblong."

long."—Found by Lewis Nee, in the kingdom of Mexico, near Acapulco. A *tree* twenty-eight feet high, with alternate *branches*; the young ones ſomewhat furrowed, and clothed with browniſh-red hairs. *Leaves* from five to ſeven inches long, an inch wide, ſcattered, on ſhort ſtalks, rather coriaceous, ſmooth, veiny, entire, wavy, pointed; reticulated and green above; yellowiſh beneath, with tufts of hairs, as big as a pin's head, in the forks of the veins. *Acorns* nearly ſeſſile, in axillary pairs, the ſize of a hazelnut, downy, half covered by the hemiſpherical, greyiſh, villous cup, beſet with very thin ſcales. *Nee.*

9. Q. *glabra*. Smooth-leaved Japan Oak. Thunb. Jap. 175. Willd. n. 9.—"Leaves lanceolate-oblong, pointed, ſmooth, with parallel veins."—Gathered by Thunberg in Japan. A *tree*, whoſe *branches* grow two or three together, ſlightly ſpreading, rugged and knotty. *Leaves* alternate, ſtalked, lanceolate-oblong, entire, pointed, with parallel ribs (veins); tapering at the baſe; ſmooth on both ſides; ſhining above, yellowiſh beneath. *Spikes* of flowers either ſolitary, or two or three together, downy. *Thunberg.*

10. Q. *concentrica*. Concentric-furrowed Oak. Loureir. Cochinch. 572. Willd. n. 10.—"Leaves lanceolate-ovate, pointed, incurved, entire. Calyx lax, very ſhort, furrowed concentrically."—Native of the lofty foreſts of Cochinchina. A large *tree*, whoſe wood is ſerviceable for various uſes. *Branches* aſcending. *Leaves* ſcattered, ſtalked, ſmooth on both ſides. *Acorns* ſtalked, oblong-ovate, ſmooth, red, pointed, their cups ſhort and lax, externally marked with five parallel circular furrows; ſee n. 27.

11. Q. *molucca*. Molucca Oak. Linn. Sp. Pl. 1412. Willd. n. 11. Rumph. Amboin. v. 3. 85. t. 56.—Leaves elliptic-lanceolate, entire, acute at each end, ſmooth. Nut roundiſh, furrowed.—Native of the Molucca iſles. A large and lofty *tree*, whoſe wood is hard and heavy, laſting long under water. *Leaves* ſix or eight inches long and three broad, on ſhort ſtalks, with eight or ten irregular lateral veins. *Acorns* ſhort and roundiſh, furrowed in their upper part; the cup ſhort, warty. By Rumphius's account, there ſeem to be more ſpecies than one comprehended under the chapter above cited, but he does not give us ſufficient marks to define them ſpecifically.

12. Q. *ſpicata*. Cluſter-fruited Oak.—Leaves elliptic-lanceolate, taper-pointed, entire, ſmooth. Spikes axillary, ſolitary, dioecious. Fruit ſpiked, aggregate, ovate.—Gathered by Dr. Francis Buchanan, in woods at Suembu, in Upper Nepaul, flowering in May, 1802. This is a *tree* of vaſt dimenſions, whoſe wood is uſeful, though inferior in quality to that of *Q. annulata*, n. 22. The younger *branches* are angular, clothed with very minute green pubeſcence. *Leaves* alternate, ſtalked, of a broad lanceolate, or elliptical figure, with a taper point, entire throughout, ſix or ſeven inches long, and two and a half wide; bright green, ſmooth and ſhining above; paler, opaque, but ſcarcely pubeſcent, beneath; furniſhed with numerous, parallel, tranſverſe veins. *Footſtalks* not an inch long, depreſſed. *Stipulas* deciduous. *Flowers* in long, linear, downy, pale, ſtraight, ſolitary, axillary *ſpikes*; the males with about eight *ſtamens*, much longer than the calyx, and a roundiſh rudiment of a germen in the centre; females on a ſeparate tree, crowded three together in ſeſſile groups in each ſpike. *Acorns* eatable, but not very good, the ſize and ſhape of a large filberd, even, pointed, dark brown; their cups ſhort, ſcaly. The original natives of Nepaul, or Nawars, know this tree by the name of *Guey Saſhi*, or *Pacuſhingali*: their Hindu conquerors, the Parbutties, call it *Arcaula*.

13. Q. *tribuloides*. Caltrop-fruited Oak.—Leaves ovato-lanceolate, taper-pointed, entire, ſmooth. Spikes aggregate. Calyx of the fruit ſpinous, covering the nut.—Diſcovered by the ſame able botaniſt as the preceding, in the foreſts of Upper Nepaul, flowering and fruiting at various ſeaſons. A *tree* with ſmooth *branches*. *Leaves* on ſhort ſtalks, lanceolate, more or leſs ovate, ſomewhat unequal at the baſe, about four inches long, and one and a half broad, rigid and rather coriaceous, with irregular, diſtant, ſlightly curved veins; the upper ſurface poliſhed; the under paler and opaque. *Flowers* monoecious, in ſlender, downy, cluſtered, axillary or terminal, pendulous ſpikes, the male ſpikes moſt numerous. *Stamens* about eight, with a dotted central diſk. *Acorns* ſpiked, ſcattered, ovate, ſmooth, obliquely pointed, about half an inch long, entirely concealed in the greatly enlarged *calyx*, which is downy, globoſe, and armed with very numerous, rigid, prominent, ſharp thorns, a quarter of an inch, or more, in length, ſpreading in every direction. This ſpecies is called *Cattum*, or *Cattunge*, in the Parbutty language; *Shingali*, or *Catu Shingali*, by the Nawars. Its great peculiarity conſiſts in the acorns, which are eatable, being entirely encloſed in a ſtrongly muricated *calyx*, or globoſe cup, which approaches the nature of the cheſnut, *Fagus Caſtanea*, and in ſome of our ſpecimens ſeems even to ſplit into two or three valves. The flowers, however, agree with *Quercus*, to which genus Dr. Buchanan referred this remarkable plant. On one tree he obſerved the *flowers* to be all female.

14. Q. *laurifolia*. Laurel-leaved Oak. Willd. n. 12. Ait. n. 4. Purſh n. 8. Michaux Querc. n. 10. t. 17, 18.—Leaves obovate, entire, ſmooth, nearly ſeſſile; tapering at the baſe. Nut roundiſh, even.—Native of ſhady foreſts, and the ſea-coaſt, in Georgia and South Carolina, flowering in May. This is ſometimes called the Swamp Willow, and was firſt brought alive to England, by the late Mr. Fraſer, in 1786. It riſes to the height of fifty or ſixty feet. Michaux ſpeaks of the wood as of a good quality, but inferior on the whole to that of our fifth ſpecies, *Q. virens*. The *leaves* are crowded about the ends of the branches, deciduous, about four inches long, uſually acute, but ſometimes, as in Michaux's t. 18, remarkably obtuſe. *Acorns* ſolitary, nearly ſeſſile, almoſt globoſe, with a ſcaly cup.

15. Q. *imbricaria*. Shingle Oak. Willd. n. 13. Ait. n. 5. Purſh n. 7. Michaux Querc. n. 9. t. 15, 16.—Leaves elliptic-oblong, acute at each end, entire, almoſt ſeſſile; downy beneath. Nut nearly globoſe.—Native of the banks of rivers among the Allegany mountains, and in the countries to the weſt, rarely to the eaſt of thoſe mountains, flowering in May and June. Brought to England in 1786, by Mr. Fraſer. The *leaves* are twice the ſize of the laſt, acute, but not contracted, at their baſe, and downy on the under ſide. *Acorns* much like the laſt-deſcribed. This *tree* is forty or fifty feet high. Its wood is chiefly uſed, by the French ſettlers in the Illinois country, for making boards to cover houſes, whence the appellation of *Q. imbricaria* in Michaux, and of Shingle Oak among the Engliſh Americans. For although the ſcales of the cup are rather larger than thoſe of *Q. laurifolia*, the ſpecific name does not allude to that circumſtance.

16. Q. *elliptica*. Oval-leaved Mexican Oak. Willd. n. 14. Nee in Annal. Scient. Nat. v. 3. 278. Fiſch. Miſc. Hiſp. v. 1. 117.—"Leaves elliptical, entire, coriaceous, nearly ſeſſile; rounded at each end; roughiſh beneath. Gathered by Louis Nee, but without flowers or fruit, in the kingdom of Mexico, by the road from Ixmiquilpan to Cimapan, as well as between Tixtala and the river Azul. The *trunk* is thick, twelve feet high, with a grey bark. *Branches* horizontal; the ſmaller ſhoots erect; all

all very leafy. *Leaves* three inches long, and one and a half broad, flightly revolute; fmooth above; roughifh and veiny beneath, the veins forked. *Footftalks* thick and very fhort. *Nee.*

17. Q. *acuta.* Pointed-leaved Japan Oak. Thunb. Jap. 175. Willd. n. 15.—" Leaves oblong, pointed, entire, with parallel veins; rounded at the bafe; downy when young."—Obferved by Thunberg in Japan. The *branches* are knotty, afh-coloured, dotted with white, fmooth downy at the fummit. *Leaves* alternate, ftalked, fmooth, when full-grown; covered at the back, when young, with rufty down. *Spikes* axillary, clothed with fimilar pubefcence. *Thunberg.*

18. Q. *magnoliæfolia.* Magnolia-leaved Oak. Willd. n. 16. Nee in Annal. Scient. Nat. v. 3. 268. Fifch. Mifc. Hifp. v. 1. 103.—" Leaves ovate-oblong, coriaceous, entire, fhining; downy beneath; fomewhat emarginate at the bafe. Fruit racemofe."—Found by Louis Nee, in the kingdom of Mexico, between Chilpancingo and Tixtala, and about the river Azul. This is an elegant *tree*, twenty feet, or more, in height. *Trunk* thick, with a dark-coloured bark full of fiffures. *Branches* horizontal; younger ones furrowed, and dotted with white. *Leaves* fix or eight inches long, and three broad, ovate, rigid; fometimes emarginate at the bafe; green and fhining above; downy beneath, with the larger veins prominent, and the fmaller reticulated. *Footftalks* thick, a line in length. *Stipulas* crifped, downy, deciduous. Female *clufters* folitary, axillary, two inches long; the lower ones alternate, upper oppofite. *Acorns* ovate, half covered by their hemifpherical cup, which is the fize of the feed of *Cicer arietinum*, its fcales fcarcely at all imbricated. *Nee.*

19. Q. *lutea.* Yellow-leaved Mexican Oak. Willd. n. 17. Nee in Annal. Scient. Nat. v. 3. 269. Fifch. Mifc. Hifp. v. 1. 105.—" Leaves obovate, entire, fhining; fomewhat heart-fhaped at the bafe; downy and yellow beneath." —Found in Mexico by the fame celebrated traveller and botanift. This agrees with the preceding in its mode of growth, and fructification, infomuch that it may be thought a variety; yet the *leaves* are very different. They are of a larger fize, broader towards the end, and contracted towards the *footftalk*, as well as more deeply emarginate at the bafe; and their under fide is clothed with ochrey yellow pubefcence.

20. Q. *femecarpifolia.* Marking-nut-leaved Oak.—Leaves obovate, obtufe, coriaceous, entire; heart-fhaped at the bafe; downy beneath; the young ones with fpinous teeth. —Gathered by Dr. F. Buchanan, on the banks of torrents in Upper Nepaul, where its Parbuttie appellation is *Caffur*, and its Nawar name *Ghirfi.* This is a middle-fized *tree*, with angular *branches*, clothed when young with fcaly down. *Leaves* evergreen, alternate, on fhort thick *ftalks*, obovate-oblong, four or five inches in length, and two in breadth; more or lefs heart-fhaped at the bafe; their upper furface fmooth and fhining; the under opaque, clothed with rufty down, and furnifhed with numerous, irregular, rather diftant, tranfverfe, prominent veins; their margin entire, flightly wavy. The extremity is ufually rounded and obtufe, fometimes abrupt, fometimes tipped with a little fpine. On young branches the *leaves* are ferrated with ftrong fpines, or even finuated, and clothed on both fides with rufty down. *Stipulas* in pairs, awl-fhaped, erect, permanent, as long as the footftalks. Dr. Buchanan did not obferve the *flowers* or *fruit.* The afpect of the adult *leaves* is much like thofe of *Semecarpus Anacardium*, or fome of the entire-leaved fpecies of *Ficus.*

Section 2.—*Leaves more or lefs toothed or ferrated.*

21. Q. *glauca.* Glaucous-leaved Oak. Thunb. Jap. 175. Banks Ic. Kæmpf. t. 17. Willd. n. 11. (Kas no ki: Kæmpf. Amoen. 816.)—Leaves obovate, pointed; ferrated towards the extremity; glaucous beneath. Nut roundifh. —Gathered near Nagafaki, in Japan, by profeffor Thunberg, to whom we are obliged for a fpecimen. He defcribes it as a very large *tree*, whofe *branches* are fomewhat umbellate, erect, round, purple, fmooth, except fome prominent white points. The *leaves* are alternate, about three inches long, and near two broad, with a blunt projecting point; their upper furface fmooth and polifhed; the under covered with a fine glaucous mealinefs, and marked with prominent, ftraight, parallel, but rather diftant, obliquely tranfverfe veins; the margin diftantly ferrated upwards. *Footftalks* about half an inch long, purple. *Flowers* axillary. *Acorns*, by Kæmpfer's figure, axillary, often in pairs, of a roundifh tumid fhape, pointed, not an inch long, their cups fhort, feemingly marked with concentric lines; their *ftalks* fimple, fhort and thick.

22. Q. *annulata.* Ring-cupped Oak.—Leaves obovate, pointed; ferrated in their upper half; fomewhat glaucous and downy beneath. Fruit fpiked. Nut oblong. Calyx furrowed concentrically.—Gathered by Dr. Buchanan, at various places in Upper Nepaul, bearing fruit, in December 1802. A very large *tree*, whofe wood is excellent; the *branches* two or three together, fmooth. *Leaves* evergreen, rigid, exactly like thofe of the laft fpecies, but fomewhat filky beneath, and lefs glaucous; the young ones very filky. *Stipulas* linear, hairy, longer than the footftalks, deciduous. *Male flowers* in pendulous, hairy, yellowifh, fhortifh fpikes, fpringing from buds below the leaves, whofe fcales are imbricated in five rows: *female* from three to fix, in folitary, axillary, upright, ftalked, fmooth fpikes, about the length of the footftalks. *Calyx* of the female flowers globofe, fmaller than hempfeed, compofed of feveral concentric imbricated layers, of which the outermoft is fmooth and notched, the reft downy and entire. *Germen* globofe. *Style* very fhort and thick. *Stigmas* three, obtufe. *Acorns* quite feffile on the common flower-ftalk. *Cup* rather fmaller than that of our Britifh oaks, entire and even at the edge, compofed of feven or eight concentric, annular, imbricated, crenate fcales, externally filky. *Nut* ovate, acute, fmooth and even, twice as long as the cup. The Parbutties call this tree *Phullaat*; the Nawars *Gufhi*, or *Paca ftringali.*

We find great reafon to think that it may be, as Dr. Buchanan fufpected, the fame fpecies with Thunberg's *glauca* laft defcribed. The *leaves* of his fpecimen fhew a flight degree of pubefcence about the veins, but have not the minute filkinefs of our's. The greateft and moft effential difference, if Kæmpfer be as correct as ufual, confifts in the female inflorefcence. He delineates the acorns of *glauca* on fhort, fimple, axillary *ftalks*, either folitary or in pairs; and Thunberg defcribes the *flowers* as axillary. In our plant the female *flowers* are indeed axillary, but they compofe a ftalked *fpike*, and neither they nor the *acorns* have any partial ftalks. Such differences are found between other fpecies of Oaks, and prove effential and invariable. We therefore cannot but, for the prefent at leaft, rely on Kæmpfer's known fidelity, and propofe our *Q. annulata* as a diftinct fpecies.

23. Q. *lamellofa.* Many-cupped Oak.—Leaves elliptic-oblong, pointed, ferrated, many-veined; glaucous and fomewhat downy beneath. Calyx of many concentric entire layers, as long as the nut.—Difcovered by Dr. Buchanan, in the more remote woods of Nepaul, bearing fruit in December 1802. In the Nawar language it is called *Tuppafufhi.* The *tree* is lofty, with fmooth bluntly-angular *branches.* *Leaves* alternate, fix inches in length and two in breadth, elliptic-

elliptic-oblong, rigid, taper-pointed, ſharply ſerrated; ſmooth and green above; glaucous and often finely downy beneath, with innumerable, prominent, crowded, ſtraight, parallel, moſtly oppoſite, obliquely tranſverſe veins: the aſpect and ſize of the *leaves* much reſembling *Dillenia indica*. *Footſtalks* an inch and half long, tumid at the baſe. *Stipulas* deciduous. Female *flowers* in ſhort axillary ſpikes. *Acorns* ovate, pointed, the ſize of cheſnuts, each completely enveloped and concealed by the large, globular, downy *cup*, which is as big as a ſmall apple, and conſiſts of eight or nine diſtinct, concentric, entire, imbricated layers, much more deeply ſeparated than the rings of *Q. annulata*. An approach towards the genus *Fagus*, or *Caſtanea* of ſome authors, may be obſerved, as Dr. Buchanan ſuggeſts, in this ſpecies, which is nevertheleſs a genuine *Quercus*, and far leſs doubtful than our *tribuloides*, n. 13. It proves however that the mere elongation of the acorn, beyond the cup, is not an indiſpenſable character of the preſent genus. See alſo *tomentoſa*, n. 42.

24. Q. *cuſpidata*. Pointed Japan Oak. Thunb. Jap. 176. Willd. n. 19. (Sui, vulgò Sſi no ki; Kæmpf. Amoen. 816.) "Leaves ovate, pointed, ſerrated, ſmooth. Calyx prickly." —Native of Japan, about Nagaſaki. A *tree*, with ſtriated, ſmooth, ſpreading *branches*. *Leaves* alternate, ſtalked, an inch long, ovate, rounded at the baſe, pointed, ſmooth on both ſides, with parallel veins; their upper half ſerrated. *Female flowers* ſcattered over the young branches, ſolitary, nearly ſeſſile. Cup of the *acorn* prickly, the ſize of a hazelnut. *Thunb*. This ſpecies, like n. 13, appears, by its prickly cup, allied to *Fagus;* eſpecially as Kæmpfer, who calls it *Fagus folio fraxini*, deſcribes the dry cup as ſplitting into three, four, or five parts. The *nut* is eaten by the Japaneſe, either raw or cooked.

25. Q. *ferrata*. Saw-leaved Japan Oak. Thunb. Jap. 176. Willd. n. 20.—"Leaves oblong, ſerrated, villous and downy, with parallel veins."—Native of Japan, flowering in May and June. A *tree*, with alternate, ſmooth, aſh-coloured, knotty, ſpreading *branches*, beſprinkled with white tubercles. *Leaves* alternate, pointed, all acutely and equally ſerrated, furniſhed with ſtraight parallel veins; green above and very ſilky when young; paler beneath, ſilky and downy at firſt, but ſubſequently more ſlightly villous; their length from one to three inches. Male *flowers* in hairy, drooping, long-ſtalked *ſpikes*, each an inch long. Our ſpecimen is in an early ſtate of foliage, nor have we any account of the *fruit*, or female *flowers*.

26. Q. *dentata*. Tooth-leaved Japan Oak. Thunb. Jap. 177. Willd. n. 69. (Koku; Kæmpf. Amoen. 816.) —"Leaves obovate-oblong, obtuſe, deeply toothed; downy beneath."—Native of hills in Japan, flowering in April and May. A *tree*, with thick, erect, rugged, furrowed *branches*, beſprinkled with dots and tubercles; downy at the ſummits. *Leaves* crowded about the extremities, on very ſhort ſtalks, obovate-oblong, obtuſe, with deep teeth deſtitute of ſpines; villous above; downy beneath; pliant, two inches long; their veins parallel. *Thunb*. Kæmpfer ſays the wood is white.

27. Q. *lanata*. Woolly-leaved Nepaul Oak.—Leaves elliptic-oblong, ſharply ſerrated, coriaceous; denſely woolly beneath. Fruit in axillary ſolitary ſpikes. Calyx ſcaly, without prickles. Native of the mountains of Upper Nepaul, flowering in April. *Buchanan*. The Parbutties call it *Banza*, or *Banja;* the Nawars *Soſhi Shingali*. This is a *tree* of vaſt dimenſions, with a ſcaly bark, and rigid, brown, warty *branches*, clothed, when young, with denſe white down. *Leaves* alternate, ſomewhat two-ranked, ſtalked, elliptic-oblong, ſometimes rather obovate, pointed, from three to five inches in length, and two or more in breadth ſtrongly and ſharply ſerrated, except at the very baſe, which is more or leſs rounded, and occaſionally unequal; the upper ſurface green, ſhining, and naked, (except when young), but not quite ſmooth to the touch; the under clothed with fine, denſe, uniform, white, woolly pubeſcence, and marked with prominent, parallel, but not very crowded, obliquely-tranſverſe veins. *Footſtalks* ſtout, downy, ſcarcely an inch long. *Stipulas* ovate, membranous, deciduous. Male *flowers* in ſhort, denſe, hairy *ſpikes*, at the baſe of the young ſhoots, as they protrude from the bud. *Calyx* with five or ſix teeth. *Anthers* about ſix, ſeſſile. Female *flowers*, as far as Dr. Buchanan could obſerve, on a ſeparate tree, in very ſhort, ſolitary, axillary *ſpikes*. *Acorns* either ſolitary, or ſeveral crowded together, ſmall, ovate, hairy, half covered by their ſcaly unarmed cups.

28. Q. *diverſifolia*. Various-leaved Mexican Oak. Willd. n. 21. Nee in Annal. Scient. Nat. v. 3. 270. Fiſch. Miſc. Hiſp. v. 1. 107. *Willd*.—Leaves ovate, undivided or deeply toothed; yellow and downy beneath. Fruit ſpiked, globoſe.—Found by Louis Nee, between the villages of Chalma and Santa Roſa in New Spain. A *ſhrub*, from ten to fourteen feet high; its *trunk* ſeldom ſtraight; the *bark* cracked, dark-coloured; the *branches* alternate. *Leaves* either an inch and half long, and undivided, or two inches and a half, and deeply toothed; ſmooth and ſhining above; downy, and dull yellow, beneath. *Footſtalks* hardly a line in length. *Stipulas* oblong, reddiſh, membranous, contracted at the baſe, deciduous. *Acorns* four or five, ſeſſile, on a thread-ſhaped axillary ſtalk, two inches long. *Cup* the ſize and ſhape of a pea, covered with ſcales. *Nuts* ſcarcely projecting above a line beyond the cup. *Nee*. The *fruit*, being ſeſſile, is evidently ſpiked, not, as the authors quoted term it, racemoſe.

29. Q. *agrifolia*. Holly-leaved American Oak. Willd. n. 22. Nee in Annal. Scient. Nat. v. 3. 271. Fiſch. Miſc. Hiſp. v. 1. 108. *Willd*. Purſh n. 9.—Leaves roundiſh-ovate, ſomewhat heart-ſhaped, ſmooth on both ſides, with ſpinous teeth. Fruit axillary, ſeſſile. Scales of the calyx lax. Nut ovate.—Native of the weſt (not eaſt) coaſt of North America, near Monterey, and Nootka ſound. *Nee*. *Branches* ſmooth, aſh-coloured. *Leaves* about two inches long, and almoſt as wide, ſmooth, veiny, nearly heart-ſhaped, bordered with diſtant ſpinous teeth. Spikes of *male flowers* an inch long. *Calyx* ſhorter than the ſtamens. *Anthers* five, two-celled. *Female flowers* axillary, ſeſſile, moſtly two together. *Calyx* hemiſpherical, beſet with lax yellow ſcales. *Nut* thrice as long as the calyx, meaſuring eight lines, ovate, acute. *Nee*.

Plukenet's t. 196. f. 3, cited with doubt by Willdenow and Purſh, appears to belong, as Linnæus thought, to his own *Hippomane ſpinoſa*. The ſhape of the leaves certainly does not agree with the above deſcription, though perfectly anſwerable to Plumier's figure of this *Hippomane*, which is *Sapium ilicifolium* of Willdenow, Sp. Pl. v. 4. 573, who there copies the ſame ſynonym from Linnæus, without any mark of uncertainty.

30. Q. *gramuntia*. Holly-leaved Montpellier Oak. Linn. Sp. Pl. 1413. Willd. n. 23. Ait. n. 6. (Ilex foliis rotundioribus et ſpinoſis, e luco gramuntio; Magn. Monſp. 140.)—Leaves roundiſh-elliptical, nearly ſeſſile, undulated, with deep ſpinous divaricated teeth; denſely downy beneath; ſomewhat heart-ſhaped at the baſe.—Native of the wood of Gramont, near Montpellier, and of Spain. Cultivated in England in 1730. It bloſſoms in June. This is rather a ſmall ſtraggling *tree*, with numerous round grey *branches*, downy when young. *Leaves* evergreen, ſcarcely an inch long,

long, rigid, broadly elliptical, often nearly orbicular, very much undulated at the margin, their deep broad fpinous teeth pointing every way; the upper furface dark green, rather glaucous, befprinkled with minute ftarry hairs; the under denfely clothed with white entangled down. We have feen neither *flowers* nor *fruit*. Willdenow appears miftaken in difcarding the fynonym of Magnol, which anfwers extremely well to the Linnæan fpecimens, though indeed the author fpeaks of his plant as a variety of *Q. Ilex*. It is, neverthelefs, true that Linnæus confounded herewith a plant from Magnol's herbarium, which is not diftinct from *Q. Ilex*.

31. Q. *Ballota*. Sweet-acorn Oak. Desfont. Atlant. v. 2. 350. Willd. n. 24. (Ilex major; Cluf. Hift. v. 1. 23?)—Leaves elliptical, coriaceous; entire or ferrated; very downy beneath. Bark even. Nut cylindrical, elongated.—Native of feveral places in the neighbourhood of mount Athos, according to profeffor Desfontaines, from whom we have a wild fpecimen. It flowers in May. This is a large and handfome evergreen *tree*, whofe *trunk* is from twenty to thirty feet high; the *wood* hard, compact, and very ufeful; the *bark* even, not corky, though full of fiffures; *branches* downy. *Footftalks* a quarter of an inch long, downy. *Leaves* various in fhape, but more or lefs elliptical, an inch or inch and half long; either quite entire, or ferrated with fmall fpinous teeth; their upper furface, at leaft when young, befprinkled with minute ftarry hairs; the under always very white and denfely downy. *Male flowers* in copious, long, lax, pendulous *fpikes*, with ufually feven *ftamens; female* on the fame tree, axillary, folitary or aggregate. *Acorns* cylindrical, an inch and half or two inches long, half an inch in diameter, eatable and very palatable, either raw or roafted. *Cup* hemifpherical, covered with numerous, obtufe, downy, clofely imbricated fcales.

32. Q. *Ilex*. Common Evergreen Oak, or Holm Oak. Linn. Sp. Pl. 1412. Willd. n. 25. Ait. n. 7.—Leaves ovate-oblong, acute, coriaceous; entire or ferrated; hoary beneath. Bark even. Nut ovate. The varieties are; α, with lanceolate entire leaves; Smilax Dalech; Bauh. Hift. v. 1. part 2. 101. Suber fecundus; Matth. Valgr. v. 1. 188, as to the figure: β, with lanceolate ferrated leaves; Ilex; Matth. Valgr. v. 1. 186. Duham. Arb. v. 1. t. 123: γ, with rounder, lefs rigid, and more or lefs ferrated leaves; Phellodrys; Matth. Valgr. v. 1. 189, as to the figure. Ilex n. 3; Duham. Arb. v. 1. t. 124. This fpecies occurs in various parts of the fouth of Europe, and north of Africa, and is hardy, as well as evergreen, with us, thriving particularly near the fea, though of flow growth, flowering in May and June. It ufually forms a large bufhy tree, but occafionally rifes with a ftraight naked trunk, and round head, to a great height. The *wood* is hard and heavy, valuable for many purpofes. The French ufe it for pullies in the navy. The *bark* is hard and even, not corky. *Leaves* various in fhape and fize; dark green, convex, and quite fmooth, above; hoary or downy beneath; their edges either revolute and entire, or irregularly notched and ferrated. *Footftalks* half an inch long, downy. *Acorns* ufually two, on an axillary downy ftalk which is longer than the footftalk, ovate, hardly an inch long, with a fcaly downy cup. They are eaten by hogs, but are very different in fhape and quality from thofe of the laft-defcribed fpecies. So many varieties, or fpecies, nearly correfponding with thefe two, are mentioned by authors, that it is difficult to underftand them. The fubject requires, and well deferves, a practical inveftigation. Lamarck, under the article Chêne, in his dictionary, mentions feveral kinds, which he knew but imperfectly, and which we have no means of elucidating further, fo that we dare not adopt, or attempt to reduce them to order.

33. Q. *Suber*. Cork Tree. Linn. Sp. Pl. 1413. Willd. n. 26. Ait. n. 8. Hunter's Evel. Sylv. 362, with a plate. (Suber; Camer. Epit. 115. S. primus; Matth. Valgr. v. 1. 187. S. latifolium, perpetuò virens; Duham. Arb. v. 2. 291. t. 80. S. latifolium; Ger. Em. 1347, the middle figure only.)—Leaves ovate-oblong, bluntifh, coriaceous; entire or fharply ferrated; downy beneath. Bark cracked, fungous.—Native of the fouth of Europe, and north of Africa. Duhamel fays it can hardly bear the climate of the north of France. It lives however in our Englifh gardens, where it has been kept more than a century. The *bark* is remarkable for a thick fpongy coat, yielding the well-known fubftance called cork. The *leaves* much refemble the broad variety of *Q. Ilex*, nor do the *acorns* greatly differ from thofe of that tree. We have not been able to afcertain what authors mean by their *Suber anguftifolium non ferratum*, the figure of which, Matth. Valgr. v. 1. 188. Duham. Arb. v. 2. t. 81, we have cited as our firft variety of *Ilex*. We fhould fufpect the *Suber* itfelf to be altogether a variety of *Ilex*, differing only in the bark; and that there might be a broad and a narrow-leaved variety of each; were not the dwarf tufted ftumpy habit of the Cork Tree, on the fandy plains of Italy, Spain, &c. fo peculiar. Yet this poffibly may, as well as the nature of the bark, be owing to the foil, for in ftrong ground the cork, according to Duhamel, degenerates. Willdenow fays "the *leaves* of *Q. Suber* are a little elongated at the bafe, running down into the *footftalk*, which is not the cafe with *Ilex*;" but this character feems fcarcely permanent.

34. Q. *coccifera*. Kermes Oak. Linn. Sp. Pl. 1413. Willd. n. 27. Ait. n. 9. (Ilex coccifera; Camer. Epit. 774. I. aculeata cocciglandifera; Garid. Aix. 245. t. 53. Niffole in Mem. de l'Acad. des Sciences for 1714. 435. t. 17, 18. I. coccigera; Ger. Em. 1342.)—Leaves elliptic-oblong, rigid, fmooth on both fides, with fpreading, briftly, fpinous teeth. Nut ovate. Calyx with fpreading pointed fcales.—Native of the fouth of Europe, and the Levant, flowering in the fpring. This is a bufhy evergreen *fhrub*, celebrated for producing the *kermes*, a valuable article of dyeing, before the introduction of cochineal, and which afforded the *color kermefinus*, or crimfon. The *kermes* is an infect, of the genus *Coccus*, which fticks to the branches, in the form of a red ball, the fize of a pea. It is now out of ufe among dyers, and is only ufed by French apothecaries. The *leaves* of this fhrub are, at moft, but half the fize of the laft, though they vary much in magnitude as well as figure. They are diftinguifhed by their rigidity, fmoothnefs on both fides, and their prominent needle-like marginal prickles. The fcales of the mature *calyx* are alfo much more elongated and prominent than in *Ilex* or *Suber*, and of an angular awl-fhaped figure.

35. Q. *Pfeudo-coccifera*. Baftard Kermes Oak. Desfont. Atlant. v. 2. 349. Willd. n. 28.—Leaves elliptic-oblong, rigid, fmooth on both fides, with fpinous ferratures. Nut ovate. Calyx with flat, flightly fpreading, fcales.—Obferved by Desfontaines at Algiers and about mount Athos. At Tunis it is called the "meal-bearing oak," probably from the ufe of the acorns as food. This is a *tree*, from fifteen to twenty feet high, with round *branches*, clothed with rufty down when young. The *leaves* are twice or thrice as large as thofe of *Q. coccifera*, thicker and lefs wavy, with much fmaller and fhorter fpinous ferratures, rather than teeth. *Calyx* clothed with numerous, flat, fhort, flightly fpreading fcales. *Nut* ovate, pointed. Willdenow, not having feen a fpecimen, has mifunderftood the

the nature of the *calyx*, and has in other refpects altered Desfontaines' fpecific character for the worfe.

36. Q. *rigida.* Rigid-leaved Oak. Willd. n. 29.—(Ilex aculeata cocciglandifera, glande maximâ, nunc cylindraceâ, nunc fubrotundâ, cupulâ echinatâ; Tourn. Cor. 40?—"Leaves oblong, undivided, with fpinous ferratures, fmooth; glaucous beneath; heart-fhaped at the bafe. Footftalks bearded at the fummit. Scales of the calyx of the fruit rigid, fpreading."—Native of the coaft of Caramania. *Willdenow.* A pretty fpecies, fufficiently diftinct from its allies. *Branches* pale brown, dotted. *Leaves* oblong, an inch or rather more in length, rigid, with fpinous ferratures; deep green and fhining above; glaucous beneath; cordate at the bafe. *Footftalks* very fhort, fmooth, except at the top, where a line of brownifh hairs, on each fide, runs up the midrib. *Calyx* of the fruit feffile, befet with rigid, woody, lanceolate, fpreading fcales. *Willd.*

A fpecimen before us, gathered by the late Dr. Brouffonet at Algiers, anfwers precifely to this defcription, efpecially in the curious character of the hairy lines, running a little way up the midrib of the leaf; but the foliage is equally green and fhining on both fides. The *calyx* refembles that of *coccifera,* but its inner fcales are longer, and more fpreading.

37. Q. *rotundifolia.* Round-leaved Spanifh Oak. Lamarck Dict. v. 1. 723. Willd. n. 30.—"Leaves obovate-oblong, abrupt, with fpinous teeth; heart-fhaped at the bafe; fmoothifh above; downy beneath."—Native of Spain. Seen by Lamarck, in a young ftate, in the garden of Monf. Cels, and by Willdenow dry without fructification. The *branches* are round and downy. *Leaves* ftalked, an inch or more in length; glaucous-grey, and not quite fmooth, above; white and cottony beneath. The *acorns* are faid to be large and long, eatable like chefnuts. This defcription is not inapplicable, on the whole, to our n. 31, *Q. Ballota.*

38. Q. *humilis.* Dwarf Portuguefe Oak. Lamarck Dict. v. 1. 719. Willd. n. 31. Ger. Em. 1340. (Q. pedem vix fuperans; Bauh. Pin. 420. Robur 7; Cluf. Hift. v. 1. 19.)—Leaves obovate, with fpinous ferratures; heart-fhaped at the bafe; downy beneath. Calyx of the fruit flattened. Nut oblong.—Found by Clufius in barren fandy ground near Lifbon, very abundantly. The whole plant is rarely more than a foot high when wild; though Lamarck fays it becomes twice or thrice as tall by culture. The young *branches* are downy. *Leaves* an inch, or inch and half long, on fhort *footftalks;* fmooth and fhining above; downy and hoary beneath; their larger veins ftraight and parallel. The *acorns* are defcribed as more bitter than our common oak, their form oblong, their cups remarkably fhort and flattened.

39. Q. *lufitanica.* Portuguefe Gall Oak. Lamarck Dict. v. 1. 719. Willd. n. 32. (Q. valentina; Cavan. Ic. v. 2. 25. t. 129? Robur 4; Cluf. Hift. v. 1. 18, and R. 5; ibid. 19. Galla five Robur majus; Ger. Em. 1348, and G. minor; ibid. 1349.)—"Leaves elliptical, with deep pointed ferratures; downy beneath. Fruit racemofe. Calyx hemifpherical. Nut oblong."—Native of Portugal, and perhaps Spain. Lamarck fays this fpecies confifts of feveral varieties, all very low *fhrubs,* fubject to bear galls; their *branches* copious and flender; their *leaves* fmall, intermediate in form between the evergreen and the ordinary oaks of Europe. Willdenow defcribes the *leaves* an inch in length, oblong, obtufe, rigid; their ferratures fomewhat pointed; the upper furface polifhed and fmooth; the under hoary with flender, ftarry, crowded hairs. *Footftalks* fhort. *Fruit* racemofe, or rather, as we fhould imagine, fpiked. He adds that the figure of Cavanilles fcarcely anfwers to the plant in queftion; and indeed that author defcribes his as a lofty *tree,* taller than *Q. Ilex,* with deciduous *leaves,* and large, folitary *acorns.* We have feen no fpecimen.

40. Q. *infectoria.* Oriental Gall Oak. Olivier's Travels, Englifh edition, v. 2. 42. t. 14, 15. Willd. n. 33.—Leaves ovate-oblong, very fmooth on both fides, deeply toothed, fomewhat finuated, deciduous. Fruit feffile. Calyx teffellated. Nut elongated, nearly cylindrical.—This oak, according to Olivier, is fcattered throughout all Afia minor, from the Bofphorus as far as Syria, and from the coafts of the Archipelago, as far as the frontiers of Perfia. It feldom attains the height of fix feet, and the *ftem* is crooked, with the habit of a *fhrub* rather than a *tree.* The *leaves* are an inch or inch and half long, deciduous, bright green, fmooth on both fides, but paler beneath; their ferratures deep and broad, not acutely pointed. *Fruit* folitary, nearly feffile. *Cup* flightly downy, its fcales not very diftinct. *Acorn* two or three times longer than the cup, fmooth, nearly cylindrical. The galls produced on the young branches of this oak, from the puncture of a fpecies of *Diplolepis,* are preferred to all others for dyeing, and are a great article of the Levant trade. (See GALLS.) Olivier obferves that the plant bears a number of different galls, befides the above, which are neglected, as ufelefs.

41. Q. *mucronata.* Pointed-toothed Mexican Oak. Willd. n. 34. (Q. caftanea; Nee in Annal. Scient. Nat. v. 3. 276. Fifch. Mifc. Hifp. v. 1. 114. *Willd.*)—"Leaves oblong-lanceolate, with pointed awned ferratures; polifhed above; downy beneath; heart-fhaped at the bafe."—Found by Louis Nee, without flowers or fruit, in New Spain, between Ixmiquilpan and Cimapan. The *tree* is twelve feet high, with a ftraight *trunk,* covered with a brittle dark-coloured *bark.* *Branches* erect, alternate, fmooth, much fub-divided. *Leaves* three inches long, and one broad, acute; abrupt and heart-fhaped at the bafe, their ferratures awned; the upper furface green and fmooth; the under clothed with fine yellow down. *Footftalks* two lines long. *Stipulas* none. *Nee.*

42. Q. *tomentofa.* Downy Mexican Oak. Willd. n. 35. (Q. peduncularis; Nee in Annal. Scient. Nat. v. 3. 270. Fifch. Mifc. Hifp. v. 1. 106. *Willd.*)—"Leaves oblong-ovate, with tooth-like notches; denfely downy beneath. Fruit racemofe. Nut globofe, nearly covered by the calyx."—Native of New Spain, in the road from Mexico to Acapulco, beyond the river Mefcala. A *tree,* twenty feet high, with an upright *trunk,* and grey brittle *bark.* *Branches* numerous, alternate, clothed with denfe reddifh wool. *Leaves* five inches long, hardly two wide, crowded; obtufe at the bafe; pointed at the end; bordered with tooth-like notches; green and fmoothifh above; downy, with prominent veins, beneath. *Footftalks* downy, very fhort. *Female flowers* on an axillary folitary ftalk, three or four inches long. *Acorns* but little bigger than pepper-corns, each almoft entirely concealed in its fcaly, downy, reddifh cup. *Nee.* This fpecies agrees with our thirteenth, *tribuloides,* in having its acorn concealed by the cup. The *fruit* is defcribed, by the authors we are obliged to copy, as *racemofe.* We have feen no fpecimens, but analogy would induce us to fuppofe it rather *fpiked.*

43. Q. *circinata.* Round-toothed Mexican Oak. Willd. n. 36. Nee in Annal. Scient. Nat. v. 3. 272. Fifch. Mifc. Hifp. v. 1. 109. *Willd.*—"Leaves ovate, crenate, undulated; acute at each end; downy beneath. Nut fcarcely longer than the calyx."—Native of New Spain, between Tixtala and Chilpancingo. A *tree* twenty or twenty-five feet high. *Trunk* erect. *Bark* brittle, afh-coloured. *Branches* horizontal; the young ones erect, furrowed,

rowed, villous. *Leaves* alternate, from five to seven inches long, and three broad; green and shining above; more or less downy, and flesh-coloured, or reddish-brown, beneath; the margin undulated and crenate, the notches rounded, their edges turned towards the point of the leaf. *Fruit* supported by a very short common stalk. *Calyx* hemispherical, the size of Chick peas, *Cicer arietinum;* its scales acute at the point. *Nut* but little larger than the calyx. Plukenet's t. 54. f. 3, in some measure resembles the species before us, but is said to have a large fruit, and is cited by authors as *Q. Prinus. Nee.*

44. Q. *splendens.* Silky-leaved Mexican Oak. Willd. n. 37. Nee in Annal. Scient. Nat. v. 3. 275. Fisch. Misc. Hisp. v. 1. 113. *Willd.*)—"Leaves oblong-ovate, bluntly toothed; slightly downy above; densely silky beneath."—Native of New Spain, near Taxala. *Trunk* erect, much branched, fifteen feet high. *Branches* partly horizontal, partly erect, clothed with red shining down. *Leaves* scattered, crowded, three inches long, and an inch and half broad; green, with a thin downy coat, above; thickly clothed beneath with shining pubescence, the midrib only being prominent; their edges bluntly and unequally toothed. *Footstalks* very short, with an awl-shaped villous *stipula* at each side. *Flowers* and *fruit* not observed. *Nee.*

45. Q. *rugosa.* Rugged Mexican Oak. Willd. n. 38. Nee in Annal. Scient. Nat. v. 3. 275. Fisch. Misc. Hisp. v. 1. 112. *Willd.*—"Leaves ovate-oblong, coriaceous, rugose; toothed towards the end; heart-shaped at the base; downy and rusty beneath."—Native of the woods of Huisquiluca and Ocuila, in the way from Mexico to Santo Christo de Chalma. A middle-sized *tree*, having numerous, alternate, round, grey *branches*, rough with minute prominent points. *Leaves* three inches in length, hardly two in breadth, thick and coriaceous; rugged, green and shining on the upper side; brown and downy at the back; heart-shaped at the base; the margin toothed from the middle to the extremity. *Footstalks* two lines long, thickened at their base. *Female flowers* in scaly axillary clusters. *Nee.*

46. Q. *macrophylla.* Large-leaved Mexican Oak. Willd. n. 39. Nee in Annal. Scient. Nat. v. 3. 274. Fisch. Misc. Hisp. v. 1. 111. *Willd.*—"Leaves obovate, crenate; tapering and heart-shaped at the base; downy beneath. Fruit spiked."—Found by Louis Nee, the discoverer likewise of the five preceding species, in the districts of Chilpancingo and La Curva, and on the mountains of Quirapu, in New Spain. This is a *tree*, thirty feet high, with a stout upright *trunk*, and dense *head*. The principal *branches* are horizontal; the rest upright, furrowed when young. *Leaves* a foot long, and seven or eight inches broad; rounded at the end; gradually tapering down to the emarginate, or heart-shaped, base, where they measure only four lines across; their upper surface green and shining; the under yellowish, clothed with very minute down; the margin crenate and wavy. *Footstalks* very short and thick. *Female flowers* sessile on a common stalk, and encompassed with downy *bracteas. Nee.*

47. Q. *Prinus.* Chesnut-leaved White Oak. Linn. Sp. Pl. 1413. Willd. n. 40. Ait. n. 10. Pursh n. 30. (Q. Prinus, var. 1, palustris; Michaux Querc. n. 5. t. 6. Q. castaneæ foliis, procera arbor virginiana; Pluk. Almag. 309. Phyt. t. 54. f. 3. Catesb. Carol. v. 1. t. 18.)—Leaves on longish stalks, obovate, acute; somewhat downy beneath; with nearly equal, dilated, callous-tipped, tooth-like serratures. Calyx of the fruit contracted at the base. Nut ovate.—Found in low shady moist woods, and on the banks of rivers, from Pennsylvania to Florida, flowering in May. It appears to have been known in England in 1730. This is one of the tallest trees produced in the southern parts of the United States, and remarkable for the beauty of its form, as well as the large size of its *acorns*, which are plentiful and sweet, a delicious and beneficial food for hogs and other wild animals. The *wood* is excellent, much used for making wheel-carriages, and yet so readily split as to serve for basket-work and brooms. The *leaves* are six inches, or more, in length, and three broad; silky in the spring; smooth and glaucous in summer; sometimes very downy on old trees. *Footstalks* an inch long. *Stamens* five to ten. *Acorns* an inch and half long, ovate; their cups shallow, covered with numerous closely-imbricated scales. Michaux says the *bark* is whitish, peeling off in long strips.

48. Q. *Chinquapin.* Chinquapin, or Dwarf Chesnut Oak. Pursh n. 34. (Q. prinoides; Willd. n. 41. Q. Prinus, var. 4, pumila; Michaux Querc. n. 5. t. 9. f. 1. Q. Prinus Chinquapin; Michaux Arb. v. 2. 65. t. 10, good. *Pursh.*)—Leaves on short stalks, obovate, smooth; glaucous beneath; tapering at the base; with nearly equal, dilated, acute, callous-tipped, tooth-like serratures. Calyx of the fruit hemispherical. Nut ovate.—Found on dry mountainous lands, from Pennsylvania to Carolina, flowering in May, when, according to Mr. Pursh, it is highly ornamental. This is a humble *shrub*, not above three or four feet high. The young *leaves* are whitish and downy beneath; the adult ones smooth and glaucous, scarcely above one-third the size of the preceding. *Female flowers*, according to Michaux, small, two or three together, on a short, solitary, axillary *stalk*. *Acorns* of a middling size, with a thin, nearly hemispherical, cup.

49. Q. *montana.* Rock Chesnut Oak. Willd. n. 42. Pursh n. 32. (Q. Prinus; Sm. in Abbot's Inf. v. 2. 163. t. 82. Q. Prinus, var. 2, monticola; Michaux Querc. n. 5. t. 7.)—Leaves on shortish stalks, obovate, acute; downy and white beneath: with nearly equal, dilated, short, blunt, callous-tipped tooth-like serratures. Fruit in pairs, on short stalks. Calyx hemispherical, with rugged scales. Nut oblong-ovate.—Found abundantly, in rocky situations, on the mountains of North America, from New England to Carolina, flowering in May. Michaux suggests that this species would be well worth cultivating in Europe. The *tree* rises to the height of sixty feet; the *wood* is tough and very useful, the *bark* excellent for tanning. It differs from *Q. Prinus*, n. 47, with which it has been confounded, in the constant white downiness of the under side of the *leaves*, which are much smaller and less dilated upward. The *acorns* moreover are but half the size of that species, and more oblong, two together on a very short stalk.

50. Q. *bicolor.* Swamp White Oak. Willd. n. 43. Pursh n. 31. (Q. Prinus, var. 5, tomentosa; Michaux Querc. n. 5. t. 9. f. 2. Q. Prinus discolor; Michaux Arb. v. 2. 46. t. 6. *Pursh.*)—Leaves nearly sessile, obovate; downy and white beneath; with very broad, unequal, obtuse, callous-tipped, lobe-like teeth. Fruit in pairs, on long bristle-pointed stalks. Calyx hemispherical. Nut oblong-ovate.—Native of low wet woods, from Pennsylvania to Carolina, flowering in May. *Pursh.* It grows to a very large *tree*. The *leaves* have extremely broad shallow teeth, or, as they might be called, lobes, approaching to the figure of our common English Oak leaves; their under side white and very downy. The *acorns* are sweet and eatable, like most of the *Prinus* tribe. Willdenow says the teeth are occasionally variable in size, one or two of them being sometimes remarkably elongated; and that the base of the *leaf* is more entire than in the foregoing.

51. Q. *Castanea.* Yellow Oak. Willd. n. 44. Pursh n. 33. (Q. Prinus, v. 3, acuminata; Michaux Querc. n. 5. t. 8.)

t. 8.)—Leaves on long footſtalks, oblong-lanceolate, pointed; ſomewhat downy beneath; with numerous, nearly equal, dilated, acute, callous-tipped, tooth-like ſerratures. Calyx hemiſpherical. Nut roundiſh-ovate.—Found in the Allegany mountains, and on the banks of the Delaware, flowering in May. *Purſh.* Michaux ſays it occurs in all the fertile countries to the weſt of thoſe mountains; and as the temperature of that climate agrees with the north of Europe, the tree in queſtion would be well worth trying here. The *wood* is excellent; *bark* very ſerviceable in tanning; and the *acorns* ſweet. The *tree* is large and handſome, ſeventy or eighty feet high. *Leaves* much like thoſe of our Sweet Cheſnut in form, but glaucous and often downy beneath. *Acorns* much rounder than in any of the four preceding, and ſhorter in proportion to the cup. Theſe Cheſnut Oaks, *Prinus* and its allies, ſeem not to have as yet attracted the notice of European cultivators, perhaps from their having been improperly confounded by botaniſts. The above accounts of their diſtinctions, and their valuable qualities, it is hoped, may cauſe them to be ſought out, and introduced into this country. Their different acorns might ſurely be eaſily imported.

Section 3.—*Leaves lobed at the extremity.*

52. Q. *aquatica.* Water Oak. Soland. in Ait. Hort. Kew. ed. 1. v. 3. 357. ed. 2. n. 11. Willd. n. 45. Purſh n. 11. Michaux Querc. n. 11. t. 19. t. 20. f. 1, 3, 4, 5, and t. 21. (Q. foliis cuneiformibus, obſoletè trilobis, intermedio productiore; Gron. Virg. 149. Q. folio non ſerrato, in ſummitate quaſi triangulato; Cateſb. Carol. v. 1. t. 20. Herb. Linn.)—Leaves wedge-ſhaped, ſmooth; tapering at the baſe; dilated and obſcurely three-lobed at the end, the middle lobe largeſt. Calyx nearly hemiſpherical. Nut roundiſh.—Native of ſwamps in North America, from Maryland to Florida, bloſſoming in May. Miller is ſaid to have cultivated this ſpecies in 1748, but it is little known in England. The *tree* is forty feet high; its wood, according to Purſh and Michaux, is little eſteemed; but the latter is of opinion that it might prove more valuable if felled in winter; he mentions alſo that the tree is not peculiar to ſwamps, or inundated meadows, but occurs ſometimes in dry ſandy ground, as on plains near the ſea-coaſt of Florida. Few trees vary ſo much in the ſhape of their *leaves*, according to age or ſituation, as this. The proper form of its *foliage* is wedge-ſhaped, much elongated and tapering at the baſe; dilated, rhomboid, or very ſlightly and bluntly three-lobed at the extremity; the edges entire; both ſides uſually ſmooth. *Footſtalks* variable in length, but rather ſhort; clothed, when young, with ſtarry hairs, which are ſometimes ſcattered over the back of the young leaf. Some of its *leaves* however, even on the ſame tree, are deeply three-lobed; and thoſe of young plants are, the firſt year, oblong and quite entire; the next two or three ſeaſons, variouſly toothed and ſinuated; inſomuch that botaniſts know not well how to diſtinguiſh its varieties from ſome of the following ſpecies. The *acorns* are ſhort and roundiſh, with a ſhallow cup, and ſtand generally in pairs, on ſhort ſtalks.

53. Q. *nigra.* Barren Oak, or Black Jack. Linn. Sp. Pl. 1413. Willd. n. 46. Ait. n. 12. Purſh n. 15. Sm. in Abbot's Inſ. v. 2. 115. t. 58. Michaux Querc. n. 12. t. 22, 23. (Q. marylandica, folio trifido, ad ſaſſafras accedente; Cateſb. Carol. v. 1. t. 19.)—Leaves wedge-ſhaped; ſomewhat heart-ſhaped at the baſe; dilated, abrupt, and very ſlightly three-lobed at the end; the middle lobe ſhorteſt; ſmooth above; ruſty beneath. Calyx hemiſpherical, with membranous ſcales. Nut roundiſh-ovate.—In barren ſandy or gravelly woods, from New Jerſey to Florida, flowering in May. This tree is of low growth, eſpecially in the more northern ſtates. It bears abundance of acorns, very good food for hogs. The wood is ſmall, but excellent for fuel. *Purſh.* The *leaves* are twice or thrice the ſize of the laſt, ſingularly dilated, and abrupt, at the end; their lobes, when young, more evident, and each tipped with a briſtle, which ſoon falls off. *Acorns* moſtly in pairs, nearly ſeſſile, with very ſcaly cups.

54. Q. *triloba.* Downy Black Oak. Willd. n. 47. Ait. n. 13. Purſh n. 14. Michaux Querc. n. 14. t. 26. (Q. rubra; Abbot's Inſ. v. 1. 99. t. 50.)—Leaves wedge-ſhaped, with three terminal, briſtly-pointed lobes, the middle one longeſt; downy beneath. Calyx of the fruit flattiſh. Nut nearly round.—Native of barren tracts, near the ſea-coaſt, from New Jerſey to Georgia, flowering in May. It was brought to England in 1800, by Meſſrs. Fraſer. The *tree* is fifty or ſixty feet high, of rapid growth, even in a poor ſoil. Michaux deſcribes it as very fit for making live fences; though the wood is moſt generally uſed in America for paling. The *leaves* are much ſmaller than thoſe of *Q. nigra*, rounded, not heart-ſhaped, at the baſe, and with longer *footſtalks*. Their lobes are direct, not laterally dilated, each tipped with one or more ſmall briſtles, and the under ſide is covered with denſe white down. The *foliage* of young ſhoots, that ſpring up where foreſts of this tree have been burnt, are often near a foot long, deeply pinnatifid, and ſharply lobed; as repreſented in Michaux, t. 26. f. 2.

55. Q. *nana.* Dwarf Jagged Oak. Willd. n. 48. Purſh n. 13. (Q. aquatica; Sm. in Abbot's Inſ. v. 2. 117. t. 59. Q. aquatica elongata; Ait. n. 11, γ.)—Leaves oblong-wedge-ſhaped, ſmooth, ſomewhat ſinuated; three-lobed at the extremity: lobes divaricated, pointed, the middle one largeſt; forks of the vein downy beneath.—In barren lands, called pine-barrens, of South Carolina, flowering in May. Purſh deſcribes it as "a low-growing ſpecies, always keeping diſtinct from *Q. aquatica.*" The *leaves* are almoſt ſeſſile, two or three inches long, much more diſtinctly lobed than in *aquatica* or *nigra*, and more ſinuated or angular beſides, than in any of the three laſt deſcribed. The *acorns* are almoſt globular, with a very ſhallow cup.

Section 4.—*Leaves ſinuated, with pointed lobes.*

56. Q. *hemiſphærica.* Hemiſpherical Oak. "Bartram's Travels 320." Willd. n. 49. Purſh n. 12. (Q. aquatica maritima; Michaux Querc. n. 11. t. 20. f. 2.)—"Leaves evergreen, oblong-lanceolate; undivided, three-lobed, or ſinuated; ſmooth on both ſides; lobes pointed." *Willd.*—Native of Georgia and Florida. Some of the *leaves* are very deeply three-lobed, or pinnatifid; others linear-oblong and undivided. Willdenow ſays they are evergreen, and that the *foliage* of the young plant is ſo like *Q. Phellos*, our firſt ſpecies, as to be hardly diſtinguiſhable. Michaux, however, aſſerts this ſuppoſed ſpecies to be but a maritime variety of *aquatica*, and Purſh thinks it a young plant of that kind.

57. Q. *elongata.* Downy-leaved Oak. Willd. n. 50. Ait. n. 14. (Q. falcata; Michaux Querc. n. 16. t. 28. Purſh n. 22. Q. diſcolor; Ait. ed. 1. v. 3. 358.)—Leaves downy beneath, ſinuated, with three or more ſomewhat falcate, briſtle-pointed lobes; the terminal one elongated, jagged. Calyx hemiſpherical.—In ſandy ſoil, near the ſea-coaſt; from New Jerſey to Georgia, flowering in May. A very large *tree*, commonly called Spaniſh Oak; in the ſouthern ſtates, Red Oak. *Purſh.* The height of the *tree* is fifty or ſixty feet. *Leaves* on long ſtalks; obtuſe or rounded at the baſe; deeply lobed, or in ſome meaſure palmate; the lobes often recurved, or ſickle-ſhaped; taper-pointed, and more or leſs notched at the end, each ſegment tipped with a long briſtle. *Acorns* ſmall, roundiſh; its cup hemiſpherical, with

lax

lax fcales. The *leaves* of young trees are faid to be very like thofe of *triloba*, n. 54.

58. Q. *tinctoria*. Dyers' Oak, Black Oak, or Quercitron. Willd. n. 51. Ait. n. 15. Purfh n. 16. (Q. tinctoria angulofa; Michaux Querc. n. 13. t. 24. Q. difcolor; Willd. Arb. 274.)—Leaves downy beneath, obovate-oblong, dilated, widely finuated; lobes fhort, obtufe, flightly toothed, briftle-pointed. Calyx of the fruit flat underneath. Nut globofe.—In all large woods, particularly in the mountainous parts, from New England to Georgia, flowering in May. It is one of the largeft trees of the American foreft, highly valuable for its timber, as well as bark, which laft is fo very fuperior in tanning to any other fpecies of Oak. *Purfh.* Michaux fays, this Oak is found only in a good foil, always at a diftance from the fea; attaining its greateft fize, which is eighty feet in height, and eight in diameter, in the vallies between the high mountains of North Carolina. The bark is ufed by tanners, throughout the north and weft parts of the United States. It gives a yellowifh colour, whence the name of Quercitron, and which enhances the value of the leather. The bark, bruifed and powdered, was in great requeft among dyers in France, before the war interrupted this branch of commerce. The *leaves* are confpicuous for their broad, angular, abrupt figure, a fpan long, and nearly as wide, with fhallow finufes, and briftle-tipped angles. *Acorns* almoft feffile, globular, with a fcaly, fhallow, flattifh cup.

59. Q. *difcolor*. Sinuous Dyers' Oak. Willd. n. 52. Purfh n. 17. Sm. in Abbot's Inf. v. 2. 111. t. 56. (Q. tinctoria finuofa; Michaux Querc. n. 13. t. 25. Q. virginiana, venis rubris muricata; Pluk. Phyt. t. 54. f. 5.)—Leaves downy beneath, oblong, pinnatifid; leaves oblong, toothed, briftle-pointed. Calyx turbinate. Nut ovate.—In large forefts, from Pennfylvania to Carolina, flowering in May. This refembles the preceding and *Q. coccinea*, n. 61. The young expanding *leaves* are covered with white down on both fides, which is not the cafe with either *rubra* or *coccinea*. *Purfh.* This differs from the laft in having much more finuated, or pinnatifid *leaves*, and larger, more ovate, *acorns*, whofe cups are turbinate, or tapering at the bafe. The qualities of the wood and bark probably agree with the *tinctoria*, or Michaux, who confiders the prefent plant as but a variety, would have mentioned the contrary.

60. Q. *rubra*. Mountain Red Oak. Linn. Sp. Pl. 1413. Willd. n. 53. Ait. n. 16. Purfh n. 20. Michaux Querc. n. 20. t. 35, 36. Abbot's Inf. v. 2. 205. t. 103. (Q. efculi divifurâ, foliis amplioribus aculeatis; Pluk. Phyt. t. 54. f. 4.)—Leaves fmooth, oblong, finuated, on long ftalks; lobes acute, fharply toothed, briftle-pointed. Calyx of the fruit flat underneath. Nut ovate.—Native of forefts on a fertile foil, from Canada to Pennfylvania, and in all the country weft of the Allegany mountains, bloffoming in May. It was cultivated by Miller before 1739, and is to be found in feveral plantations. A large and handfome timber *tree*, of rapid growth; its *wood* highly ufeful for building and for carriages; and the *bark* is faid by Michaux to be the very beft known for tanning, the European tanners, fettled in America, having found it, by experiment, more efficacious than any of the oak barks of Europe. The *tree* is ninety or one hundred feet high. *Leaves* four or five inches long, on *footftalks* about half that length; unequally finuated or pinnatifid, with rather fpreading, but not remote, lobes, whofe ends are very acute, as well as, here and there, fharply toothed, each tooth and point tipped with a long briftle. *Acorns* rather large, ovate, with a fhortifh flat-bottomed cup. The *leaves* turn of a deep red in autumn, which hue is common to moft American trees and fhrubs, in a greater or lefs degree. Purfh fays, this is exclufively known by the name of Red Oak, though various others are fo denominated in feveral parts of America.

Q. *ambigua*, Michaux Arb. v. 2. 120. t. 24. Purfh n. 19, is fuppofed by the latter to be a hybrid between this and the following.

61. Q. *coccinea*. Scarlet Oak. Willd. n. 54. Ait. n. 17. Purfh n. 18. Michaux Querc. n. 18. t. 31, 32. (Q. rubra β; Ait. ed. 1. v. 3. 357.)—Leaves fmooth, oblong, deeply and widely finuated, on long ftalks; lobes divaricated, acute, fharply toothed, briftle-pointed. Calyx of the fruit turbinate, half as long as the nut.—Native of woods, on a fertile foil, from New England to Georgia, bloffoming in May. This was one of the firft American trees brought to Europe, having been cultivated before the end of the 17th century, by bifhop Compton, as well as by the firft earl of Portland. The bright red of the foliage in autumn gives the tree a beautiful and ftriking appearance, both in its native forefts and our European plantations. It nearly equals the preceding in fize; the *wood*, according to Michaux, is better, but the *bark* lefs valuable. The *leaves* are larger, with deeper, more rounded, finufes, and more diftant lobes. *Acorns* half covered by the deeper, more turbinate, cup.

62. Q. *Catefbæi*. Barren Scrub Oak. Willd. n. 55. Purfh n. 21. Michaux Querc. n. 17. t. 29, 30. (Q. rubra β; Sm. in Abbot's Inf. v. 1. 27. t. 14. Q. efculi divifura, foliis amplioribus aculeatis; Catefb. Carol. v. 1. t. 23.)—Leaves fmooth, oblong; wedge-fhaped at the bafe; deeply and widely finuated, on fhort ftalks; lobes three or five, divaricated, acute, two or three-cleft, briftle-pointed. Calyx of the fruit turbinate, half as long as the nut.—Native of dry barren ground in Maryland, Virginia, Carolina, and Georgia, abundantly, flowering in May. This fpecies is fhrubby, not above fifteen feet high; its *wood* of a bad quality, ufed only for firing. The fhortnefs of the *footftalks*, and the fewnefs of the lobes of the *leaves*, added to their acute bafe, are fufficient botanical diftinctions between the prefent and the two laft, efpecially as the fize and quality of the tree are fo unlike thofe fpecies.

63. Q. *paluftris*. Marfh, or Pin, Oak. Willd. n. 56. Ait. n. 18. Purfh n. 23. Michaux Querc. n. 19. t. 33, 34.—Leaves fmooth, oblong, deeply and widely finuated, on long ftalks; lobes diftant, parallel, acute, fharply toothed, briftle-pointed; forks of the veins denfely woolly beneath. Calyx of the fruit flattened. Nut nearly globofe.—Native of low fwampy woods, from New England to Pennfylvania, and in the Illinois country, flowering in May. Meffrs. Frafer are recorded as having brought this fpecies to England in 1800, but it was previoufly cultivated in Holland and France. This is a large *tree*, whofe wood is tough, ufed for making fpokes of wheels. The *leaves* are fmaller than thofe of *rubra* or *coccinea*, and with more numerous lobes than *Catefbæi*; their finufes rounded and very wide, and the forks at the origin of their veins marked by a tuft of glandular hairs. The *acorns* are fmall, globular, with fhallow cups, and generally very abundant.

64. Q. *acutifolia*. Pointed-leaved Mexican Oak. Willd. n. 57. Nee in Annal. Scient. Nat. v. 3. 267. Fifch. Mifc. Hifp. v. 1. 102. *Willd.*—"Leaves ovato-lanceolate, finuated, taper-pointed; unequal at the bafe; lobes toothed, briftle-pointed; forks of the veins villous beneath. Fruit racemofe."—Native of New Spain, in the road from Acapulco to Mexico. This is the largeft of all the Oaks in New Spain. *Trunk* thick, twenty-five feet high, ornamented with a denfe head of innumerable *branches*. *Leaves* from five to feven inches long, an inch and a half or two inches

inches broad, their *footſtalks* an inch in length; ovate and unequal at the baſe, gradually contracting upwards to a ſharp point, ſinuated, beſet with awl-ſhaped teeth; green and ſhining above; reddiſh and veiny beneath, the forks of the veins villous. *Female flowers* in axillary four-flowered cluſters, (or rather, we preſume, *ſpikes.*) *Germens* ovate. *Acorns* ſmall, ſcarcely ſo big as a pea, nearly covered by the cup, which is clothed with blackiſh ſcales. *Nee.*

65. Q. *candicans.* Hoary Mexican Oak. Willd. n. 58. Nee in Annal. Scient. Nat. v. 3. 277. Fiſch. Miſc. Hiſp. v. 1. 115. *Willd.*—"Leaves ovate, ſinuated; white and downy beneath; lobes toothed, briſtle-pointed."—Native of New Spain, in ſandy ground near Tixtala. A *tree* of a middling ſize, with a denſe head of upright *branches. Leaves* nine inches long, four wide, tapering at each end, ſinuated, with briſtle-pointed teeth; green and ſmooth above; white and downy underneath. *Footſtalks* four lines in length. *Flowers* and *fruit* not obſerved. *Nee.*

66. Q. *ilicifolia.* Holly-leaved, or Bear Oak. "Wangenh. Amer. 79. t. 6. f. 17." Willd. n. 59. Ait. n. 19. (Q. Baniſteri; Michaux Querc. n. 15. t. 27. Purſh n. 24. Q. aquatica? Sm. in Abbot's Inf. v. 2. 157. t. 79?)—Leaves obovate-wedge-ſhaped, with three or five deep briſtle-pointed lobes, entire; downy beneath. Fruit ſtalked, in pairs.—Found in dry barren fields, and on mountains, from New Jerſey to Virginia, flowering in May; covering, wherever it occurs, large tracts of ground, thence termed Oak-barrens. It is known by the name of Bear Oak, Black Scrub Oak, and Dwarf Red Oak. *Purſh.* A *ſhrub* four to ſix feet, occaſionally more, in height, with downy *branches. Footſtalks* downy, near an inch long. *Leaves* two inches, or two inches and a half long, and near two wide, tolerably uniform, acute at the baſe, cut into five, rarely but three, deep divaricated, broad, acute lobes, entire at the margin, and ſcarcely toothed at the ſummit, though tipped with one or two briſtles; the upper ſide green, veiny, and ſmooth; the under pale, and finely downy. *Female flowers* in pairs, on thick, ſolitary, axillary, downy *ſtalks*, much ſhorter than the footſtalks. *Acorns* about half an inch long, nearly globular, half covered by their ſcaly hemiſpherical cups. Michaux thinks this ſpecies would ſerve well for making quick hedges. A ſpecimen from Kalm, unnamed, is in the Linnæan herbarium.

67. Q. *Pſeudo-ſuber.* Baſtard Cork Oak. "Santi Viagg. 156. t. 4." Spreng. Antiq. Bot. 16. t. 1. Willd. n. 60. Desfont. Atlant. v. 2. 348.—Leaves ovate-oblong, ſinuated, hoary beneath; lobes numerous, pointed, entire. Bark fungous, cracked. Nut ovate. Calyx muricated, with lax, recurved, linear ſcales.—Native of the mountains of Tuſcany, Spain, and Barbary. Desfontaines gathered it on mount Atlas, and the abbé Durand near Tangier. A *tree* fifty or ſixty feet high, whoſe *bark* is corky, though leſs ſo than in *Q. Suber*, n. 33. Young *branches* downy or hoary, ſometimes ſmooth, ſtriated. *Leaves* deciduous, an inch and a half to three inches long, an inch or an inch and a half wide, acute; entire and ſlightly heart-ſhaped at the baſe; ſomewhat dilated upwards, and bordered with numerous, uniform, ſmall, broad, acute, lobes or ſerratures, ſeparated by roundiſh ſinuſes; upper ſurface green and ſmooth; under glaucous, hoary, or ſomewhat downy. *Acorns* on ſhort ſtalks, ovate, above an inch long, half covered by the cup, which is downy, and clothed with lax bluntiſh ſcales, recurved at their tips. Desfontaines ſays the *leaves* of young trees are deeply ſinuated and ſerrated; thoſe of old ones more ſlightly ſo. In our ſpecimens from Durand and Brouſſonet, the under ſide is ſcarcely downy, except a denſe fringe to the mid-rib. The tranſverſe veins are more numerous, ſtraight, and parallel, than in Sprengel's plate. *Footſtalks* rather above half an inch long, ſmooth or downy. *Acorns* nearly ſeſſile, crowded about the ends of the branches. Yet we think it muſt be, at leaſt, the plant of Desfontaines.

68. Q. *Aegilops.* Great-prickly-cupped Oak, or Velanida. Linn. Sp. Pl. 1414. Willd. n. 61. Ait. n. 20. Mill. Ic. t. 215. Olivier's Travels, Engliſh edition, v. 2. 44. t. 13. (Q. orientalis, caſtaneæ folio, glande recondita in cupula craſſa et ſquamoſa; Tourn. Cor. 40. Velani; Tourn Voy. v. 1. 128. Glans Cerri; Dalech. Hiſt. v. 1. 7.)—Leaves ovate-oblong, with briſtle-pointed tooth-like lobes; hoary beneath. Calyx of the fruit very large, hemiſpherical, with lanceolate, elongated, ſpreading ſcales.—Native of the Levant. Miller cultivated this Oak in 1731. The *tree* is not ſo lofty as ſome other ſpecies, nor is the *wood* much eſteemed, or uſed, but in cabinet work. *Leaves* ſtalked, about three inches long, bright green; a little downy at the back; their edges, as in the laſt, very coarſely and acutely ſerrated, rather than lobed, each tooth tipped with a briſtly point. *Acorn* large, ſhort, a little hollow at the top. *Cup* ſeſſile, woody, two or three inches in diameter, from the projection of its numerous, oblong, thick ſcales. Theſe cups are uſed, as well as the gall-nut, (ſee n. 40.) by the Orientals, Italians, and Engliſh, in dyeing, and are a conſiderable article of commerce. Tournefort ſays the modern Greeks call theſe acorns *Velani*, a corruption of *βάλανι*, and the tree *Velanida.* The young acorns and cups, gathered from the tree, are much more eſteemed than ſuch as fall of themſelves, when fully grown, and ſell for twice the price of the latter. Dalechamp, Lobel, and Bauhin, miſtake the unripe cup and acorn of this ſpecies, as belonging to *Q. Cerris*, n. 83.

Sect. 5.—*Leaves ſinuated, with blunt or pointleſs lobes.*

69. Q. *alba.* White Oak. Linn. Sp. Pl. 1414. Willd. n. 62. Ait. n. 21. Purſh n. 29. Michaux Querc. n. 4. t. 5. (Q. alba virginiana; Cateſb. Carol. v. 1. t. 21. f. 2.)—Leaves oblong, deeply pinnatifid; glaucous beneath; lobes linear-oblong, obtuſe, entire, dilated upwards. Fruit ſtalked. Calyx depreſſed, warty.—Native of woods, on a fertile ſoil, from New England to Carolina, flowering in May; cultivated here in 1724, by Mr. Furber. Purſh ſays it is one of the moſt abundant and uſeful of its genus, in America, and grows in the middle States to an immenſe ſize. The adult *leaves* are nearly a ſpan long, deeply and elegantly pinnatifid; tapering and acute at the baſe; gradually dilated upward; ſomewhat abrupt, though three-lobed, at the end; their lobes all entire, blunt, pointleſs, veiny; the upper ſurface green and ſhining; the under opaque and glaucous; not downy, as Linnæus and Willdenow define them, except perhaps when young. *Footſtalks* ſtout, angular, half an inch, or more, in length. *Fruit-ſtalks* twice as long, each bearing one or two, laterally ſeſſile, ovate *acorns*, full an inch in length, with a ſhort tuberculated cup. Michaux obſerves, that this Oak is preferred to all others in America, for building houſes and ſhips; as well as for caſks. The wood is ſo tough and pliable, as to ſerve for making baſkets and brooms. The acorns are ſweet, and Parkinſon records that, in his time, the Indians were ſaid to obtain from them, by boiling, an oil which they uſed in cookery. A ſuppoſed variety, called *repanda*, is figured by Michaux, in which the *leaves* are merely waved, not lobed; and green on both ſides, though downy beneath. With this we are unacquainted, as alſo with Willdenow's intermediate variety, called *pubeſcens.*

70. Q. *Eſculus.* Italian, or Small-prickly-cupped Oak. Linn.

Linn. Sp. Pl. 1414. Willd. n. 63. Ait. n. 22. (Phagus esculus, mas et foemina; Dalech. Hist. 5.)—Leaves ovate-oblong, sinuated, smooth; paler beneath; segments bluntish; somewhat angular at the base. Fruit nearly sessile. Calyx scaly, hemispherical.—Native of the south of Europe. Cultivated by Miller in 1739; hardy in our gardens, flowering in May. *Aiton.* So little attention has been paid to this species by botanical writers, that we can find no certain description nor figure of it, except in Dalechamp. We even doubt whether the plant intended in the first edition of the Hortus Kewensis be the true one; yet this seems what Willdenow meant in his *Arbores*, or Baumzucht, though he does not cite either that work or Hort. Kew. in his Sp. Pl. What Linnæus briefly described in his Mantissa, 496, under the name of *Esculus*, seems to be *Cerris*, with which latter the description, copied by Willdenow, and the specific character extracted therefrom, well agree; but not at all with the original and authentic specimen of *Esculus* in the Linnæan herbarium. By this last alone can any one determine what Linnæus had in contemplation, when he wrote both editions of Species Plantarum, and we shall here describe the specimen. The *branch* is angular, furrowed, and smooth. *Leaves* scattered, aggregate at the top, from two to three inches long, and one and a half, at most, in breadth; smooth and shining above; paler, rather glaucous, and almost equally smooth, beneath, with finely reticulated veins; tapering at the very base, but just above it dilated, angular, and in some measure cordate, as Dalechamp's figures more distinctly shew. The summit is obtuse, and the margin cut unequally, on each side, into about five broad, blunt, entire, tooth-like serratures, or small lobes. *Footstalks* near an inch long, destitute of the long, linear, tufted, stipulaceous scales, or *ramenta*, found in *Aegilops, Cerris*, and *austriaca* hereafter mentioned. Young *acorns* axillary, nearly sessile, solitary or in pairs; the cups scaly, the size of small peas. Dalechamp represents the full-grown acorns about an inch long, embraced by an hemispherical scaly cup, about one-third that length. He says they are sweet and eatable, brought to table roasted by the Spaniards, as well as the rustic Italians, but sometimes found to affect the head, like darnel. The name *Esculus* is derived by etymologists from *esca*, food, and is commonly taken for the Beech-tree, ordinary readers of Virgil's Georgics not distinguishing one from the other; just as the *Cicada* of that poet has been vulgarly supposed the grasshopper. The Delphin edition of the Georgics has the above word *Aesculus*, as Linnæus has adopted it, unwarrantably, for the generic appellation of the Horse Chesnut; and the editors rightly observe, that some persons confound it with *Fagus*, the Beech. Our *Q. Esculus* is most probably the φηγος of Dioscorides, which he expressly says is a kind of Oak. See FAGUS.

71. Q. *Robur*. Common British Oak. Linn. Sp. Pl. 1414. Sm. Fl. Brit. n. 1. Engl. Bot. t. 1342. Woodv. Med. Bot. t. 126. Mart. Rust. t. 10, var. pedunculata. (Q. pedunculata; Willd. n. 65. Ehrh. Arb. 77. Pl. Off. 168. Ait. n. 24. Q. foemina; Roth. Germ. v. 1. 408. v. 2. p. 2. 488. Fl. Dan. t. 1180. Q. racemosa; Lamarck Dict. v. 1. 715. Q. cum longo pediculo; Bauh. Pin. 420. Q. hemeris; Dalech. Hist. 4. Quercus; Fuchs. Hist. 229. Matth. Valgr. v. 1. 184. Duham. Arb. v. 2. t. 47. Tabern. Kreuterb. 1374. Oak-Tree; Hunt. Evel. Sylv. 69, with a plate.) Leaves deciduous, oblong, smooth, dilated upwards; sinuses rather acute; lobes obtuse. Stalks of the fruit elongated. Nut oblong.—Common in woods and hedges, throughout the more temperate parts of Europe, flowering in April. Nothing is more general in the woods and hedges of Britain, nor more important as an object of national culture. The *tree* is the most ornamental to our plantations and landscapes; the *wood* more useful than any other, for its hardness, toughness, and durability; the *bark* peculiarly valuable for tanning. The *leaves* are alternate, with short, or scarcely any, footstalks, obovate-oblong, smooth, irregularly sinuated, with obtuse, rounded, pointless, entire lobes; their upper side of a rich shining green; the under paler, slightly glaucous; the base somewhat heart-shaped, or auricled. *Clusters*, or rather *spikes*, axillary; the male ones lax, pendulous, many-flowered, yellow; female on stalks an inch and a half or two inches long, composed of about three, laterally sessile, green *flowers*, surmounted by a naked elongation of the common stalk. *Calyx* of the male membranous, bell-shaped, mostly five-cleft, with about ten *stamens*; of the female coriaceous, scaly, downy, globose, at length hemispherical, woody, entire. *Germen* ovate. *Style* short, cylindrical. *Stigmas* three. *Acorn* elliptic-oblong, thrice the length of the cup. This being what Linnæus, as well as British botanists, always considered as *Quercus Robur*, the superior quality of its wood, no where better understood than here, entitling it, above all others, to that appellation, we cannot, on any account, submit to the errors of Willdenow, or any other writer, who has been pleased to change the name; and we feel equal surprise and regret that the excellent editors of the new Hort. Kew. should, in this case at least, have carried their implicit conformity so far. We trust they will hereafter correct themselves in this point, as well as in the barbarous name *Araucaria*, retained by Willdenow, contrary to all propriety, for DOMBEYA. See that article.

72. Q. *sessiliflora*. Sessile-fruited Oak. Salisb. Prodr. 392. Sm. Fl. Brit. n. 2, α. Engl. Bot. t. 1845. (Q. Robur; Willd. n. 64. Ait. n. 23. Lamarck Dict. v. 1. 717. Mart. Rust. t. 11, var. sessilis. Q. sessilis; Ehrh. Arb. 87. Q. platyphyllos mas et foemina; Dalech Hist. 2, 3. Q. latifolia mas, quæ brevi pediculo est; Bauh. Pin. 419. Raii Syn. 440.)—Leaves on longish footstalks, deciduous, oblong, smooth; sinuses opposite, rather acute; lobes obtuse. Fruit sessile. Nut oblong.—Native of woods and hedges, in the temperate parts of Europe; rather less common in England than the preceding, flowering in April or May. Professor Martyn has rightly corrected Miller, who mentions the present as the common Oak of this country, and the former as rare. Why the German botanists, like Lamarck, take this for *Robur*, is difficult to understand, unless the measure originated in inattention to the qualities, as well as history, of the trees. The *wood* of our *sessiliflora*, in which name we gladly follow Mr. Salisbury, is of far less value than the true British Oak, and the importance of distinguishing the two species becomes, therefore, the more obvious. The *leaves* grow on longer *footstalks*, and are generally more equally and regularly pinnatifid. The *female flowers*, and the *acorns*, are almost perfectly sessile. In English Botany four *stigmas* are delineated; but we know not how far that character, which would be an excellent one, is constant.

73. Q. *pubescens*. Downy-waved-leaved Oak. Willd. n. 66, excluding the reference to Fl. Brit. (Q. Robur lanuginosa; Lamarck Dict. v. 1. 717. Robur prima; Clus. Hist. v. 1. 18.)—Leaves oblong-obovate, stalked, sinuated; downy beneath; lobes obtuse, angular, wavy; somewhat heart-shaped and unequal at the base. Fruit nearly sessile.—Native of France, Austria, Hungary, Tartary, and of the Val d'Aost, Piedmont, in which last place it was gathered by Mr. Davall. We have seen a tree of

this species, growing on the north lawn at Holkham, Norfolk, the seat of Mr. Coke, where it was planted by his ancestor, the earl of Leicester; but no British writer seems acquainted with the species in question, though unquestionably distinct. Willdenow justly says it is like his *Robur*, our *sessiliflora*, but abundantly different, being of more humble stature, with smaller *leaves*, downy beneath, very hoary and white in the spring, somewhat heart-shaped at the base, and with smaller *fruit*. To this we would add, the *leaves* are remarkably undulated, especially in drying, and their upper surface is more or less besprinkled with very minute, scattered, starry hairs. The *fruit* in Mr. Davall's specimens is quite sessile, either solitary, or in one instance accompanied by two abortive ones; in those from Holkham the female *flowers* are more or less elevated, three together, on a thick downy *stalk*. Hence perhaps Willdenow terms the *fruit* subsessile. The scales of the *cup* in both are downy, thin, flat, and closely imbricated.

A variety of this, with deeper segments, and of more humble growth, is Robur tertia, Clus. Hist. v. 1. 18. f. 1. Of this a specimen, erroneously named *Cerris*, and pinned to *Esculus*, n. 70, above described, is preserved in the Linnæan herbarium.

74. Q. *atro-virens*. Durmast Oak. Mart. Rust. t. 12. (Q. sessiliflora β; Sm. Fl. Brit. 1027. Q. pubescens; Ait. n. 25, but not of Willdenow. Q. Robur nigra; Lamarck Dict. v. 1. 717. Chêne noir; Secondat du chêne. 3. t. 5?)—Leaves elliptic-oblong, stalked, sinuated; downy and hoary beneath; lobes numerous, obtuse, even, and entire; base equal. Fruit sessile.—Native of France and the south of England, flowering in April and May. Professor Martyn had his specimens from the New Forest, Hampshire, where it is known by the name of the Durmast Oak. The whole *tree* is well described by him as having much the air of a chesnut, and being of freer growth than the true *Robur;* the *bark* lighter coloured and smoother; the *wood* not so strong, nor of so firm a texture. The *leaves* are less deeply, but more copiously, sinuated, with five, six, or seven short lobes at each side; the under surface downy, and of a hoary grey, with purplish ribs. The *foliage* appears later than in either of our common Oaks, and lasts longer, sometimes the whole winter. *Acorns* sessile, rather large. Lamarck's description, indicated above, accords exactly with our English plant, to which also, we presume, the synonym of Secondat must belong, though we have not been able to consult his book. A more accurate study of this genus has led us to agree with our departed friend Willdenow, in distinguishing the Durmast Oak from our *sessiliflora*, but he errs in referring it to his *pubescens*, and has led Mr. Aiton into the same mistake. Its *leaves* are more oblong, less deeply sinuated, flat, not undulated; the under side whiter, with coloured veins. The *fruit* larger, and more decidedly sessile.

75. Q. *pyrenaica*. Pyrenean Oak. Willd. n. 67.—"Leaves oblong, pinnatifid, stalked; downy beneath; somewhat heart-shaped and unequal at the base; lobes obtuse, slightly toothed. Fruit stalked."—Native of the Pyrenees. The *leaves* are larger than in *sessiliflora*, stalked, deeply sinuated; densely downy underneath. *Footstalks* downy. *Acorns* four, sessile on one common elongated stalk. It differs abundantly from *pubescens*, in having much larger *leaves*, sinuated in a pinnatifid manner, very downy beneath; and stalked *fruit*. Such is Willdenow's account. We have seen no specimen. Can this be our above-mentioned variety of *pubescens?*

76. Q. *faginea*. Beech Oak. Lamarck Dict. v. 1. 725. Willd. n. 68. (Phellodrys alba angustifolia, folio serrato; Dalech. Hist. 25.)—Leaves on short downy stalks, obovate, with numerous, uniform, shallow lobes; downy beneath; somewhat heart-shaped and unequal at the base. Fruit sessile.—Native of Spain and the south of France. *Leaves* small, an inch and half long, deciduous, obovate, very slightly sinuated, or, more properly speaking, coarsely toothed, the lobes being very short, equal, and obtuse; the upper side polished and smooth; the under white and downy. *Footstalks* downy. *Fruit* sessile. *Willdenow*. In the Linnæan herbarium are specimens, gathered by Baron Alstroemer in Spain, which answer extremely well to the above description, and not amiss to the figure of Dalechamp, which Lamarck cites with hesitation. In these however, the lobes, or teeth, are acute, and the upper surface covered with minute starry hairs. There are also long, linear, recurved, ramentaceous *stipulas*, that are soon deciduous. We do not scruple to consider this as Lamarck's plant at least, and probably Willdenow's.

77. Q. *lobata*. Round-lobed Mexican Oak. Willd. n. 70. Nee in Annal. Scient. Nat. v. 3. 277. Fisch. Misc. Hisp. v. 1. 116. *Willd.*—"Leaves obovate-wedge-shaped, sinuated, smooth; lobes toothed."—Native of New Spain. *Branches* furrowed, alternate. *Leaves* four inches long, two inches and a half wide, smooth, alternate, orbicular towards the extremity; wedge-shaped at the lower part; sinuated; the lobes rounded, obtuse, toothed. *Footstalks* slender, three or four lines in length. *Nee.*

78. Q. *obtusiloba*. Blunt-lobed Iron Oak. Michaux Querc. n. 1. t. 1. Pursh n. 25. (Q. stellata; Willd. n. 71. Ait. n. 26. Wangenh. Amer. 78. t. 6. f. 15.)—Leaves oblong, sinuated, roughish on both sides; lobes obtuse; the upper ones dilated, abrupt, slightly divided. Calyx of the fruit hemispherical.—Found in most of the upland forests, from Canada to Florida, blossoming in May. The *tree* is fifty or sixty feet high, spreading, its timber of great value for ship-building. The whiteness of the *bark*, as in *Q. alba*, causes both these species to be called White Oak by the Americans, who nevertheless know how to distinguish their timber. The *leaves* of the present are roughish beneath, with minute rusty hairs, not hoary; and their upper surface appears to partake occasionally, if not always, of the same sort of pubescence. Their length is from three to five inches; the base wedge-shaped, spreading upwards into two smaller, opposite, rounded lobes, beyond which the *leaf* dilates, suddenly and widely, into a pair of broad, slightly cloven, or emarginate, lobes, and, after another sudden contraction, ends in a terminal three-cleft one. The margin is entire throughout. *Footstalks* short, downy. *Acorns* three or four on a short stalk, of a middling size, scarcely exceeding our British Oaks, elliptical, about half enclosed in the scaly cup.

79. Q. *lyrata*. Over-cup Lyrate Oak, Swamp-post, or Water White Oak. Walt. Carol. 235. Willd. n. 72. Ait. n. 27. Pursh n. 28. Michaux Querc. n. 3. t. 4.—Leaves oblong, deeply sinuated, smooth; much contracted in the middle; lobes acute; the upper ones dilated, angular, and abrupt. Calyx of the fruit globose, muricated, nearly covering the nut.—Native of swamps, from Carolina to Florida, and on the Missisippi; flowering in May. *Pursh.* Michaux says, that though he always found this species in watery places, its growth, in a dry nursery-ground, exceeded that of most other species planted with it. He gives fifty or sixty feet as the height of the *tree;* Pursh from eight to fifteen only. The smooth fine-green *leaves* have more acutely-angular lobes than the foregoing, and are remarkably contracted about the middle. *Acorn* globose, nearly covered by the globular prickly cup.

80. Q. *macrocarpa*. Large-fruited Oak, or Over-cup White Oak. Willd. n. 73. Purſh n. 26. Michaux Querc. n. 2. t. 2, 3. Leaves oblong, lyrate; downy beneath; terminal lobe very large, three-cleft, ſinuated. Calyx of the fruit hemiſpherical, ſcaly, fringed with briſtles.—Found on dry ſlate or limeſtone hills, in all the countries to the weſt of the Allegany mountains, flowering in May. A large *tree*, whoſe *wood*, according to Purſh and Michaux, is very excellent. The *bark* of the young branches is corky. In wet ſituations the whole plant languiſhes, and becomes covered with lichens. The *leaves* are a foot long, more truly and preciſely lyrate than thoſe of the laſt; but the ſpecific name of the preſent is excellent, the *acorns* being larger than thoſe of any other known American ſpecies. Their form is oval, their length two inches, and they are half covered by the cup, ſeveral rows of whoſe broad ſcales end in long briſtles, making a rigid fringe.

81. Q. *olivæformis*. Olive-ſhaped Moſſy-cup Oak. "Michaux Arb. v. 2. 32. t. 2." Purſh n. 27.—"Leaves oblong, ſmooth; glaucous beneath; deeply and unequally pinnatifid. Fruit elliptic-ovate. Calyx cup-ſhaped, fringed."—Obſerved by Michaux on the banks of Hudſon's river, and in the weſtern parts of New York; by Purſh in Pennſylvania and Virginia, on iron-ore hills; flowering in May. This is deſcribed as a large *tree;* the *foliage* handſome, ſomewhat reſembling that of the laſt. We have not examined either a ſpecimen or figure. Willdenow does not mention this ſpecies.

82. Q. *crinita*. Hairy-cupped Oak. Lamarck Dict. v. 1. 718, ε. Olivier's Travels, Engliſh edition, v. 2. 5. t. 12. (Q. Tournefortii; Willd. n. 74. Q. orientalis latifolia, foliis ad coſtam pulchrè inciſis, glande maximâ, cupulâ crinitâ; Tourn. Cor. 40. Voy. v. 2. 172.)—Leaves on long ſtalks, oblong, deeply pinnatifid; downy beneath; lobes lanceolate, bluntiſh, nearly entire. Calyx of the fruit hemiſpherical, downy, briſtly.—Gathered by Tournefort in vallies and plains near Tocat, in Armenia. Olivier ſays it is met with throughout great part of Aſia Minor and Syria. The timber is brought to the arſenal of Conſtantinople, from the ſouthern ſhores of the Black Sea, and is alſo moſt commonly employed for the frame-work of houſes. The *tree* grows to a conſiderable height, and furniſhes excellent wood. This author, who takes the tree in queſtion for *Q. Cerris* of Linnæus, may, poſſibly, confound the real *Cerris* along with it, as Lamarck, though not without ſcruple, has combined them. Olivier's plate, however, very clearly repreſents the above plant of Tournefort; and Lamarck's excellent definition of the ſame, as variety ε of his *crinita*, is abundantly ſufficient to ſtamp it a ſpecies. "Leaves very ſoftly villous, deeply pinnatifid; their ſegments oblong, nearly ſimple, obtuſe, ſomewhat pectinate," (or parallel.) He ſays it is reported to grow wild in the province of Angoumois, and is a tree of handſome aſpect, remarkable for its ſoft, downy, broad *leaves*, cut very deeply into large ſegments, blunt at their extremity, often ſimple, ſometimes furniſhed with a few angles, or ſhort lobes, at their poſterior margin. *Acorns* ſeſſile, their cup briſtly, as in the Burgundy Oak (*Cerris*). Tournefort's ſpecimens agree with the Angoumois Oak, as it is called, ſeen by Lamarck in a cultivated ſtate at Godonvillier. We have ſeen no ſpecimen, but the above accounts are ſufficiently clear to admit of no doubt. Olivier's plate repreſents the *leaves* three or four inches in length, their ſegments about an inch long, almoſt all ſimple and undivided, bluntiſh, entire, more or leſs diſtant, each making an angle with the narrow linear border of the main rib. *Footſtalks* ſlender, an inch, more or leſs, in length, apparently ſmooth. *Acorns* lateral, about an inch long, elliptical, obtuſe, ſolitary, on ſhort ſimple ſtalks; the *cups* beſet with numerous ſoft taper briſtles, divaricated upwards and downwards, near half an inch long. Nothing is exhibited, or deſcribed, concerning the *ſtipulas*, which are very remarkable in the two following ſpecies.

83. Q. *Cerris*. Turkey Oak. Linn. Sp. Pl. 1415. Willd. n. 75. Ait. n. 28, γ. (Q. crinita α et β; Lamarck Dict. v. 1. 718. Q. haliphlæos; Juſſ. in Hort. Paris. Q. burgundiaca, calyce hiſpido; Bauh. Pin. 420. Cerris Plinii, majore glande; Lob. Ic. v. 2. 156. Dod. Pempt. 831. Ger. Em. 1345. Cerrus; Dalech. Hiſt. v. 1. 6, good.)—Leaves on very ſhort ſtalks, oblong, deeply and unequally pinnatifid; hairy beneath; lobes lanceolate, acute, ſomewhat angular. Stipulas longer than the footſtalks. Calyx of the fruit hemiſpherical, briſtly.—Native of France, Italy, and the Levant. Sometimes cultivated in England, but not commonly. This is a tall handſome *tree*, whoſe ſynonyms are much confounded by old writers with *Q. Aegilops*, n. 68, and by more recent botaniſts with the following. Its *leaves* are deeply pinnatifid in the manner of the foregoing; more or leſs unequally; but the lobes are more acute, pointed, and moſt generally angular, ſometimes remarkably lobed or compound. The under ſide differs eſſentially, in being neither downy nor hoary, but rough with minute, ſcattered, tawny, briſtly hairs; the upper, which is of a darker green, and rather ſhining, is alſo occaſionally roughiſh to the touch. *Footſtalks* rough, thick, hardly a quarter of an inch, ſometimes not a line, in length. *Stipulas* linear, acute, downy, from half an inch to an inch long, permanent, accompanied by an axillary tuft of ſimilar, but ſmaller, ſcales. The *acorns* we have not ſeen. They are repreſented ſeſſile, two or three together, large, oblong, with an hemiſpherical cup, which is ſhaggy with long briſtles, projecting in every direction. They are ſaid to be peculiarly bitter and auſtere.

Lamarck aſſerts, from his own obſervation, that the Q. orientalis latifolia, glande maximâ, cupulâ crinitâ, Tourn. Cor. 40, ſcarcely differs in any reſpect from this. If ſo, the term *latifolia* is not happily applied, unleſs Tournefort had alſo noticed, as in our laſt, the deep diviſions of the *leaves*, which are full as remarkable in the preſent ſpecies.

84. Q. *auſtriaca*. Auſtrian Oak. Willd. n. 76. (Q. Cerris; Hoſt. Syn. 520, α and β. Ait. n. 28. Q. crinita γ, cerris Linn.; Lamarck. Dict. v. 1. 718. Q. calyce hiſpido, glande minore; Bauh. Pin. 420. Cerrus; Cluſ. Hiſt. v. 1. 20, excellent. Cerri minoris ramulus cum flore; Ger. Em. 1346, with Cluſius's figure. Cerris Plinii minore glande; Lob. Ic. v. 2. 156. Ger. Em. 1345. Aegilops minore glande; Dod. Pempt. 831. Haliphloeos, Cerrus foemina; Dalech. Hiſt. v. 1. 7.)—Leaves on longiſh ſtalks, ovate-oblong, ſlightly but copiouſly ſinuated; downy and hoary beneath; lobes ſhort, ovate, acute, entire. Stipulas ſhorter than the footſtalks. Calyx of the fruit hemiſpherical, briſtly.—Native of Auſtria, Hungary, Carniola, Italy, and other parts of the ſouth of Europe, in ſtony mountainous places. It occurs not unfrequently in plantations of exotic trees, both in France and England, being generally miſtaken for *Q. Cerris*, from which nothing can be more certainly diſtinct. This *tree* is taller than the Common Oak, *Q. Robur*, and in favourable ſituations riſes perpendicularly to a conſiderable height, as Cluſius deſcribed it, though Lamarck ſays it is ſmaller, leſs handſome, more twiſted and knotty, than the laſt, as well as often hollow. The *wood* is whiter, ſofter, and leſs valuable, than *Q. Robur;* the *bark* grey, tolerably even. *Branches* forming

a round

a round and compact head. *Leaves* two or three inches long, acute, generally rounded and a little unequal at the base; their upper surface of a fine shining green, and nearly smooth; the under whitish, clothed with fine dense down; the margin cut, at each side, into four, five, or six, tolerably regular, rounded or ovate, acute, pointed, entire lobes, more or less deep, separated by round sinuses; the disk of the leaf being left entire, of a considerable width. *Footstalks* near an inch long, downy. *Stipulas* as in the foregoing, but smaller and shorter, usually about half the length of the footstalks. *Acorns* like those of the last, but smaller. The figures of Lobel, Dodonæus, and Ger. Em. 1345, do not well represent the *leaves* of this species, or indeed of the former: that of Clusius, adopted by the editor of Gerarde, in p. 1346, is perfectly correct. The cuts of Dalechamp, both of one and the other, are sufficiently expressive, and very correct as to the footstalks. The lobes of neither of these species are quite pointless, but rather more pointed, as well as acute, than those of *Esculus*, n. 70.

We have thus added eight species of *Quercus* to Willdenow's list. Those botanists who may take the trouble of following us with attention, will perceive that this valuable genus still requires elucidation, particularly with respect to the European, and, above all, the oriental kinds; some of which last, barely indicated by authors, we have been obliged to leave unexplained. Of the most common and important species, *Q. Robur*, we have seen in Mr. Coke's woods at Holkham, some striking varieties, at least, whose distinctions and qualities are well worthy of examination. Two of these have shorter *flower-stalks* than the common *Robur*, and one of them is three weeks earlier in coming into leaf than the other. The *footstalks* of both are longer than is usual in *Robur*. How far a difference of quality in the wood may accompany these botanical distinctions, we must refer to the inquiries of those who are interested in, and have the means of investigating, so important a subject, which is indeed of the first economical, and even national, consequence. It is much to be wished that the species of the Norway Oak, so valuable for floors, on account of its straightness, and freedom from knots, could be determined. Perhaps these circumstances are owing to its being drawn up straight, with few branches, in its close native forests, and therefore it may not be specifically different from one or other of our own species. Michaux, and other writers on the American Oaks, have taught us, that the pubescence of the *leaves* in this genus is of more specific importance than had previously been supposed, and we therefore have paid the more regard to it in discriminating some of the European kinds. The *flowers*, male and female, appear still to demand more precise investigation and comparison, than they have any where received. S.

Quercus, in *Gardening*, furnishes plants of the forest, deciduous, evergreen, ornamental tree-kinds, of which the species cultivated are, the common oak-tree (Q. robur); the willow-leaved oak-tree (Q. phellos); the chesnut-leaved oak-tree (Q. prinus); the black oak-tree (Q. nigra); the red oak-tree (Q. rubra); the white oak-tree (Q. alba); the Italian or small prickly-cupped oak-tree (Q. esculus); the great prickly-cupped oak-tree (Q. ægilops); the Turkey oak-tree (Q. cerris); the evergreen or holm oak-tree (Q. ilex); the holly-leaved evergreen oak-tree (Q. gramuntia); the cork-barked oak, or cork tree (Q. suber); and the kermes oak-tree (Q. coccifera).

Of the first there are several varieties; as with the acorns on long peduncles. This is found in the wilds of Kent and Sussex, where there are many large trees. The leaves are not so deeply sinuated, nor are they so irregular as in the common sort, but the indentures are opposite; they have scarcely any footstalks, but sit close to the branches; but the acorns stand upon very long footstalks. The timber of this sort is accounted better than that of the common oak, and the trees have a better appearance.

The broad-leaved evergreen oak, which grows upon the Apennines, and also in Suabia and Portugal. The leaves are broader, and not so deeply sinuated as those of the common oak; they are of a lighter green on their upper side, and pale on their under; have very short footstalks, and their points are obtuse; the acorns have very long footstalks, which frequently sustain three or four in a cluster.

The dwarf oak, which grows in the south of France and Italy, and is a low bushy oak, rises but six or seven feet high, sending out many slender branches the whole length. The leaves are oblong, and obtusely indented, about three inches long, and an inch and a half broad, standing upon slender footstalks; the acorns small, growing in clusters.

There are also many other varieties of common oak, which dealers in timber and woodmen distinguish by their use, qualities, and accidents, and to which they give different names; but these being merely local, and not founded on permanent characters, it is difficult to ascertain them.

In the second species they distinguish two sorts; one of which is called the Highland willow oak, and grows upon poor dry land; the leaves are of a pale green, and entire, shaped like those of the willow tree; the acorns are very small, but have pretty large cups. The other grows in low moist land, and rises to a much greater height; the leaves are larger and narrower, but the acorns are of the same size and shape. It is suggested, as probable, that their difference may be owing to the soil in which they grow. Martyn observes, that the latter becomes a large timber tree, and that there are said to be several varieties of it.

The third species has seemingly two varieties, one of which grows to a much larger tree than the other; but this may be occasioned by the soil, for the largest trees grow in rich low lands, where they become bigger than any of the North American oaks. The wood is not of a very fine grain, but is very serviceable; the bark is grey and scaly; the leaves are five or six inches long, and two inches and a half broad in the middle, indented on the edges with many transverse veins running from the midrib to the borders; they are of a bright green, and so nearly resemble those of the chesnut tree as scarcely to be distinguished from it. The acorns are very large, and their cups are short. The leaves of the other variety are not so large, nor so strongly veined; and the acorns are smaller, and a little longer. The different varieties are distinguished by the form of their leaves, which in the one is ovate, and in the other oblong.

The fifth sort has several varieties.

And in the ninth sort there are several varieties.

The tenth species has likewise several varieties, differing greatly in the size and shape of their leaves; but these will all arise from acorns of the same tree: even the lower and upper branches have very frequently leaves very different in size and shape; those on the lower branches being much broader, rounder, and their edges indented and set with prickles; but those on the upper long, narrow, and entire. The leaves are from three to four inches long, and an inch broad near the base, gradually lessening to a point; they are of a lucid green on their upper side, but whitish and downy on their under, and do not fall till they are thrust off

off by young leaves in the ſpring. The acorns are ſmaller than thoſe of the common oak, but of the ſame ſhape.

The twelfth ſpecies has alſo two or three varieties; one with a broad leaf, a ſecond with a narrow leaf, both evergreen; and one or two which caſt their leaves in autumn: but the broad-leaved evergreen is the moſt common. The leaves of this are entire, about two inches long, and an inch and quarter broad, with a little down on their under ſides, on very ſhort footſtalks: theſe leaves continue green through the winter till the middle of May, when they generally fall off juſt before the new leaves come out, ſo that the trees are often almoſt bare for a ſhort time. The acorns are very like thoſe of the common oak.

The exterior bark forms the cork, which is taken from the tree every eight or ten years; but there is an interior bark which nouriſhes them, ſo that ſtripping off the outer bark is ſo far from injuring the trees, that it is neceſſary to continue them: for, when the bark is not taken off, they ſeldom laſt longer than 50 or 60 years in health; whereas trees which are barked every eight or ten years will live 150 years, or more. The bark of a young tree is porous, and good for little: however, it is neceſſary to take it off, when the trees are twelve or fifteen years old, for without this the bark will never be good. After eight or ten years, the bark will be fit to take off again; but this ſecond peeling is of little uſe. At the third peeling, the bark will be in perfection, and will continue ſo for 150 years; as the beſt cork is taken from old trees. The time for ſtripping the bark is in July, when the ſecond ſap flows plentifully: the operation is performed with an inſtrument like that which is uſed for diſbarking the oak.

It is from the laſt ſpecies they collect the kermes, or ſcarlet grain, a little red gall, occaſioned by the puncture of an inſect called *coccus ilicis.* With this the ancients uſed to dye cloth of a beautiful colour.

Method of Culture.—Theſe trees are all capable of being raiſed from the ſeed or acorns, which, in the common oak, ſhould be gathered in autumn when quite ripe, juſt as they drop from the trees; but thoſe of moſt of the foreign oaks are generally procured from abroad, and ſold by the ſeedſmen.

All the ſorts ſhould be ſown as ſoon after they are obtained as poſſible, as they are apt to ſprout if they remain long out of the ground; and for their reception, a ſpot of light ground in the nurſery ſhould be prepared by digging or ploughing, dividing it into four feet wide beds, in which the acorns ſhould be ſown, either in drills, two inches deep, in five or ſix rows lengthwiſe of the bed; or rake the mould off the bed, the depth of two inches, into the alleys; then ſowing the acorns all over the ſurface, about two or three inches apart, preſs them down with the ſpade, and ſpread the earth evenly over them two inches thick. When they come up in the ſpring, they ſhould have occaſional waterings and weeding; and when the plants are one or two years old, it is proper to plant them out in nurſery-rows: this may be done in autumn, winter, or early in the ſpring, taking them carefully up out of the ſeed-bed, ſhortening their perpendicular tap-roots, and trimming off any lateral ſhoots from the ſtem, leaving their top perfectly entire; then planting them in lines two feet and a half aſunder, and fifteen or eighteen inches in the rows, where they ſhould ſtand, with the uſual nurſery care, till of a proper ſize for final planting out either as foreſt trees, or for ornament, training them up as full ſtandards, with clean ſtraight ſtems, and with their tops ſtill entire.

But in raiſing the ſtriped-leaved varieties of the common oak, and any particular variety of the other ſpecies, it ſhould be by grafting, (as they will not continue the ſame from ſeed,) which ſhould be performed upon any kind of oakling ſtocks raiſed from the acorns, and trained for ſtandards, as in other kinds.

With reſpect to the final planting out, it may be performed in all ſorts of deciduous oaks any time in open ſettled weather, from November till February or March; and in the evergreen kinds in October, November, or the ſpring; and in a mild open ſeaſon in any of the winter months.

When the trees of all the ſorts are from about three or four to ſix feet ſtature, they are proper for being planted out for good; though, as foreſt or timber trees, it is better to plant them out finally while they are quite young, as from two to three or four feet in height; or when planted immediately from the ſeed-bed, where they are to remain, it may be advantageons, as the very young oaks root more freely than older trees, and take a freer growth. Thoſe deſigned as foreſt or timber trees ſhould be planted in large open tracts of ground, to form woods, placing them in rows only from four or five to ten feet aſunder, and from two or three to five or ſix feet in the rows, to allow for a gradual thinning. But perhaps the beſt method of all for raiſing them, as timber trees, is from the ſeed, by ſowing or ſetting the acorns. See PLANTATION and PLANTING.

Sometimes, indeed, large plantations of theſe trees, for woods, are raiſed by ſowing the acorns at once in the places where they are to remain; it being generally found that the trees raiſed at once from the acorn, from their not being checked, much outſtrip the tranſplanted trees in their growth. The method of performing it is this: the ground being prepared by good ploughing and harrowing in the autumn, having procured a proper quantity of acorns, draw drills acroſs the ground four feet aſunder, and two inches deep, dropping the acorns into them ſix or eight inches aſunder, allowing for failing and thinning, covering them in evenly with the earth the depth of the drills; or, inſtead of drilling them in, they may be planted with a dibble the ſame depth and diſtance.

The general management of theſe trees in woods, or timber plantations, is the ſame as directed for foreſt trees in general. See PLANTATION.

All the above ſorts of trees may be employed to diverſify large ornamental plantations in out-grounds, and in forming clumps in ſpacious lawns, parks, and other extenſive open ſpaces: the evergreen kinds, in particular, have great merit for all ornamental purpoſes in pleaſure-grounds and plantations. And all the larger growing kinds, both deciduous and evergreens, are highly valuable as foreſt trees for timber; but the firſt ſort claims precedence as a timber tree, for its prodigious height and bulk, and ſuperior worth of the wood.

In planting any of the ſpecies for ornament or variety in large pleaſure-grounds, ſome may be diſpoſed in aſſemblage in any continued plantation, ſome in clumps, and others ſingly.

All the different ſorts of the oak will ſucceed in any ſoil of a middling quality, where the expoſure is not unfavourable; but to the moſt advantage, where the land is of a loamy nature: they, however, thrive tolerably in thoſe ſoils which are of a gravelly, ſandy, or clayey deſcription.

Beſides the great value of theſe ſorts of trees for the utility and durability of their wood, as timber, for the purpoſes of ſhip-building, houſe-building in ſome parts, parkpaling, poſts, railings, and a variety of other ſtrong uſes; they, in many of the kinds, afford conſiderable additional advantage

advantage by their produce in bark, for the ufe of the tanners and cork-cutters, in tanning leather, and being made into corks; after the former of which, it is alfo much employed in gardening, for the forming of bark hot-beds, in raifing tender hot-houfe exotic plants: as well as in their annual crops of acorns, as an excellent food for the keeping and fattening of fwine, deer, and fome other animals.

QUERCUS, in *Planting*, a claffical term fometimes applied to the oak-tree in nurfery collections, intended for this fort of application. See OAK-*Tree*.

QUERCUS *Marina*, the *Sea-Oak*, in *Botany*, the name of one of the broad-leaved dichotomous fea-fucufes.

It is not agreed, among the late botanifts, what was the fea-oak of Theophraftus; and the moft ancient botanifts, Clufius and Cæfalpinus, fuppofe it to have been a fpecies of the fhrubby coralline; but that feems by no means to have been the cafe, fince Theophraftus fays his fea-oak had a long, thick, and flefhy leaf, whence we may much more naturally conclude it to have been of the fucus clafs.

QUERCY, in *Geography*, a province of France before the revolution, in the government of Guienne; bordered on the E. by Rouergue and Auvergne, on the S. by Upper Languedoc, on the W. by Perigord and Agenois, and on the N. by Limofin: it contained two bifhoprics, *viz.* Cahors and Montauban. The air is good, and the land is fertile: its capital was Cahors. It now conftitutes the department of the Lot.

QUEREIVA, in *Ornithology*, the purple-throated chatterer of Latham, a fpecies of Ampelis.

QUERELA, QUARREL, in *Law*, denotes an action, or declaration, preferred in any court of juftice. See QUARREL.

In an action where the plaintiff is called *querens*, *i. e.* complainant, his brief, complaint, or declaration, is called *querela*.

QUERELA *Audita*. See AUDITA.

QUERELA *coram rege et concilio*, a writ by which one is called to juftify a complaint of a trefpafs made to the king himfelf, before the king and his council.

QUERELA *Duplex*. See DOUBLE *Quarrel*.

QUERELA, *Ex gravi*. See EX GRAVI, &c.

QUERENGHI, ANTONIO, in *Biography*, a man of letters, was born at Padua in 1546. He difplayed, at an early period of his life, a decided attachment to literature; he wrote verfes before he was twelve years of age, and foon became diftinguifhed by his deep knowledge of the languages, civil laws, and the philofophy that was taught at that period. For fome time he applied himfelf to theology, and made confiderable proficiency in it. He next went to Rome, where he entered into the fervice of feveral cardinals, and at length became fecretary of the facred college, in which capacity he was prefent at the election of five popes. Clement VIII. conferred upon him the canonry of Padua, which occafioned him to refide in that city, but he returned to Rome in the pontificate of Paul V., by whom he was promoted to fome offices of truft. He died at Rome in 1633, at the age of 87. He was a man of various and extenfive literature, and was much regarded by the learned of the time in which he flourifhed. His writings were numerous, and comprehended the fciences and polite literature. He is chiefly known to pofterity by his poems, which are correct and elegant, but by no means animated. Moreri.

QUERETANO, in *Geography*, a town of Mexico; 80 miles N.N.W. of Mexico. N. lat. 20° 25′. W. long. 101° 36′.

QUERFAA, in the *Materia Medica of the Arabians*, a name given by Avicenna and others to cinnamon, when gathered with the wood of the young branches.

It was a common practice in the early times not to ftrip the fmall bark from medicinal trees, but to cut off the little boughs, and ufe the bark and wood together. This the Greeks called *xylo cinnamomum*, or woody cinnamon; and the Arabians, *querfaa*, *querfe*, or *kerfe*.

QUERFURT, in *Geography*, a town of Saxony, fituated on the little river Weite, inconfiderable in itfelf, but having large fuburbs; the number of houfes is eftimated at upwards of 500. The old caftle belonging to it ftands on a hill, and it has likewife a fuperintendency; 16 miles S.W. of Halle. N. lat. 51° 23′. E. long. 11° 45′.

QUERIA, in *Botany*, received that name from Loefling and Linnæus, in compliment to Don Jofeph Quer y Martinez, a Spanifh furgeon, who though he wrote againft the Linnæan fyftem, and even the fexes of plants, contending that palm-trees ripen fruit without impregnation, was an affiduous practical botanift. He publifhed a Spanifh Flora, in his native tongue, confifting of four volumes quarto, of which the firft three appeared in 1762, and the fourth in 1764. A fifth and fixth were added by Ortega in 1784. Quer was profeffor of botany in the royal garden at Madrid, and died in 1764, aged 69. He wrote alfo on the *Uvi Urfi*, (which he removes from the genus *Arbutus*,) as a fpecific in calculous complaints; and on the medical ufe of *Cicuta*.—See Haller's Bibl. Bot. v. 2. 516. and Dryandr. Bibl. Banks.— Linn. Gen. 43. Schreb. 58. Willd. Sp. Pl. v. 1. 493. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 185. Juff. 300. Lamarck Illuftr. t. 52. Gærtn. t. 128?—Clafs and order, *Triandria Trigynia*. Nat. Ord. *Caryophylleæ*, Linn. Juff.

Gen. Ch. *Cal.* Perianth inferior, of five erect, oblong, acute, permanent leaves; the outermoft recurved. *Cor.* none. *Stam.* Filaments three, capillary, fhort; anthers roundifh. *Pift.* Germen fuperior, ovate; ftyles three, the length of the ftamens; ftigmas fimple. *Peric.* Capfule roundifh, of one cell, with three valves. *Seed* folitary, roundifh, compreffed.

Eff. Ch. Calyx of five leaves. Corolla none. Capfule of one cell, with one feed.

Obf. Linnæus remarks, that this genus differs evidently from MINUARTIA, fee that article, in having a folitary feed. *Q. canadenfis*, figured by Gærtner, is removed hence by Michaux to his genus *Anychia*, which belongs to a different natural order, the *Holeraceæ* of Linnæus, and has a capfule deftitute of valves. Gærtner indicates its clofe affinity, except in number of ftamens, to his PARONYCHIA, fee that article. Michaux and Purfh affert that its ftamens vary from two to five.

1. Q. *hifpanica*. Spanifh Queria. Linn. Sp. Pl. 132. Willd. n. 1. Ait. n. 1. Loefl. It. 48. 83. Quer. Fl. Efpan. v. 6. 667. t. 15. f. 2.—Flowers crowded into a tuft.—Native of fandy grounds in Spain. Seeds were fent to Kew, in 1800, by the late marchionefs of Bute. The plant is a diminutive hardy annual, flowering moft part of the fummer. *Root* fibrous. Whole *herb* whitifh, brittle, one or two inches high, with feveral leafy, round, rather downy, flightly reddifh *ftems*. *Leaves* oppofite, feffile, awl-fhaped, three-ribbed, curved to one fide, rather longer than the joints of the ftem. Head of *flowers* obfcurely quadrangular, denfely dichotomous, eafily breaking off from the ftem. *Bracteas* oppofite, awl-fhaped, recurved, and hooked, eafily catching hold of the coats of animals. *Flowers* very minute.

2. Q. *canadenfis*. Canadian Queria. Linn. Sp. Pl. 132. Willd. n. 2. Ait. n. 2. Gærtn. v. 2. 217. t. 128. f. 10. Gron. Virg. ed. 2. 16. (Mollugo foliis oppofitis, ftipulis quaternis,

quaternis, caule dichotomo; Gron. Virg. ed. 1. 14. Anychia dichotoma; Michaux Boreal-Amer. v. 1. 113. Purſh v. 1. 176.)—Flowers ſolitary, ſtem forked.—Native of dry lime-ſtone hills, from New York to Kentucky, flowering from June to Auguſt. Introduced at Kew, in 1806, by his royal highneſs the duke of Kent, according to Mr. Aiton, who marks it as a hardy biennial. Linnæus and others make it perennial; which the appearance of the plant contradicts. The *root* is ſmall, tapering, with a few pale fibres. *Stem* ſolitary, near a ſpan high, round, jointed, ſmooth, reddiſh, erect, leafy; ſimple below; repeatedly ſubdivided, forked and ſpreading, above; the branches divaricated, capillary, leafy, many-flowered. *Leaves* oppoſite, on ſhort ſtalks, obovate, entire, ſmooth, from one-fourth to three-fourths of an inch long, covered on both ſides with reddiſh dots, which become prominent as the leaves dry. Theſe dots, Linnæus ſays, diſappear by culture. *Stipulas* two at each ſide, membranous, acute. *Flowers* very ſmall, axillary or lateral, green, on ſhort ſtalks. *Calyx-leaves* concave, or vaulted, below the point. *Stamens*, according to Michaux, always five in the wild plant; in the cultivated one often but two. Linnæus juſtly points out the reſemblance of this herb, at firſt ſight, to *Linum catharticum;* but its ſtrict affinity to *Illecebrum*, *Polygonum*, &c. is far more ſtriking, as well as its total unlikeneſs to the original *Queria;* ſo that there can be no doubt of the neceſſity of removing it from the preſent genus, whether the *Anychia* of Michaux be permanently eſtabliſhed or not.

3. Q. *trichotoma*. Three-forked Queria. Thunb. in Tranſ. of the Linn. Soc. v. 2. 329. Willd. n. 3. (Rubia ſpicis ternis; Thunb. Jap. 357.)—Flowers racemoſe. Stem triply forked.—Native of Japan.—*Herb* with widely ſpreading, thread-ſhaped, ſmooth *branches*. *Leaves* oppoſite, on very ſhort ſtalks, ovate, acute, nearly entire, ſmooth, widely ſpreading, as long as the finger nail. *Cluſters* axillary, three; two oppoſite, one terminal, compoſed of three or four pair of oppoſite, minute, deciduous *flowers*. To this deſcription Thunberg adds—"*Corolla* cylindrical. *Fruit* inferior, oblong, ſmooth."—This muſt be altogether a miſtake, if the plant has any pretenſions to be reckoned a *Queria*. Having ſeen no ſpecimen, we leave the matter as we find it. The genus before us muſt probably depend on the firſt ſpecies only; and whether the character of the ſolitary ſeed, by which alone it ſtands diſtinguiſhed from *Minuartia*, be ſufficient, there being the ſtricteſt conformity in habit and every other particular, we feel much inclined to doubt.

QUERIGUT, in *Geography*, a town of France, in the department of the Arriége, and chief place of a canton, in the diſtrict of Foix; 27 miles S.E. of Taraſcon. The place contains 809, and the canton 2483 inhabitants, on a territory of 132½ kiliometres, in ſeven communes.

QUERIMBA, a cluſter of iſlands, deriving its name from the principal, in the Indian ſea, near the coaſt of Africa; fertile in dates, oranges, grapes, and other fruits and legumes. The paſtures feed great numbers of large and ſmall cattle, and the coaſts abound with fiſh. Theſe iſlands, when firſt diſcovered by the Portugueſe, were inhabited by Arabians; but at preſent they are chiefly occupied by the deſcendants of Portugueſe. S. lat. 12° 20′. — Alſo, a country of Africa, bordering on the coaſt. S. lat. 9° to 13°. —Alſo, a river of Africa, which runs into the Indian ſea, S. lat. 12° 20′.

QUERKEINESS, or Kerkeines, two iſlands in the Mediterranean, near the coaſt of Tripoli; one of them about ten miles long and five wide, anciently called "Cercina;" the other, which is ſmaller, is united to the larger by a bridge; 15 miles S.S.E. of cape Oudia. N. lat. 34° 59′. E. long. 11° 12′.

QUERO, a town of South America, in the juriſdiction of Riobamba.

QUERPO. See Cuerpo.

QUERQUEDULA, in *Ornithology*, a ſpecies of *Anas*. See Duck and Teal.

QUERRE′, in *Geography*, a town of France, in the department of the Mayne and Loire; 12 miles N. of Angers.

QUERRIEN, a town of France, in the department of the Finiſterre; ſix miles N. of Quimperle.

QUERRIES, or Equerries. See Equerry.

QUERRIEUX, in *Geography*, a town of France, in the department of the Somme; ſix miles N.E. of Amiens.

QUERRY, *Gentleman of the*, is an officer appointed to hold the king's ſtirrup, when he mounts on horſeback.

QUERS, in *Geography*, a town of France, in the department of the Upper Saone; three miles S.E. of Luxeuil.

QUESADA, a town of Spain, in the province of Jaen; 12 miles S.E. of Ubeda.

QUESENDORF, a town of Pruſſia, in the palatinate of Culm; four miles S.E. of Bretchen.

QUESNAY, Francis, in *Biography*, a celebrated French phyſician, was born at Merey, a little town not very diſtant from Paris, in 1694. His family were employed in ruſtic occupations, and gave him no other education than was deemed neceſſary for their mode of life; ſo that at the age of ſixteen he was ſcarcely able to read. About this time, however, a thirſt for information ſeized him, and partly by the aſſiſtance of a country ſurgeon, and the few books that he poſſeſſed, but principally by his own labour, he acquired a knowledge of Latin and Greek, and entered with ardour into the ſtudy of the ancient and modern writings on philoſophy. In oppoſition to the grovelling notions of his relations, he reſolved to turn his purſuits to medicine, having perceived its connection with the various branches of phyſical ſcience; and his maſter, the ſurgeon of Ecquevilly, was ſoon convinced of the ſuperior acquirements of his pupil, ſome of whoſe eſſays he preſented as his own, on applying for admiſſion into the college of St. Côme, and they were received with great applauſe. This ſtill farther rouſed the zeal of Queſnay, and he repaired to Paris, where he entered with great aſſiduity into the ſtudies connected with the profeſſion. After ſome time he ſettled at Mantes, a conſiderable town in his native province. Here he was diſcovered by Garengeot, an eminent ſurgeon, who was engaged with Peyronie in an attempt to eſtabliſh an academy of ſurgery, for the collection of ſurgical knowledge. Having written a refutation of the doctrines of Silva, reſpecting blood-letting, which led him to a public controverſy, in which he was deemed victorious by Peyronie, he diſplayed ſuch profound views, indefatigable zeal, and great general knowledge, as determined Peyronie to appoint him the ſecretary of his new academy. This diſtinguiſhed poſt raiſed him ſtill higher in the public eſtimation; but the labours connected with it at length injured his health, which had been for ſome time delicate, and he determined to turn his attention to medicine more particularly, and took the degree of doctor of phyſic. He had been employed during the campaigns of the king, and on the death of M. Terray was appointed conſulting phyſician to his majeſty; and was much eſteemed and favoured by madame de Pompadour; he ſeems, indeed, to have been much employed, and to have been held in high conſideration by the dauphin, the

the father of Louis XVI., and by the whole court. After the dauphin had undergone the ſmall-pox, the king preſented him with letters of nobility, unſolicited, as a mark of his eſteem. He was appointed alſo firſt phyſician in ordinary to his majeſty. He was a member of the Academy of Sciences, of the Royal Society of London, &c. Notwithſtanding his long life, and his courtly favour, as well as extenſive employment, he died poſſeſſed of little fortune, his liberality to his friends having prevented him from accumulating money. His death took place at Verſailles, in December, 1774, at the age of eighty.

This able and indefatigable man left ſeveral works, which bear the ſtamp of conſiderable reſearch, clear and methodical views, and acute obſervation, mixed, however, with ſome diſpoſition to hypotheſis. His firſt eſſay on blood-letting, already mentioned, was publiſhed in 1730, under the title of "Obſervations ſur les Effets de la Saignée, avec des Remarques critiques ſur la Traité de Silva;" and a ſecond edition, conſiderably enlarged, was printed in 1750. But in the mean time he publiſhed another work, entitled "L'Art de Guerir par la Saignée," Paris, 1736, in which he recommends blood-letting in many diſeaſes. In the ſame year appeared his "Eſſai Phyſique ſur l'Economie Animale," in two volumes, 12mo., which was reprinted in 1747, in three volumes. This work, however, was deemed very imperfect by Haller, and is in fact characteriſed by a love of hypotheſis, rather than by the details of experience and obſervation. In 1743, his "Preface des Memoires de l'Academie de Chirurgie," gained him conſiderable applauſe, as a work of literary reſearch. In 1744 he publiſhed his "Recherches critiques et hiſtoriques ſur l'Origine, ſur les divers Etats, et ſur les Progrés de la Chirurgie en France," which called forth ſome replies on the alleged inaccuracy of ſome of the hiſtorical ſtatements. His other publications were entitled, "Teſtament de M. de la Peyronie du 18 Avril, 1747;" "Examen impartial des Conteſtations des Medecins et des Chirurgiens de Paris," 1748, 12mo.; "Memoire préſenté au Roi par ſon premier Chirurgien, où l'on examine la Sageſſe de l'Ancienne Légiſlation ſur l'Etat de la Chirurgie en France," 4to.; "Traité de la Suppuration," 12mo.; and "Traité de la Gangrene," 12mo.; all in the year 1749. And laſtly, his "Traité des Fièvres continues," 1753, in two volumes, 12mo. Eloy Dict. Hiſt. de la Médécine.

QUESNE, Abraham du, an able French naval commander, was deſcended from a noble family in Normandy. He was born in 1610, and was brought up to the ſea-ſervice under his father, who gave him the command of a veſſel when he was only ſeventeen years of age. In 1637 he was preſent at the attack of the iſles of Sainte Marguerite, and in the following year contributed greatly to the defeat of the Spaniards before Gattori. He was afterwards in various actions on the coaſt of Spain. In 1644 he went to ſerve in Sweden, and was promoted to the rank of vice-admiral of the Swediſh fleet. In this ſtation he had a command in the famous battle in which the Danes were entirely defeated, and his veſſel was one that boarded and took the enemy's admiral ſhip. On his return to France he commanded a ſquadron ſent to the expedition againſt Naples. The French navy being in a low ſtate on account of the minority of the king, he fitted out ſeveral ſhips at his own expence in 1650, with which he aſſiſted in the reduction of Bordeaux, which had revolted, and was aided by a Spaniſh fleet. In 1676 he had the glory of being oppoſed to the great De Ruyter. The Spaniſh and Dutch fleets had united to prevent the French from ſuccouring the inhabitants of Meſſina, but Du Queſne, after a deſperate fight, ſucceeded in entering the port. He was alſo engaged with De Ruyter when the latter was mortally wounded. Du Queſne obtained a more glorious and decided ſucceſs in another engagement with the Spaniſh and Dutch fleets at Palermo, when, by means of his fire-ſhips, he deſtroyed twelve large ſhips of the enemy, and thus procured for his king the ſovereignty of the Mediterranean. In 1682 he was ſent with a fleet to awe the piratical ſtates of Barbary, which had committed depredations on the French coaſts, and in the following year he ſailed to Algiers, and bombarded the town with ſuch fury as nearly to lay it in ruins. In the following ſpring the admiral anchored before the city, and did not leave it till he had deſtroyed almoſt all the buildings, with the whole of the ſhipping and fortifications, the conſequence of which was they were obliged humbly to ſue for peace. He ſtruck equal terror into the ſtates of Tripoli and Tunis, which were likewiſe compelled to purchaſe peace with France by ſubmiſſion. He performed other great and important ſervices for his ſovereign, but the recompence due to him on account of all he did was impeded by his firm attachment to the reformed religion in which he was bred, and which the bigotry of the king regarded as criminal. He received, however, the royal gift of a fine eſtate, which was erected into a marquiſate, and gave him a title; and on the repeal of the edict of Nantes, he was the only perſon exempted from its penalties. This great hero, one of the chief boaſts of the French navy, preſerved an extraordinary degree of health and vigour, notwithſtanding the many wounds which he had received, till his death in 1688, when he had attained to the 78th year of his age. He left a ſon, of whom we ſhall ſay a few words.

Quesne, Henry du, was born in 1652, and at the age of fourteen he entered the French navy, and ſerved with great diſtinction under his father. He was preſent at the bombardment of Algiers in 1683, and negotiated the peace of Tunis. At the period when the higheſt proſpects in his profeſſion lay before him, his attachment to the Proteſtant religion cauſed him, at the repeal of the edict of Nantes, to quit his country and the ſervice, but he refuſed with indignation the offers that were made him to take a command in the armies of its enemies, and retired to Switzerland. His high reputation raiſed him to great credit with the Proteſtant powers, which he employed in engaging them to undertake the protection of his perſecuted brethren; and through his means a great number of victims of the moſt cruel intolerance procured their liberation from the gallies. In 1701 he ſold his eſtate in Switzerland, and retired to Geneva, of which he was admitted to the citizenſhip. Here he died in 1723, reſpected alike for his learning and piety. As an author he had taken a conſiderable ſhare in the verſion of the New Teſtament publiſhed by the paſtors of Geneva, and he was author of a work entitled "Reflexions Anciennes et Modernes ſur l'Euchariſtie."

Quesne, *Fort du*, in *Geography*. See Pittsburg.

QUESNEL, Pasquier, in *Biography*, a French prieſt of much celebrity, was born at Paris in the year 1634. Having completed his education, and being admitted a member of the congregation of the oratory, he took prieſt's orders in 1659. From this time he devoted himſelf, with great diligence, to the ſtudy of the ſcriptures, and of the fathers, and to the compoſition of books in practical piety. At the age of 28 he was appointed firſt director of the inſtitution belonging to his order at Paris. The firſt of his publications was entitled "Moral Reflections upon the Goſpels." After this he was employed in preparing for the preſs a new edition of "The Works of St. Leo," in two volumes, 4to. in which he has given a vaſt number of notes that

that reflect great honour on the learning of the editor. Its value was enhanced, in the judgment of his countrymen, by his introducing into it an able defence of the sentiments of the Gallican church, in opposition to the pretensions of the church of Rome. This circumstance gave great offence to the papal government, and the edition was condemned in the following year at Rome. On account of his attachment to father de Sainte-Marthe, general of the oratory in France, he was obliged to quit his diocese, and from other unpleasant circumstances he thought it right to withdraw privately from France into foreign countries. He took refuge at Brussels, where he continued his "Moral Reflections" on the acts of the apostles, and the epistles. This, with his former work, he published in 1687. He afterwards revised and made additions to the former work on the Evangelists, and printed an uniform edition of the whole in 1693 or 1694, in four vols. 8vo. In the year 1703 the Jesuits, always inimical to the rights and liberties of mankind, and who, to the utter disgrace of the present period, have been just re-established in their powers, availed themselves of their influence with an ignorant and bigotted king of Spain, to obtain an order for the arrest of father Quesnel, who was now thrust into a dungeon belonging to the archiepiscopal palace at Brussels. From this situation he was unexpectedly delivered in less than four months by the ingenuity of a Spaniard, who contrived to open a passage through the walls of the prison sufficiently large for his escape. Having thus obtained his liberty, he made the best of his way to Holland, where he published several pieces in vindication of himself and writings from charges preferred against both before the ecclesiastical court of Mechlin, and the sentence of condemnation pronounced by the archbishop. In the year 1705 the enemies of Quesnel applied to the pope Clement XI. for the condemnation of the "Moral Reflections," to which he acceded, although he had some years before expressed his decided approbation of them, and even wished to engage the author to come to reside at Rome. Such, however, was the pontiff's inconsistency, that he issued a decree which condemned the "Moral Reflections" in general, but without specifying any particular doctrines which merited such a sentence. At length, at the instigations of the Jesuits, eager in the cause of persecution, Lewis XIV. joined himself against Quesnel, and applied to the pope for a more definite decree; his holiness, for so the most wicked as well as most virtuous of the popes have ever been denominated, in consequence of this application, established a congregation of cardinals, prelates, and divines, to enter into a particular examination of the doctrines and maxims which Quesnel had advanced. That his work might not be condemned without any efforts on his part to vindicate it from the accusations of his enemies, our author wrote, on this occasion, two letters to the pope, which were safely conveyed to Rome, but Clement did not deign to give a reply. State policy had already determined what measures he should adopt, and, after the sessions of the congregation were ended, he issued the celebrated bull Unigenitus, in September 1713, which pronounced a sentence of condemnation upon 101 propositions extracted from the "Moral Reflections."

Father Quesnel spent the last years of his life at Amsterdam, where he formed some Jansenist churches, and published his apologetic and controversial pieces against the bull Unigenitus, and its abettors. He died in 1719, in the 86th year of his age. Independently of his "Moral Reflections," he was author of several other works of high reputation, of which we may mention, a treatise on "Predestination and Grace," in four vols. 12mo. under the fictitious name of sieur Germain; and "The Discipline of the Church deduced from the New Testament," in two vols. 4to. A list of this author's works may be seen in Moreri.

QUESNOI, Francis du, called the Fleming, an excellent sculptor, was born at Brussels in 1594. He learned his art under his father, who was a sculptor, and at an early age displayed so much ability, that the archduke Albert gave him a pension and sent him into Italy. After the death of that prince, he was patronized by the constable Colonna; and the celebrated Poussin residing with the constable at the same time, the two artists contracted an intimate friendship, and studied together. Quesnoi formed himself upon the taste of the ancients, and chiefly excelled in making bas-reliefs and models in a small size, representing cupids and children, to which he gave singular grace and delicacy. He employed himself several years on a marble saint, for the chapel of Loretto, in which he imitated the genuine beauties of the antique. When the canopy of St. Peter's was finished, pope Urban VIII. ordered four colossal statues to be placed in the niches. That of St. Andrew was given to Quesnoi, and although one of his competitors ventured to affirm that he would only produce a great child, yet when the figure was completed, it entirely effaced his own performance. Notwithstanding the talents of this artist, which were united to much perseverance and industry, he could barely earn a subsistence, and was in a very low state of health and spirits, when, in 1642, Lewis XIII. engaged him as his sculptor, and as the head of an intended school for that branch of art, at a very liberal salary. This change of fortune he was unable to bear, and as he was on the point of setting out, he sunk into a melancholy derangement, from which he never recovered. His death, which happened at Leghorn in 1646, has been imputed, but probably on insufficient evidence, to poison, administered by the hand of a brother with whom he lived on very bad terms. He was mild in his manners, but of a reserved disposition. His reputation is chiefly founded upon the exquisite softness which he gave to marble, and the peculiar grace and beauty of his infantile groups, finished with perfect anatomical exactness.

QUESNOY, Le, in *Geography*, a town of France, in the department of the North, and chief place of a canton, in the district of Avesnes. The place contains 2960, and the cantons, to which belong the east and west divisions, 9099 each, on a territory of 235 kiliometres, in 29 communes. N. lat. 50° 15′. E. long. 3° 43′.

Quesnoy-*sur-Deule*, a town of France, in the department of the North, and chief place of a canton, in the district of Lille. The place contains 4002, and the canton 15,047 inhabitants, on a territory of $82\frac{1}{2}$ kiliometres, in nine communes.

QUEST, or Inquest, an inquisition, or inquiry, made upon oath of an impannelled jury. See Inquest, and Jury.

The word is formed from the French *quete, search*; of the Latin *quæsitum, a thing sought.*

Quest, in *Hunting*, the seeking out of hounds, or the venting and winding of spaniels. See Hound.

QUESTEMBERT, in *Geography*, a town of France, in the department of Morbihan; five miles W.S.W. of Rochfort. The place contains 3668, and the canton 12,118 inhabitants, on a territory of $257\frac{1}{2}$ kiliometres, in nine communes.

QUESTION, Quæstio, in *Logic, &c.* a proposition, whose truth a person being inquisitive about, proposes by way of interrogation to another.

Logical questions are variously distributed; the ordinary division

division is into *firſt* or *primary* queſtions; as, *Quid eſt? What is ſuch a thing?* And *ſecondary*, which ariſe out of the former; as, *How is it?*

Question, *Quodlibetical.* See Quodlibetical.

Question, in *Law*. The *quæſtio de jure* is generally to be diſtinguiſhed from the *quæſtio de facto.*

Question is alſo ſometimes uſed for *torture;* which ſee.

QUEST-MEN, perſons choſen yearly in each ward, to inquire into abuſes and miſdemeanors, eſpecially ſuch as relate to weights and meaſures.

Quest-men, in *Eccleſiaſtical Law*. See Sidesmen.

QUESTOR, Quæstor, formed *a quærendo, ſeeking, ſearching*, or *collecting the revenues of the ſtate*, an officer in ancient Rome, who had the care of the public treaſure.

The queſtorſhip, *quæſtura*, is very ancient, as having been eſtabliſhed under the kings, probably in the time of Romulus or Numa, or at leaſt under Tullus Hoſtilius. Tacitus (Annal. xi. 22.) ſays, that the firſt queſtors were elected by the people, 64 years after the foundation of the republic; but he is of opinion that they had, long before that period, been annually appointed by the conſuls, and even by the kings. But this obſcure point of antiquity is conteſted by other writers. Dionyſius and Livy date the original of queſtors about A. U. C. 269. Plutarch refers the inſtitution to the time of Valerius Poplicola, when he allotted the temple of Saturn for the treaſury, and granted the people the liberty of chooſing two young men for the treaſurers. Afterwards, *viz.* A. U. C. 332, two others were created to take care of the payment of the armies abroad, of ſelling the plunder and booty, &c. for which purpoſe they generally accompanied the conſuls in their expeditions; and they were diſtinguiſhed by the name of *peregrini* from the other queſtors, who aſſumed the title of *urbani.* This number continued till the entire conqueſt of Italy; and then, A. U. C. 439, it was again doubled. The four that were added reſided with the proconſuls and proprætors, in the provinces, where they were employed in regulating the taxes and cuſtoms due to the ſtate.

In the time of the republic, the ſenate appointed queſtors in each province, to aſſiſt the proconſuls, as lieutenants or treaſurers, in the adminiſtration of the revenues; but, under the emperors, there was properly but one queſtor, or treaſurer-general of the empire; thoſe other inferior or ſubordinate queſtors were then called aſſiſtants of the queſtor, *adjutores quæſtoris.*

The queſtor's office was originally confined to the army. They paid the ſoldiery, and took charge of monies coming by ſpoil and plunder, &c.

At length there were new ones erected to reſide in the city, and to receive the public money, taxes, tribute, &c. Their number was increaſed as the empire increaſed. Sylla augmented it to twenty; Julius Cæſar to forty; ſome being nominated by the emperor, and the others by the people. Tacitus (Annal. xi. 22.) ſeems to conſider twenty as the higheſt number of queſtors; and Dion (lib. xliii. p. 374.) inſinuates, that if the dictator Cæſar once created forty, it was only to facilitate the payment of an immenſe debt of gratitude. Under ſucceeding emperors their number was not fixed. Of theſe, two were appointed for the city, to take care of the public treaſure, and to keep the laws and decrees of the ſenate; the others pertained to the provinces and the armies.

The queſtorſhip was the firſt office which any perſon could bear in the commonwealth, and might be undertook at the age of twenty-four or twenty-five years. Accordingly, the quæſtorſhip was called the firſt ſtep of honour, and the queſtors, who were generally employed in the provinces abroad, aſſigned to them ſeverally by lot, no ſooner returned from their provincial adminiſtration than they took their places in the ſenate; and from that time forward, from the rank of equeſtrians, or what we commonly call knights, became ſenators for life.

The youth and inexperience of the queſtors, who entered on that important office in the 25th year, engaged Auguſtus to remove them from the management of the treaſury; and though they were reſtored by Claudius, they ſeem to have been finally diſmiſſed by Nero. In the provinces of the imperial diviſion, the place of the queſtors was more ably ſupplied by the procurators, or, as they were afterwards called, "rationales." But in the provinces of the ſenate we may ſtill diſcover a ſeries of queſtors till the reign of Marcus Antoninus. From Ulpian we may learn, that under the government of the houſe of Severus, their provincial adminiſtration was aboliſhed; and in the ſubſequent troubles, the annual, or triennial elections of queſtors, muſt have naturally ceaſed.

There was alſo another kind of queſtors, called *quæſtores parricidii*, whoſe office was to enquire into, and take cognizance of capital crimes, after the conſuls were denied this privilege.

Questor *ſacri palatii*, or of the *ſacred palace*, was one of the firſt dignities under the emperors of Conſtantinople.

It was this queſtor that ſubſcribed the reſcripts of the emperor, and the anſwers to the petitions and ſupplications preſented to him. He alſo drew up and ſigned the laws and conſtitutions which the emperor thought fit to publiſh; and took care of the adminiſtration of juſtice.

Some compare his function to that of our lord high chancellor. It was uſually one of the juriſconſulti that was charged with this office; it being required, that he ſhould know the laws of the empire, be able to preſcribe and ſee them executed, and judge of cauſes brought by way of appeal before the emperor.

Conſtantine was the firſt who erected queſtors of the ſacred palace.

QUESTUS, or Quæstus. See Quæstus.

Questus *eſt nobis*, a writ of nuſance, which, by ſtat. 15 Edw. I. lies againſt him to whom a houſe, or other thing, that breeds a nuſance, is deſcended, or alienated; whereas before that ſtatute, the action lay only againſt him who firſt levied, or cauſed the nuſance, to the damage of his neighbour.

QUETIF, James, in *Biography*, a learned French Dominican monk, was born at Paris in the year 1618. He embraced the monaſtic profeſſion among the preaching friars when he was not more than 17 years of age, and having completed his philoſophical courſe at Paris, he was ſent by his ſuperiors to Bordeaux, where he ſtudied divinity, and received prieſt's orders in 1648. He lived to a great age, exerciſing his talents in various ways, and died in the year 1698, highly reſpected for his great erudition, his extenſive knowledge, and his virtues. He publiſhed a new edition of the "Summa Theologiæ" of Aquinas, in three vols. folio, with notes. He did the ſame by a work entitled "Concilii Tridentini Canones." He was editor of "The Spiritual and Aſcetic Letters of Savonarola;" and he publiſhed, with his own notes, "The Life of Savonarola," from the Latin of John Picus, count of Mirandula, with conſiderable additions. He wrote the preface to "The Letters of Peter Morin," which he publiſhed from the author's manuſcripts; as he alſo did his treatiſe "On the good Uſe or Abuſe of the Sciences." He was author of a conſiderable part of the work

work entitled "Scriptores Ordinis Prædicatorum, cum notis Hiſtoricis," which was completed by father Echard.

QUETREVILLE, in *Geography*, a town of France, in the department of the Channel; ſix miles S. of Coutances.

QUETTEHOU, a town of France, in the department of the Channel, and chief place of a canton, in the diſtrict of Valognes; nine miles N.E. of Valognes. The place contains 1291, and the canton 14,956 inhabitants, on a territory of 150 kiliometres, in 18 communes.

QUETTENBRUN, a town of Auſtria; eight miles E. of Laab.

QUETZ, a town of Saxony, in the circle of Leipſic; two miles S.S.E. of Zorbig.

QUEVACAMPS, a town of France, in the department of Jemappe, and chief place of a canton, in the diſtrict of Tournay. The place contains 955, and the canton 10,264 inhabitants, on a territory of $107\frac{1}{2}$ kiliometres, in 15 communes.

QUEVAUVILLERS, a town of France, in the department of the Somme; eight miles S.W. of Amiens.

QUEUE, in *Commerce*, a wine meaſure uſed in ſome parts of France. A queue of Champaigne contains 384 pintes of Paris, or about 95 Engliſh gallons; a queue of Burgundy contains 432 pintes of Paris, or 107 Engliſh gallons.

Queue, *Fr.* tail, as applied to the heads of muſical notes; the minim is the only white note with a tail to it, and the crotchet the firſt black note with a tail to it.

Queue, in *Heraldry*, the tail of a beaſt.

If a lion has a forked tail, he is blazoned by double-queued.

Queue *d'Aronde*, q. d. *ſwallow's tail*, in *Fortification*, a term applied to outworks, when narrower at the gorge than at the face or front; *i. e.* where the ſides open towards the champaign, and contract towards the gorge. The name is occaſioned by its reſemblance, in figure, to a ſwallow's tail, which the French call queue d'aronde.

Of this kind are ſome ſingle as well as double tenailles; and ſome horn-works whoſe ſides are not parallel.

On the contrary, when the ſides are leſs than the gorge, the work is called *contre queue d'aronde*.

Queue *d'Aronde*, in *Carpentry*, a method of jointing, called alſo dove-tail.

QUEVEDO de Villegas, Francisco, in *Biography*, a celebrated Spaniſh writer, was born at Madrid in 1570. He became diſtinguiſhed at an early period for his literary attainments, and obtained the honour of knighthood, but indulging his ſatirical vein too freely againſt the adminiſtration of count d'Olivares, he was thrown into priſon, from whence he did not make his eſcape till the diſgrace of that miniſter. He died in the year 1645, at the age of 75. He is regarded by his countrymen as having attained to a conſiderable degree of excellence in moſt of the different kinds of compoſition. His heroical poems are ſaid to be characterized by energy and ſpirit; his lyrical by ſweetneſs and beauty; and his humorous poems by eaſe, pleaſantry, and ingenious invention. His printed works fill three vols. 4to. of which two are occupied by poetry and one by proſe. The former were collected by Joſeph Gonzales de Salas, who illuſtrated them with notes and diſſertations. They were publiſhed in 1650, at Madrid, under the title of "Il Parnaſſo Eſpagnol." The humorous pieces of Quevedo have rendered his name beſt known in foreign countries, and have been tranſlated into the Engliſh and other languages.

QUEVILLY, in *Geography*, a town of France, in the department of the Lower Seine; three miles W. of Rouen.

QUEULEN, a river of Chili, which runs into the Pacific ocean, S. lat. 39° 10′.

QUEYPO, a town of Mexico, in the province of Coſta Rica, near the Pacific ocean.

QUEYRAS, a town of France, in the department of the Higher Alps; 12 miles S.E. of Briançon.

QUEYTOR, a name ſometimes given to the river Ava, at leaſt to that part which runs between Ava and Prom.

QUI, in *Rural Economy*, a common term frequently applied to the female of the cow kind of animals while in the young ſtate. It is the moſt generally employed in the northern parts of the country. See Why.

Qui-*Calf*, a name uſually made uſe of in the northern parts of the iſland, to ſignify a female or heifer calf. See Why-*Calf*.

Qui *Tam*, in *Law*, is uſed where an information is exhibited againſt any perſon on a penal ſtatute at the ſuit of the king and the party who is informer, when one part of the penalty for breach of the ſtatute is to be given to the king, the poor, or to ſome public uſe, and the other part to the informer or proſecutor; and the party informing proſecutes for the king and himſelf. The ſuit is called a *qui tam* action, becauſe it is brought by a perſon, "qui tam pro domino rege, &c. quam pro ſe ipſo in hac parte ſequitur." If the king, therefore, himſelf commences this ſuit, he ſhall have the whole forfeiture. (2 Hawk. P.C. 268.) But if any one hath begun a "qui tam" or "popular" action, no other perſon can purſue it; and the verdict paſſed upon the defendant in the firſt ſuit is a bar to all others, and concluſive even to the king himſelf. This has frequently occaſioned offenders to procure their own friends to begin a ſuit, in order to foreſtall and prevent other actions; which practice is in ſome meaſure prevented by a ſtatute made in the reign of a prince very ſharp-ſighted with regard to penal laws, *viz.* 4 Hen. VII. c. 20.; which enacts, that no recovery, otherwiſe than by verdict, obtained by colluſion in an action popular, ſhall be a bar to any other action proſecuted *bonâ fide*. A proviſion, ſays judge Blackſtone, that ſeems borrowed from the rule of the Roman law, that if a perſon was acquitted of any accuſation, merely by the prevarication of the accuſer, a new proſecution might be commenced againſt him. Ff. 47. 15. 3. See Information.

QUIA, in *Logic*. See Reason.

Quia *dominus remiſit curiam*, in *Law*. See Recto.

Quia *emptores*, a denomination given to the ſtatute of Weſtm. 3. 18 Edw. I. which directs, that upon all ſales or feoffments of land, the feoffee ſhall hold the ſame, not of his immediate feoffor, but of the chief lord of the fee, of whom ſuch feoffor himſelf held it; and hence it is held that all manors exiſting at this day muſt have exiſted by immemorial preſcription, or at leaſt ever ſince this ſtatute was made: for no new manor can have been created ſince that ſtatute; becauſe it is eſſential to a manor, that there be tenants who hold of the lord, and that ſtatute enacts, that for the future no ſubject ſhall create any new tenants to hold of himſelf.

Qui *improvidè*, a ſuperſedeas granted in many caſes where a writ is erroneouſly ſued out, or miſawarded.

Such is that granted in behalf of a clerk of the chancery ſued againſt the privilege of the court, in the common pleas, and purſued to the exigent.

QUIADKOUA, in *Geography*, a town of Pruſſia, in the province of Bartenland; nine miles S.E. of Allerſburg.

QUIBBLETOWN, a town, or rather a village of America,

rica, in Middlefex county, New Jerfey; fix miles N. of New Brunfwick.

QUIBERON, a fortified town of France, in the department of Morbihan, and chief place of a canton, in the diftrict of L'Orient, fituated at the extremity of a peninfula, to which it gives name, oppofite to the ifland of Belle Ifle; remarkable for an unfortunate expedition of Englifh troops and emigrants againft France, in the year 1795; 17 miles S.E. of Port Louis. The place contains 1916, and the canton 5618 inhabitants, on a territory of 95 kiliometres, in three communes. N. lat. 47° 30'. W. long. 3° 2'.

QUIBO, a fmall ifland on the outer part of the bay of Panama; it is uninhabited, but affords wood and water for fhipping.

QUIBONDO, a fmall ifland in the Indian fea, near the coaft of Africa. S. lat. 8° 8'.

QUIBOR, a town of South America, in the government of Caraccas; 15 miles S.W. of Segovia Nuova.

QUIBURI, a town of New Navarre; 20 miles S.S.E. of Cafa Grande.

QUICAPOUX, a river of America, which runs into the Miffifippi, N. lat. 43° 4'. W. long. 92° 5'.

QUICARO, a town of New Navarre; 150 miles S.S.E. of Cafa Grande.—Alfo, a fmall ifland in the Pacific ocean, near the coaft of Veragua. N. lat. 7° 54'. W. long. 82° 42'.

QUICI, in *Entomology*, a fpecies of the cerambyx, mentioned by Marcgrave.

QUICK, in *Gardening*, a term applied to fignify any fort of young plant, but efpecially thofe of the white-thorn kind. By it is alfo often underftood a live hedge, but more properly the fhrubs of which fuch live hedge is formed. In a ftrict fenfe it is, however, applied to the cratægus oxyacantha, or hawthorn, the young plants or fets of which are commonly fold by the nurfery gardeners under the name of quicks.

In the choice of thefe fets, thofe which are raifed in the nurfery are in general to be preferred to fuch as are drawn out of the woods, as the latter have feldom good roots: many perfons, however, prefer them, as they are larger plants than are commonly to be had in the nurfery. See CRATÆGUS.

QUICK. See MEDLAR and PYRUS.

QUICK-*Beam*. See PYRUS, and SERVICE-*Tree*.

QUICK-*Beam*, in *Planting*, a name given in fome places to the tree ufually known by the title of mountain-afh. It has been recommended as ufeful for forming fences, in fome cafes, by Dr. Anderfon, and others. Where it is employed in this way, the plants muft be kept down to the proper height, by being cut over as often as there may be occafion; and thus encouraging them to throw out lateral branches in a greater abundance, and, of courfe, induce the fence to become more clofe and thick in its lower parts. By thefe means a tolerably perfect hedge may be raifed, from plants of this fort, in fituations where the white-thorn will not fucceed in any proper manner.

QUICK-*Hatch*, in *Zoology*. See URSUS *Lufcus*.

QUICK-*Hedges*, in *Agriculture*, a name given to all fuch as are raifed from quicks, or any other fort of living plants. The proper forming and planting of quick-hedges have hitherto been much too little attended to by the farmer, as it is a matter of great importance, and which interefts him in a very high degree. Whatever fort of plants may be employed for this purpofe, the work fhould conftantly be well performed in the firft inftance, and the hedges and plants be afterwards kept in due order and regularity by fuitable pruning, cutting in, and other proper management. There is a great number of different methods of raifing and making hedges of this kind, as by planting the fets on the plain furface, or the mould a little raifed above it, or on mounds, formed by the fods and mould dug up in the line of the hedge, elevated to different confiderable heights; by fetting the plants out in one row only, in double ones, or fometimes in a ftill greater number; by putting them in, in ftraight lines, in irregular manners, in the triangular form, or in the quincunx method. They are fometimes cut over at certain heights, at others not cut down at all; the fides are alfo in fome cafes clipped or cut in, but in others this is avoided altogether. When planted on banks, they are moftly cleaned and moulded up annually.

A great variety of different forts of plants is employed in forming and conftructing thefe hedges, as thofe of the hawthorn, the black-thorn, the crab-tree, the hazel, the willow, the beech, the elder, the poplar, the alder, and feveral other kinds, according to particular circumftances and fituations. And on the expofed coafts or fhores of the fouthern parts of the kingdom, a new fort of fhrub or plant has lately been recommended for this ufe, which is that of the tamarifk, or *tamarix gallica*, as it thrives rapidly, it is faid, when planted in fituations moft expofed to the blaft or ftroke of the fea; forms an admirable fhelter, and being of quick growth, foon comes to anfwer the end defigned. The writer of the agricultural report of the county of Cornwall has known a hedge of it, which he has been told was planted about feven years ago, and the bufhes, apparently, cannot be lefs now than from ten to twelve feet in height, and are feathered to the very bottom. It thrives well about the Lizard, bears cutting perfectly well, and in expofed fituations, where it might be injured if left to grow high, may be kept clofe and low to much advantage. It unfortunately, however, will not ftand the froft, and fhould never be attempted, of courfe, in fituations expofed to the fevere effects of it. The propagation of it is by cuttings, which take root without any difficulty. It is fuppofed that this fhrub was brought by the monks from Normandy to Mont St. Michael in the above county, and thence fpread to other parts. See HEDGE, and QUICKSET *Hedge*.

The quick-hedges of this country are in a very great degree raifed from the white-thorn, which unqueftionably forms the cheapeft and moft durable kind, where the nature of the foil, fituation, and other circumftances are favourable for the purpofe. It will not, however, flourifh in bad land, in expofed fituations, where the bottom is wet and fpringy, or where the growth of weeds is very abundant. In all fuch cafes other kinds of plants are therefore had recourfe to in the formation of them.

In many upland diftricts beech-hedges have been planted to confiderable extents, and found, when kept under proper management, to be very handfome, and of great fervice in fuch expofures. Birch-hedges have likewife been tried in different cafes, and found to grow remarkably faft, even in cold bare tilly foils, but they require to be cut over at the time they are about four feet in height and carefully plafhed. Both thefe forts of hedges have this in their favour, that they will grow in very poor foil as well as in very expofed fituations; and both will flourifh and grow ftrongly where the white thorn cannot live. Their want of prickles, however, is a great objection to them in this view: but they afford good fhelter.

Quick-hedges conftitute the ordinary fort of fences in this country, and unlefs in particular fituations, and for particular purpofes, are the moft proper and eligible. It has been

been obferved by the writer of a late work, that in parts which have been long inclofed without arable cultivation, hedges, of feemingly great age, are met with, which are many times crooked, ragged, and irregular, as though they had been, in the firft inftance, formed and laid out from the wild underwood of fuch places. While in other cafes, low plants of the various coppice kinds rife and grow on dikes or mounds but little raifed above the furface of the land, feemingly as though they had formerly been collected from brufh-woods and replanted on fuch banks, in fomewhat the fame manner as is ftill practifed on higher banks in particular diftricts towards the weft, and in South Wales. But taking the country at large, the method of raifing quick-hedges by fetting grown plants taken from fuch fituations, has long ceafed to exift and prevail as a general practice ; young plants of white-thorn, or other forts, fet out in the bank and ditch mode with a low protecting dead fence on the fide contrary to the ditch at firft, is the plan commonly had recourfe to, fuch plants being firft raifed in fmall grounds for the purpofe in regular rows, and not taken, as formerly, from brufh-woods and wafte commons.

QUICK-*Lime*, in *Rural Economy*, fuch lime as is in the cauftic or moft active ftate, and which poffeffes the greateft power of operating upon different fubftances with which it may come in contact. It is quite the oppofite in its qualities and properties, to that which has fallen down into a powdery ftate, in confequence of being faturated with water and carbonic acid gas, or fixed air, or which is flaked and become effete. Its powers, when applied upon land in this condition, have already been noticed in fpeaking of lime. See LIME.

But it poffeffes qualities and properties in the way of a cement, the utility of which for building, for various domeftic purpofes, properly belong to this place. According to Dr. Anderfon, lime is in the beft and moft fit ftate for this ufe when the moft perfectly cauftic, or in the moft cryftallizing condition. It is remarked, that the powder of lime, when reduced by means of water into a thin or fluid fort of pafte-like form, and then fuffered to become dry, concretes into a coherent mafs, which fixes to ftones and other rough bodies in a very firm manner, and in this way becomes a proper cement for building any fort of walls. And that, after this pafty material has once become firmly dry, it is quite indiffoluble in water, and incapable of ever being foftened again by the moifture of the atmofphere or other fimilar caufes. Hence it excels many other forts of cements.

When compofed for the purpofe of building walls, &c. it is ufually denominated *mortar ;* but when formed as an application in the way of a fmooth coating upon any plain furface without intermixture with ftony matters, it is commonly here termed *plaifter*.

When made from the lime of the purer fort of lime-ftone, it is found to be more foft and crumbly, and to acquire a lefs degree of hardnefs, and to be broken with much lefs force, than where the lime-ftone from which it is made contains a large proportion of fand, in which cafe it becomes much more hard, firm, and durable.

It has, however, been difcovered that the pureft lime may be rendered a firm cement by adding a proper proportion of clean hard fand to it ; hence the practice of blending fand with lime, when intended for mortar, has become fo univerfal. This is fully fhewn to have been very early the cafe, by the oldeft lime-built walls which are now to be met with.

It neverthelefs ftill remains a defideratum to afcertain the due proportion of fand which is neceffary, as both writers and practical mafons greatly difagree in opinion on this matter, as well in their directions about the mode of mixing the materials, as of applying the cement ; fome of the more modern, efpecially, afcribing extraordinary effects to a fmall variation in thefe particulars, while others deny that thefe circumftances have any fenfible effect on the durability and firmnefs of the cement.

It is conceived that thefe different and contradictory opinions arife from an imperfect knowledge of the nature of quick-lime, and the variations it may admit of ; for thefe variations are fo very great, as to render it impoffible to afford any general rules that can poffibly apply in all cafes. It is, therefore, conceived to behove thofe who are defirous of acquiring any confiftent and fatisfactory knowledge on this head, to endeavour to afcertain, in the firft place, the circumftances which render calcareous fubftances *at all* capable of becoming a cement, and then to trace the feveral changes that may be produced upon it by other extraneous caufes.

Having explained the circumftances which caufe the differences in lime-ftone, and pointed out the different conftituent principles of it, as well as various other peculiarities ; it is ftated that lime, which has in any way abforbed its full quantity of air from the atmofphere and become mild, is altogether unfit for becoming a cement, and that, of courfe, it is evident, that a great change may be produced upon the quality of any lime, by having allowed lefs or more of it to be in this ftate before it is worked up into mortar. And further, that if a large quantity of water be put to frefh flaked quick-lime, and beat up with it into a thin fort of pafte, the water diffolves a fmall portion of the lime, which as it gradually abforbs its air, is converted into cryftals ; between the particles of which cryftals, that part of the lime which was not diffolved, and the other extraneous matters which may have been mixed with it, are entangled, fo as to form a firm coherent mafs of the whole. And that the pafty fubftance formed in this manner, is the well-known article mortar ; and this heterogeneous, imperfectly femi-cryftallized mafs, conftitutes the common cement employed in building ordinary walls or other erections. Thefe circumftances, therefore, being known, it is thought that it will not be difficult to comprehend what are the particulars that are neceffary to form the moft perfect cement of this nature. That fince lime becomes a cement only in confequence of a certain degree of cryftallization taking place in the whole mafs, it is fufficiently obvious that the firmnefs and perfection of that cement muft depend upon the perfection of the cryftals ; and the hardnefs of the matters that are entangled among them ; for if the cryftals are ever fo perfect and hard of themfelves, if they be feparated from one another by any brittle incoherent medium, it is evident that the whole mafs muft remain in fome degree brittle and incoherent. That as water can only diffolve a very fmall proportion of lime, even when in its moft perfect faline or cauftic ftate, or while it remains deprived of its carbonic acid gas, and as happens in other fimilar cafes, no more of the lime can be reduced to a cryftalline mafs than has been actually diffolved in the water ; it happens of courfe, that if mortar be made of pure lime and water alone, a very fmall proportion only can be diffolved by that fmall quantity of water that is added to it : and as this fmall proportion alone can afterwards be cryftallized, all the remaining undiffolved particles of the lime will be entangled among the few cryftals that are formed. And as the undiffolved lime in this mafs will in time abforb its air, and be converted into *mild* calcareous earth without having had a fufficiency of water to allow it to cryftallize, it muft concrete into a friable mafs exactly refembling chalk ; it follows, that this kind of mortar,

tar, when as dry as it can be made, and in its higheſt degree of perfection, will always be ſoft, and eaſily crumbled into powder.

But that, if, inſtead of forming the mortar of pure lime alone, a large proportion of ſand be added to it, the water will in this caſe diſſolve as much of the lime as in the former; and the particles of hard ſand, like ſticks or threads, when making ſugar-candy or other cryſtals, while ſurrounded by the watery ſolution, will help to forward the cryſtallization, and render it more perfect than it otherwiſe would have been, ſo as firmly to cement the particles of ſand to one another. And as the granules of ſand are perfectly hard of themſelves, ſo as not to admit of being broken down like the particles of chalk, it neceſſarily follows, that the cement made of theſe materials muſt be much more perfect in every reſpect than the former.

After conſidering a variety of circumſtances in regard to the ſolubility of lime in water, and its cryſtallization, it is remarked, that when a large quantity of ſand is mixed in the mortar, that ſand will of courſe bear a great proportion to the whole maſs; ſo that the water that may be mixed with the mortar will be much greater in proportion to the quantity of lime contained in this mortar, than if the whole had conſiſted of pure calcareous matter. And that, as the ſand abſorbs none of that water,—that water, now pure, is at liberty to act once more upon thoſe few particles of cauſtic lime that may ſtill remain in the mortar, which will be diſſolved and converted into cryſtals in their turn. In this way it may happen, in ſome circumſtances, that a very large proportion of the lime may become cryſtallized; ſo that the mortar will conſiſt almoſt entirely of ſand enveloped in cryſtalline matter, and become in due time as hard as ſtone itſelf; whereas mortar, conſiſting of pure lime, without ſand, can hardly ever be much harder than chalk. It is not, however, to be ſuppoſed, that in any caſe this dried mortar will aſſume that tranſparent cryſtalline form, or the compact firmneſs of ſome ſorts of calcareous matters, ſuch as marble and lime-ſtone. In mortar, in ſpite of the utmoſt care that can ever be taken, a very conſiderable quantity of the lime muſt remain undiſſolved; which undiſſolved lime, although it may be ſo much ſeparated by the ſand and cryſtalline lime-ſtone as not much to affect the hardneſs of the mortar, yet it muſt ſtill retain its white chalk-like appearance. As marble and lime-ſtone are, however, always formed by thoſe particles of lime that have been wholly diſſolved in water, and from which they have been gradually ſeparated by a more ſlow and more perfect mode of cryſtallization, they have nothing of that opaque calx-like appearance, but aſſume other colours, and appear more firm, uniform, and compact; the ſand and other matters that may be enveloped in them being entirely ſurrounded with a pure cryſtalline matter.

But to obtain the moſt perfect kind of mortar, it is not, however, enough that a large proportion of ſand ſhould be employed, and that the ſand ſhould be intimately mixed with the lime; it is alſo of the utmoſt importance that a large proportion of water be added; for without this it is impoſſible that a large proportion of the lime can be cryſtallized: and the mortar, in that caſe, would conſiſt only of a mixture of chalky matter and ſand, which could hardly be made to unite at all, and would be little more coherent than ſand by itſelf, and leſs ſo than pure chalk. In that caſe, pure lime alone muſt afford rather a firmer cement than lime with ſand. It is alſo of very great importance that the water be retained as long in the mortar as poſſible: for if it be ſuddenly evaporated, it will not only be prevented from acting a ſecond time upon the lime, after a part of what was firſt diſſolved has been cryſtallized, but even the few cryſtals that would be formed when the water was ſuddenly evaporating, would be of themſelves much more imperfect than they otherwiſe moſt certainly would have been. In proof of which, inſtances of the cryſtallization of common ſalt, lump ſugar, and ſugar-candy, are adduced; after which it is noticed, that every one knows what a difference there is between the firmneſs of the different ſubſtances; and that as great muſt be the difference between the firmneſs of that cement which has been ſlowly dried, and that which has been haſtily hardened by the powerful action of a warm air.

It is contended, that it is owing to this circumſtance that the lime, which remains all winter in a mortar tub filled with water, is always found to be much firmer and more coherent than the mortar that was taken from the ſame tub and uſed in any work of maſonry, although in this caſe the materials were exactly the ſame. From the ſame cauſe, any work cemented with lime under water, if it has been allowed to remain undiſturbed and uninjured until it has once become hard, is always much firmer than that which is above the ſurface of the water.

In order to render the force of the above reaſoning more ſtrong and convincing, lime cement or mortar is compared to a maſs of matter conſiſting of a congeries of ſtones cloſely compacted together, and united by a ſtrong cementing matter that had, while in a fluid ſtate, pervaded all the interſtices between the ſtones, and afterwards become a ſolid indiſſoluble ſubſtance. If the cementing matter be exceedingly hard and coherent, and if the ſtones bedded among it be alſo very hard and firm, the whole maſs will become like a ſolid rock, without fiſſures, that can hardly be broken to pieces by the power of man. But, although the cement ſhould be equally firm, if the ſtone, of which it conſiſts, be of a ſoft and friable nature, ſuppoſe chalk or ſand-ſtone, the whole maſs will never be capable of attaining ſuch a degree of firmneſs as in the former caſe; for when any force is applied to break it in pieces, although the cement ſhould keep its hold, the ſolid matter cemented by it would give way, and the whole would be eaſily broken to pieces. Whereas in mortar, the ſand that is added to it repreſents the ſtones of a ſolid matter in the compoſition, the particles of which are united together by the lime which had been formerly diſſolved, and now cryſtallized, which becomes an exceedingly ſolid and indiſſoluble concretion. And as the particles of ſand are of themſelves exceedingly hard, and the cement by which they are united equally ſo, it is plain that the whole concretion muſt be extremely firm, ſo as to require very great force to diſunite any particle of it from the whole maſs. But if, inſtead of employing ſand, the only ſolid body that is entangled among the cementing matter ſhould be chalk, (as in all caſes where the mortar conſiſts of pure lime alone,) or any other ſlightly cohering ſubſtance, let the cementing particles of that compoſition be ever ſo perfect, it is impoſſible that the whole can ever attain a great degree of firmneſs, as theſe chalky matters will be eaſily broken aſunder.

It is remarked, in addition, that a variety of conjectures have been made about the nature of the lime cement employed by the ancients. It has been thought that they poſſeſſed an art of making mortar, which has been long ſince entirely loſt; as the cement in the walls which have been built by them, appears to be, in many caſes, much firmer than that which had been made in modern times. Yet, when the mortar of theſe old buildings is analyſed, it is found to conſiſt of the ſame materials, and nearly in the ſame proportions, in which they are now made uſe of.

And

And it is thought probable, that their only fecret confifted in mixing the materials more perfectly than the rapidity or avarice of modern builders will permit, in employing their mortar in a much more fluid ftate than is done now, and in allowing it to dry more flowly, which the immoderate thicknefs of many of their walls would naturally produce, without any preconcerted defign on their part. Tradition has even handed down to the prefent times the memory of the moft effential of thefe particulars; as the lower clafs of people, in every part of the nation, at this moment invariably fuppofe and believe that thefe old walls were compofed of a mortar fo very thin, as to admit of its being poured, like a fluid, between the ftones, after they were laid in the wall: and the appearance of thefe old walls, when taken down, feems to favour this popular tradition. Nor is it doubted but that this may have been the cafe. The ftones in the outer part of the wall, it is thought, were probably bedded in mortar nearly as is practifed at prefent; and the heart, after being packed well with irregular ftones, might have the interftices between them entirely filled up with fluid mortar, which would infinuate itfelf into every cranny, and in time adhere as firmly as the ftones themfelves, or even more fo, if the ftones were of a fandy friable nature. And that, as thefe walls were ufually of very great thicknefs, it might often happen, that the water in this mortar, by acting fucceffively upon different particles of cauftic lime, would at length be entirely abforbed by fucceffive cryftallizations, fo as to become perfectly dry, without any evaporation at all; in which cafe, a very large proportion of the original lime muft have been regularly cryftallized in a flow and tolerably perfect manner, fo as to attain a firmnefs little inferior to lime ftone or marble itfelf.

It is fuppofed that, upon thefe principles it is eafy to account for the fuperior hardnefs of fome old cements, when compared with that of modern times, in which a practice very different is ufually followed, without having recourfe to any wonderful *arcana* whatever.

Monfieur Loriot, a late French writer, imagined that he had made a perfect difcovery of the way in which the ancients employed their quick-lime, fo as to obtain fuch an extraordinary firm cement; from which difcovery, he conceived, very important benefits might be derived to fociety. According to his opinion, the ancient cement confifted of lime and fand nearly in the fame proportions as are commonly employed for that purpofe at prefent. But inftead of making it of flaked lime entirely, as is done now, he contends that they employed a certain proportion of their lime *unflaked*, which they mixed with their mortar immediately before it was ufed. And it is further noticed, that this newly difcovered cement dries and hardens almoft under the hand of the operator, without cracks or flaws of any fort; that it neither expands nor contracts with the air;—that it is impervious to moifture, and may not only be employed for making roofs of houfes that are fubjected to the continual dropping of water, bafons, aqueducts, canals, &c. which will inftantly contain water in any quantities, but even finer works of the pottery kind; that it perfectly refifts frofts, and has a variety of other interefting qualities. The trials of Dr. Anderfon with the fame fort of materials do not, however, confirm the great certainty and utility of this difcovery. "That fuch effects as the writer defcribes," fays the doctor, "will invariably be produced, merely by adding a certain proportion of unflaked lime in powder to mortar, or even by making the mortar entirely with powdered quick-lime, I may without hefitation venture to deny, not only from the reafoning that has been given, but from actual experiment, again and again repeated by myfelf; and which is likewife, in fome meafure, corroborated by the experience of Mr. Doffie."

On thefe accounts, it is fuppofed, that if Monfieur Loriot, has really experienced thefe uncommon effects from the mortar he has tried, it muft have been occafioned by fome other unobferved peculiarity, and not merely by the circumftance to which he feems to afcribe it. Poffibly the doctor fuppofes the lime he employed may have been impregnated with a gypfum, or the fulphate of lime, as is probable, for many reafons. The effects and qualities of which, as to becoming a fine powder, and of fuddenly fetting, are well known, but it never acquires the ftony hardnefs that lime cement is fometimes endowed with, although it takes the fmootheft polifh of any cement we know: on which account, it has long been employed as a plaifter where fine ornaments are required.

There are unqueftionably, however, many doubtful and myfterious circumftances connected with this matter, which require the aid of further trials and experience in their full explanation.

There are ftill further a few other circumftances that may influence the quality of common lime-mortar. If lime-ftone be fufficiently calcined, it is deprived of all its moifture, and of all its carbonic acid gas, or fixed air. But experience fhews, that lime-ftone will fall to powder on the effufion of water upon it, when it is much lefs perfectly calcined, and while it ftill retains almoft the whole of its fixed air. And that as mafons have hardly any other rule for judging whether lime-ftone be fufficiently calcined, except this fingle circumftance of its falling to a powder when water is poured upon it, it may thus eafily be perceived, that the fame lime may be more or lefs fitted for making good mortar, according to a circumftance that, in a great meafure, eludes the obfervation of operative mafons; for if it fhould happen that all the pieces of lime drawn from a kiln at one time, were juft fufficiently calcined to make it fall to a powder with water and no more, that powder would be altogether unfit for making mortar of any kind. This is a cafe that can feldom happen: but as there are a great many intermediate degrees between that ftate and perfect calcination, it muft often happen that the ftone will approach nearer to one of thefe extremes at one time than at another; fo that the mortar may be much more perfect at one time than at another, owing to a variation in this particular.

All thofe who have written on the fubject of lime as a cement, have endeavoured to afcertain what is the due proportion of fand for making the moft perfect cement. But a little attention to the matter will fhew, that all rules, which could be prefcribed as to this particular, muft be fo vague and uncertain, as to be of little utility to the practical mafon; as, befides the variation which may arife from a more or lefs perfect degree of calcination as above, it is a certain fact, that fome kinds of lime-ftones are much more pure, and contain a much fmaller proportion of fand than others do; fome being found almoft perfectly pure, while others contain eleven-twelfths of fand and all the intermediate proportions of it. Therefore it would be abfurd to fay that pure lime would require as fmall a proportion of fand when made into mortar, as that which originally contained in itfelf a much larger proportion of fand than any writer has ever ventured to propofe for being put into mortar.

Befides, there are differences caufed by the different nature of the calcination in the different forts of lime-ftone, from which it may, upon the whole, be concluded, that about one-tenth of *pure* lime-ftone is not enough calcined to admit of being made into mortar; and that of the moft impure forts of lime-ftone, not above one-fourth part of the lime contained in it is fo much calcined as to be in a cauftic ftate.

The variation that is produced by thefe means in regard to the proportion of fand that will be required to the lime in the one or the other cafe, is found to be fo extremely great as hardly to be conceived. It is, however, ftated, that the beft mortar that has been feen made, was formed of lime which had been found to contain eleven parts of fand to one of lime: to this there was added between twice and thrice its whole bulk of fand by meafure; which may be allowed to have been at leaft three times its quantity *by weight*. Therefore, fuppofing that every particle of that lime had been fo perfectly calcined as to be in a cauftic ftate, there could not be lefs than forty-feven parts of fand to one of lime. As much may, however, be allowed for the uncauftic part of the lime as is pleafed, and the calculation made accordingly. But it is hardly poffible to fuppofe that above one-hundredth part of this mafs, independent of the water, confifted of pure cauftic calcareous earth.

On thefe confiderations it is conceived, that it is impoffible to prefcribe any determinate proportion of fand to lime, as that muft vary according to the nature of the lime and other incidental circumftances, which would form an infinity of exceptions to any general rule. But it would feem that it might be fafely inferred that the moderns in general rather err in giving too little fand, than in giving too much. It deferves, however, to be noticed, that the fand, when naturally in the lime-ftone, is more intimately blended with the lime than can poffibly be ever effected by any mechanical operation; fo that it would be in vain to hope to make good mortar artificially from pure lime, with fuch a fmall proportion of cauftic calcareous matter as may fometimes be effected when the lime naturally contains a very large proportion of fand. But there feems to be no doubt, that if a much larger proportion of fand were employed, and if that were more carefully blended and expeditioufly worked than is common, the mortar would be much more perfect than is ufual in modern times, as has been proved by actual trials.

Another circumftance that tends greatly to vary the quality of cement, and to make a greater or fmaller proportion of fand neceffary, is the mode of preparing lime before it is beaten up into mortar. When for plaifter, it is of great importance to have every particle of the lime-ftone flaked before it is worked up; for, as fmoothnefs of the furface is the moft material point, if any particles of lime fhould be beaten up in it, and employed in work before fufficiently fallen, the water, ftill continuing to act on them after it was worked up, would infallibly flake fuch particles, which forcibly expanding themfelves, would produce thofe excrefcences on the furface of the plaifter commonly termed blifters. Confequently, in order to obtain a perfect kind of plaifter that will remain fmooth on the furface and free of blifters, there is an abfolute neceffity to allow the lime to lie for a confiderable time macerating or *fouring* in water, before it is worked up. And the fame fort of procefs is neceffary for the lime when intended for ufe as mortar, though not fo abfolutely. Great care is, however, required in the management in this refpect; the principal things being the getting of well-burnt lime, and the allowing it to macerate or *four* with the water for only a *very fhort time* before it is ufed; but that which is the beft burnt will require the maceration of fome days in the water before it is fufficiently flaked in the whole mafs for this purpofe. See Souring *Lime for Mortar and Plaifter*.

It has been almoft univerfally admitted, that the hardeft lime-ftone affords a lime that will confolidate into the firmeft cement; and hence generally concluded, that lime made of chalk, produces a much weaker cement than what is made of marble or lime-ftone. It would feem, however, that if ever this be the cafe, it is only incidentally, and not neceffarily fo. As from the nature of calcareous matter, every kind of lime is equally fit for becoming a firm cement, if it be firft reduced to a proper degree of caufticity, and has afterwards a due proportion of fand properly mixed with it, before it be employed in work. Different forts of lime, without doubt, differ much from each other in the proportion of fand they naturally contain, and, of courfe, require very different proportions of fand to be added to them before they can be made equally perfect as a cement; which is an economical confideration, of no fmall moment in fome cafes, as it may make one fort of lime a great deal cheaper than another on fome occafions, and, of courfe, deferves the attention of builders in general. See Lime.

The excellencies and defects of other fubftances that may be occafionally mixed with lime in making cement may be juft noticed. Thofe commonly ufed as an addition to mortar, befides fand of various denominations, are powdered fand-ftone, brick-duft, and fea-fhells. And for forming plaifter, where clofenefs rather than hardnefs is required, they are lime that has been flaked and kept long in a dry place, till it has become nearly effete, powdered chalk or whiting, and gypfum in various proportions; befides hair and other materials of that nature. But fome others have been more lately advifed, fuch as earthy balls, flightly burnt and pounded, powdered and fifted old mortar rubbifh, and others of a fimilar kind. All of which fubftances are found objectionable in fome refpect or other for this ufe, fand being the only perfectly fuitable material that can be eafily met with; on which account it has been always juftly preferred. Pure firm cryftallized fand is the beft, but all pure fands are not equally proper in this intention. See thefe fubftances refpectively. See alfo Cement and Sand.

It is ftated by fir Humphry Davy, in his work on "Agricultural Chemiftry," that there are two modes in which lime acts as a cement; in its combination with water, and in its combination with carbonic acid. When quick-lime is rapidly made into a pafte with water, it foon lofes its foftnefs, and the water and the lime form together a folid coherent mafs, which confifts of feventeen parts of water, to fifty-five parts of lime. When this hydrate of lime, while it is confolidating, is mixed with red oxyd of iron, alumina, or filica, the mixture becomes harder and more coherent than when lime alone is ufed; and it appears that this is owing to a certain degree of chemical attraction between hydrate of lime and thefe bodies; and they render it lefs liable to decompofe by the action of the carbonic acid in the air, and lefs foluble in water. It is thought that the bafis of all cements that are ufed for works which are to be covered with water muft be formed from hydrate of lime; and that the lime made from impure lime-ftones anfwers this purpofe very well. Puzzolana, it is faid, is compofed principally of filica, alumina, and oxyd of iron; and it is ufed mixed with lime, to form cements intended to be employed under water. It is ftated that Mr. Smeaton, in the conftruction of the Eddyftone lighthoufe, ufed a cement compofed of equal parts, by weight, of flaked lime and puzzolana. Puzzolana, it is faid, is a decompofed lava. Tarras, which was formerly imported in confiderable quantities from Holland, is found to to be a mere decompofed bafalt: two parts of flaked lime and one part of tarras form the principal part of the mortar ufed in the great dykes of Holland. It is fuppofed that fubftances which will anfwer all the ends of puzzolana and tarras, are abundant in the Britifh iflands. An excellent red tarras may be procured in any quantities from the Giant's Caufeway, in the north of Ireland: and decompofing bafalt is abundant in many parts of Scotland, and in the northern diftricts of England in which coal is found.

It is obferved that Parker's cement, and cements of the fame kind made at the alum-works of lords Dundas and Mulgrave, are mixtures of calcined, ferruginous, filiceous and aluminous matter, with hydrate of lime.

It is noticed, that the cements which act by combining with carbonic acid, or the common mortars, are made by mixing together flaked lime and fand. Thefe mortars at firft folidify as hydrates, and are flowly converted into carbonate of lime by the action of the carbonic acid of the air. It was found by Mr. Tennant, that a mortar of this kind, in three years and a quarter, had regained fixty-three *per cent.* of the quantity of carbonic acid gas, which conftitutes the definite proportion in carbonate of lime. The hardnefs of the mortar in very old buildings is alfo thought to depend upon the perfect converfion of all its parts into carbonate of lime. The pureft lime-ftones are the beft adapted, it is faid, for making this kind of mortar. The magnefian lime-ftones make excellent water cements, but act with too little energy upon carbonic acid gas to make good common mortar. The Romans, on Pliny's authority, made their beft mortar a year before it was ufed; fo that it was partially combined with carbonic acid gas before it was employed, it is fuppofed.

It is likewife fuggefted, in regard to the cultivation and improvement of land by means of this material, that quick-lime in its pure ftate, whether in powder, or diffolved in water, is injurious to plants; grafs in feveral inftances having been killed by watering it with lime-water: but that lime, in its ftate of combination with carbonic acid, is an ufeful ingredient in foils. Calcareous earth is found in the afhes of the greater number of plants; and expofed to the air, lime cannot long continue cauftic, but foon becomes united to carbonic acid. That lime, when combined with about one-third of its weight of water, conftitutes hydrate of lime; and that it becomes carbonate of lime by long expofure to the atmofphere, the place of the water being fupplied by carbonic acid gas. On mixing frefhly burnt or flaked lime with any moift fibrous vegetable matter, a ftrong action occurs between them, and they form a fort of compoft, part of which is commonly foluble in water. In this way, lime renders matter, before comparatively inert, nourifhing; and from charcoal and oxygen, abounding in vegetable matter, it becomes converted into carbonate of lime at the fame time. Mild lime, or powdered calcareous fubftances, have no action in this way on vegetable matter; by their operation they prevent the too quick decompofition of bodies previoufly diffolved; but do not tend to form foluble matters. Confequently it is clear that the operation of quick-lime and mild calcareous fubftances, depend upon wholly different principles. The former, on being applied to land, tends to bring the hard vegetable matter contained in it into more rapid decompofition and folution, as a proper food for plants. The latter only improve the texture of it, or its relation to abforption: it is merely an earthy ingredient. Quick-lime, in becoming mild, has a fimilar action, but while taking on that ftate, prepares foluble out of infoluble matter. On this depends the operation of lime in the preparation for wheat crops, its efficacy in fertilizing peats, and in bringing into cultivation all forts abounding in hard roots, dry fibres, or inert vegetable matter. The queftion, of courfe, whether quick-lime fhould be applied to land or not, depends on the quantity of inert vegetable matter it contains; and that whether mild lime, marle, or powdered lime-ftone, fhould be ufed or not, on the quantity of calcareous matter already in the land. All forts of land are improved by mild lime, and ultimately by quick-lime, which do not effervefce with acids; and the fandy forts more than the clayey kinds. In land deficient in calcareous matter, but containing much *foluble* vegetable manure, the ufe of quick-lime fhould conftantly be avoided, as tending either to decompofe the foluble matters, by uniting to their carbon and oxygen in becoming mild, or to combine with the foluble matters, and form compounds with lefs attraction for water than the pure vegetable fubftance. The fame is the cafe in regard to moft animal manures; but its operation is different in different cafes, according to the nature of the animal matter. On the whole, it fhould however never be employed with animal manures, except when too rich, or for preventing noxious effluvia. It is hurtful in mixture with common dung, and tends to produce infolubility in the extractive matter. It is ufeful in mixture with fimple vegetable barks, &c.

The folution of the queftion about the inutility and difadvantage of magnefian lime, which has lately been found ufeful in fmall quantities on the poorer lands in Leicefterfhire, as from twenty-five to thirty bufhels the acre, and in larger ones, on the rich foils; it is fuppofed to depend upon that fort of lime having a lefs attraction for carbonic acid than the other, in confequence of the portion of that fubftance in it, and thereby remaining longer in the cauftic ftate; and its becoming fooner a carbonate of lime in the rich than in the poor foils. Magnefia, while in the cauftic ftate, is poifonous to certain kinds of plants, and acts fo in the mixture as lime. It may be ufefully applied in large quantities to peat-earths; and to lands injured by too much of this fort of lime, peat-earth will be a proper and effectual remedy, when ufed in a fuitable proportion.

More full information may be met with on this curious and interefting fubject in the firft volume of Anderfon's Effays on Agriculture and Rural Affairs, in Doffie's Memoirs of Agriculture, vol. ii. and in fir Humphry Davy's "Agricultural Chemiftry."

Quick-*Manure*, a term fometimes applied to that fort which is ftrewed over crops upon the furface of the land, fuch as foot, fmall dungs, different forts of afhes, &c. As manures in this intention on pafture lands, wheat, clover, tare, and other fimilar crops, twenty bufhels of foot is recommended to the acre, fixty bufhels of rabbit or poultry dung, and fifty of pigeons' dung and afhes; but much larger as well as fmaller proportions are made ufe of in different inftances and circumftances. The foot and dungs fhould be fown over the crops about the middle of March, the afhes in February, and all in the moft equal and exact manner poffible, as much depends upon this being properly performed. See Ashes, Dung, and Soot.

In different counties there is much difference in the ufe of fubftances of thefe kinds in this way as manures. In Hertfordfhire the ufual quantities of foot employed in this manner are from about twenty to forty bufhels, on the wheat crops; but in fome places they are ufed to the extent of fifty or more on the acre. The application of this material is univerfal throughout almoft every parifh in the whole county, in this mode and intention. Afhes in the fame diftrict are confidered by fome as rendering the foil more light and open, without contributing, in any great degree, to the nutrition of the crops over which they are ſown. The proportions in which they are uſed to the acre over the clover, and occaſionally the wheat crops, are from fifty to one hundred buſhels. They are ſuppoſed to be very ſerviceable to the two clover crops, and greatly beneficial to the ſucceeding wheat one, by ſome perſons; but others are of quite the contrary opinion, thinking them of very little uſe to the wheat, except by increaſing the quantity of the clover. They are alſo uſeful in deſtroying moſs in the ſurface of graſs lands. They are to be kept dry, and commonly ſown over the crops in November or January in mild moiſt weather.

In Oxfordſhire, peat-aſhes are made uſe of from about twelve to forty buſhels upon the acre; and thoſe of coal from fixteen to upwards of fifty. They are ſown over the wheat, clover, ſaintfoin, and turnip crops, the coal being ſomewhat the beſt on the clovers, and the peat on the turnips.

In Berkſhire, peat-aſhes are uſed very generally for moſt ſorts of crops, except wheat, barley, and peas, either ſown with the ſeeds and harrowed in together, or ſown on the land as a top-dreſſing, only; but they are more preferred for all ſorts of artificial graſs crops, and on natural meadow and paſture graſſes, as well as turnips. The quantities employed are from fifteen to twenty buſhels and upwards on the acre. They are applied in March or April, ſeveral acres being capable of being ſown in the courſe of the day. They only laſt about a couple of years in the land. The aſhes of bean ſtubble are likewiſe found beneficial hereabouts, bringing up white clover when put upon the graſs lands.

Different ſorts of aſhes have been found very uſeful on the graſs lands in Suſſex, at the rate of from twenty to thirty buſhels on the acre, employed as a manure.

In Eſſex coal-aſhes are laid upon the clover, ſaintfoin, and graſs crops to the quantity of ſixty buſhels on the acre or more, with very great effects in promoting their increaſe.

In the county of Hertford they manure for turnips and ſome other crops with rabbit and poultry dungs, at the rates of from fifty to ſixty buſhels or more on the acre, with good ſucceſs. And in ſome part of the Oxford diſtrict, pigeons' dung is found an excellent manure when thrown over the young barley crops, mixed with that of poultry. In Eſſex too, it is found beneficial for promoting ſeed when ſown over the rape or cole crops in the proportion of eight buſhels to the acre.

There are ſeveral other articles which are occaſionally thrown over crops on the ſurface of the lands as a manure, in this intention, ſuch as thoſe of the duſt of malt, rape-cake, bones, plaiſter of Paris, and ſome others. Malt-duſt is made uſe of on wheat and barley in many parts of the county of Oxford, and on the young wheats in Hertfordſhire, in the quantity of five quarters to the acre. In Berkſhire thirty buſhels *per* acre. Rape-cake duſt is alſo uſed in the former of theſe laſt counties on the wheats with great ſucceſs. Pounded bones are likewiſe greatly beneficial when ſtrewed over the graſs and ſome other ſorts of crops, being ſometimes a very forcing manure, and at the ſame time laſting. The plaiſter of Paris has been uſed on clover, ſaintfoin, lucern, and other crops with immenſe effect, in ſome parts of Oxfordſhire, ſown over them about March, to the quantity of ſix buſhels *per* acre. But in Suſſex, in the proportion of eight buſhels to the acre, when ſown over natural graſs, bean, potatoe, pea, and barley crops, it had not the leaſt good effect. Nor even when tried on other ſorts in the quantity of ſix buſhels to the ſame extent of land.

Powdered oil-cake that has been ſpoiled by keeping, is an excellent application as manure in the above way. The ſame is alſo the caſe with chopped tanners' hair, which has been found ſuperior in this uſe to either malt-duſt or any ſort of calcareous matter. Horn-ſhavings are likewiſe very beneficial when laid on in this manner to graſs lands, in the proportion of from fifty to one hundred buſhels to the acre, laſting five or ſix years, and being of very eaſy carriage they ſhould be employed in damp weather about February or March. See Manure.

All theſe different ſorts conſtitute excellent quick forcing manures, when applied in ſome of theſe ways for ſome of the above purpoſes, and ſhould be much more generally employed in ſuch methods than is at preſent the caſe.

Quick *Match*, in *Artillery*, is formed of three cotton ſtrands drawn into length, and dipped in a boiling compoſition of white wine vinegar, ſaltpetre, and mealed powder. After this immerſion, it is taken out hot, and laid in a trough where ſome mealed powder, moiſtened with ſpirits of wine, is thoroughly incorporated into the twiſts of the cotton, by rolling it therein: thus prepared, they are taken out ſeparately and drawn through mealed powder, and then hung upon a line to dry. There is alſo quick match made of worſted inſtead of cotton. For its uſe, ſee Fire-*Ships*.

Quick *with Child*, in *Law*. See Reprieve.

Quick *Pulſe*, in *Medicine*. See Pulse.

Quick *Sand*, in *Sea Language*, denotes a looſe quaking ſand, into which a ſhip ſinks by her own weight, as ſoon as the water retreats from her bottom. See Quicksand.

Quick *Thorn*, in *Agriculture*, a name frequently applied to young plants of the hawthorn or white-thorn kind, which are fit for being planted out for the purpoſe of forming a hedge-fence. See Quicks, and Quickset.

It alſo ſignifies this ſort of thorn generally.

QUICKEN Tree, in *Gardening*, the common name of a tree of the ornamental fruit kind. See Sorbus.

QUICKENING, in *Midwifery*, the firſt perception women have of the motion of the fœtus. This uſually happens in the third or fourth month of pregnancy. It has puzzled phyſiologiſts to explain why the motion of the fœtus ſhould not be perceived earlier, as it is endowed with life from the firſt moment of conception. But, beſides that the parts of the fœtus are too ſoft and tender to affect the uterus by its motion, the membranes enveloping it are too thick, and there is then a proportionably larger quantity of fluid in the ovum than afterwards, which keeps the embryo from touching the ſides of it. The uterus alſo during this period is confined in the cavity of the pelvis, which being of ſmall capacity, and every way ſurrounded with bones, leaves little room for the motion of the fœtus. But as ſoon as the uterus emerges into the cavity of the abdomen, it readily yields to the motion of the incloſed fœtus, and the parts by which it is now ſurrounded being extremely delicate and ſenſible, they are affected by the ſlighteſt ſtirring of it. In ſome women of delicate habits, the moment of quickening is marked by a ſlight hyſteric paroxyſm. In theſe caſes it ſeems probable, that the uterus has ſlipped ſuddenly into the abdomen, but ordinarily it riſes ſlowly and gradually, whence the ſhock on the bowels is ſo inconſiderable, as ſcarcely to make any ſenſible impreſſion. See Conception.

QUICKING-Drag, in *Agriculture*, a name ſometimes given in different diſtricts to the couch and quitch drag. See Drag.

QUICKJOCK, in *Geography*, a town of Sweden, in the Lapmark of Lutea; 15 miles N.W. of Lutea. N. lat. 67° 20′. E. long. 17°.

QUICKS,

QUICKS, in *Agriculture*, a name commonly given to the young fets of the white-thorn, which are ufed in planting hedges of that fort. See QUICKSET-*Hedge*.

It is thought to be indifpenfably neceffary to the fuccefs of this fort of fets, as hedge plants, in every fituation, that they be well provided with roots and root fibrils of the healthy kind, by Mr. Nichol, who has had much experience upon the fubject. And that this is beft fecured by taking them from a feminary of rich mould at the end of the firft or fecond year, according to their ftrength; and nurfing them, after that, likewife in rich earth, for one or two feafons longer at the fartheft: but, in the latter cafe, removing them into frefh rows at the end of the firft year. It is contended, that plants of this age, and thus treated, will outgrow thofe of greater fize in any fort of foil or fituation. This has been repeatedly proved by impartial trials; and the caufe, it is fuppofed, is obvioufly this, that fmall plants, even by the fame treatment, are raifed with better roots, in proportion to their ftems, than large ones. Therefore in the choice of quicks, regard fhould be had to the roots, not the tops of the plants. Their being nurfed the feafon previous to their being removed for hedging purpofes, in rich mellow earth, and being allowed a fufficiency of room, kept clear of weeds and other matters, is the beft mode of preparation, it is imagined, that can poffibly be adopted.

There is, however, it is maintained, a double advantage in making ufe of young plants of this nature. They are cheaper and fitter for expofed fituations than thofe of older growths; not becaufe their tops are lefs bufhy, which, fince they are to be cut over about half their lengths before being planted, is immaterial, but becaufe they have better proportioned roots to the fize and ftrength of the ftems, and of courfe are better fitted to feek pafturage for their common fuftenance and fupport.

The ftems of the plants, as has been fuggefted above, fhould be cut over about half their lengths, or, in general, about fix inches above the ground mark: an operation which may be performed by the common hedge fhears, a large fharp knife; or by gathering a handful of them evenly, and laying them upon a block or other fimilar body, and chopping them off by means of a hatchet. They fhould always be carefully raifed, and even the fmalleft fibre be retained. And at all times, until replanted, the roots fhould be expofed as little as poffible to the air or atmofphere. See QUICKSET.

QUICKS is alfo a term fometimes applied to the weed called couch-grafs, in different places, and which is of a very troublefome nature, not being extirpated out of the land without much difficulty. See COUCH.

QUICKSAND, any fort of fpot or bed of running fand, either near to the furface of the foil, or at any depth below it, which has a fhaking quaggy feel under the foot at certain times or feafons, in confequence of containing certain proportions of water. The writer of the work on "Landed Property" has remarked, that they are for the moft part topical, and in general only temporary, commonly appearing in and after wet feafons only; clofing and becoming firm when their fupplies of moifture are exhaufted by long drought. In thefe cafes the furfaces are free from the depofition of the moory earth of bog plants, which demand a conftant coolnefs, if not a perpetual fupply of moifture, being caufed by heads or fmall beds of fand or gravel rifing through firmer ftrata to the furface. They are of courfe apt to be fcorched in dry hot feafons. In order to remove them, the fame writer advifes, that the centre of the part which is affected fhould be marked out when the feafon is wet, in order that a drain may be cut, when it is dry, of a fufficient depth quite up to the mark, letting it have the neceffary defcent, and then filling it with fuitable materials to admit of the water being conveyed off as it is collected in the fub-foil. When the defect has been thus removed, where it is fituated in the area of a field, it is a good practice to cover the part by foil of the fame nature as that of the field where it is fituated, by bringing it from thofe parts which are the moft elevated, as by this means it may be rendered of an uniform quality with the reft, and of courfe have a better appearance, as well as be more advantageous in the growth of crops.

Dangerous tracts and fpots of this nature are frequently found in marfhy and fandy lands, which are occafionally covered by the tides. And large deep beds or layers of quick or running fand are often met with in digging pits, quarries, mines, and other forts of fhafts, to great depths under the ground, and caufe much trouble and difficulty in getting on with fuch kinds of work, on account of the quantities of water which they contain and let pafs off into them: thus occafioning the neceffity of much difficult drainage, and other inconveniences. See QUARRIES, *Pits*, &c. *Draining of*.

QUICKSAND *Bay*, in *Geography*, a bay on the weft coaft of North America. N. lat. 45° 50'. W. long. 124°.

QUICKSET, in *Agriculture*, a term generally applied to the white, or hawthorn plant, the fets or young plants of which are raifed by nurferymen for fale, for the purpofe of planting and forming hedge-fences. The roots of the thorn will, however, anfwer equally well, and in fome cafes much better, as there is a certainty of their being of the right fort, or fuch as have prickles upon them, which does not always happen in ufing the quickfets, as they are liable to difappear when raifed in this method, but which is never the cafe in the root-mode. See FENCE-*Thorn*, and WHITE-*Thorn*.

Young plants of the quickfet kind are beft raifed in fmall portions of ground fet apart for them; in which, after they are come up from the feed to fome height, they fhould be tranfplanted in lines at narrow diftances, in a ftraight manner, with fmall intervals between the rows; where they are to remain from three to five years or more, being annually well cleaned and moulded up. Some, however, tranfplant them more than once, and think it an advantageous way, but they do well in either method. Well grown plants, with ftout clean ftems, are the moft proper for planting out as hedge plants.

QUICKSET *Hedge*, a name given to all forts of hedge-fences which are conftituted of any fort of living plants; but more efpecially of thofe of the white-thorn kind. Hedges of this nature compofe the principal fences of this country. In the drier and better forts of foil, thofe of the thorn kind generally prevail; but in moft other fituations, thofe of fome other forts of plants, according to the particular nature of the foils and expofures. The quicks or quickfets of the thorn forts are commonly fuppofed to form the beft hedges, when planted in the raifed bank or dike method. The manner of placing them out in thefe, is different in different cafes, both in refpect to the form and number of the rows, as well as the diftances of the plants from each other. Some think one regular or irregular row the moft proper, others prefer two ftraight ones; and fome fuppofe a few inches diftance from plant to plant the moft beneficial; while others think eight or nine inches to be much better. Strong well-grown quickfets are commonly preferred in all cafes. It is remarked in the Effex Report, by one of the perfons engaged in drawing it up, that in the parifh parish of Birdbrook, in the north-east part of it, "some excellent hawthorn hedges have been lately raised, by planting one row only at six inches asunder, rather than two rows nine inches or a foot apart. The hedges have not been cut down, nor do they require it, to thicken their bottoms, as they are, at this time, a complete protection against hogs, and in other respects form a beautiful and effectual fence. Nothing can be more evident, it is thought, than that a row of plants set thus, ... six inches distant from each other, must form a more complete and effectual fence at the bottom, than an equal number planted thus, .·.·.·.· at a double distance, and occupying the same length, but a greater depth of ground upon the hedge row." This reasoning of Mr. Vancouver's, Mr. Young observes, may, for aught he certainly knows, be conclusive, but it strikes him in a different light. It is true, that the plants in each row are, in the latter mode, at double the distance from each other than they are in the former; but it is to be observed, that in the double row, the plants are diagonally as near each other as in the single row, and, consequently, there is the same vacant space for any animal to pass through in the single row as in the double; and what must be a great advantage to the latter, the plants will shoot out their branches laterally on the outsides at least, just as far as those in the single row, and twice as far lengthwise, meeting with no obstruction in their progress. Of course, it is naturally to be concluded, that the double-rowed plantation must form a fence, if not altogether twice as strong and secure, yet vastly stronger and securer than the single one. He does not, however, presume to set speculation against fact, as he has not seen the hedge noticed above, while Mr. Vancouver has. He has, however, himself planted one in a single row, as above described and recommended; the plants have grown well; the hedge is a good one, but would, he thinks, have been still better, if there had been two rows instead of one, as some others are that he has of that description.

In Sussex, the quickset hedges at Goodwood are capital, and deserving of every attention, being raised and trained in a most masterly manner. The duke of Richmond planted them about eighteen or twenty years ago. They surround a very considerable farm, and are in a wonderful state of preservation. They form an excellent fence, without the assistance of any ditch, bank, rail, or pale; consist of three rows of white-thorn plants, which spread three or four feet at bottom, but are clipped regularly and gradually to a thin edge at top; the shoots are so numerous, and trained with such care, that even in winter, without a leaf, the thickness is uncommon. By the young hedges now in training, it appears that one method pursued has been to plant the centre row first, and when that is well established, to add another on each side of it; at least this is done in these new hedges. They are kept in a state of garden cleanness; the branches are drawn into the line desired, by being tied with mat, or other lines, and the clipping done with the exactest attention; the union of the hedges with the gate-posts is close and perfect, and as to gap, &c. there is no such thing. How they have been preserved from cattle, but especially from sheep, is marvellous, if either are ever allowed to enter these closes;—an attention never ceasing, and a boundless expence, so far as necessary, must have been exerted. They cannot be recommended to the imitation of farmers on account of the trouble and expence of them, but they are beautiful as an object to the farming eye, and for their perfection, they merit all that can be said of them.

On the Walburton farm in the same district, there are some very good quickset hedges, which were planted about twenty-three years ago; the quick was set about two inches asunder, and single; they are cut twice in a year; are four and a half feet high, and two feet thick. There is very little ground lost by the hedge, as it occupies only four feet. The same excellent sort of quickset hedges has also been made in some other places.

Here two rows of white-thorn plants are common, which are put on the bank of the ditch, care being taken not to have them too near it, for fear of its draining them too much and preventing their growth.

In some districts, where the cultivation is principally of the arable or tillage kind, and in exposed upland situations, there is frequently a great prejudice and objection to the introduction and formation of any sort of live hedges, whether of the quickset or any other description, as they take up much space, harbour birds and insects, greatly shade the grain, and tend to promote blight, rust, and mildew, by preventing the free circulation of air. Also in bleak exposures they are not raised without great difficulty. Such objections, however, speedily vanish where they are kept sufficiently low and well cut in and trained on the sides. See Hedge and Fence.

QUICKSILVER, a very ponderous fluid mineral, by the chemists called *mercury*. For the method of gaining, preparing it, &c. with its properties, uses, &c. see Mercury.

Quicksilver, when rubbed down and blended with unctuous matters, forms a sort of ointment, which is useful in the curing of different diseases of the cuticular kind, as well as in destroying lice and other vermin that infest animals of different kinds, which form the live-stock of the farmer.

It has also been stated on the authority of Mr. Bradford, as communicated to the Society for the Encouragement of Arts, &c. to have been found useful in its crude state in destroying insects on fruit trees. On a plum-tree he made the following trials: he took a small awl, and pierced, sloping, through the rind, and into part of the wood of the branch, but not to the heart or pith of it; and poured in a small drop or two of the quicksilver, and stopt it up with a small wooden plug, made to fit the orifice: and the result was, he says, that the insects all dropt off from that very branch the next day; and in a day or two more, from off the other branches of the tree, without any other puncture: and the tree continued in full vigour, and throve well all the summer after. Encouraged by this success, he next tried it upon an honeysuckle, the leaves of which were quite covered with them: and here he scraped away the top of the ground with a trowel, and run his awl, in the same sloping manner, into the main stem, just above the roots; but with the same caution as above, not quite to the inner pith; and the success was the same as before. The insects all dropt off dead the next day after the experiment was made.

These trials are said to have been confirmed by other experiments; but they are still in want of full and satisfactory confirmation.

Quicksilver, *Virgin*. See Virgin.

Quicksilver *Water*. See Water.

QUICKSTADT, in *Geography*, a town of Norway, in the province of Aggerhuus; 42 miles N. of Christiania.

QUICK-WORK, in a *Ship*, is a general name given to all that part of a ship which is under the surface of the water, when she is laden fit for a sea-voyage. The term is also applied, occasionally, to that part of the side which is above the sheer-rail, and which is usually painted with trophies, &c. on the outside. Falconer.

Quick-work is likewise applied to the strakes that shut in the inside, between the spirketting and clamps.

QUID,

QUID, *What*, in the *Schools*, is ufed to denote the definition of a thing.

It is thus called, becaufe the definition anfwers to the queftion, *quid eft? what is it?*

Hence we have two kinds of quids; nominal, *quid nominis;* and real, *quid rei.*

Quid *juris clamat*, in *Law*, a writ that lies where I grant the reverfion of my tenant for life by fine in the king's court, and the tenant will not attorn; then the grantee fhall have this writ to compel him.

This writ feems to be obfolete, fince the fourth and fifth of Anne. See Attournment.

Quid *pro quo*, q. d. *what for what*, denotes the giving one thing of value for another; or the mutual confideration and performance of both parties to a contract.

Quid *pro quo*, or Qui *pro quo*, is alfo ufed, in *Phyfic*, to exprefs a miftake or cheat of an apothecary, in adminiftering one medicine for another: or in ufing an ingredient in a compofition different from that prefcribed.

A northern phyfician, in a printed thefis on *quid pro quos*, owns ingenuoufly, that they are very frequent. He diftinguifhes very accurately a great variety of kinds of *quid pro quos;* fome with regard to the operation, others with regard to the fubject; and others with regard to their form, or effects. The firft comprehends the *quid pro quos* of the phyfician; the fecond, thofe of the patient; the third, thofe of the apothecary.

Quid *Loft*, a term which fignifies the lofs of the ruminant power in animals of the live-ftock kind. It is moftly produced by local weaknefs of the ftomach, caufed by eating improper coarfe kinds of food in too large quantities, or other fimilar means. It may be beft reftored by the ufe of ftrong acids of the vegetable and other kinds, and its return prevented by ftrong bitter infufions, as thofe of gentian, bark, &c. See Cud.

QUIDDEINEN, in *Geography*, a town of Pruffia, in Oberland; 6 miles S.E. of Holland.

QUIDDENY, Quiddany, (of the Latin *cydonium*, or *cydoniatum*,) a conferve of quinces, called alfo marmalade.

QUIDDITY, Quidditas, in the *Schools*, a word of the fame fignification with *effence*.

The name is derived hence, that it is by the effence of a thing that it is *tale quid*, fuch a quid, or very thing, and not another. When upon feeing, or hearing, the name of a thing, with whofe nature, &c. we are unacquainted, we afk, *Quid eft? What is it?* we mean no more by the interrogation, but that we defire to have its nature and effence explained by a definition. Whence quiddity is ufually defined the effence known or expreffed in a definition.

And hence what is effential to a thing is faid to be quidditive; as quidditive knowledge, &c.

QUIEBOU, in *Geography*, a town of France, in the department of the Channel; 6 miles S.W. of St. Lo.

QUIEN, Michael le, in *Biography*, a learned Dominican monk, who flourifhed in the latter part of the 17th and in the 18th century, was born in the year 1661. He received a liberal education, having been inftructed in claffical learning at his native place, and he was then fent to ftudy philofophy at the college du Pleffis, at Paris. At twenty years of age he determined to renounce the world, and took the habit in a Dominican convent. Here he ftudied with uncommon affiduity and proportionate fuccefs, the Greek, Hebrew, and Arabic languages, criticifm, divinity, the facred fcriptures, and ecclefiaftical antiquities. In the year 1690 he firft appeared as an author, by publifhing "A Defence of the Hebrew Text and the Vulgate Verfion," againft a work, entitled "The Antiquity of Time reftored," written by father Pezron. The latter having publifhed a reply, Quien anfwered in a work entitled "The Antiquity of Time exploded." He next attacked him in "Remarks" on his "Attempt at a literal and hiftorical Commentary on the Prophets," printed in the Memoires de Trevoux, for March 1711. During the following year he publifhed "S. Joannis Damafceni Opera quæ extant Gr. et Lat." in 2 vols. fol. accompanied with differtations abounding in erudition. He intended to have given a third volume, containing fuch pieces as had been falfely attributed to that father, but it was never fent to the prefs. The fame fortune has attended his labours on "The Works of Leo of Byzantium," to which he had paid a confiderable fhare of attention. Towards the clofe of his life he entered into a controverfy with father Courayer, concerning the validity of the ordinations of the church of England, in which the palm of victory was given to his opponent. Le Quien died in 1733, at the age of 72 years, refpected for his piety, and uniform correctnefs of conduct. He was author of various "Differtations" to be found in Defmolets "Memoires de Literature et d'Hiftoire," and the "Mercure de France." At the time of his death he was engaged in printing the moft confiderable of his works, relating to the ancient and prefent ftate of the eaftern churches. "His plan includes the whole of his churches, under the four grand patriarchates of Conftantinople, Alexandria, Antioch, and Jerufalem; prefents a geographical defcription of each diocefe, and of the epifcopal cities, and then gives a particular account of the origin and eftablifhment of the churches, their extent, their jurifdiction, their rights, their prerogatives, the fucceffion and order of their bifhops, their political government, the changes which they have undergone," &c. As the author did not live to finifh his work, it was publifhed with additions, in the year 1740, under the title of "Michaelis le Quien Oriens Chriftianus, in quatuor Patriarchatus digeftus, qua exhibentur Ecclefiæ, Patriarchæ, cæterique Prefules Orientis," &c. in 3 vols. fol. Moreri.

QUIENFIORD, in *Geography*, a bay on the coaft of Norway; 27 miles N. of Chriftianfand.

QUIENS, a river of Norway, which runs into the fea, 18 miles N. of Cape Lindefnefs.

QUIESCENT, fomething at reft.

QUIETISM, in *Ecclefiaftical Hiftory*, the fentiments of the Quietifts, a religious fect, which made a great noife towards the clofe of the 17th century.

Molinos, a Spanifh prieft, who died at Rome in the prifon of the inquifition, paffes for the author of Quietifm; and yet the Illuminati in Spain had taught fomething like it before.

A fect fimilar to this had appeared at Mount Athos, in Theffaly, towards the clofe of the fourteenth century, under the appellation of Hefychafts, which denotes the fame with Quietifts. Thefe were a branch of the *Myftics*, (which fee,) or thofe more perfect monks, who, by a long courfe of intenfe contemplation, endeavoured to arrive at a tranquillity of mind entirely free from every degree of tumult and perturbation. Thefe Quietifts, in conformity to an ancient opinion of their principal doctors, (who imagined that there was a celeftial light concealed in the deepeft retirements of the mind,) ufed to fit every day, during a certain fpace of time, in a folitary corner, with their eyes eagerly and immoveably fixed upon the middle region of the belly, or navel; and boafted, that, while they remained in this pofture, they found, in effect, a divine light beaming forth from the foul, which diffufed through their hearts inexpreffible fenfations of pleafure and delight. To fuch as inquired what kind of light this was, they replied, by way of illuftration, that it was the glory of God, the fame celeftial radiance that furrounded

Chrift

Chrift during his transfiguration on the mount. Barlaam, a monk of Calabria, from whom the Barlaamites derived their denomination, ftyled the monks, who adhered to this inftitution, Maffalians and Euchites: and he gave them alfo the new name of Umbilicani. Gregory Palamas, archbifhop of Theffalonica, defended their caufe againft Barlaam, who was condemned in a council held at Conftantinople in the year 1341.

The name is taken from a fort of abfolute reft, and inaction, which the foul is fuppofed to be in, when arrived at the ftate of perfection, which in their language is called *the unitive life.* To arrive at this, a man is firft to pafs through the purgative way; that is, through a courfe of obedience, infpired by the fear of hell: hence he is to proceed into the illuminative way, before he arrives at perfection.

The fentiments of the Quietifts, with regard to God, are wonderfully pure and difinterefted. They love him for himfelf, on account of his own perfections, independently of any rewards or punifhments: the foul acquiefces in the will of God, even at the time when he precipitates it into hell; infomuch that inftead of ftopping him on this occafion, B. Angelo de Foligny cried out, "Hafte, Lord, to caft me into hell: do not delay if thou haft abandoned me: but finifh my deftruction, and plunge me into the abyfs."

At length the foul, after long travail, enters into reft, into a perfect quietude. Here it is wholly employed in contemplating its God; it acts no more, thinks no more, defires no more; but lies perfectly open, and at large, to receive the grace of God, who by means thereof drives it where it will, and as it will.

In this ftate it no longer needs prayers, or hymns, or vows; prayers where the fpirit labours, and the mouth opens, are the lot of the weak, and the imperfect: the foul of the faint is, as it were, laid in the bofom, and between the arms of its God, where, without making any motion, or exerting any action, it waits, and receives the divine graces. It then becomes happy: quitting the exiftence it before had, it is now changed; it is transformed, and, as it were, funk and fwallowed up in the Divine Being, infomuch as not to know or perceive its being diftinguifhed from God himfelf. Fenel. Max. des Saints.

QUIETISTS, the difciples of Mich. de Molinos; or the adherents to the opinions delivered in the article QUIETISM. The fentiments of Molinos were contained in a book, which he publifhed at Rome in the year 1681, under the title of the "Spiritual Guide:" in confequence of which he was caft into prifon in 1685, where he was foon obliged to renounce, in a public manner, the errors of which he was accufed: and this folemn recantation was neverthelefs followed by a fentence of perpetual imprifonment, from which he was in an advanced age delivered by death, in the year 1696. Molinos had a confiderable number of difciples in Italy, Spain, France, and the Netherlands. One of the principal patrons and propagators of Quietifm in France, was Marie Bouvieres de la Mothe Guyon, a woman of fafhion, remarkable for the goodnefs of her heart, and the regularity of her manners; but of an unfettled temper, and fubject to be drawn away by the feduction of a warm and unbridled fancy. This female apoftle of myfticifm derived all her ideas of religion from the feelings of her own heart, and defcribed its nature to others as fhe felt it herfelf. Accordingly, her religious fentiments made a great noife in the year 1687; and they were pronounced unfound, after accurate examination by feveral men of eminent piety and learning, and profeffedly confuted, in the year 1697, by the celebrated Boffuet. Hence arofe a controverfy of great moment, between the prelate laft mentioned, and Fenelon, archbifhop of Cambray, who feemed difpofed to favour the religious fyftem of Madame Guyon, and who, in 1697, publifhed a book, cited in the laft article, containing feveral of her tenets. Fenelon's book, by the intereft of Boffuet, was condemned in the year 1699, by Innocent XII. and the fentence of condemnation was read by Fenelon himfelf at Cambray, who exhorted the people to refpect and obey the papal decree. Notwithftanding this feeming acquiefcence, the archbifhop perfifted, to the end of his days, in the fentiments which, in obedience to the order of the pope, he retracted and condemned in a public manner. See the article FENELON.

QUIETO, in *Geography*, a river of Iftria, which runs into the Adriatic, two miles W. of Baftia.

QUIETUS, *freed* or *acquitted*, a term ufed by the clerk of the pipe, and the auditors in the exchequer, in their acquittances or difcharges given to accomptants, which ufually conclude with the words *abinde receffit quietus*; which is called a *quietus eft*.

A *quietus eft* granted to a fheriff, difcharges him of all accounts due to the king.

QUIFORO, in *Geography*, a diftrict of Africa, on the Gold Coaft.

QUIGNONES, FRANCIS DE, in *Biography*, an eminent Spanifh cardinal in the 16th century, who embraced the religious life at an early age, in a monaftery of Francifcans, and fubfequently afforded fuch evidence of fuperior talents, that he was elected general of his order in the year 1522. He obtained the office of confeffor to Charles V. and upon the capture of Rome by the imperial army in 1527, and the imprifonment of pope Clement VII. in the caftle of St. Angelo, his fervices were folicited by that pontiff, in negociating for his liberty, and were afterwards rewarded with a cardinal's hat. After this, he was by the fame intereft nominated bifhop of Cauria, and fent in the capacity of apoftolical legate into Spain, and the kingdom of Naples. He died in the year 1540. He was author of a reformed breviary printed at Rome in 1536, which met with the approbation of popes Clement VII. and Paul III. but it was afterwards fupprefled by Pius V.; hence it has become fcarce, and is fought after by collectors. Several fpurious editions have been printed at different times. It is inferted in the "Annales Minores" of Wadingus, and in the fecond edition of Joly's treatife "De Reformandis Horis Canonicis."

QUIJUBATUI, in *Ornithology*, the name of an American fpecies of paroquette.

It is of the fize of a lark, and in general of a yellow colour. Its eyes are black, and its beak grey. The edges of its wings are of a dufky green, and its tail long and yellow. It is a very beautiful bird, and very eafily tamed. See PSITTACUS *Guarouba*.

QUIKNE, in *Geography*, a town of Norway, in the province of Bergen; 105 miles N. of Chriftiania.

QUIL, in *Zoology*. See QUIRPELE, and VIVERRA *Mungo*.

QUILAQUIL, in *Ornithology*, the name given by the people of the Philippine iflands to a very beautiful fpecies of parrots, which is commonly found wild in the woods there. It is all over of a fine green colour, and is fmaller than the common parrots, and has a broad black bill, and black legs. It is a very wild bird, and will not learn any thing.

QUILATE, in Spanifh and Portuguefe *Coinage*, a term ufed for *carat*; which fee.

QUILEA, in *Geography*, a fea-port town of Peru, near the Pacific ocean, which gives name to a fertile valley, in the jurifdiction of Arequipa. S. lat. 16° 45'.

QUILICI,

QUILICI, Gaetano, in *Biography*, an Italian opera-finger, with a bafe voice: a good mufician, who arrived here in 1759, during the performance and opera regency of the Mattei. He continued to perform on our lyric ftage near thirty years, and is, we believe, ftill living in London, we fear, in penury and obfcurity. Since quitting the ftage, he has fupported himfelf, a bed-ridden wife, and an ideot fon, by teaching to fing, and has made fome admirable fcholars.

QUILIMANCY, in *Geography*, a river of Africa, which runs into the Indian fea, 20 miles S. of Melinda. S. lat. 3° 16′. E. long. 40° 10′.—Alfo, a fea-port town of Africa, in the kingdom of Melinda, at the mouth of the before-mentioned river, belonging to the Portuguefe. S. lat. 3° 10′.

QUILIMANE, a town of Africa, in Mozambique. S. lat. 18° 15′. E. long. 37° 30′.

QUILLAJA, in *Botany*, a genus of plants found in Chili, and defcribed by Molina. Juff. 444. Lamarck Illuftr. t. 774.—Clafs and order, *Monoecia Dodecandria*. Nat. Ord. uncertain.

Eff. Ch. Male, Calyx five-cleft. Corolla none. Stamens twelve, or more.

Female, Calyx five-cleft. Corolla none. Germens five, fuperior, oppofite to the fegments of the calyx. Styles five. Capfules five, coriaceous, of two valves, and one cell. Seeds numerous, oblong, inferted into the bottom of the capfule, dilated and winged at the fummit.

Such is the character made out by Juffieu, from the publications of Molina and Frezier, and from fpecimens of the fruit, brought to Europe by Dombey. They belong to a *tree*, whofe *bark* has a foapy quality. The *leaves* are alternate, fimple, evergreen. *Flowers* axillary.—The genus appears akin to the *Magnoliæ* of Juffieu, but whatever it may be, the name is barbarous and quite inadmiffible; only tolerable for a time, till fome botanift, furnifhed with better materials to define the genus, fhall be entitled to give it a more claffical appellation. Juffieu remarks, that another plant of Dombey's appears to belong to the above genus. This is a tree referred by him to *Dioecia Icofandria*, whofe fruit is called *Gayo colorado*, and which is the fame with the "*Loque*, or Peruvian tree with five capfules," of Jofeph de Juffieu, whofe branches, according to his manufcript account, are fo long and pliant, as to be twifted into cords, ferving, in the province of Cufco, for the fupport of hanging bridges.

QUILLALA, in *Geography*, a town of Chili, on the Aconcagua; 30 miles E.N.E. of Valparayfo.

QUILLAN, a town of France, in the department of the Aude, and chief place of a canton, in the diftrict of Limoux; 10 miles S. of Limoux. The place contains 1568, and the canton 9195 inhabitants, on a territory of 272½ kiliometres, in 22 communes. N. lat. 42° 52′. E. long. 2° 16′.

QUILLA-YACU, a town of Peru, in the diocefe of Lima; 60 miles E.N.E. of Guanuco.

QUILLE, a town of Sweden, in Weft Gothland; 23 miles N. of Uddevalla.

QUILLEBŒUF, a town of France, in the department of the Eure, and chief place of a canton, in the diftrict of Pontaudemer, feated on the Seine; eight miles N. of Pontaudemer. The place contains 1200, and the canton 7272 inhabitants, on a territory of 107½ kiliometres, in 16 communes. N. lat. 49° 29′. E. long. 0° 38′.

QUILLET, Claude, in *Biography*, born at Chinon, in Touraine, about the year 1602, was brought up to medicine, which he practifed fome years, till he was obliged to quit the country on account of his oppofition to a meafure of Richelieu, which is thus narrated. Quillet was at Loudun at the time that Loubardemont, a creature of the cardinal, was fent thither to take informations refpecting the pretended poffeffion of fome nuns by the forceries of Urban Grandier (fee his article), an impofture which Richelieu thought fit to favour. The counterfeit Satan one day threatened, that on the morrow he would lift up to the roof of the church any one who fhould prefume to call his power in queftion. A large company appeared on the next day with M. Loubardemont, when Quillet, who alfo was prefent, challenged the devil to keep his word. To the furprife of the fuperftitious who had met on the occafion, nothing followed, but the challenger found to his coft that he had given offence to a mightier power than Satan, and felt it neceffary to quit Loudun in hafte, and retire to Italy. He went to Rome, and was engaged as fecretary to the French ambaffador at that court. He probably returned to France with that minifter, after the death of Richelieu, and in 1655 he publifhed at Leyden, under the name of Calvidius Lætus, the poem by which he is chiefly known, entitled "Callipædia five de pulchræ Prolis habendæ ratione." In the firft edition were fome fatirical lines againft Mazarin. The cardinal fent for him, and having gently remonftrated with him for treating his friends with feverity, promifed to give him the firft vacant abbey. Quillet threw himfelf at the cardinal's feet, afked pardon, affured him he would inftantly obliterate the offenfive lines, and begged, as a fign of his penitence, to be allowed to dedicate the poem to him. This was done in the Paris edition of 1656, and Quillet became the flatterer of him who had been the object of his fatire. He died at Paris in 1661, repenting not of his adulation, but of the licentious caft of fome of his verfes. The Callipædia has gone through many editions, and has been tranflated into various languages. "It is," fays an able critic, "an ingenious performance, agreeably varied by fable and epifode, but frivolous in its main topic, and in its reafonings. Its details are frequently loofe and inflammatory, and that a cardinal fhould have allowed it to have been dedicated to him, is a proof how little regard was paid, at that period, to the rules of decorum. The verfification, though generally free and flowing, is by no means correct, and the diction is frequently impure." Quillet compofed a verfion of Juvenal in French verfe, and a Latin poem in twelve books, entitled "Henriados," or the actions of Henry IV. This, with other papers, he left to Menage, with 500 crowns to defray the charge of printing them, but the abbe took the money, and neglected the conditions.

QUILLIGA, in *Geography*, a country of Africa, in Upper Guinea, near the river Maqualbary.

QUILLOBO, in *Botany*, a name given by fome to a fpecies of ketmia, called alfo *quingombo*.

QUILLOT, Killo, or *Kiflo*, in *Commerce*, a Turkifh corn meafure, weighing, in wheat, about 23 okes, or 60lbs. avoirdupois: 4 killos make 1 fortin; 8½ killos anfwer nearly to 1 Englifh quarter. A killo of rice contains 10 okes, and the oke is 400 drachms.

QUILLOTA, in *Geography*, a town and jurifdiction of Chili. The town does not contain above 100 families, but thofe fcattered over the country exceed 1000.

QUILLY, a town of France, in the department of the Lower Loire; 7 miles N. of Savenay.

QUILOA, a country and kingdom of Africa, fituated near the eaft coaft, near the mouth of the Coavo, about 180 miles from north to fouth; but the extent inland towards the weft is unknown. This country was firft difcovered by the Portuguefe, in the year 1498. The king and his fubjects are Mahometans; the latter partly black and partly tawny. They all ſpeak the Arabic and ſeveral other languages, which they learn from the nations they traffic with. Their dreſs is that of the Arabian Turks: the women eſpecially affect finery, with variety of ornaments about their necks, arms, wriſts, and ankles; particularly bracelets made of ivory, curiouſly wrought, which upon the death of a parent, huſband, or near relation, they break in pieces, in token of ſorrow, whilſt the men expreſs theirs by ſhaving their hair, and abſtaining from food. The capital of the kingdom is ſituated on an iſland near the mouth of the Coavo, and is ſaid to be large, rich, and well built. The houſes are of ſtone and mortar, handſome, and after the Spaniſh manner. They are ſeveral ſtories high, and have each a pleaſant garden behind, well watered and cultivated, here being plenty of ſprings of freſh water. The houſes are finely furniſhed within, and terraces on the top, with a kind of hard clay, and the ſtreets ſo narrow, that one may eaſily ſtep from one ſide to the other. On one ſide of the town is the citadel, where reſides the Mahometan prince. It is adorned with ſtately towers, and ſurrounded with a ditch and other fortifications. It hath two gates, one towards the port, whence one may ſee the ſhips ſailing in and out; the other looking towards the land. The country about Quiloa, though low, is yet very pleaſant and fertile in rice and millet, fruits and good paſture; ſo that they breed abundance of cattle, beſides poultry of all ſorts, both wild and tame. They have fiſh likewiſe in great plenty, and very good. The climate is likewiſe affirmed by moſt travellers to be very temperate and healthy; Sanut being the only author we know of who hath ventured to aſſert the contrary in all theſe reſpects. S. lat. 8° 35′.

QUILONNE, a province of Africa, in the kingdom of Sabia.

QUILOVIA, a ſmall iſland in the Indian ſea, near the coaſt of Africa. S. lat. 13°.

QUILTAINEN, a town of Pruſſia, in the province of Oberland; 8 miles S.E. of Holland.

QUILTAON, one of the Laccadive iſlands, in the Indian ſea. N. lat. 12°. W. long. 72° 45′.

QUILTING denotes the operation of weaving a ſort of coat or texture, formed of the ſtrands of rope, about the outſide of any veſſel, to contain water, &c. as a jar, caſk, bottle, &c.

QUIMICHPATLAN, in *Zoology*. See SCIURUS *Volucella*.

QUIMINATIN, in *Geography*, a ſmall iſland in the ſea of Mindoro. N. lat. 10° 55′. E. long. 120° 40′.

QUIMIRI, a town of Peru, in the dioceſe of Lima; 40 miles N.E. of Naſca.

QUIMO, a ſmall iſland on the eaſt ſide of the gulf of Bothnia. N. lat. 63° 17′. E. long. 21° 52′.

QUIMPER, a city of France, capital of the department of Finiſterre, and chief place of a diſtrict, ſeated on the Oder; before the revolution the ſee of a biſhop, the ſeat of a governor, an admiralty, &c. The place contains 6608, the canton 17,028 inhabitants, on a territory of 90 kiliometres, in ſeven communes. N. lat. 47° 59′. W. long. 4° 1′.

QUIMPERLE, a town of France, and chief place of a diſtrict, in the department of the Finiſterre. The place contains 4162, and the canton 9128 inhabitants, on a territory of 125 kiliometres, in 15 communes.

QUIN, DR., of Dublin, in *Biography*, an eminent phyſician, and one of the moſt enlightened dilettante muſicians with whom we have ever been acquainted. This gentleman, who, during his travels, reſided in Italy ſome years, had heard and ſtudied muſic with ſuch taſte and intelligence, that his opinions and converſation on the ſubject were equally entertaining and inſtructive. He reſided in Dublin at the time of Handel's arrival in that city, 1742, and perfectly remembering his performance, perſon, and manners, in 1788 wrote us word, that "he (Handel) was received in Ireland by perſons of the firſt diſtinction with all poſſible marks of eſteem, as a man, and admiration as a performer and compoſer of the higheſt order." And adds, "the Meſſiah, I am thoroughly convinced, was performed in Dublin for the *firſt time*, and with the greateſt applauſe. Mrs. Cibber and ſignora Avolio were the principal performers. Theſe, with the aſſiſtance of the choriſters of St. Patrick's cathedral and Chriſt-church, formed the vocal band; and Dubourg, with ſeveral good inſtrumental performers, compoſed a very reſpectable orcheſtra. There were many noble families here, with whom Mr. Handel lived in the utmoſt degree of friendſhip and familiarity. Mrs. Vernon, a German lady, who came over with king George I. was particularly intimate with him, and at her houſe I had the pleaſure of ſeeing and converſing with Mr. Handel; who, with his other excellencies, was poſſeſſed of a great ſtock of humour; no man ever told a ſtory with more. But it was requiſite for the hearer to have a competent knowledge of at leaſt four languages: Engliſh, French, Italian and German; for in his narratives he made uſe of them all."

QUIN, JAMES, was born in London in 1693. He was the ſon of an Iriſh gentleman, and received his education in the capital of that country. His father had, ignorantly, married a woman ſuppoſed to be a widow; whoſe huſband, after a long abſence, returned and claimed her. The ſubject of this article was the offspring of this connection, and was accordingly illegitimated, and upon his father's death, in 1710, was left almoſt deſtitute. For want of education he was, at the age of twenty-one, without a profeſſion, and was under the neceſſity of appearing on the ſtage at Dublin, in the very loweſt characters. He diſplayed, however, riſing talents, which induced a friend to adviſe him to attempt ſome better parts in London, and he was accordingly admitted into Drury-lane company in 1715. After the experience of a year or two, he entered himſelf under Rich at Lincoln's-Inn theatre, where he continued to perform during ſeventeen years. He was allowed, by the moſt competent judges, to ſhine both in tragedy and comedy. His utterance was weighty and impreſſive, which, however, was accompanied with various defects. He was, from cauſes not well aſcertained, continually changing from one theatre to another, and perhaps he may be ranked among that number with whom it was difficult to keep terms. His paſſions were ſtrong, his temper irritable, and his language often coarſe. He was of convivial habits, and, it has been ſaid, groſsly attached to the pleaſures of the table. There was, however, a fund of generoſity in his temper, which ſhewed itſelf in manly ſentiments, and, occaſionally, in benevolent actions. The circumſtance of his giving a 100*l.* to the poet Thomſon, when he was under an arreſt for debt, has often been told to his honour. It was the commencement of a ſtrong friendſhip between them. After Thomſon's death, he appeared in that poet's tragedy of Coriolanus, and ſpoke a prologue, written on the occaſion by lord Lyttleton, with a pathos that did honour to his feelings. His laſt performance was the favourite part of Falſtaff, for the benefit of his friend Ryan in 1753. He now retired to Bath, where his fund of anecdote, and ſtrong pointed ſenſe, rendered his company much ſought after. He had good breeding, which fitted him for the higheſt ſocieties, when he choſe to act the gentleman; and his ſenſuality and coarſeneſs were frequently

frequently put up with for the fake of his companionable qualities. Quin died at Bath in 1766, at the age of feventy-three. Garrick, whofe fuperior talents are fuppofed to have driven him from the ftage, but afterwards his fteady friend, wrote a poetical epitaph for his monument. While Quin continued on the ftage, he conftantly kept company with the moft celebrated geniufes of the age. He was on intimate terms with Pope and Swift; and was frequently invited by the earl of Chefterfield to his table. His peculiar judgment in the Englifh language recommended him to his royal highnefs, Frederic prince of Wales, who appointed him to inftruct his children in fpeaking and reading with graceful propriety. When Quin was informed of the elegant manner in which his prefent majefty had delivered his firft gracious fpeech from the throne, he was in raptures, and the king foon after gave orders, without any application on the part of Quin or his friends, that a genteel penfion fhould be paid him during his life.

Quin, in *Geography*, a village of the county of Clare, Ireland, where are the remains of a monaftery, which was founded for Francifcan friars in 1402, and repaired by the Roman Catholics in 1604. Bifhop Pococke fpeaks of it as one of the fineft and moft entire monafteries he faw in Ireland. It is fituated on a fine ftream, with an afcent of feveral fteps to the church: at the entrance one is furprifed with the view of the high altar, entire, and of an altar on each fide of the arch of the chancel. The building is quadrangular, with piazzas fupported by a number of pillars; there are apartments on three fides of the cloifters, with a vaulted room under them all. A round tower and fome other ruins are adjoining. Quin is 15 miles from Limerick, on the road to Galway, and about 106 miles W.S.W. from Dublin. Archdall's Monafticon. Carlifle.

QUINA Folia, in *Botany*. See Leaf.

QUINABAUG, in *Geography*, a river of America, formerly called "Mobegan," which rifes in Brimfield, Maffachufetts, and is joined at Oxford by French river, which has its fource in Sutton, Worcefter county. It runs a foutherly courfe, and difcharges itfelf into Shetucket, about three miles above Norwich Landing, in Connecticut. In the firft part of its courfe it furnifhes many good mill-feats: as it advances, the intervals in many places are wide, and afford a moft excellent foil.

QUINA-QUINA, in *Botany*, a Peruvian name, generally applied to the Peruvian bark. (See Cinchona.) Juffieu, however, in his Gen. Pl. 366, informs us, that it properly belongs to a tree, nearly if not entirely agreeing in genus with *Myrofpermum* of Jacquin, or Myroxylon of Linnæus. (See the laft-named article.) An account of the *Quina-quina* may be found in the Memoires de l'Acad. des Sciences for 1738, p. 237.

QUINARIA, fo called by Loureiro, Fl. Cochinch. v. 1. 272, from the prevalence of the number five in the parts of fructification, is the *Wampfe* or *Wampi* of the Chinefe, now eftablifhed as a genus by the name of Cookia. (See that article.) This plant paffed long; in the gardens of England, for *Guarea trichilioides*, according to the obfervation of the late Mr. Dryander.

QUINARIUS, Quinary, in *Antiquity*, a little Roman coin, equal to half the denarius. See Coin.

The quinarius was properly the Roman halfpenny.

Medalifts indeed ufe the term quinarius in the general for a medal of any matter, not exceeding the fize of our fixpence; but F. Chamillart, in an exprefs differtation, fhews this to be an abufe. The filver coins, current under the republic, he fhews, were two: the one weighing a drachm, and called denarius, as containing ten affes; the other weighing half a drachm, and called quinarius, as containing five affes: which coins continued on the fame footing under the emperors.

Hence the origin of the word quinarius: and hence, in propriety, it is only the filver medal of the weight of half a drachm that the name belongs to; the Romans having never given it to any other fpecies of the fame fize with it. It is only by way of analogy, therefore, that the moderns apply it to the medals of gold, or copper, of the fame fize with the filver quinarius; thofe of gold being fixed at a value much above, and thofe of brafs much below five affes.

The only relation between thefe quinarii is, that the gold quinary is the half of a gold medal, as to weight and value; and the brafs quinary half a brafs medal, as the filver quinary is half a filver one.

Hence a feries of quinaries fhould feem at leaft a neceffary in the cabinets of the curious, as the feries of great medals; they being all equally different fpecies of money, which teach us how many kinds of pieces there were of any metal current in commerce.

Add to this, fays our author, that the quinaries were of a finer and more finifhed coin than the other medals, being wrought by the hands of the mafters; which feems owing to the nicety required in engraving whole figures in fo fmall a compafs. He adds, that though quinaries are very fcarce, yet M. the duke of Maine had almoft a complete fet of them.

QUINAULT, Philip, in *Biography*, a French poet, was born in 1636, probably in a low condition; though while fome fay he was the fon of a baker, others maintain that he was defcended from a family of confequence at Paris. He had, however, very few advantages of education, but was foon found to poffefs a talent for poetry and the belles lettres. Before the age of twenty he brought out fome pieces on the ftage; and for a number of years, he continued to produce dramatic works of different kinds, which were much applauded by the public voice; but fome of which drew upon the author the fatires of Boileau, who carried the matter fo far as to injure his own reputation. Quinault now affociated himfelf with Lulli in the compofition of operas, and difplayed an excellence in lyric poetry, or that adapted to mufic, which placed him beyond competition in that branch, and has ranked him among the diftinguifhed characters of the age of Lewis XIV. Nothing, it is allowed, can be more tender, delicate, and ingenious, than the turn of his fongs and love-dialogues; and no one has more happily accommodated the melody of French verfe to mufical expreffion. His "Armida" and his "Atthys" are fpoken of as mafter-pieces of their kind. Notwithftanding the high reputation which he enjoyed as a poet, he applied himfelf to the ftudy of the law, and eventually made his fortune by marrying the rich widow of a merchant, to whom he had been ufeful in his profeffion. After this, he purchafed the place of an auditor in the chamber of accounts. He was received into the French academy, and, in the name of that fociety, harangued the king on his return from the campaigns of 1675 and 1677. He died in 1688, having enjoyed a penfion from Lewis XIV. feveral years previoufly to his deceafe. In his laft illnefs he was extremely penitent, on account of his having devoted his talents too frequently to the excitement of the licentious paffions. He left a family of five daughters, and was efteemed in fociety attentive, polite, and mild. Befides his numerous pieces for the ftage, he wrote occafional poems. His works were printed at Paris in 5 vols. 12mo., 1739, and again in 1778.

 It

It has been faid that Quinault's apprenticefhip to poetry was ferved under Triftan l'Hermile, by being his domeftic. The leffons of Triftan were probably of fome ufe to him, as that author had had long experience in theatrical matters; but Quinault owed ftill more to nature: as before he was twenty years old, he had diftinguifhed himfelf by feveral pieces for the ftage, which had confiderable fuccefs: and before he was thirty, he produced fixteen dramas, fome of which were well received by the pit; but not all equally. It is fuppofed that fome of thefe early pieces prejudiced Boileau againft Quinault early in his career. There was neither regularity in the plan, nor force in the ftyle: romantic lovers and common-place gallantry, in fcenes which required a nervous pencil and vigorous colouring. Thefe were defects not likely to efcape the lafh of the French Juvenal. He covered the young poet with ridicule; reproached him with the affectedly foft and languifhing dialogue of his lovers, by whom even *I hate you* was faid tenderly.

Quinault, born with great fenfibility, was fo wounded by his feverity, that he applied to the magiftrates, not only to filence Boileau, but oblige him to remove his name from his fatires; but the attempt was vain. His enemy infulted him ftill more cruelly by an epigram on the fubject.

" ——Peace! peace! my friend—
If from the public thou'dft avoid difgrace,
From thy own works, not mine, thy name efface."

It was not till after Quinault was inlifted by Lulli to write for the opera, that he filenced all his enemies, except Boileau and his party, who envied him his fuccefs. The French nation knew no better mufic that that of Lulli, and thought it divine. Quinault's was thought of fecondary merit, till after his deceafe; and then, in proportion as the glory of Lulli faded, that of Quinault increafed. Voltaire, in the firft edition of his " Siecle de Louis Quatorze," in 1749, feems to have been the firft who fpoke out on the fubject; not forry, perhaps, to lower Boileau a little in the eyes of the public. He there fays, that " Quinault was celebrated for his beautiful lyric poetry, and for the gentlenefs with which he oppofed the unjuft fatires of Boileau. His poetry was greatly fuperior to the mufic of Lulli. It will always be read; and Lulli, except in a few of his recitatives, can no longer be fupported. However, it was long believed that Quinault entirely owed his favour to Lulli. Time appreciates all things."

After this, his writings began to be examined and felt; and of late years, his name is never mentioned by his countrymen without eloge. His operas, though admirable to read, are ill calculated for modern mufic; and are obliged to be new written, ere they can be new fet, even in France. Marmontel, who had modernized feveral of them for Piccini to fet in 1788, gave M. Laborde a differtation on the dramatic writings of Quinault for mufic; which is publifhed in the fourth volume of his " Effai fur la Mufique."

He begins by afferting that Quinault was the creator of the French opera upon the moft beautiful idea that could be conceived; an idea which he had realized with a fuperiority of talent, which no writer has fince approached.

His defign was to form an exhibition, compofed of the prodigies of all the arts; to unite on the fame ftage all that can intereft the mind, the imagination, and the fenfes. And this illufive theatre Voltaire has admirably defcribed:

" Il faut fe rendre à palais magique," &c.

" Hafte to the magic palace, where abound
The joys fublime of verfe, of dance, and found;
Where bright illufion fafcinates the fight,
And firen-notes the inchanted ear delight;
Where all the plaftic powers of art are fhewn,
And joys unnumber'd are combin'd in one."

For this purpofe a fpecies of tragedy is neceffary, that fhall be fufficiently touching to move, but not fo auftere as to refufe the enchantments of the arts that are neceffary to embellifh it. Hiftorical tragedy, in its majeftic and gloomy fimplicity, cannot be fung with any degree of probability, nor mixed with feftivals and dances, or be rendered fufceptible of that variety, magnificence, fhow, and decoration, where the painter and the machinift ought to exhibit their enchantments.

In Italy, where genuine tragedy has no theatre appropriated to its ufe, a people paffionate for mufic have permitted Regulus, Themiftocles, Alexander, and even Cato himfelf, to utter their fpeeches in fong; but a people, whofe tafte ought to be more fevere, and more delicate, as to probability, having for comparifon the fchool of Corneille and Racine, would have been very unwilling to fubftitute the recitative of Lulli to the declamation of Baron. Melody itfelf is a fabulous and magical language; and in a theatre " where all is prodigy, it feems confiftent that the manner of fpeaking fhould be that of enchantment as well as the reft. We are then in a new world: it is nature enchanted, and vifibly animated by a crowd of intelligences, whofe wills are laws. Mufic there plays a marvellous part; mufic there conftitutes the probability of the marvellous; but in a reprefentation where all paffes for natural, according to truth and hiftory, by what means can we be prepared to hear Auguftus, Cornelia, Agrippina, or Brutus fing?" Might it not be replied, " By the fame means as the French are reconciled to thefe fame exalted characters converfing in rhyme." When once it is fettled that all the characters converfe in a mufical language, no other is expected, and the audience is foon reconciled to it. But all this is to prove that the French alone are right, and Italy and all the reft of the world wrong as to the mufical drama. The reft of Europe is tired and afhamed of flying gods and goddeffes, and have long fince furrendered mythological wonders both in poetry and mufic to their children. But all people are thought barbarians, who do not implicitly adopt the tafte and fafhions of France.

But to return to Quinault, whom all the wits of the time tried to write down. Ignorant of mufic and its powers, they thought Lulli always right, and the poor, modeft, unpretending Quinault always wrong. Pofterity has long difcovered the converfe of this fuppofition to be the truth. Quinault's great miftake and misfortune, fays La Harpe, was the calling his pieces tragedies, and not operas. He would not then have been regarded as a rival of Racine, or have offended claffical hearers or readers with the little refemblance thefe compofitions had to Greek and Roman dramas, or to the genuine tragedies of the moderns.

QUINCE Tree, in *Gardening*, the common name of a tree of the apple kind. See Pyrus *Cydonia*.

Quince, in the *Materia Medica*. The fruit of the quince is aftringent and ftomachic; and its expreffed juice, in fmall quantities, as a fpoonful or two, is of confiderable fervice in naufeæ, vomitings, nidorous eructations, and fome kinds of alvine fluxes. This juice was formerly ordered in the Lond. Pharm. to be made into a fyrup, called " fyrupus cydoniarum," or fyrup of quinces, prepared by digefting three pints of the depurated juice with a drachm of cinnamon, half a drachm of ginger, and half a drachm of cloves, on warm afhes.

aſhes, for ſix hours, then adding a pint of red port, and diſſolving in the ſtrained liquor nine pounds of ſugar. But the only preparation of the quince which it now directs is, a mucilage of the ſeeds, made by boiling a drachm of the ſeeds in eight ounces of water, till it acquires a proper conſiſtence. This has been recommended in aphthous affections, and excoriations of the mouth and fauces: however, though it may be a more pleaſant mucilage, it is certainly leſs efficacious than that of the ſimple quince. Lewis and Woodville.

An uſeful reſtringent marmalade is made by boiling the juice with fine ſugar to a due conſiſtence, in the proportion commonly of three pints to a pound. The juice of quinces becomes richer, by keeping them for ſome time, after they are gathered, in a dry airy place.

Quince *Iſland*, in *Geography*, a ſmall iſland near the S.W. coaſt of Ireland, and county of Cork; five miles W. of Gally-Head.

QUINCHAC, a ſmall iſland in the Pacific ocean, between the iſland of Chiloe and the continent of Chili. S. lat. 43° 30′.

QUINCHAMALA, in *Botany*, altered by Willdenow, one can ſcarcely ſee with what reaſon or advantage, from *Quinchamalium* of Juſſieu, a barbarous and totally exceptionable name, taken from the Peruvian *Quinchamali.*—Willd. Sp. Pl. v. 1. 1217. Mart. Mill. Dict. v. 4. Juſſ. 75. Lamarck Illuſtr. t. 142.—Claſs and order, *Pentandria Monogynia.* Nat. Ord. *Elæagni*, Juſſ. Rather perhaps *Rubiaceæ.*

Gen. Ch. *Cal.* Perianth ſuperior, of one leaf, in four deep, ovate, unequal ſegments, one larger than the reſt. *Cor.* of one petal; tube funnel-ſhaped, much longer than the calyx, quadrangular, curved; limb in five lanceolate, acute, ſpreading ſegments. *Stam.* Filaments five, very ſhort, inſerted into the top of the tube; anthers oblong, the length of the limb. *Piſt.* Germen roundiſh; ſtyle thread-ſhaped, the length of the tube; ſtigma capitate. *Peric.* Berry (rather drupa) roundiſh. *Seed* ſolitary.

Eſſ. Ch. Calyx in four unequal ſegments, ſuperior. Corolla funnel-ſhaped, five-cleft. Stigma capitate, undivided. Drupa dry.

1. Q. *chilenſis.* Willd. n. 1. (Quinchamali lini folio; Feuill. Plantes Médécinales, 57. t. 44.)—Gathered by Feuillée on the mountains of Chili, and by Dombey, among ſtones on the hills about Lima, flowering in December and January. The *root* is annual, compoſed of a few ſimple yellow fibres. *Stems* ſeveral, proſtrate, ſimple, round, leafy, from four to ſix inches long. *Leaves* ſcattered, ſeſſile, linear, entire, fleſhy, ſmooth, bluntiſh with a ſmall point. *Flowers* in ſimple, terminal, ſolitary, denſe ſpikes. *Corolla* green externally, of a ſaffron yellow within. *Seed* round, unconnected.—We have taken the generic character, and the deſcription, from Dombey's manuſcript, compared with one of his original ſpecimens. The *fruit* appears to be a *drupa*, (he terms it *bacca*,) the ſize of hemp-ſeed, whoſe coat becomes coriaceous by drying, and ſeparates, along with the permanent calyx at its ſummit, from the *ſeed*, or *nucleus*, to whoſe upper part the *corolla* remains attached. Juſſieu, Lamarck, and Willdenow, having formed their ideas from dried ſpecimens only, take the coat of the *drupa* for an inferior *calyx*, and the firſt of theſe writers conceives the *flower* to conſiſt of a ſuperior inner *calyx*, to which he was led by an idea of the affinity of this genus to *Theſium.* Willdenow, not adverting to any ſuch affinity, terms the inner calyx of Juſſieu, a *corolla*, which agrees with the opinion of Dombey, the only botaniſt who has examined the living plant, and by whoſe authority we are led to conſider the true *calyx* as ſuperior. If we are right, this genus will belong to the natural order of *Rubiaceæ*, notwithſtanding its ſolitary *ſeed.* Dombey expreſsly ſays it is akin to *Morinda.*

Feuillée relates, that the Indians take a decoction of this plant for internal diſorders, eſpecially when they believe themſelves labouring under an internal abſceſs, of which there is no external appearance. The decoction, taken warm, is ſuppoſed to break the abſceſs, and to cauſe an evacuation of its contents by the uſual paſſages.

QUINCUNX, *Quinque unciæ*, denotes a thing that conſiſts of five twelfth parts of another.

Quincunx, in *Gardening*, is the name of a form of planting in which trees are planted by fives, four of them forming a ſquare, and the fifth placed in the middle, thus,

*   *
  *
*   *

and which may be repeated over and over again in one continued plantation, with as many trees in ſeveral ranges as may be proper. It was formerly a faſhionable mode of planting groves and other regular plantations, but is now leſs common. It is ſeen more fully below:

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Something of this mode of arrangement has always a good effect in the diſpoſition of ſhrubby plants, &c. though not in the regular order of it, but ſomething nearly ſo, which gives the ſhrubs a greater ſcope of growth, and ſhews them to greater advantage. It is likewiſe a mode of planting that is proper in the kitchen-garden, in tranſplanting many kinds of eſculent plants; ſuch as lettuces, endive, ſtrawberries, and even all the cabbage kinds, and many other plants, which gives them a greater ſcope to grow than if planted exactly ſquare at the ſame diſtance from each other.

It is of this kind of quincunx that Cicero ſpeaks, in his Cato Major; and Quintilian, lib. viii. cap. 3.

The modern quincunces, Daviler obſerves, are made like thoſe of the ancients, except for the fifth tree, which is now generally diſuſed; ſo that, being as it were netted, and their alleys viewed by the ſide of the rectangle, they formed a perfect chequer.

Quincunx, in *Aſtronomy*, &c. denotes a poſition, or aſpect of the planets when diſtant from each other a hundred and fifty degrees, or five ſigns.

QUINCY, in *Geography*, a town of France, in the department of the Seine and Marne; ſix miles S.W. of Meaux.

Quincy, a poſt-town of America, in Norfolk county, Maſſachuſetts, taken from Braintree; 10 miles S. of Boſton. It contains 1281 inhabitants, moſt of whom are farmers; but large quantities of ſhoes and boots are manufactured for exportation. The town has an epiſcopal and congregational church.

QUINDECAGON, in *Geometry*, a plain figure which has fifteen ſides and fifteen angles.

The word is formed ſomewhat irregularly, from the Latin *quinque*, *five*, and the Greek δεκα, *ten*, and γωνια, *angle.* *Pentedecagon* would be a more regular term.

If the ſides be all equal, it is a regular quindecagon.

Euclid ſhews how to inſcribe it in a circle, Prop. xvi. lib. 4. And the ſide of a regular quindecagon ſo deſcribed, is equal in power to the half-difference between the ſide of the equilateral triangle, and ſide of the pentagon; and alſo to the difference of the perpendiculars let fall on both ſides, taken together.

QUINDECIM VIR, XV. VIR, a Roman magiſtrate, who

who had fourteen colleagues joined with him in the fame function.

Under Tarquin the Proud, there were firft two magiftrates erected to take care of the facrifices to be performed; thefe were called *duumviri*. Their number, at length, grew to ten, and then they were called *decemviri*. In the time of Cicero it had reached to fifteen, when they affumed the name of *quindecimviri:* and though their number grew to forty afterward, yet Servius obferves, on the fixth of the Æneid, that their name never after changed, but they ftill continued to be called quindecimviri.

They were the perfons who examined the Sibyls' books, and were the interpreters of them; yet they never did this but by exprefs order of the fenate, declared by a fenatus confultum. They alfo prefided at the facrifices, and all other extraordinary ceremonies of religion.

On medals, a dolphin joined with a tripod marks the priefthood of the quindecimviri; who, to publifh their folemn facrifices, ufed on the eve of them to carry a dolphin at the end of a pole throughout the city; that fifh being efteemed facred to Apollo, as the crow was among birds.

QUINEPAUGE, or *Eaft River*, in *Geography*, a river of America, in Connecticut, which runs a foutherly courfe into the N.E. corner of New Haven harbour.

QUINGEY, a town of France, in the department of the Doubs, and chief place of a canton, in the diftrict of Befançon; nine miles S.W. of Befançon. The place contains 1079, and the canton 11,734 inhabitants, on a territory of $272\frac{1}{2}$ kiliometres, in 36 communes. N. lat. 46° 6′. E. long. 5° 57′.

QUINGOMBO, in *Botany*, the name given by the people of Congo to a fpecies of ketmia, diftinguifhed by M. Tournefort by the name of the ketmia Brafilienfis folio ficus, fructu pyramidoto fulcato, the fig-leaved Brafilian ketmia, with a pyramidal fulcated fruit.

QUINISDAL, in *Geography*, a town of Norway, in the province of Chriftianfand; 35 miles W.N.W. of Chriftianfand.

QUINI-SEXTUM, in *Ecclefiaftical Hiftory*, denotes a council held at Conftantinople in the year 692; called alfo the council in Trullo, and by the Greeks *Penthecte, q. d. five-fixth;* as intimating that it was only a fupplement of the two preceding councils. Though, in propriety, Fleury obferves, it was a council itfelf.

Marfhall obferves, that the fifth and fixth general councils having made no canons relating to the external celebration of divine worfhip, the government of the church, and the lives and manners of Chriftians, the Orientals judged it neceffary to fupply that defect by this; fo that the 102 canons falfely attributed to thofe, were in reality made here. See Trullum.

QUINNET, in *Mining*, the name of a tool ufed in the cleaving rocks by means of gunpowder. This is a fort of wedge fitted to the flat fide of what is called the *gun;* that is, a cylindric piece of iron, only flattened in one part to receive this, and drilled through. When a proper hole has been made in the rock by the borer, the powder is put in, and then the orifice being ftopped by the gun, and that wedged in by this quinnet, the powder being fired by a train communicating with the hole drilled through the guns, exerts all its force on the rock, and fplits it in feveral directions at one explofion. Phil. Tranf. N° 167.

QUINOLA, in *Geography*, a town of Mexico, in the province o Culiacan; 50 miles S.E. of Culiacan.

QUINQUAGENARIUS, among the Romans, was an officer in the army, who had the command of a company of fifty men.

Quinquagenarius was alfo an officer of policy, who had the infpection of fifty houfes, or families.

And in the ancient monafteries, quinquagenarius was a fuperior who had fifty monks under his guidance.

QUINQUAGESIMA-SUNDAY, Shrove-Sunday. It is thus called, as being about the fiftieth day before Eafter. Anciently they ufed Quinquagefima for Whitfunday, and for the fifty days betwen Eafter and Whitfunday; but to diftinguifh this Quinquagefima from that before Eafter, it was called the Pafchal Quinquagefima.

QUINQUANGULAR Leaf. See Leaf.

QUINQUANNION, Quinquennium, in the *French Cuftoms*, a refpite of five years, which infolvent debtors formerly obtained by virtue of the king's letters, to have time for the payment of their debts.

When the thing intended was only to prevent the fale of their effects at an under-value, the term of one year was ordinarily granted, and this was called the benefit of *annion*.

But when the debtor would avoid the furrendering of his effects, upon proving that he was reduced by poverty, loffes, &c. to make ufe of this expedient, the term of five years was granted, and called the benefit of *quinquannion*.

QUINQUATRIA, in *Antiquity*, a name given to the feafts of Minerva, otherwife called Panathenæa.

Some think they were termed quinquatria, becaufe they lafted five days; but others, with more reafon, think it was becaufe they fell out five days after the ides of the month.

QUINQUE Portus, the five cinque ports.

" Servitium quod barones quinque portuum præfcriptorum recognofcunt facere ad fummonitionem regis per annum, fi contigerit per 15 dies ad cuftum eorum proprium; ita quod primus dies computatur a die quo vela navium erexerunt, ufque partes ad quas tendere debent, vel ulterius, quamdiu rex voluerit ad cuftum ejus." Thorn.

QUINQUEFOLIUM, in *Botany*, Cinquefoil, the old name of the Linnæan genus *Potentilla*, many, but by no means a majority, of whofe fpecies have five leaflets on a ftalk. Gærtner, who, like many others, was difcontented with *Potentilla*, fubftituted the word *Pentaphyllum*. See Potentilla.

QUINQUEMPOIX, in *Geography*, a town of France, in the department of the Lower Seine; feven miles N. of Rouen.

QUINQUENNALIA, in *Antiquity*, games, or feafts founded at Tyre, celebrated every five years, in honour of the deified emperors.

The quinquennalia began to be expreffed on medals about the middle of the third century. F. Pagi produces a medal whereon are engraven thofe of the emperor Pofthumus; they are not found on any medals of his predeceffors.

QUINQUENNALIS, a magiftrate in the colonies, and municipal cities of the Roman commonwealth; much the fame with ædile at Rome.

They were not thus called from their continuing in their office five years; but becaufe they were elected every fifth year, to prefide at the cenfus, and to receive the declaration each citizen made of his effects.

QUINQUENNES, in fome old *Hiftorians*, a name given to a certain people of India, among whom the women began to bear children at five years old, and feldom lived to more than eight years. Pliny gives us this account; and Solinus, who repeats it from him, increafes the miracle by telling us, that

that they were a nation of women who had no men among them.

QUINQUEPARTITE Leaf, among *Botaniſts*. See Leaf.

QUINQUEPRIMI, among the Romans, the five principal men in the ſenate of every municipal town.

QUINQUEREMIS, in the *Naval Architecture of the Ancients*, a name given to a galley which had five rows of oars. They divided their veſſels in general into monocrota and polycrota: the former had only one tier of rowers; the latter had ſeveral tiers of them, from two or three, up to twenty, thirty, or even forty; for ſuch a veſſel we have an account of in the time of Philopater, which required no leſs than four thouſand men to row it. See Polycrota.

QUINQUERTIONES, among the Romans, an appellation given to thoſe who had gained the victory in the *quinquertium*, or *pentathlon*.

QUINQUERTIUM was the ſame with the Grecian pentathlon, comprehending the five exerciſes of running, leaping, throwing, darting, and wreſtling. See Pentathlon.

QUINQUE VIR, frequently wrote V. VIR, a Roman magiſtrate, who had four colleagues joined with him in the ſame function.

There were various kinds of officers thus denominated. Pomponius the lawyer mentions quinqueviri on this and on that ſide of the Tiber, eſtabliſhed for the adminiſtration of juſtice in the night-time, in lieu of the ordinary magiſtrates, who were not judged proper to run up and down the ſtreets in the dark.

Roſinus tells us, that they were ſometimes the quinqueviri who conducted the colonies, and divided the lands aſſigned to them among the ſeveral families.

Sometimes the epulones were five in number; in which caſe they were called quinqueviri. See Epulo.

QUINQUEVIRI Monetarii, were officers firſt erected under the conſulate of Valerius Poplicola, to moderate the exceſſive uſury, or intereſt, which creditors or bankers uſed to exact from the people.

QUINQUINA. See Cortex *Peruvianus*.

QUINSEY, ſometimes written *Quinanſey*, and *Quinzy*, in *Medicine*, a corruption of the French word *eſquinancie*, which again is derived from the Greek, *cynanche*, κυναγχη, ſignifying ſore-throat, or inflammation and tumour of the internal fauces. The term is applied generally to inflammations of the throat, but more particularly to the acute inflammation of the tonſils. A tonſil, enlarged from inflammation, is alſo emphatically called a *quinſey*. See Cynanche *tonſillaris*.

Quinsey, among domeſtic animals of the live-ſtock ſort, is an affection about the throat and breaſt, which often attacks them, and which is very obſtinate and troubleſome. In horſes it is uſually called anticor.

QUINSIEME, or Quinzieme, in our old *Law Books*. See Fifteenth.

QUINSIGAMOND, or *Long Pond*, in *Geography*, a lake of Maſſachuſetts, between Worceſter and Shrewſbury. This is a beautiful lake, in form of a creſcent, about five miles long, and from 60 to 100 rods broad. It is interſected with a number of iſlets, one of which is upwards of 200 acres in extent.

QUINSON, a town of France, in the department of the Lower Alps; 25 miles S.S.W. of Digne.

QUINT, a ſequence of five cards of the ſame colour. See Sequence.

QUINTA, Ital. Quinte, Fr. (See Fifth and Diapente.) The chord of the $\frac{6}{5}$ in thorough-baſe is reſolved two ways: firſt, by the baſe riſing one note, and the loweſt treble note deſcending; ſecondly, by the higheſt note of the chord riſing, and the loweſt remaining ſtationary, when the diſcord is reſolved upwards. This is what Rameau calls *le double emploi de la diſſonance*.

Quinta *Pars*, in old madrigals, a 5th vocal part, compoſed of the refuſe of the other four.

Quinta *Eſſentia*. See Quintessence.

QUINTAIN, Quintana, in *Ancient Cuſtoms*, a poſt, or pillar, driven into the ground, with a buckler fixed to it, for the performance of military exerciſes on horſeback, the throwing of darts, breaking of lances, &c.

Matth. Paris deſcribes the quintain as a kind of mark, formed like a man from the navel upwards, holding a ſhield in his left hand, and in his right a ſword or ſtick; the whole ſo fitted as to turn round on its foot, and ſo as that a cavalier running a-tilt againſt it with a lance, if he hit it in the breaſt, it wilked round, and, unleſs he were very dextrous, ſtruck him with the ſword held in the other hand.

In other places, at the top of a poſt, was erected a ſlender beam fitted to turn round a ſpindle; at one of whoſe ends was a ſlope or flat board, and at the other a bag of ſand or dirt. The ſport was, with a long ſtaff, or wooden lance, to ride a-tilt at the board, and to be either ſo ſkilful or lucky to eſcape the blow of the ſand-bag.

This ſome take to be the ſame with the *arietum levatio*, frequently prohibited in our old ſynods and epiſcopal conſtitutions.

The cuſtom is ſtill retained in Shropſhire, and ſome other counties, among the nuptial ſolemnities. He that breaks the moſt poles againſt the quintain, has the prize; which was anciently a peacock, but is now a garland.

Some derive the word from an ancient game called *quintus*; others from a man of the name of Quintus.

The vallus and palus, mentioned in Cæſar, are taken, by Vigenere, for a kind of quintain, or wooden man, fixed up as an adverſary, or man of ſtraw, to prove one's dexterity againſt.

Mention is made of this exerciſe in the Code, De Aleatoribus, and in the Paratitles of Cujas on the ſame. Juvenal ſpeaks of women engaging in it:

"Aut quis non vidit vulnera pali? &c."

Quintain was alſo a right which the lord had to oblige all the millers, watermen, and other young people unmarried, to come before his caſtle every three years, and break ſeveral lances or poles againſt a poſt, or wooden man, for his diverſion.

QUINTAL, in *Commerce*, the weight of a hundred pounds.

The quintal admits of ſome difference in different places, according as the pound conſiſts of more or fewer ounces, and as the ounce is lighter or heavier.

Thus, *e. gr.* the Paris quintal, or hundred, in the old ſyſtem, yields 123lbs. at Montpelier; and the Montpelier hundred only 81lbs. 9 oz. 18 gr. French poids de marc, or 88lbs. avoirdupois nearly. The quintal of Conſtantinople is eſteemed the heavieſt of all thoſe uſed in the Levant: it contains 44 okes, or 100 rottoli; the oke being 4 yuſdromes or chequees, or 400 drachms, and the rottolo 176 drachms. The quintal, or kintal, of cotton yarn is 45 okes. The quintal, or cantaro, weighs about 123¾lbs. avoirdupois, and the oke 2lbs. 13 oz.; the rottolo, 19¾ oz. and the chequee, 11¼ oz. avoirdupois. The quintal is equal to 112¾lbs. of Amſterdam; 124lbs. of Venice; and 160 of Leghorn. The quintal of Liſbon contains 4 arrobas, the arroba 32 pounds, the pound, libra, or arrate, 2 marks, or 16 ounces; the ounce, 8 outavas: 13½ quintals make a ton. The

pound

pound of Lifbon weighs 9552 Dutch afes, $7084\frac{2}{4}$ grains Englifh troy weight; and therefore 83lbs. of Lifbon = 84lbs. avoirdupois weight.

The Englifh quintal ufually confifts of 112lbs. avoirdupois, and is divided into four quarters.

QUINTAL was alfo formerly ufed for a weight of lead, iron, or other common metal, ufually equal to a hundred pounds, at fix fcore to the hundred.

QUINTE', *Ifle de*, in *Geography*, an ifle in lake Ontario, Upper Canada, which lies clofe off the fhore of Ameliafburg, and oppofite the W. point that forms Sandy bay.

QUINTE, in *French Mufic*, is the name of the inftrumental tenor part in full pieces, ufually written in the mezzo foprano clef on the fecond line. All the inftrumental tenor or alto viola parts, in Purcell's time, were written in this clef, as may be feen in his overtures and act-tunes. This was an imitation of France, where all the tenor parts in Lulli and Rameau's operas are in the mezzo foprano clef.

QUINTELLO, Ital. QUINQUE, Fr. a vocal or inftrumental compofition in five parts, dialogued, and generally *a parte equale*. The inftrumental quintets of Boccherini and Mozart are fublime productions: there is, perhaps, no inftrumental mufic in which more genius and abilities are manifeft, than in the quintets of thefe great mafters.

QUINTENAR, EL, in *Geography*, a town of Spain, in New Caftile; 37 miles S. of Hueta.

QUINTER, QUINTOIER, Fr. in the firft attempts at harmony, was counterpoint in a feries of 5ths, any two of which, in aftertimes, would ruin for ever the reputation of a compofer.

QUINTESSENCE, *quinta effentia*, in the old *Chemiftry*, properly denoted the fifth effence, or the refult of five fucceffive diftillations. The term, now obfolete, was ufed to exprefs the higheft degree of rectification to which any fubftance can be brought. It alfo fignified a preparation confifting of the effential oil of fome vegetable fubftance, mixed and incorporated with fpirit of wine.

Thus, on a proper quantity, *e. gr.* of effential oil of fennel, pouring twelve times the quantity of pure alcohol prepared *per fe*, they inftantly unite into one fimilar liquor, which is the quinteffence of that plant.

The ancients were perfectly unacquainted with the method of diffolving oil in fpirit of wine; and even fome of the moderns have queftioned its reality: but the certainty of the thing is eafily proved, from the inftance above, and from a thoufand others.

If fuch quinteffence be feveral times digefted, cohobated, &c. the oil will at length be broken fo fine, as, like the fpirit itfelf, perfectly to mix with water; which is one of the moft extraordinary effects in all chemiftry.

After the like manner is made a quinteffence of camphor, by only pouring on it fpirit of wine.

Quinteffences, thus prepared, were fuppofed to have great medicinal virtues; on account of the pure and potent ingredients ufed in their compofition; which retain, in a great degree, all the virtues of the plants they are procured from: and hence their denomination.

Boerhaave thinks, they might properly be called vegetable fulphurs made potable, and raifed to their utmoft degree of power and efficacy.

Dry quinteffences may be made from the liquid ones, by adding to them fome more effential oil of the fame vegetable from whence the liquid quinteffence was procured, with a little fugar, all mixed together, and diftilled, by a very gentle heat, till all the moifture is come over; the matter remaining is then a dry quinteffence.

This form was deemed principally ufeful for travellers, failors, &c. inafmuch as it renders the quinteffence portable; fo that the quantity, *e. gr.* of a pin's point, fhall be an efficacious medicine.

QUINTESSENCE, in *Alchemy*, is a myfterious term, fignifying the fifth, or laft and higheft effence, or power, of a natural body.

This is fuppofed to be, as it were, the foul drawn from the grofs body and its four elements, by a moft perfect diftillation; and, by means of which, the thing is faid to be fpiritualized, *i. e.* rendered exceedingly pure, fpirituous, and, as it were, incorruptible.

The ancients, who allowed nothing to be real but what has a body, would have the foul of man to be a fifth element, a kind of quinteffence without a name, unknown here below, indivifible, immoveable, all celeftial, and divine. Fenelon.

QUINTESSENCE *of the Elements*, is the hermetical mercury.

QUINTESSENCE *of Wine*, a term ufed by Glauber to exprefs an effential oil of wine, which he directs to be made by a careful diftillation; and which he is very fond of, as having a power to meliorate, improve, and even to fpecificate the poorer wines into the nature of thofe from which it was obtained.

This is one of the fchemes of Glauber, generally efteemed an impracticable one, though very plaufible in theory: but though in general there is a difagreeable flavour in the quinteffence drawn after his method, which is different from the true flavour of the wine, and fpoils the liquor it is added to; yet, by proper care, there is a poffibility of fucceeding fo far as to render this extraneous flavour almoft imperceptible, and produce an oil that will mend poor wines extremely, and give a truly vinous flavour to fuch as are in themfelves taftelefs. But whatever may be done by this method, may alfo be done with much more certainty, and much lefs trouble, by the concentration of wines by freezing. This may be eafily practifed in the wine countries; and by this means Burgundy, Champaigne, and other the moft valuable wines, may be reduced into thick extracts and robs, by the means of which wines may be made in England; a very fmall quantity of thefe concentrated wines being fufficient to convert the whole of any of the poor taftelefs and infipid wines, which are of themfelves of little or no value, into the very wine from which the rob was made; and that in fuch perfection, that the niceft judge cannot find out the difference.

Thefe robs of wine, made and preferved upon the fpot, would alfo be of infinite ufe in the wine countries, as they might be kept to improve the wines of bad years. Stahl, De Concentr. Vin. Shaw's Chem. Eff.

QUINT-EXACT, in old *Law Books*, the laft call of the defendant fued to an outlawry. If he appear not to it, he is, by the judgment of the coroners, returned outlawed, if a feme, waived.

QUINTI, *Bay of*, in *Geography*, a bay and harbour in the N.E. part of lake Ontario, at the mouth of the Trent; formed by a large peninfula, confifting of the townfhips of Ameliafburg, Sophiafburg, and Maryfburg, extending eafterly from an ifthmus, where is a portage at the head, or W. end of the bay, to Point Pleafant, the eafternmoft extremity of the peninfula, oppofite to Amherft ifland. The river Trent difcharges itfelf into the head of the bay, weftward of the portage, and fupplies it with the waters of the Rice lake. Weftward of the portage in lake Ontario, is the harbour of Prefque Ifle de Quinté, now called Newcaftle. The fertility of the foil about the bay of Quinté is generally allowed. The land is rich and eafily wrought, and produces feveral crops without manure; 25 bufhels of wheat being often

often produced from an acre. The timber, like that of the other parts of the province, confifts of oak, elm, hiccory, maple, &c. The bay is narrow throughout, and about 50 miles long, through which diftance it is navigable for the fmall veffels that are ufed on the lakes. It abounds with wild fowl, and various kinds of fifh. The river Trent affords a falmon fifhery. In paffing from the head of the bay of Quinté into lake Ontario, you crofs a fhort portage, in front of the townfhip of Murray, being the ifthmus between it and the peninfula of Prince Edward. At the end of the portage, and before you enter lake Ontario, is a fmall but very beautiful lake, having very good land on its banks. To the northward of this portage it has been propofed to make a canal for connecting the waters of the bay with thofe of the lake. A little to the weftward of the portage and propofed canal, is the harbour of Newcaftle, a fituation well fuited for commerce and protection, and fheltered from all winds. A knoll on the peninfula affords a healthy feite for the town.

QUINTILE, Quintilis, in *Aftronomy*, an afpect of the planets, when they are feventy-two degrees diftant from one another, or a fifth part of the zodiac.

QUINTILIAN, Marcus Fabius, in *Biography*, a celebrated teacher of eloquence, was born about the year 42 of the Chriftian era, during the reign of the emperor Claudius. He is fuppofed to have defcended from a family originally Spanifh, but that his father, or grandfather, had fettled in Rome. The place of his birth is not known, but it feems certain that he was educated in that capital, where he ftudied rhetoric under Domitius Afer, a celebrated orator. He opened a fchool at Rome, and was the firft who obtained a falary from the ftate as a public teacher. After he had remained twenty years in this laborious employment, and obtained the applaufe of the moft illuftrious Romans, not merely as a preceptor, but as a pleader at the bar, Quintilian retired to enjoy the fruits of his labours and induftry. In his retirement he affiduoufly devoted his time to the ftudy of literature, and wrote a treatife on the "Caufes of the Corruption of Eloquence." Some time after, he wrote his "Inftitutiones Oratoriæ," the moft perfect and complete fyftem of oratory extant. It is, in truth, one of the moft valuable remains of antiquity. It was compofed for the ufe of his fon, whofe early death he had occafion to deplore, and is an inftitute for the education of an orator, whom he takes up from the cradle, and conducts through all the periods of inftruction to the exercife of his proper art. It accordingly contains many excellent precepts with refpect to education in general, efpecially the early parts of it, which are applicable in all times and countries, as being founded on the nature of the mind. The ftyle of Quintilian is faid, by critics, to exhibit tokens of the deterioration of the Latin tongue; but, on the other hand, it muft be obferved, that every deviation from the ufage of the Auguftan age has been too readily regarded as a depravation. Quintilian was appointed preceptor to the two young princes whom Domitian deftined for his fucceffors on the throne; but the celebrity which the rhetorician received from the favours and attention of the emperor, and from the fuccefs which his writings met with in the world, were embittered by the lofs of his wife, and of his two fons, one of whom he defcribes as a prodigy of early excellence. It is faid that Quintilian was poor in his retirement, and that his indigence was relieved by the liberality of his pupil, Pliny the younger. He is fuppofed to have died about the year 95. His "Inftitutiones" were difcovered in the year 1415, in an old tower of a monaftery at St. Gall, by Poggio Bracchiolini. The treatife on the "Caufes and Corruption of Eloquence" has not come down to us. The name of Quintilian is affixed to certain "Declamations," of which there are 19 of moderate length; but as the ftyle, method, and manner, are totally different from the rules laid down in the "Inftitutiones," no good judges attribute them to the name of Quintilian. Of the editions of Quintilian fome of the moft valuable are thofe of Gefner, 4to. Gotting. 1738; of Lug. Batavorum, 8vo. cum notis variorum, 1665; of Gibfon, 4to. Oxon. 1693; and that of Rollin, re-publifhed in London in 1792. There is an Englifh tranflation by Mr. Guthrie.

QUINTILIANS, Quintiliani, in *Ecclefiaftical Hiftory*, a fect of ancient heretics, the fame with the Pepuzians; thus called from their prophetefs Quintilia.

In this fect, the women were admitted to perform the facerdotal and epifcopal functions; grounding their practice on that paffage of St. Paul to the Galatians, where he fays, "That in Chrift there is no diftinction of males and females."

In their affemblies, it was ufual to fee the virgins enter in white robes, perfonating the propheteffes. The Quintilians bore fome refemblance to the modern Quakers.

QUINTILIS, in *Chronology*. See July.

QUINTIN, or Quint, in *Commerce*. See Quentin.

Quintin, in *Geography*, a town of France, in the department of the Northern Coafts, and chief place of a canton, in the diftrict of St. Brieuc; nine miles S.W. of St. Brieuc. The place contains 3976, and the canton 12,510 inhabitants, on a territory of 147½ kiliometres, in eight communes.

QUINTINIE, John de la, in *Biography*, famous for his fkill in horticulture, was born at Poictiers in 1626. He received a learned education, and was brought up to the profeffion of the law, in which he gained reputation as a pleader at the bar. A paffion for agricultural knowledge led him to ftudy, with great attention, all the authors, ancient and modern, upon that topic; and on a vifit to Italy as tutor to a youth, he made great additions to his knowledge from actual obfervation. On his return he devoted himfelf almoft entirely to experiments on the culture of trees and plants, and made many difcoveries which greatly improved the art of gardening. He was the firft perfon who laid down juft principles of the art of pruning fruit-trees. He alfo remarked that a transfplanted tree grew only by the new roots which it threw out, and that the old fibres were ufelefs, and ought to be cut off. It does not appear at what time he began to follow gardening as a profeffion, but he had certainly acquired a high degree of reputation in it when he was invited to England by Charles II. who offered him a confiderable penfion to engage him in his fervice. He twice vifited London, and a paper of his was publifhed in the Philofophical Tranfactions, on the culture of melons. He was made, by Lewis XIV., director-general of the gardens in all the royal palaces. In 1690 he publifhed "Inftructions pour les Jardins Fruitiers et Potagers," which obtained a high degree of popularity, was frequently reprinted, and was tranflated into feveral modern languages. The laft edition was entitled "Parfait Jardinier," in two vols. 4to. The author died at Paris in the year 1700.

QUINTO, in *Geography*, a town of Spain, in Arragon; 20 miles S.E. of Saragoffa.

QUINTUS Calaber, in *Biography*, a Greek poet, who wrote a fupplement to Homer's Iliad, in 14 books, in which a relation is given of the Trojan war from the death of Hector to the deftruction of Troy. He is fuppofed, from the ftyle of his work, to have lived in the fifth century, but nothing certain can be collected concerning his perfon and country. His poem was firft made known by cardinal

cardinal Beſſarion, who diſcovered it in St. Nicholas' church, near Otranto in Calabria; hence the author was named Quintus *Calaber*. It was publiſhed at Venice by Aldus, but there is no date attached to the title page.

Quintus Curtius. See Curtius.

Quintus *Femoris*, in *Anatomy*, a name given by Fallopius and many others to one of the muſcles of the thigh, now called the pſoas magnus.

Quintus *Oculorum*, a name given by Veſalius and ſome others to one of the muſcles of the eyes, more expreſſively called by others obliquus ſuperior oculi, and opiſex circumgyrationis oculi.

QUINVA, in *Botany*, a name by which ſome authors have called the amaranth, or cockſcomb.

QUINZANO, in *Geography*, a town of Italy; 18 miles S.W. of Breſcia.

QUINZIEME, Fr. in *Muſic*, the double octave, above or below any ſound (ſee Fifteenth); which is the name of a ſtop in our organs, equidiſtant from the diapaſon.

QUIOPELA, in *Zoology*. See Viverra *Mungo*.

QUIPOS, in *Literary Hiſtory*, a name given to knots on cords of different colours, in Peru, which imperfectly ſupplied the place of writing. This device was adopted, as it has been ſaid, for rendering calculation more expeditious and accurate. The various colours denoted different objects, and each knot expreſſed a diſtinct number. Thus an account was taken, and a kind of regiſter kept of the inhabitants in each province, or of the ſeveral productions collected there for public uſe. But as by theſe knots, however varied or combined, no moral or abſtract idea, no operation or quality of the mind could be repreſented, they contributed little towards preſerving the memory of ancient events and inſtitutions. The Mexican paintings and ſymbols, rude as they were, conveyed more knowledge of remote tranſactions than the Peruvians could derive from their boaſted quipos. If, indeed, the latter had been of more extenſive uſe, and better adapted to ſupply the place of written records, they periſhed ſo generally, together with other monuments of Peruvian ingenuity, in the wreck occaſioned by the Spaniſh conqueſt, and the civil wars ſubſequent to it, that no acceſſion of light or knowledge is derived from them. Robertſon's Hiſt. Amer., vol. iii.

QUIQUI, in *Zoology*, a ſpecies of *Muſtela*; which ſee.

QUIRAZAI, or Curapoa, in *Ornithology*. See Crax *Alector*.

QUIRE *of Paper*, of the French *cahier*, the quantity of twenty-four or twenty-five ſheets.

QUIRICIA, a name given by ſome to the ſtone called *quiris* by the generality of writers.

QUIRICU, in *Geography*, a town of France, in the department of the Iſere; 12 miles E. of Ballay.

QUIRINACIUM Opium, in the *Materia Medica*, a name given by ſome to the gum we know by the name of aſſa fœtida.

QUIRINALIA, in *Antiquity*, feaſts celebrated, among the Romans, in honour of Romulus, who was called Quirinus. See Quirites.

The Quirinalia, called alſo *ſtultorum feriæ*, were held on the 13th of the calends of March, *i. e.* on our 17th of February.

QUIRINI, Angiolo-Maria, in *Biography*, a learned cardinal, by deſcent a Venetian, was born in the year 1680. While young he entered into the order of the Benedictines of Monte Caſſino. At Florence he purſued a very extenſive courſe of ſtudy under ſeveral of the moſt eminent men in ſcience and literature of that age. Upon his entering a profeſſorſhip in his convent, he delivered an oration "De Moſlicæ Hiſtoriæ Preſtantia," which was printed. His ſtudies were interrupted ſome time, by an imagination that he was afflicted with a ſtone in his bladder; but the death of his phyſician, who fell a victim to a falſe impreſſion reſpecting his own caſe, freed him from his fancied complaint, and in the year 1710 he ſet out upon his literary travels. He viſited Germany, Holland, England, and France, making in the latter country an abode of more than two years, during the greateſt part of which time he reſided in the Benedictine abbey of St. Germain des Pres. In the courſe of his travels he formed an acquaintance with almoſt all the literary characters in thoſe countries, and viſited every object of learned curioſity, at the ſame time every where exciting a general eſteem of his talents, his induſtry, and his conduct. Upon his return to Italy he publiſhed a Diſſertation containing a Plan for a Hiſtory of Italy;—an Eſſay on the Hiſtory of Farfa, in the Duchy of Spoleto;—and an edition of the Office for Divine Service according to the Uſage of the ancient Greek Church. He was ſoon after created biſhop of Corfu, by pope Innocent XIII., a dignity which he filled in ſuch a manner as to inſpire the Greek ſeparatiſts with veneration for his perſon. His reſidence in Corfu was the cauſe of his compoſing a learned work, entitled "Primordia Corcyræ ex antiquiſſimis Monumentis illuſtrata," 4to. 1725. In the year 1727, Benedict XIII. raiſed Quirini to the cardinalate, after having nominated him to the biſhopric of Breſcia. His promotion to that ſee was followed by ſome publications relative to the literature of Breſcia. His attachment to the ſee of Rome was diſplayed by a life of pope Paul II. printed in 1740, the object of which was to defend the memory of that pontiff againſt the attacks of Platina. Soon after this he was appointed librarian to the Vatican; in this and other poſts he continued to ſerve the cauſe of literature. It was through his means that a new edition of the works of St. Ephrem was given in 6 vols. fol. in the Greek, Syriac, and Latin languages. He likewiſe edited the letters of cardinal Pole, written againſt the principles of the reformers. This prelate died, greatly regretted, at his epiſcopal reſidence, in 1755, at the age of 75. Though a vigorous champion of the papacy, he wrote with a ſpirit of candour and moderation, which obtained the applauſe of the Proteſtants themſelves. He was aſſociated to ſeveral literary ſocieties, among which were the academies of Peterſburg, Berlin, and Vienna, and the Inſtitute of Bologna. He enjoyed a large revenue, which he expended with munificence, on objects of charity and public ſplendour. At Rome he beautified the church of St. Mark, whence he derived his cardinal's title, and he contributed liberally to the fine Catholic church at Berlin. He laid the foundation, by a valuable gift of books, of a public library at Breſcia. His own ſelect and valuable library he preſented to the Vatican. His charities were numerous and extenſive, and he was indefatigable in performing his paſtoral duties, viſiting the alpine parts of his dioceſe in the moſt inclement ſeaſons. Beſides the works already mentioned, he publiſhed an account of his own life, and a narrative of his travels.

QUIRIQUING, in *Geography*, an iſland on the coaſt of Chili, near the entrance into the bay of Conception. S. lat. 36° 35′.

QUIRIS, *Quirinus lapis*, a name given, by the writers of the middle ages, to a ſtone famous among them for its imaginary virtues, but of which they have left us no deſcription.

QUIRISTER, Chorister, or *Choriſta*, a perſon appointed

pointed to fing in the quire, or choir, of a cathedral. See Anthem, Chantor, and Choir.

QUIRITES, in *Antiquity*, an appellation given to the people of Rome, chiefly the common citizens, as diftinguifhed from the foldiery.

It took its rife from the Curetes, the inhabitants of the Sabine town Cures. On this occafion Romulus, and Tatius king of the Sabines, having united their two people, and their two ftates, into one; upon Romulus's death and deification, the Sabines, outdoing the Romans in number, became mafters of the councils; and accordingly appointed, that Romulus fhould be denominated Quirinus, from Cures, a city of the Sabines; or rather from Quirinus, the name of a god worfhipped in that city.

From the new Quirinus, all the people came afterwards to be called Quirites; unlefs we will fuppofe, that the fame authority which denominated Romulus Quirinus, from Cures, did alfo denominate the people Quirites, immediately from the Curetes.

Some authors derive the word Quirinus from Curis; which, in the Sabine tongue, fignified a pike, or halbert. Struvius adds, that Romulus was always painted with a pike in his hand.

Julius Cæfar, as Tacitus informs us, (Annal. i. 43.) appeafed a fedition by the ufe of this word *Quirites*, which oppofed to *foldiers*, expreffed contempt, and reduced the offenders to the lefs honourable condition of mere citizens. The emperor Alexander alfo applied it to the fame purpofe. See his biographical article.

QUIRK, in *Building*, a piece of ground taken out of any regular ground-plat, or floor.

Thus, if the ground-plat were fquare, or oblong, and a piece be taken out of a corner, to make a court, or yard, &c. the piece is called a quirk.

QUIROGA, in *Geography*, a town of Spain, in Galicia; 24 miles N.E. of Orenfe.

QUIROS, Cape, lies on the E. coaft of the ifland of Efpiritu Santo, in the South Pacific ocean. S. lat. 14° 56′ 8″. E. long. 167° 20′.

QUIRPELE, in *Zoology*, the name of a fmall animal, called by fome authors the *Indian ferret*, or *viverra Indica*, and by others *quil*. See Viverra *Mungo*.

Garcias and fome authors give very remarkable accounts of the enmity this creature has to ferpents of all kinds. They tell us, that when this little creature intends an attack upon one of thefe animals, it firft prepares againft danger, by gnawing a quantity of the root of the lignum colubrinum, or fnake wood; and when it has thoroughly impregnated its faliva, it wets with it firft its fore-feet, and with them daubs over its head and its whole body; and that thus prepared, it boldly attacks the fnake, and never leaves off till it has killed it. Garcias affures us, that many of the Portuguefe have been eye-witneffes of thefe combats.

It is probable enough, that this creature may attack a fnake when thoroughly hungry, knowing its flefh to be good food; but the ftory of the antidote is to be fufpected. See Ichneumon.

QUIRPEN, in *Geography*, an ifland in the North Atlantic ocean, near the N. coaft of Newfoundland. N. lat. 51° 40′. E. long. 52° 22′.

QUIRSWYCK, a town of Norway; 60 miles N.N.E. of Romfdal.

QUIS, in *Natural Hiftory*, a kind of marcafite of iron or copper, from which vitriol is drawn. It is more frequently called pyrites.

QUISBRO, in *Geography*, a town of Sweden, in Nericia; 12 miles S.W. of Orebro.

QUISCALA, in *Ornithology*, a fpecies of *Gracula*; which fee.

QUISIBI, in *Geography*, a town of Arabia, in the province of Oman; 180 miles W. of Julfar.

QUISIL Auren, a town of Afiatic Turkey, in Caramania; 15 miles W. of Cogni.

QUISONGALA Islands, a clufter of fmall iflands in the Indian fea, near the coaft of Africa. S. lat. 10° 40′.

QUISPICHANCHI, a jurifdiction in the diocefe of Cufco in Peru, beginning at the fouth gates of Quito, and ftretching from E. to W. about 20 leagues. The lands of this jurifdiction belong, in general, to the richer inhabitants of Cufco, and produce plenty of wheat, maize, and fruits. Here are alfo manufactures of baize and coarfe woollen ftuffs. Part of the jurifdiction borders on the forefts inhabited by wild Indians, and produces great quantities of coca, or cacoa, an herb greatly ufed by the Indians working in the mines, and forming one of the principal branches of its commerce; the town lies 12 miles S. of Cufco.

QUISQUALIS, in *Botany*, a name combined by Rumphius of *quis*, who, and *qualis*, what kind or manner, by which he intended to exprefs the fingular variablenefs of the plant, as if nothing could be found like it.—Linn. Gen. 215. Schreb. 292. Willd. Sp. Pl. v. 2. 579. Mart. Mill. Dict. v. 4. Juff. 78. Lamarck Illuftr. t. 357. —Clafs and order, *Decandria Monogynia*. Nat. Ord. *Veprecula*, Linn. *Thymelææ*, Juff.

Gen. Ch. *Cal.* Perianth inferior, tubular, thread-fhaped, very long, deciduous, its border in five fpreading fegments. *Cor.* Petals five, inferted into the mouth of the tube, feffile, oblong, obtufe, fpreading, much larger than the fegments of the calyx. *Stam.* Filaments ten, briftle-fhaped, inferted into the tube of the calyx, five of them below the reft; anthers oblong, in or above the mouth of the tube. *Pift.* Germen fuperior, ovate; ftyle thread-fhaped, longer than the ftamens; ftigma obtufe, dilated. *Peric.* Drupa dry, with five unequal angles. *Seed.* Nut elliptic-oblong, pentagonal.

Eff. Ch. Calyx with a thread-fhaped tube; five-cleft. Petals five. Drupa fuperior, with five angles.

1. Q. *indica*. Linn. Sp. Pl. 556. (Quifqualis; Rumph. Amb. v. 5. 71. t. 38. Q. pubefcens; Burm. Ind. 104. t. 35. f. 2, and Q. glabra; t. 28. f. 2.)—Native of Java, and the Molucca ifles; naturalized by Rumphius in Amboyna. The *ftem* is fhrubby, at firft low and ftumpy, but fubfequently throwing out long trailing or twining fhoots, which become as thick as a man's arm. To this diverfity of habit, and the changeable hue of the *flowers*, the name alludes. The young *branches* are clothed with fine foft down. *Leaves* oppofite, occafionally fcattered, on fhortifh downy ftalks, ovate, pointed, entire, two or three inches long; their ultimate veins finely reticulated; both furfaces more or lefs downy, rarely fmooth. *Flowers* in axillary or terminal bracteated fpikes. *Bracteas* ovate, downy. *Corolla* two inches long, downy, whitifh in the morning, turning pale red in the afternoon, rofe-coloured in the evening, and the next morning of a blood red. *Fruit* as big as one joint of the finger. *Nut* eatable when quite ripe, having the flavour of a filbert. When unripe, Rumphius compares its tafte to that of a radifh. Thefe *nuts* are a popular remedy, among the Malays, for worms in children. Two or three of the pungent unripe ones, or five of thofe that are arrived at maturity, are a dofe. Some perfons are attacked with a dangerous hiccup from eating two or three of the nuts in queftion, whilft others find no fuch effect from a confiderable number. The integuments are carefully removed. They probably partake of the

poifonous

poisonous qualities of the Mezereon tribe; though in a mild degree, as Rumphius speaks of the flavour of several parts of the plant, without mention of any very hurtful properties. Even the kernels of our European *Daphnes* are highly acrimonious.

QUISQUISANA, in *Geography*, a town of Peru, in the diocese of Cusco; 32 miles S.S.E. of Cusco.

QUISSAC, a town of France, in the department of the Gard, and chief place of a canton, in the district of Le Vigan, having a mineral spring; 20 miles N. of Montpelier. The place contains 1310, and the canton 3884 inhabitants, on a territory of 160 kiliometres, in 12 communes.

QUISTELLO, a town of Italy, in the department of the Mincio; 15 miles S.S.E. of Mantua.

QUISTORP, John, in *Biography*, a German Lutheran divine and professor, was born at Rostock in the year 1584. He pursued his academical studies at his native city, at Berlin, and at Franckfort on the Oder; and afterwards travelled through Holland, Brabant, and Flanders, in the capacity of governor to the son of a patrician of Lubec. In 1614, his learning and abilities pointed him out as a fit person to fill the divinity chair at Rostock; but before he entered upon the duties of his office, he was created doctor of divinity. He obtained other preferments in the church, particularly the archdeaconry of St. Mary's at Rostock. In 1645 he was appointed pastor of the same church, and superintendant of the churches in the district of that city. He had the felicity of rendering important services to the celebrated Hugo Grotius, during his last fatal illness at Rostock. Upon the death of that great man, he wrote a Latin letter to Calovius, containing an account of his sickness and last sentiments, which is inserted in the "Bibliotheque Choisie" of Colomies; and in the "Vindiciæ Grotianæ," under the title of "Grotii Manes." Quistorp died in 1648, at the age of 64. He was the author of "Annotationes in omnes Libros Biblicos," "Commentarius in Epistolas Sancti Pauli," and several other works. He left a son of the same name, who was born at Rostock in 1624, and died in 1669. He became pastor, professor of divinity, and rector of the university in that city.

QUISTRUM, in *Geography*, a town of Sweden, in the province of West Gothland; 9 miles N.W. of Uddevalla.

QUITANGONE, a river of Africa, which runs into the Indian sea, 15 miles N. of Mozambique, S. lat. 14° 40′.

QUITAPABILLA, a river of America, being a branch of the Swetara, which falls into the Susquehannah at Middleton.

QUITAPORA, a town of the state of Georgia. N. lat. 33° 27′. W. long. 89° 58′.

QUITCH, in *Agriculture*, a name frequently applied, in many districts, to a very troublesome set of plants of the weed kind; for though it properly belongs to the couch-grass plant only, it is much used to signify others of the creeping perennial rooted sort, as the bent, creeping, soft, and tall oat-grass, as well as some others, which are only capable of being destroyed by repeated summer ploughings, or forking them out and burning them on the ground. See Couch.

Quitch-*Grass*, the common name given in some places to a very troublesome sort of weed, found in many districts, and which requires great exertion to eradicate it out of the land. See Couch.

Quitch-*Drag*, that sort of useful tool of the drag-kind, which is employed in the dragging out and removing this sort of weed from ploughed lands. It is made in several different methods, according to circumstances; but has mostly something of the long triangular form in the beam part, into which the teeth or tines are fixed. These are seldom made so large in this as in the heavy sorts of drags; but they are mostly a little hooked, or bent forward, towards the points or lower ends. The frame-part is sometimes set with two rows of tines, or more.

It is a sort of tool which is frequently made use of for rendering arable ground perfectly clear of root weeds, being had recourse to before the last ploughings. Where the land has been cross-ploughed, this kind of drag may be employed with great advantage in bringing it into proper order. It has some other names in different counties. See Couch-*Drag*, and Drag.

Quitch-*Rake*, a name given in many districts to the rake employed in collecting the weed called couch, from the surface of ploughed ground, as well as some other sorts in particular cases. The head of this tool, into which the teeth or tines are fastened, is usually about five feet in length; the tines are made in a round form, having a projection of about eighteen inches below the head, each being gradually turned or crooked forward about two inches; the distance from each other also about two inches. There is commonly a small beam made to fasten in the middle with two pieces of wood, which come from each corner of the rake-head, into which the tines are fastened by means of a pin that goes through the beam, and keeps the rake steady. In working, this implement may be put on the carriage-part of a two-wheeled plough, to be drawn by one horse; a man going behind to occasionally lift up the rake when full, in order to leave the couch and other weeds in rows, for the purpose of burning them. In this manner, a great deal of weeds and trumpery may be collected together in the course of a day. See Couch-*grass Rake*.

QUIT-CLAIM, a release, or quitting one's claim or pretensions to a thing.

QUITERVA, in *Geography*. See Sofala.

QUITEVA, or Kitea, a town of Africa, in the country of Darah, defended by a castle; 75 miles S.E. of Morocco. N. lat. 28° 6′. W. long. 5° 26′.

QUITO, an extensive province of South America, which was subjected to the Peruvian empire, by Huana Capac, about the year 1526, at the time when the Spaniards first visited the coast of Peru. Huana prevailed on his legitimate and eldest son Huascar to allow one of his natural children, Atahualpa, by the daughter of the last king of Quito, to hold this kingdom as a fief of the empire. Atahualpa, however, rebelled, seized the empire, imprisoned his brother, and soon after put him to a violent death. His prosperity was of short duration; for in the year 1533 he suffered the same fate, by order of Don Francisco Pizarro, who had deputed Sebastian de Benalcazar to conquer the kingdom of Quito. Having by a series of victories made himself master of the kingdom, he proceeded in the year 1534 to rebuild the capital, which had suffered much from internal commotions, and called it "San Francisco de Quito," a name which it still retains, though it was not till seven years after this date that it obtained the title of city. The province, which the Spaniards found annexed to the kingdom of Peru, continued in that state till the year 1718, when it was dismembered from Peru, and attached to the viceroyalty of New Granada. At the same time the audience of Quito was suppressed, together with that of Panama, in the kingdom of Terra Firma: though the latter continued dependent on the viceroys of Lima. See *New* Granada and Peru.

This province is bounded on the north by that of Santa Fé de Bogota, and includes part of the government of Popayan; on the south it is limited by the governments of

Peru and Chachapoyas; towards the eaft it extends over the whole government of Maynas, and the river of the Amazons, to the meridian of demarcation, or that which divides the dominions of Spain and Portugal. Its boundary on the weft is the fea, from the coaft of Machala, in the gulf of Puna, to the coaft of the government of Atacames, and the jurifdiction of Barbacoas, in the bay of Gorgona. Its greateft breadth from north to fouth is about 200 leagues; and its length from eaft to weft, the whole extent from Cape de Santa Elena, in the South fea, to the above-mentioned meridian, which, by the moft accurate computation, is 600 leagues. All the parts, however, that can properly be faid to be peopled, and actually fubject to the Spanifh government, are thofe intercepted by the two Cordilleras of the Andes, which, compared with the whole extent of the country, may be termed a ftreet or lane, extending from the jurifdiction of the town of St. Miguel de Ibarra to that of Loja; the country from hence to the government of Popayan, and alfo that comprehended between the weftern Cordillera and the fea. With this limitation, the extent of the jurifdiction from eaft to weft will be 15 leagues, or fomewhat more, being the diftance intercepted between the two Cordilleras. But to this muft be added the countries comprehended in the governments of Jaen de Bracamaros, which borders on the jurifdiction of Loja, and the extremity of the whole province, and fituated on the eaft fide of the eaftern Cordillera; and to the northward, the government of Quixos, and that of Maynas to the eaftward of it, but feparated by large tracts of land inhabited by wild Indians; and on the north fide of the province from that of Popayan; though the latter is properly a diftinct province from that of Quito. Thus on the weft fide of that interval between the two Cordilleras lies the government of Atacames, and the jurifdiction of Guayaquil; on the eaft fide, the three governments above mentioned; and on the north, that of Popayan.

This province, exclufive of thefe five governments, confifts of nine jurifdictions, called in that country provinces, that of Quito being fubdivided into as many others as there are governments and jurifdictions. Thofe in the province of Quito, beginning with the moft northern, are the following, *viz.* the town of San Miguel de Ibarra, the village of Otabalo, the city of Quito, the affiento of Latacunga, the town of Riobamba, the affiento of Chimbo, or Gaaranda, the city of Guayaquil, the city of Cuença, and the city of Loja.

The jurifdiction of Quito, the third of thofe above enumerated, confifts of 25 parifhes, befides thofe in the city, and extends more than five leagues, comprehending lands covered with plantations, producing a variety of plants and fruits, according to the quality, fituation, and expofure of the ground. Thofe in the temperate parts yield plentiful harvefts of maize; and thofe at the bottoms of deep cavities, being in a hot temperature, are planted with fugar-canes, from which are extracted great quantities of fugar and rum. The plantations near the fummits of the mountains, having a variety of temperatures, produce wheat, barley, potherbs of all kinds, and potatoes. Above thefe plantations are fed numerous flocks of fheep, producing that wool which affords employment to a great multitude of people. Some farmers breed cows, with the view to the advantage derived from their milk in making cheefe and butter. In other farm-houfes, various occupations are obferved, fuch as breeding of cattle, agriculture, and manufactures, particularly of cloth, bays, and ferges. The degree of cold and heat in this jurifdiction is fubject to fudden variations, according to the fituation of different places; but in the fame place viciffitudes feldom occur. The villages in this jurifdiction are conftructed with little regularity. They confift principally of a church and parfonage, called the convent, the priefts being formerly all religious; the other parts prefent a number of huts with mud-walls, fcattered all over the country, where every one has his appropriate piece of ground, which he tills for his fubfiftence. A great part, and in fome villages the whole, of the inhabitants are Indians, who live there when out of place; though in fome parts the inhabitants are Meftizos, and here and there a Spanifh family; but thefe are extremely poor. Ulloa's Voyage, vol. i.

QUITO, the capital of the above defcribed province, rebuilt in the year 1534, (fee the preceding article,) and fituated in the inland parts of the continent of South America, on the eaftern fkirts of the Weft Cordillera of the Andes; diftant from the coaft of the South fea about thirty-five leagues to the weft. On the N.W. is the mountain and defert of *Pichinca* (which fee), on the acclivity of which the city is built, and alfo among the breaches that are formed by the eminences of this mountain; fo that many of the buildings ftand upon arches, and the ftreets are of courfe very irregular and uneven. With regard to magnitude, this city may be compared to one of the fecond order in Europe; but the unevennefs of its fituation is a great difadvantage to its appearance. Near the city are two fpacious plains, one on the S., called Turu-bamba, three leagues in length; and the other on the N., termed Inna-Quito, about two leagues in extent; both of which are interfperfed with feats and cultivated lands, which much contribute to the variety and beauty of the fcenery. Thefe plains contract as they approach the city, and at their junction form a neck of land, covered with thofe eminences on which part of Quito ftands. The principal fquare in Quito has four fides, in one of which ftands the cathedral, and in the oppofite the epifcopal palace; the third fide is taken up by the town-houfe, and the fourth by the palace of the audience: this fquare is very fpacious, and has in its centre an elegant fountain. The four ftreets terminating at the angles of the fquare are ftraight, broad, and handfome; but at the diftance of three or four *quadras*, (each quadra being about one hundred yards,) the troublefome declivities commence; and on this account the inhabitants cannot enjoy the benefit of coaches, or wheel carriages. The principal ftreets are paved; and thofe which are not paved are almoft impaffable after rain, which is here very common. Befides the principal fquare, there are two others, that are very fpacious, and feveral that are fmaller. In thefe moft of the convents are fituated, and thefe make a handfome appearance, and fome of them, particularly that of the order of Francifcans, are elegant ftructures. The principal houfes are large, and fome of them have fpacious and well-contrived apartments, though none are above one ftory in height, but their doors and windows are low and narrow. The materials made ufe of in building at Quito are "adobes," or unburnt bricks and clay, cemented by a fubftance called "fangagua," a fpecies of mortar that is uncommonly hard, ufed by the ancient Indians for building all kinds of houfes and walls. The city is divided into feven parifhes; the cathedral is richly adorned with tapeftry hangings and other coftly decorations; but the parifh churches are of mean appearance. The convents of monks are thofe of the Auguftines, Dominicans, and Fathers of Mercy, &c. colleges, &c. Quito has alfo feveral nunneries. The college of Jefuits, as well as all the convents of monks, are large, well built, and very fplendid. Here is alfo an hofpital, with feparate wards for men and women, under the name of the order of our Lady of of Bethlehem. Among the courts whofe feffions are held at Quito, the principal is that of the Royal Audience, eftablifhed there in 1563; the exchequer or chamber of finances, a treafury for the effects of perfons deceafed, &c. The corporation confifts of a corregidor, two ordinary alcaldes chofen annually, and regidores. The cathedral chapter confifts of the bifhop, dean, archdeacon, chanter, treafurer, a doctoral, a penitentiary, a magiftral, three canons by prefentation, four prebends, and two demi-prebends, with the following falaries; that of the bifhop 24,000 dollars, the dean 2500, the four fucceeding dignities 2000 each, the canons 1500 each, the prebends 600, and the demi-prebends 420. This church was created into a cathedral in 1545, and among other feftivals celebrated in it, the moft magnificent are thofe of Corpus Chrifti, and the Conception of our Lady, when all the courts, offices, and perfons of eminence affift. In the former there is a fingular pomp of the proceffion of the hoft, and here are alfo dances of a peculiar nature, which were performed before their converfion to Chriftianity. The corporation and cathedral chapter keep, by vow, two annual feftivals in honour of two images of the Virgin, which are placed in the villages of Guapulo and Quincha, belonging to this jurifdiction. Thefe images or ftatues are brought with great folemnity to Quito, and each feftival is fucceeded by nine days' devotion, the audience and other courts affifting on the occafion. Thefe feftivals are held in commemoration of the affiftance vouchfafed by the holy Virgin, at the time of an earthquake and terrible ejection from Pichincha, by which Latacunga, Hambato, and a great part of Riobamba, were utterly deftroyed; whereas by the fuppofed interpofition of the Virgin, the city efcaped even the flighteft damage.

The celebrated city of Quito is faid by Alcedo to contain 58,000 perfons, fome of whom are diftinguifhed by their rank. Thefe are the defcendants either of the original conquerors, or of other perfons who in fucceeding times came over from Spain invefted with fome lucrative office, and who have preferved the luftre, both of their defcent and wealth, by intermarriages, without mixing with meaner families though famous for their riches. The lower orders of people confift of four claffes, Spaniards or whites, Meftizos, Indians or natives, and Negroes, with their progeny. The former, according to the ftatement of Ulloa, compofe about a fixth part of the population; the Meftizos, or defcendants of Spaniards and Indians, amount to about a third part; the Indians form about another third; and the others, who are about one-fixth, are the Cafts. The Spaniards are prevented by their pride from applying to any kind of bufinefs, and therefore many of them are poor and wretched. The Meftizos occupy themfelves in arts and trades, but principally in thofe of the higheft repute, fuch as painting and fculpture, in which they excel. Thefe men of talents, however, are indolent and flothful, fo that they loiter about the ftreets during the whole day. The Indians, who are generally fhoemakers, bricklayers, weavers, or engaged in fimilar occupation, are not more induftrious. Perfons of fortune among the Spaniards affect great magnificence in their drefs, wearing the fineft gold and filver tiffues; but that of the middling and lower clafs is a black cloak, and under it a long coat, reaching down to their knees, with a clofe fleeve, open at the fides, without folds, and ornamented with rows of buttons. The Meftizos generally wear blue cloth, manufactured in this country. The drefs of the Indians confifts only of white cotton drawers, made either from the ftuffs of the country, or from others brought from Europe, reaching down to the calf of the leg, and edged with lace fuitable to the ftuff. The ufe of a fhirt is fupplied by a black cotton frock, wove by the natives; and over this is a kind of ferge cloak, through which the head paffes, and a hat made by the natives. The men, both Creoles and Spaniards, are well made, of a proper ftature, and of a lively agreeable countenance. The Meftizos in general are alfo well made, often taller than the ordinary fize, very robuft, and have an agreeable air. The Indians, both men and women, are generally low, but well proportioned and very ftrong. The Indians have no beard, nor have either males or females any indications of the age of puberty. The youths of family are inftructed in philofophy and divinity, and fome, with reluctance, proceed to the ftudy of the civil law. The country is obferved to abound more in women than men; and it is obferved, that nature begins to decay at the age of thirty in the male fex, efpecially among thofe who have been tenderly brought up; whereas the females enjoy a more confirmed ftate of health and vigour. This difference is afcribed partly to the climate and partly to the food, but principally to early intemperance and voluptuoufnefs, and alfo the want of proper employments. The liquors that are ufed here are rum and brandy, in which they freely indulge, and alfo the infufion of the Paraguay herb, which ferves for tea. The vices prevalent here are idlenefs, drunkennefs, and gaming. The common people and Indians are much addicted to theft, in which they are very artful and dextrous. In Quito, and in all the towns and villages of its province different dialects are fpoken, Spanifh being no lefs common than the Inga.

Quito is fo happily fituated, that neither the heat nor cold is troublefome; though the extremes of both may be felt in its neighbourhood. An equality of temperature takes place throughout the whole year, the difference between the feafons being fcarcely perceptible. The winds are falubrious, and blow continually, but never with any violence. The rain occafionally defcends in impetuous torrents. Earthquakes are not uncommon, and when they occur very violent; that of 1775 was very deftructive. The great earthquake on the 4th of February 1797, which changed the face of the whole province, and in one inftant deftroyed thirty-five or forty thoufand perfons, has fo altered the temperature of the air, that the thermometer is now commonly 41° to 54°, and feldom rifes to 68° or 70°; whereas Bouguer obferved it conftantly at 66° or 68°. Since this cataftrophe earthquakes are continually recurring; and fuch fhocks, it is probable, that all the higher ground is one vaft volcano. Von Humboldt adds, that what are called the mountains of Cotopaxi and Pichincha are but little fummits, the craters of which form different conduits terminating in the fame cavity. The earthquake of 1797 afforded a melancholy proof of this; for the ground then opened every where, and vomited forth fulphur, water, &c. Notwithftanding the dangers and horrors that furround them, the people of Quito are gay, lively, and variable, and very much addicted to pleafure, luxury, and amufement. Humboldt informs us, that the volcanos of Quito eject pumice, bafalt, and porphyry fcorified; with enormous quantities of water and liquid clay, which diffufe fertility eight or ten leagues round. The fertility of this country is fuch, that, as we are informed, a full defcription of it would appear incredible. The equability of the climate, as well as the fertility of the foil, occafion a regular fucceffion of the productions of the earth: when the fruits have obtained their maturity, and the leaves begin to change their colour, frefh leaves, bloffoms, and fruits, are feen in their proper gradations on the fame tree. The fame inceffant fertility is confpicuous in the corn, reaping and fowing being both carried on at the fame time. This remarkable fecundity of the foil is naturally productive of excellent

excellent fruits and corn of every kind, as is evident from the delicacy of the beef, veal, mutton, pork, and poultry of Quito. One of the principal foods ufed by the inhabitants is cheefe, of which it is computed that the quantity annually confumed amounts to between feventy and eighty thoufand dollars of the money of that country. The vicinity alfo affords excellent butter. The manufactures of this province are cottons, fome white, called tucuyos, and others ftriped bays and cloths, which meet with a good market at Lima, for fupplying all the inward provinces of Peru; and the returns are made partly in filver, and partly in gold and filver fringes made in that city, wine, brandy, oil, copper, tin, lead, and quickfilver. The products of the earth are chiefly confumed within the province; except the wheat, part of which is fent to Guayaquil. But this trade is carried on by Meftizos and poor people. Goods, manufactured by the public, or woven by private Indians, are fent, together with fome kinds of provifions, to the jurifdiction of Barbacoas. Thefe provifions are exchanged for gold, found in that country, and which is afterwards fent to Lima, and difpofed of at a greater price. Their ftuffs find a vent in the governments of Popayan and Santa Fé. The coaft of New Spain fupplies this province with indigo, of which a great quantity is confumed; blue being univerfally the colour which thefe people affect in their apparel. They alfo import, by way of Guayaquil, iron and fteel, both from Europe and the coaft of Guatemala. S. lat. 0° 13′ 27″. W. long. 78° 10′ 15″. Ulloa's Voyage, vol. i.

QUIT-RENT, q. d. *quiet rent*, a certain fmall rent, payable yearly, by the tenants of moft manors, in token of fubjection; upon the payment of which, they are quiet, and free. It includes both rents of affife and chief rents.

Thefe rents differ very greatly in different manors, being in fome a mere trifle, while in others they are very heavy and oppreffive to the tenants. This part of the feudal fyftem is now confiderably on the decline.

In fome ancient records it is written white rent, becaufe paid in filver, to diftinguifh it from rent-corn, rent-pepper, &c.

QUITTA, in *Geography*, a town of Africa, on the Slave coaft. N. lat. 6°. E. long. 0° 8′.

QUITTANCE. See ACQUITTANCE.

QUITTER, or QUITTOR, in horfes, is an ulcer formed between the hair and hoof, ufually on the infide quarter of a horfe's foot; it often arifes from treads and bruifes, fometimes from gravel, which by working its way upwards, lodges about the coronet; if it is only fuperficial, it may be cured with cleanfing dreffings, bathing the coronet every day with fpirits of wine, and dreffing the fore with lime-water, or a detergent application, fuch as red precipitate. But where the matter forms itfelf a lodgment under the hoof, there is then no way to come at the ulcer but by taking off part of the hoof; and if this be done well, the cure may be effected without danger.

When the matter happens to be lodged near the quarter, the farrier is fometimes obliged to take off the quarter of the hoof, and the cure is then for the moft part but palliative; for when the quarter grows up, it leaves a pretty large feam, which weakens the foot; this is what is called a falfe quarter, and a horfe with this defect feldom gets quite found.

If the matter, by its confinement, has injured or deftroyed the coffin-bone, which is of fo foft and fpongy a nature that it foon becomes carious, it will be neceffary to enlarge the opening, cut away the fpongy flefh, and apply the actual cautery, or hot iron, pointed pyramidically, dreffing the bone with doffils of lint dipped in tincture of myrrh, and the wound with the green or precipitate ointment. When the fore is not enlarged by the knife, which is the beft and leaft painful method, fublimate is generally applied; or blue vitriol powdered, and embued with a few drops of oil, is alfo ufed for this purpofe, and is faid to act as effectually, and with lefs pain to the animal.

In the time of the action of thefe cauftic remedies, the foot fhould be kept in a poultice. And where finufes form they fhould be laid open by a knife, and be afterwards ftimulated by the application of fome detergent remedy. The following has been advifed by a late writer: Take of corrofive fublimate, red precipitate in fine powder, of each equal parts; honey fufficient to form a pafte.

The wound is advifed to be afterwards dreffed with common digeftive ointment, preffure being given by means of a bandage. It is fometimes written quittor.

QUITTER-*Bone*, another term applied to the fame difeafe by farriers and perfons engaged in hufbandry.

QUITY, in *Botany*, a Brafilian name ufed by fome authors for the fapindus, or foap-berry tree of the Weft Indies.

QUIVER, feemingly corrupted from the Fr. *couvrir*, to cover, a cafe or fheath for arrows.

QUIVISA, in *Geography*, a town of Hindooftan, in Bahar; 25 miles S.W. of Bettyah.

QUIVISIA, in *Botany*, from the vulgar name of this tree or fhrub in the ifles of Bourbon and the Mauritius, *bois de quivi*. Juff. Gen. 264. Cavan. Diff. 367. (See GILLIBERTIA.) One cannot but wonder how a writer of Juffieu's learning could, for a moment, tolerate fo faulty a name; efpecially as his authority leads heedlefs perfons into the adoption of fuch, for want of reading his preface; where, in a note to p. 24, he declares thefe rude and barbarous names to be merely borrowed for a time, till the genera to which they belong are better determined.

QUIXOS, in *Geography*, a jurifdiction of South America, attached to the province of Quito, on the eaft fide of the Cordillera of the Andes. Quixos on the north fide borders on the jurifdiction of Popayan; reaching eaftward to the river Aguarico, and towards the weft feparated from the jurifdictions of Quito, Latacunga, and the town of San Miguel de Ibarra, by the Cordilleras of Cotopaxi and Cayamburo. This country was firft difcovered, in 1536, by Gonzalo de Pineda, one of the officers fent from Popayan by Sebaftian de Belalcazar (or Benalcazar), to trace the courfe of the river Magdalena; and in confequence of his report, Gonzalo Pizarro, in 1539, reconnoitred its whole extent, and eftablifhed fettlements in it. But upon the failure of his expedition, the conqueft of this country was fufpended till the year 1549, when the marquis de Canete, viceroy of Peru, gave a commiffion to Gil Remirez Davalos, a man of undaunted courage, for reducing the Indians, and making fettlements in the country. This object he accomplifhed, and founded the town of Baeza, the capital of the government, in the year 1559; and this was foon followed by other towns and villages, the principal of which are Archidona and Avila. The temperature of this country is hot and moift, the rains being almoft continual. It is covered with thick woods, fome trees being of a prodigious magnitude. In the S.W. part of the jurifdiction of Quixos is the canela or cinnamon tree, which led Gonzalo de Pineda to call the country Canelos, a name which it ftill retains. The other products of Quixos are the fame with thofe in all the other lands under the fame climate as this government. Adjoining to this is the diftrict of Macas and Maynas. See MACAS and MAYNAS.

QUIZA, in *Ancient Geography*, a town of Africa, in Mauritania Cæfarienfis. This was a fortrefs, according to Pomponius Mela and Pliny. Antonine makes it a municipium, and places it between Portus Magnus and Arfenaria.

QUIZAMA, in *Geography*, a province of Africa, in the fouthern part of Angola; the country is extenfive, mountainous, and badly cultivated; but it produces abundance of honey, wax, and falt. The inhabitants are warlike, and have not fubmitted to the Portuguefe.

QUIZIBA, a fmall ifland in the Indian fea, near the coaft of Africa. S. lat. 12° 30′.

QUIZIMAJUGO, a river of Africa, which difcharges itfelf into the Indian fea, S. lat. 8° 50′.

QUIZINA, or Teusin, a chain of mountains in Fez, 90 miles in extent.

QUIZUMGO, a river of Africa, which runs into the ftraits of Mozambique, S. lat. 17° 20′.

QUO Jure, in *Law*, a writ that lies for him who has land, wherein another challengeth common of pafture time out of mind: its defign is to compel the party to fhew by what right or title he challengeth it. This is now out of ufe, as, on the claimant's putting his cattle in, the owner may bring trefpafs, when the claimant muft plead and prove his title.

Quo *Minus* is alfo a writ which lies for the king's farmer or debtor in the court of exchequer, againft him to whom he felleth any thing by way of bargain, touching his farm, or againft whom he hath any caufe of perfonal action; becaufe by the vendee's detaining any due from him, the farmer is lefs able to pay the king's rent. This was formerly allowed only to fuch perfons as were tenants or debtors to the king: at this day the practice is become general for the plaintiff to furmife, that, for the wrong which the defendant doth him, he is lefs able to fatisfy his debt to his majefty; which furmife gives jurifdiction to the court of exchequer to hear and determine the caufe. Finch. 66. Old N.B. 148.

Quo minus is alfo a writ that lies for him who has a grant of houfe-bote and hay-bote in another man's woods, againft the grantor making fuch wafte, as that the grantee cannot enjoy his grant.

Quo *Warranto*, a writ that lies againft any perfon or *corporation* (which fee) who ufurps any franchife, or liberty, againft the king; as to have waife, ftray, fair, market, court baron, leet, or fuch like, without good title; to inquire by what authority he fupports his claim, in order to determine the right. Finch. L. 322. 2 Inft. 282.

It alfo lies for mif-ufer or non-ufer of privileges granted; and even, according to Bracton, againft him that intrudeth himfelf as heir into land. See Intrusion.

This writ was originally returnable before the king's juftices at Weftminfter; but afterwards only before the juftices in eyre, by virtue of the ftatutes of "quo warranto," 6 Edw. I. c. 1. and 18 Edw. I. ft. 2. (2 Inft. 498. Raft. Entr. 540.); but fince thofe juftices have given place to the king's temporary commiffioners of affife, the judges on the feveral circuits, this branch of the ftatutes hath loft its effect: and writs of "quo warranto" (if brought at all) muft now be profecuted and determined before the king's juftices at Weftminfter. And in cafe of judgment for the defendant, he fhall have an allowance of his franchife; but in cafe of judgment for the king, for that the party is entitled to no fuch franchife, or hath difufed or abufed it, the franchife is either feifed into the king's hands, to be granted out again to whomever he fhall pleafe; or, if it be not fuch a franchife as may fubfift in the hands of the crown, there is merely judgment of "oufter," to turn out the party who ufurped it. Cro. Jac. 259. 1 Show. 280.

The judgment on a writ of *quo warranto* (being in the nature of a writ of right) is final and conclufive even againft the crown. (1 Sidd. 86. 2 Show. 47. 12 Mod. 225.) This circumftance, together with the length of its procefs, probably occafioned that difufe into which it is now fallen, and introduced a more modern method of profecution, by information filed in the court of king's bench by the attorney general, in the nature of a writ of "quo warranto," in which the procefs is fpeedier, and the judgment not quite fo decifive. This is properly a criminal method of profecution, as well to punifh the ufurper by a fine for the ufurpation of the franchife, as to ouft him, or feife it for the crown; but hath long been applied to the mere purpofes of trying the actual right, feizing the franchife, or oufting the wrongful poffeffor; the fine being nominal only. Blackft. Com. b. iii. See Information.

QUOAD HOC, a term often ufed in law reports to fignify, "as to the thing named" the law is fo, &c.

QUOCOLOS, the name of a ftone found in Tufcany, as hard as a flint, fomewhat tranfparent, and, in fome meafure, refembling marble. In the fire it lofes its tranfparency, and becomes lefs ponderous, and white; and a ftrong fire readily converts it into glafs. It has no medicinal virtues, but is ufed at fome glafs-houfes.

QUOD, Cape, or *Quada*, a cape on the coaft of Patagonia, in the ftraits of Magellan. S. lat. 53° 33′. W. long. 74° 6′.

Quod *clerici beneficiati de cancellaria*, in *Law*, a writ to exempt a clerk of the chancery from the contribution towards the proctors of the clergy in parliament. Rep. Orig. 261.

Quod *clerici non eligantur in officio ballivi*, &c. is a writ that lies for a clerk, who, by reafon of fome land he hath, is made, or like to be made, a bailiff, beadle, reeve, or fuch like officer.

Quod *cum*, *that whereas*, being by way of recital, and not pofitively, is not good in indictments. 3 Salk. 188. See Indictment.

Quod *ei deforceat*, a writ for tenant in tail, tenant in dower, by the courtefy, or for term of life, having loft their lands by default, againft him that recovers, or his heir. Reg. Orig. 171. Stat. Weftm. 2. cap. 4.

This, though not ftrictly a writ of right, fo far partakes of the nature of one, as that it will reftore the right to him who has been thus unwarily deforced by his own default. (F.N.B. 155.) But in cafe the recovery were not had by his own default, but upon defence in the inferior poffeffory action, this ftill remains final with regard to thefe particular eftates, as at the common law: and hence it is, that a common recovery (on a writ of entry in the *poft*) had, not by default of the tenant himfelf, but (after his defence made, and voucher of a third perfon to warranty) by default of fuch voucher, is now the ufual bar to cut off an eftate-tail.

This writ may be brought againft a ftranger to the recovery; as if a man recover by default, and maketh a feoffment, this writ may be had againft the feoffee.

Quod *medium*. See Medium.

Quod *permittat*, in *Law*, a writ that lies where a man is diffeifed of his common of pafture, and the *diffeifor aliens* or dies feifed, and his heir enters; then if the diffeifee die, his heir fhall have this writ. See Disturbance *of Common*.

Quod *permittat profternere*. See *Affife of* Nusance.

Quod *perfona nec præbendarii*, &c. a writ that lies for fpiritual perfons, when diftrained in their fpiritual poffeffions, for the payment of a fifteenth, with the reft of the parifh. F.N.B. 176.

QUODLIBETICAL Question, *Quæftio quodlibetica*, a college term for a thefis, or problem, anciently propofed to be debated in the fchools, out of curiofity and entertainment, rather than for the fettling of any ufeful point.

The term is formed from the Latin *quodlibet*, *any thing*, *what you pleafe*: and fo well fatisfied were the public of the impertineneces of thefe queftions, that the term *quodlibet* has been fince retained, to fignify any little ridiculous quibble.

QUOJA, in *Geography*, a country of Africa, fituated above 100 miles from the coaft of the Atlantic, between the 8th and 10th degrees of W. longitude, and between the 7th and 9th degrees of N. latitude.

QUOIF, in *Ship-Building*, a piece of oak thickftuff on the deck-hook, to which the deck water-way on each fide is butted, otherwife the butt would come in the middle, and could not be caulked.

QUOIL, QUOYL, or *Coile*, in the *Sea Language*. A cable is faid to be quoiled, when it is laid round in a ring, one turn over another, on the deck of a fhip.

The middle of fuch ring, or quoil, is a good place to lay fhot in: they are more fafe there, than in lockers along the fide, where the enemy's fhot may fall into them.

QUOIL, *Weather*. See WEATHER *Quoil*.

QUOIN, or COIN, formed from the French *coin*, of the Latin *cuneus*, *wedge*, aboard a fhip, is a wedge faftened on the deck, clofe to the breech of the carriage of a gun, to keep it firm up to the fhip's fide, and prevent its rolling; and alfo to raife or deprefs it.

QUOINS, *Cantic*, are fhort three-legged quoins, put between cafks to keep them fteady. See COIN.

QUOINS, in *Architecture*, denote the corners of brick or ftone walls.

The word is particularly ufed for the ftones in the corners of brick buildings. When thefe ftand out beyond the brick-work (their edges being chamferred off) they are called *ruftic* quoins.

QUOIN, in *Geography*, a fmall ifland in the Indian fea, near the W. coaft of Madagafcar. S. lat. 14°. E. long. 48° 14'.—Alfo, an ifland in the Eaft Indian fea, N. of the Nicobar iflands. N. lat. 9° 56'. E. long. 93° 20'.

QUOITS, a kind of exercife or game, known among the ancients under the name of the *difcus*. See DISC.

QUOLL, in *Zoology*, a name given by the natives of New Holland to an animal refembling a pole-cat, with a brown back, fpotted with white, and the belly of a pure white, in which it differs from others of thefe fetid animals. Cook's Voy. 1770. vol. iii. p. 626.

QUONDANGA, in *Geography*, a town of the Birman empire; 32 miles N. of Prone.

QUORUM, a term frequently mentioned in our ftatutes, and often ufed in commiffions, both of peace, and others. A juftice of the quorum is thus called from the words in the commiffion, *Quorum* C. D. or A. B. *aliquem veftrum unum effe volumus*.

For an example: where a commiffion is directed to feven perfons, or to any three of them, of which A. B. and C. D. are to be two; there A. B. and C. D. are faid to be of the quorum, becaufe the reft cannot proceed without them.

So a juftice of the peace and quorum is one without whom the reft of the juftices, in fome cafes, cannot proceed. See JUSTICES *of the Peace*.

QUORUM *Nomina*. In the reign of king Henry VI. the king's collectors, and other accomptants, were much perplexed in paffing their accounts, by new extorted fees, and forced to procure a then late-invented writ of *quorum nomina*, for the allowance and fuing out their quietus, without the allowance of the king.

QUOTA, in *Law*, a tax to be levied in an equal manner.

QUOTATION, in *Literature*, a citation; or a paffage rehearfed exprefsly in one author from another.

Quotations are ufually diftinguifhed by inverted commas.

The manner of quoting by book, and chapter, or fection, is chiefly affected by men of erudition; but it is abufed: this method ought only to obtain where the whole chapter or fection is exprefsly on the fubject. On other occafions, quoting by page is more commodious; except in claffics, and other ancient writings, of which there are many editions in different forms; where this method is of little ufe, unlefs the edition be alfo fpecified.

The quotations from the Old Teftament, found in the New, have occafioned great doubt, difpute, and criticifm. The apoftles are frequently referring to the Old Teftament, and quoting paffages and prophecies thence, as fulfilled in our Saviour; yet thefe paffages, thus quoted, are frequently either not found in the Old Teftament at all, or they are not urged in the New, according to the literal and obvious fenfe they feem to bear in the Old.

A late ingenious author, in an "Effay upon the Truth of the Chriftian Religion," frankly owns, that the evangelifts fometimes apply to the Meffiah paffages of the Old Teftament, which, as they lie in our prefent copies, plainly relate to fome other perfon, or thing. This is evident, *e. gr.* in the paffage, Matthew, ii. 15. *Out of Egypt have I called my fon*; which is quoted from Hofea, xi. where it is plainly underftood of the coming of the Ifraelites out of Egypt.

This circumftance has been urged as a great objection to Chriftianity, which the divines, commentators, critics, &c. have long laboured to remove, though by very different means.

Some have recourfe to a double completion; and imagine, that though the prophecies were primarily accomplifhed in other events, yet they might have a fecondary accomplifhment in the Meffiah: but others fet afide a double completion, except where the prophet himfelf declares as much, this otherwife making all prophecy ufelefs. See PROPHECY.

The generality choofe, therefore, to have recourfe to an allegorical, typical, or fpiritual meaning in the prophecies, &c. and fuppofe them to have been thus underftood among the ancient Jews, thus fulfilled in our Saviour, and thus applied by the apoftles.

In effect, the Jewifh rabbins, it is allowed, took great liberty in quoting and interpreting fcripture; and it is fuppofed the apoftles might follow thefe rules in their quotations.

Accordingly, M. Surenhufius, Hebrew profeffor at Amfterdam, has endeavoured to retrieve thefe rules, long fince loft, in an exprefs treatife on this fubject, publifhed in 1713. This author obferves a great deal of difference applied in the different forms of quoting ufed by the facred writers: as, *It has been faid; it is written; that it might be fulfilled which was fpoken by the prophets*; *the Scripture fays*; *fee what is faid*; *the Scripture forefeeing*; *it is not written*, &c. He adds that the books of the Old Teftament having been difpofed in a different order at different times, and having had different names, it is thence, that one book or writer is fometimes confounded with another.

For the rules of quoting and interpreting practifed among the rabbins, he gives us ten; recovered with much ftudy from the Talmud, and the ancient Jewifh doctors: inftances of which he gives us in the writings of the apoftles; and by thofe rules he endeavours to explain and juftify all the quotations made from the Old Teftament in the New.

The rules are, 1. Reading the words not according to the

the points placed under them, but according to others substituted in their stead; as is done by St. Peter, Acts, iii. 23. by Stephen, Acts, vii. 43. and by Paul, 1 Cor. xv. 54. 2 Cor. viii. 15, &c. The second is by changing the letters; as is done by Paul, Rom. ix. 33. 1 Cor. xi. 9 Heb. viii. 9. and x. 5. and by Stephen, Acts, vii. 43. The third is by changing both letters and points; as is done by Paul, Acts, xiii. 41. and 2 Cor. viii. 15. The fourth is by adding some letters and taking away others. The fifth is by transposing words and letters. The sixth is by dividing one word into two. The seventh, adding other words to make the sense more clear. The eighth, changing the order of the words. The ninth, changing the order of the words and adding other words. Both of which are done by the apostles. And lastly, changing the order of words, adding words, and retrenching words; which is a method often used by St. Paul.

Other authors, as bishop Kidder, M. le Clerc. Mr. Sykes, &c. solve the difficulty another way. That usual form of quotation among the evangelists, "That it might be fulfilled which was spoken by the phrophets," according to these authors, means no more than an accommodation of the prophet's words to the case in hand.

The word πληρωθη, *fulfilled*, does not necessarily determine us to such a sense, as if the evangelists designed to speak of a prediction of future events *accomplished;* but may barely express an accommodation of borrowed words. In effect, says bishop Kidder, a scripture may be said to be fulfilled two ways; *properly*, as when that which was foretold comes to pass; and *improperly*, by way of accommodation, as when an event happens to any place or people like to what fell out some time before. And thus it is that St. Matthew says, on occasion of the murder of the innocents, that "then was fulfilled what was spoken by the prophet Jeremy, *In Rama was a voice heard*," &c.

This interpretation is confirmed by M. le Clerc, who observes that the Jews, in their language, used to say, that a passage of scripture was fulfilled, as often as any thing happened to which it might be applied; so that the evangelist Matthew, who was a Hebrew, and wrote, as is commonly supposed, in that language, intended no more in the passage just cited, but that a thing happened, to which one might apply what Jeremy had formerly said on another occasion.

Accordingly, says Mr. Sykes, the evangelists, in citing that passage of Isaiah, *Behold, a virgin shall be with child*, &c. only use it as words of that prophet remarkably agreeing to the miraculous birth of Jesus, and not as a prophecy of his birth.

It may be added that this way of speaking was not unknown among the heathen writers. Thus in Ælian, Diogenes Sinopensis used continually to say of himself, that he fulfilled and underwent all the curses of tragedy.

The difficulty stated in this article has been already the subject of discussion under the terms ACCOMMODATION and PROPHECY. Whilst it is allowed, that many passages in the New Testament, and also in the writings of the Christian fathers, are very different from the correspondent passages as they now stand in the Hebrew text; and that some words are introduced as quotations which are no where to be found: those who urge the objection should be disposed to pay due attention to the various modes of replying to it, which biblical critics have proposed. Some have supposed, with Whiston, that those early Christian writers quoted from the LXX: others have alleged that they sometimes quoted from their memory; and this, it is said, is the more probable, because the same passage is quoted in some cases by different authors in very different words, even where the sense agrees. It is moreover alleged, that the *sense* of the passages supposed to be lost is still to be found in the Old Testament, though the *words* be not; such especially are Matt. ii. ult. and John, vii. 38. But if it were granted, that some of the verses originally belonging to the Old Testament are lost, or materially corrupted, no objection could be justly alleged against the authenticity and divine authority of the sacred writings in general. As for the quotations that occur in the New Testament, the most probable opinion is, that some of them are made from the Greek version and some from the Hebrew text. To those who assume, that though such quotations are made from the Greek version, where that differs from the Hebrew, yet both the text and the version are in such places always the same in sense, we reply with Dr. Kennicott, that this is not the case: and he thinks, that the only way of doing justice to our Saviour and his apostles in their references to the Old Testament, is to say, that for whatever purpose such quotations were made (whether by way of express prophecy, or only of allusion and accommodation) they were always consonant to the true sense of the Hebrew text. For he says, it is scarcely possible to conceive, how any speaker or writer can quote justly such and such words, as (*e. g.*) from Moses or from Isaiah, when the words quoted are not the words of Moses or Isaiah, and do not express even the sense of Moses or Isaiah; but are only taken from some version, which (upon the present supposition) was no version at all in these instances, because it did not agree here in sense with its original. The foundation of this mistake, as this learned writer adds, is the notion that has prevailed of the integrity of the modern Hebrew text; for the writers who have held this to be perfect, have never been able and never will be able to vindicate the prophetical quotations. Passages quoted from the several Jewish writers by inspired men must (he thinks) have been quoted agreeably to the sense of the Hebrew text; but such quotations do not agree in sense with the printed Hebrew text. Therefore some alterations have happened, either in the Greek text of the New Testament, or the Hebrew text of the Old. Collins says that the Hebrew text has been delivered down perfect, and therefore that the quotations are either forged or falsified in the New Testament. To this it is replied, that as it appears from a collation of the Greek MSS. of the New Testament, that the words of the quotations are not corrupted in the Greek text, so it appears from a collation of the Hebrew MSS. that the words have been corrupted in the Hebrew. And this is an answer which should approve itself to all Christians. See Kennicott's State of the Hebrew Text, vol. ii. p. 345—347, &c.

Upon the whole we observe, that the writers of the New Testament did not make it a constant rule to quote from the Greek version, because there are many places where their quotations differ from that version and agree with the Hebrew. And as the quotations now agree with the Hebrew, frequently in the express words, generally in the sense; so it it is most probable, that they always agreed at first, and that where the Hebrew was expressed properly in the Greek version, they used the words of that version; and where the version was not proper, they translated for themselves.

With regard to Matt. ii. ult. the first of the passages above cited, Dr. Doddridge (Fam. Expos. in loc.) observes, that Nazareth was a little city on the confines of Zabulon and Issachar; so contemptible among the Jews, that it was a proverb among them, No good thing can be expected from thence. Thus was fulfilled what was spoken in effect by many of the prophets, "he shall be called a Nazarene;" *i. e.* he

shall

ſhall appear in mean and deſpicable circumſtances, and be treated as the mark of public contempt and reproach. If this ſenſe be not approved, Dr. Doddridge profeſſes to acquieſce in Chryſoſtom's opinion, that the paſſage referred to is loſt, avouching his diſſatisfaction with other interpretations of this paſſage. The ſecond paſſage, *viz.* John, vii. 38, our learned expoſitor thus explains. "He that believeth in me, as the ſcripture hath ſaid, out of his belly ſhall flow rivers of living water, *i. e.* as the ſcripture has in many places ſaid and promiſed, he ſhall receive thoſe ſupplies in ſo great an abundance, that he ſhall not only be refreſhed himſelf, but out of his belly, or from within him ſhall flow vital ſtreams, and as it were rivers of living water for the refreſhment and comfort of others." Chryſoſtom, and after him many other eminent writers, Caſtalio, Zegerus, and I. Capellus, refer the words "as the ſcripture hath ſaid," to the former clauſe, and underſtand them, as if our Lord had ſaid, "He that hath faith in me," which the ſcripture requires, and thus they avoid the difficulty, which ariſes from our not finding the following words in ſcripture. But Grotius, with whom Dr. Doddridge agrees, ſuppoſes, that here is a general reference to the ſeveral prophecies which refer to the effuſion of the ſpirit by the Meſſiah, under the ſimilitude of pouring out water. See Iſaiah, lii. 15. xliv. 3. lviii. 11. Joel, ii. 28.

QUOTIDIAN, in *Medicine*, ſignifying literally *daily*, is applied to all intermitting diſeaſes, which return once in twenty-four hours. As the moſt remarkable of theſe is the *ague*, or intermittent fever of marſhy countries; ſo the term *quotidian* ſignifies emphatically a quotidian ague. The paroxyſm uſually returns in the morning. See Ague.

Quotidian, *Double*, returns twice in twenty-four hours.

QUOTIENT, Quotiens, formed from the Latin *quoties*, *q. d. how often is ſuch a number contained in ſuch another*, in *Arithmetic*, the number reſulting from the diviſion of a greater number by a ſmaller; and which ſhews how often the ſmaller is contained in the greater, or how oft the diviſor is contained in the dividend.

In diviſion, as the diviſor is to the dividend, ſo is unity to the quotient. Thus the quotient of 12 divided by 3 is 4; which is thus diſpoſed, 3) 12 (4 quotient.

QUOVEDO, in *Geography*, a town of Iſtria; ſix miles E. of Capo d'Iſtria.

QUOUSQUE. *Execution with a Quouſque.* See Execution.

QUOYL. See Quoil.

R.

R, A liquid conſonant, and the ſeventeenth letter of the alphabet.

The grammarians hold it a ſemi-vowel; eſpecially in the Greek, where, in common with the other vowels, it admits an aſpirate, &c. though whether the aſpirate ſhould be ſounded before or after it, is ſome doubt. We find inſtances of each.

Thus ῥεδη the Latins wrote *rheda;* and ῥοδον the Ætolians wrote βροδον; and in Engliſh words derived from the Greek it is followed by an *h*, as *rhapſody*. The ancient Goths, and Teutones, Littleton obſerves, always prefixed *h* to *r*. See H.

The ſound is formed by a guttural extruſion of the breath, vibrated through the mouth, with a ſort of quivering motion of the tongue drawn from the teeth, with the tip a little elevated towards the palate.

In ſome words, as *Rome*, *rape*, and *river*, it has a rough ſound; in others, as *bard*, *card*, *regard*, its ſound is ſmooth. *Re* at the end of many words is pronounced like a mute *er*, as in *theatre*, *ſepulchre*, and *maſſacre*. *Rh* is uſed in words derived from the Greek, as *myrrh*, *rheum*, and *rhyme*.

The Hebrews allow the *r*, or ר, the privilege of a guttural; that is, they never double it, which yet is done by the Arabs, Greeks, and Latins, &c.

Perſius calls the *r*, *litera canina*, becauſe the dogs ſeem to pronounce it in ſnarling; yet it ſhould ſeem to have had a ſofter ſound among the Romans than among us, by its being frequently interpoſed to prevent the claſhing of vowels; as in *rarus*, αραιος, *nurus* from νυος, *murex* from μυαξ, *mus muris* from μυς μυος; and this ſoftneſs was ſuch as frequently occaſioned its being dropt as uſeleſs in writing. Thus for *Hetruſci* they frequently wrote *Thuſci*, and even *Tuſci;* and for *ſurſum*, *rurſus*, *prorſus;* *ſuſum*, *ruſus*, *proſus*.

In effect, there was that agreement between the ſound of the *s* and *r*, that as the Romans avoided the doubling of their conſonants, it was no wonder they here dropped the *r* in ſuch words; the *s* ſupplying the place of both. Hence too it came to paſs, that what they at firſt pronounced *aſa*, *aſena*, *caſmen*, was afterwards *ara*, *arena*, *carmen;* and thoſe firſt named *Fuſii* and *Valeſii*, were afterwards called *Furii* and *Valerii*. Cicero tells us, the *Papirii* were firſt called *Papiſii;* and even fixes the time when the change was made, *viz.* in the year of Rome 415. Feſtus adds, that *olera*, *pignora*, *plurima*, were anciently written *oleſa*, *pignoſa*, *pluſima*.

From the ſame ſoftneſs of the ſound of the *r*, it came to be uſed indifferently with the *l*, in many words; *e. gr. Latiaris* and *Latialis*, *Palilia* and *Parilia*, &c.

Though the *r* more frequently degenerated into *l*; thus *remures* became changed into *lemures;* *interlego*, *perluceo*, into *intelligo* and *pelluceo;* *frater* into *fratellus*, &c.; and the ſame is ſometimes done between *n* and *r*, as *areus*, and *aneus*, &c.

In the notes of the ancients, *R.* or *RO.* ſignified *Roma;* *R. C. Romana civitas;* *R. G. C. rei gerendæ cauſa;* *R. F. E. D. recte factum et dictum;* *R. G. F. regis filius;* *R. P. res publica*, or *Romani principes;* and *R. R. R. F. F. F. res Romana ruet ferro*, *fame*, *flamma*.

R was anciently a numeral letter, ſignifying 80; according to the verſe,

"Octoginta dabit tibi R, ſiquis numerabit."

When a daſh was added at top, as $\overline{R}$, it ſignified eighty thouſand.

The Greek *r*, ρ́, with a ſmall mark over it, ſignified a hundred; with the ſame mark under it, it denoted 1000 × 100; thus ͵ρ ſignified 100,000.

In the Hebrew numeration, ר denoted 200; and with two horizontal points over it, 1000 × 200; thus ר̈ = 200,000.

R on the French coins, denotes their being ſtruck at Orleans.

R, or ℞, in *Medicinal Preſcription*, ſtands for *recipe*, *take.*

RAA, in *Geography*, a town of Norway; 10 miles N.E. of Frederickſtadt.

RAAB, Gyor, or *Javarin*, a town and fortreſs of Hungary, ſituated in a pleaſant level country, at the conflux of the Danube, the Raab, and Rabnitz, which ſurround it. Its houſes are conſtructed of ſtone, and its ſtreets are large and ſtraight. It is the ſee of a biſhop. Its fortification conſiſts of ſeven baſtions, and it has always a ſtrong garriſon, provided with military ſtores. The fortifications of the city and caſtle are chiefly the works of the emperors Ferdinand I. and Maximilian II. In this place are ſeen ſome Roman antiquities; 56 miles S.E. of Vienna. N. lat. 47° 42′. E. long. 18° 45′.

Raab, a river of Stiria, which riſes near mount Rettlſtein, and runs into the Danube, near Raab in Hungary.

RAAF, or Raff, Anthony, in *Biography*, the moſt exquiſite and celebrated tenor ſinger of the laſt century, was born at Bonn in 1710. He was a ſcholar of Bernacchi, and equally admired for his taſte, expreſſion, and ſtyle of ſinging, by the Italians and Germans. In 1729 his voice was ſettled from a high treble to a ſweet and firm tenor, ſufficiently for him to perform a capital part in an opera at Naples. After ſinging in all the great cities of Italy, he returned to Germany, where he was courted and careſſed by all the princes of the empire. He was knighted by the elector of Bavaria, and appointed his chamber muſician. In 1751 he performed again at Naples in Metaſtaſio's "Attilio Rigolo," with the Mingotti, and in the letters of Metaſtaſio of that period, we have the poet's opinion of his performance. (Mem. of the Life and Writings of Metaſtaſio, vol. i. p. 403.) He performed in an opera compoſed by Chriſtian Bach at Manheim in 1770, when the celebrated air "Non ſo donde viene" was in his part, and which was afterwards ſung on our opera ſtage with ſuch effect by Ciprandi. Raff was at Paris more than once; for in 1780, his 70th year, Laborde ſpeaks of him with great reſpect. "This celebrated tenor has acquired great reputation, and though at preſent d'un certain age, he obliges us ſtill to admire his taſte, and regret all that he has loſt." According to Gerber, Muſical Lexicon, vol. ii. he ſung at Manheim in 1783, and was living in 1792.

RAAGOE, in *Geography*, a ſmall iſland of Denmark, near the N. coaſt of the iſland of Laland. N. lat. 54° 58′. E. long. 11° 19′.

RAAJAGUR, a town of Hindooſtan, in the country of Malwa, near the river Nieunoudge; 74 miles N.E. of Ougein. N. lat. 24° 2′. E. long. 76° 56′.

RAALBRANN, a town of Auſtria; ſeven miles S.E. of Meiſſau.

RAAN, a town of Auſtria; four miles E.S.E. of Hooren.

RAASAY, an iſland of the Hebrides, or Weſtern Iſlands, Scotland, is ſituated between the main land and the Iſle of Skye, and is included within the pariſh of Portree and ſhire of Inverneſs. It is about fifteen miles in length, and from two to five in breadth. On all ſides the coaſt riſes to a great height above the level of the ſea; and on the eaſt ſide its aſcent is peculiarly bold, and almoſt perpendicular. The interior is throughout its whole extent mountainous; and hence is better adapted for paſturage than for tillage, but there are nevertheleſs ſeveral ſpots of very fertile and well cultivated land. The ſupply of free-ſtone is almoſt inexhauſtible, and there is likewiſe plenty of lime-ſtone. Formerly there were in Raaſay ſeveral ancient chapels, but theſe are now ruinous and only uſed as places of burial. Here are likewiſe remains of two forts, the higheſt of which was ſituated at the ſouthern extremity of the iſland, and is called Dunn-Cann, as tradition records, from Canne, couſin to one of the ancient kings of Denmark. The other fort, called Caſtle-Broichin, is a well-known land-mark among ſailors. The rock on which it is ſituated is nearly round, covering an area of little more than ſeventy feet ſquare; is forty feet high, except at the ſpot where the ſtair leads up to it; and is ſixty feet above the level of the ſea at its baſe. The caſtle is built of ſtone and lime, and ſeems to have been no leſs ſtrongly fortified by art than by nature. It was anciently the chief ſeat of the lairds of Raaſay. Now, however, the family reſidence is at Clachan, or Kirk-town, near the oppoſite extremity of the iſland. One of the old Highland alliances has continued for more than two hundred years, and is ſtill ſubſiſting between Macleod of Raaſay, and Macdonald of Skye, in conſequence of which the ſurvivor always inherits the arms of the deceaſed; a natural memorial of military friendſhip. At the death of the late ſir James Macdonald, his ſword was delivered to James Macleod, eſq. the preſent laird of Raaſay. Dr. Johnſon, in his Tour to the Hebrides, ſpeaks in warm terms of the elegance and hoſpitality with which he was entertained by this truly reſpectable family. Carliſle's Topographical Dictionary of Scotland, 2 vols. 4to. 1813. Pennant's Tour through Scotland, vol. ii.

RAASS, a town of the duchy of Stiria; five miles W. of Marburg.

RAASTORF, a town of Auſtria; four miles N. of Entzerſtorff.

RAAT, a town of Hindooſtan, in the country of Agra; 128 miles S.S.E. of Agra. N. lat. 25° 37′. E. long. 79° 58′.

RABAÇAL, a town of Portugal, in the province of Beira; 12 miles S. of Coimbra.

RABANUS, Maurus Magnentius, in *Biography*, a celebrated German prelate in the ninth century, was born at Fulda in the year 785. He was educated partly at Fulda, and partly at Tours, under the famous Alcuin. In the latter ſituation he diſtinguiſhed himſelf by an unwearied application to his ſtudies, and his almoſt unequalled proficiency in all the learning of the times, both profane and ſacred. Not long before the death of Alcuin he returned to Fulda, and embraced the religious profeſſion in its abbey. In the year 810 he was placed at the head of a ſchool belonging to the abbot Ratgarius, and the fame of his ſuperior learning ſoon raiſed the ſeminary into great reputation, and filled it with pupils, many of whom were afterwards promoted to the higheſt eccleſiaſtical dignities, and proved the brighteſt ornaments of the age. In 815 he was ordained prieſt, and in 822 he was elected abbot of Fulda. About 830 he was, by his prudence and good conduct, the means of effecting a reconciliation between the emperor Lewis le Debonnaire and his ſons. Shortly after this, Ebbo, archbiſhop of Rheims, who had been condemned for high treaſon, was committed to his cuſtody. In 838, at the requeſt of of count Erlafrid, he fent a colony of monks from Fulda, to occupy a monaftery lately founded by him at Hirfchau; and at the fame time, in order that he might be enabled to purfue his ftudies with lefs interruption, he devolved upon another perfon the care of governing the abbey. In the following year the monks expelled him from his poft, complaining, that in confequence of his devoting himfelf to his ftudies, the neceffary affairs of the monaftery were neglected, and its eftates fuffered to be much dilapidated. He now retired either to St. Peter's Mount, or, as others report, to an humble apartment in the outer court of the abbey, where he fpent his time in devotion, the ftudy of facred literature, and the compofition of his various writings, deaf to the repeated entreaties of the monks who exhorted him to refume his authority. In 847 he was elected to the archbifhopric of Mentz, and in the following year he fummoned a council, in which he procured the condemnation of Godefchale, for maintaining the doctrine of St. Auguftine refpecting predeftination and grace. Rabanus died in 856, at the age of 71. He is defcribed by Dupin as "having excelled all his contemporaries in the learning of thofe times, in explaining the principles of the liberal arts and fciences, and the rules of grammar and rhetoric; in a readinefs in collecting from the fathers of the church common places upon the facred fcriptures; in allegorizing the hiftorical parts of the bible; in an expofition of the myftical reafons of the ceremonics; in a facility at turning profe into verfe, and in the manner of reducing all common places in precepts and inftructions." And Mofheim fays "he is defervedly placed at the head of the Latin writers of this age; the force of his genius, the extent of his knowledge, and the multitude of productions that flowed from his pen, entitle him to this diftinguifhed rank, and render improper all comparifon between him and his contemporaries." He was denominated the great light of Germany and France, becaufe from his fund of knowledge thofe nations derived principally their religious inftructions. His writings were every where in the hands of the learned, and were held in fo much veneration, that during four centuries, the moft eminent Latin divines appealed to them as authority in religious matters. His writings confift of Commentaries on the Scriptures; Homilies on the Epiftles and Gofpels; Scripture Allegories, and a great many theological and literary pieces. Of which the moft confiderable number were collected and publifhed at Cologne in 1627, in fix vols. folio. Some other pieces of this author, not to be found in that collection, may be found in Baluze's "Mifcellanea," among Father Sirmond's publications, and in the eighth vol. of the Collect. Concil. Mofheim. Dupin.

RABASTENS, in *Geography*, a town of France, in the department of the Upper Pyrenées, and chief place of a canton, in the diftrict of Tarbes; 10 miles N.N.E. of Tarbes. The place contains 750, and the canton 7422 inhabitants, on a territory of 150 kiliometres, in 25 communes.

RABASTENS, or *Rabafteins*, a town of France, in the department of the Tarn, and chief place of a canton, in the diftrict of Gaillac; 21 miles S.S.W. of Alby. The place contains 6076, and the canton 8124 inhabitants, on a territory of 152½ kiliometres, in five communes. The principal article of its trade is wine.

RABAT, a town of Africa, in the empire of Morocco, fituated on the S. fide of the river Sallee. Rabat had formerly, at intervals, a number of European factories; but the difficulty of navigating the river, the obftacles arifing from the arbitrary power of the fovereign, and the difpofition and prejudices of the Moors, have difgufted the Europeans. Neverthelefs, Rabat is the moft proper place for trade of any upon this coaft, both for its vicinity to Europe, and the quantity of wool, leather, and wax, which it is capable of furnifhing. From its central fituation in the empire, it is alfo better adapted for the conveying the commodities imported to every part of the country; but a defpotic government acknowledges no principle but the convenience of the moment; it commands, judges, and executes, without confidering either caufe or confequence. At Rabat, near the mouth of the river, are the ruins of a caftle, built in the twelfth century by Jacob Almanfor, but entirely deftroyed by the late emperor. The walls, which ftill remain, are near two miles round, and fortified by fquare towers. They enclofe the caftle, the town of Rabat, and a large fpace of ground where J. Almanfor built beautiful palaces, and laid out delightful gardens, watered by plentiful ftreams, which he brought from the neighbouring fpring. Thefe walls, as well as the palace and the town, were built by Spanifh flaves, whom he took prifoners in his firft campaign. Within the fame inclofure he alfo built a very large mofque, of which the ruins ftill remain. The roof was fupported by 360 columns of rough marble. Near it was a handfome fquare tower, ftrongly built with cut ftone, near 200 feet high, and called the tower of Haffan. From this tower may be had an extenfive view over the fea, and fhips may be difcovered at a prodigious diftance. This monument is in almoft perfect prefervation. There are fome docks for building fhips both at Sallee and Rabat; but the difficulty of navigating the channel, and the probability that the fand will continue to accumulate, give ground for apprehending, that very foon, only veffels with oars will be able to enter the river. Chenier's Morocco, vol. i.

RABAT *Affarmacan*, a town of Perfia, in Farfiftan; 120 miles E. of Schiras.

RABAT *Arvah*, a town of Perfia, in the province of Kerman; 40 miles E. of Kelvah.

RABAT *el Cadi*, a town of Perfia, in the province of Kerman; 40 miles E. of Maftih.

RABAT *Maabad*, a town of Perfia, in the province of Kerman; 60 miles N. of Kabis.

RABAT *al Naffi*, a town of Perfia, in the province of Kerman; 60 miles N.E. of Maftih.

RABAT *Shehariftan*, a town of Perfia, in the province of Chorafan; 260 miles N.E. of Ifpahan.

RABATE, in *Falconry*. A hawk is fometimes faid to rabate, when, by the motion of the hand of the bearer, the lure, call, &c. fhe leaves purfuing her prey, or quarry, and recovers the fift.

RABATE, in *Commerce*. See REBATE.

RABBA, in *Ancient Geography*, a town of Judea, which belonged to the tribe of Gad; fituated upon the torrent of Jaba; it was befieged by Joab, after he had defeated the Ammonites. Here was feen the head of Og, king of Bafhan, who alone remained of the race of giants.—Alfo, a town of Paleftine, in the tribe of Judah. See RAHABAH.

RABBATH-AMMON, or PHILADELPHIA, a town of Afia, fituated in the mountains of the fouthern part of Paleftine; S.E. of Tiberias, and S. of Boftra.

RABBATH-MOAB, or ARCOPOLIS, a town of Afia, fituated at fome diftance to the eaft of the lake into which the river Jordan difcharges itfelf.

RABBEN, in *Geography*, a fmall ifland in the gulf of Bothnia. N. lat. 63° 14'. E. long. 22° 14'.

RABBET, in *Carpentry*, is a deep groove or channel, cut in a piece of timber longitudinally, to receive the edge of a plank, or the ends of a number of planks, which are to be fecurely faftened in it. The depth of this channel is equal to the thicknefs of the plank, fo that when the end of the latter is let into the rabbet, it will be level with the outfide of the piece. Thus, in fhip-carpentry, the ends of the lower planks of a fhip's bottom terminate upon the ftem afore, and the ftern-port abaft, with whofe fides their furfaces are even. The furface of the garboard ftreak, whofe edge is let into the keel, is, in the fame manner, level with the fide of the keel at the extremities of the veffel.

RABBET-*Plane*. See PLANE.

RABBETING, the planing or cutting of channels, or grooves, in boards.

RABBI, or RABBIN, a doctor of the Jewifh law.

The word in its original, רבי, fignifies *mafter*.

The words *rabbi* and *rabbin* have the fame fignification; yet is there fome difference in their ufe. When we fpeak abfolutely, and without applying the term to any proper name, we fay *rabbin*, not *rabbi*. Thus we fay, it would be unjuft to attribute to the ancient rabbins all the notions of the modern ones.

On the other hand, when we prefix the term to the proper name of fome Jewifh doctor, we fay *rabbi*, not *rabbin*; rabbi Salomon Jarchi is of this opinion.

Yet rabbi having no plural, we fay, the rabbins Juda Chiug, and Juda ben Chabin, are the authors of two ancient Hebrew grammars.

The title rabbi is faid to have been firft affumed, as a diftinguifhing title of honour, by men of learning, about the time of the birth of Chrift; though it had been anciently given to feveral magiftrates and officers of ftate, and to thofe who were of fuperior rank and condition in life. See Efther, i. 8. Jer. xli. 1. Job, xxxii. 9.

The firft Jewifh rabbi faid to have been diftinguifhed with any title of honour, was Simeon, the fon of Hillel, who fucceeded his father as prefident of the fanhedrim; and his title was that of *rabban*. The later rabbins tell us, that this title was conferred with much ceremony. When a perfon had gone through the fchools, and was thought worthy of this degree, he was placed in a chair raifed above the company; and then were delivered to him a key and a table-book; the key as a fymbol of the authority conferred on him to communicate the knowledge he had acquired, which key he wore as a badge of honour, and when he died, it was buried with him; and the table-book was a fymbol of his diligence in his ftudies, and defire of farther improvement. To thefe ceremonies were added the impofition of hands by the delegates of the fanhedrim, and the proclamation of his title. It has been difputed, chiefly between Vitringa and Selden, whether our Lord had taken the degree and title of rabbi in the Jewifh fchools; Vitringa maintains the affirmative, and Selden the negative. See Jennings's Jewifh Ant. vol. i. p. 400, &c.

The Jewifh writers diftinguifh betwixt the titles *rab*, *rabbi*, and *rabban*.

In the Old Teftament we find the term רב, *rab*, in compofition with fome other words, employed as a name of office and dignity, but not till the people became acquainted with the Chaldæans, concerning whom only it is ufed. The word, both in Hebrew and in Chaldee, fignifies fometimes *great*, fometimes *many*, and when ufed fubftantively, denotes one who is at the head of any bufinefs, of whatever kind it be. Thus רב החבל, *rab hachebel*, is, in the LXX, πρωρευς, רב טבחים, *rab tebachim*, αρχιμαγειρος, *chief cook*. (Jonah, i. 6. Jer. xxxix. 11, fee alfo Dan. i. 3.) It is ufed in the plural alfo for *chief men* in general, fuperintendents, or thofe at the head of affairs. Thus רבי המלך, *rabbi hammelech*, are the chief men employed by the king over the different departments of the ftate. (Jer. xxxix. 13.) The original term fuits entirely the import of the Latin word *princeps*, but not of the Englifh word *prince*, at leaft in its moft common acceptation; for they are not the king's fons, or nobles of any order, who are fo denominated among the Chaldæans. The word evidently appears to have been equivalent to the term שַׂר, *fhar*, among the Hebrews. Accordingly, he who is ftyled by Daniel, in the above cited paffage, רב סריסים, *rab ferifim*, is four times, in the fame chapter, called שַׂר הסריסים, *fhar haferifim*. (Dan. i. 7, 8, 9. 18.) And this ufe of the name *rab* feems to have continued long in Syria, as well as in Chaldea. Thus in the Syriac New Teftament, it is found in the fame manner, united with the common appellation of any fort of officer, in order to denote the principal perfon in that office: thus, *rab-cohana*, (Matt. xxvi. 51.) is the high prieft, *rab-machfa* (Luke, xix. 2.) is chief of the publicans, and *rab-raghotha* (1 Pet. v. 4.) is chief fhepherd. *Rab*, conftrued in this manner, is equivalent to the Greek αρχι, as ufed in compofition. The preceding titles are accordingly thus expreffed in Greek, αρχιερευς, αρχιτελωνης, and αρχιποιμην.

Again, the word *rab* is fometimes found in that verfion, combined not with the title of any fort of officer, but with a term denoting the office or charge itfelf; in which cafe it always means the perfon who is principally entrufted with the bufinefs. Thus, *rabbeth* (Matt. xx. 8.) is the fteward, επιτροπος, he who is over the houfehold; and *rab-conofhetha* (Mark, v. 35.) is the ruler of the fynagogue, αρχισυναγωγος. It is not unlikely, though no example occurs in fcripture, that the term has at firft been fimilarly compounded with fome word fignifying a fchool, or, perhaps, with the name of the art or fcience taught, in order to denote the overfeer of fuch a feminary, or the teacher of fuch an art. When the term *rab* came to be peculiarly applied, as an honourable compellation of the learned, the word with which it was, at firft, for diftinction's fake, compounded, would be fuperfeded as unneceffary. It is, at leaft, certain, that the Jewifh doctors, who refided at Babylon about the time of our Saviour, were called fimply *rab*. But in the Old Teftament there is no trace of fuch a title as *rab*, *rabbi*, or *rabban*, given to a man of letters; nor is any one of the old prophets, or fcribes, or indeed any other perfon, diftinguifhed by this mark of refpect prefixed to his name. Although the introduction of titles is always occafioned by the erection of ufeful important offices, it is commonly in the decline of merit that pompous titles are moft affected. At firft, without doubt, vain-glory has led many to affume them, to whom they did not belong, in right of office, and an interefted adulation has induced others to give them. Some of them, however, came foon, among the Jews, to be converted into a kind of academical diftinctions, which, in order to give them more weight, are faid to have been conferred folemnly in their fchools or colleges, accompanied with certain religious ceremonies. From this practice fprung literary degrees in Chriftian univerfities, to which there is nothing fimilar in all Pagan antiquity, either Greek or Roman, but to which the Jewifh cuftom above-mentioned bears an evident and clofe analogy.

As for *rab* and *rabbi*, the only difference, it hath been faid, betwixt them is, that *rab* was the title of fuch as had had their education, and taken their degree in fome foreign fchool, *e. gr.* at Babylon; whereas *rabbi* was the title of fuch as were educated in the land of Judea, and more honourable than the other. But the higheft and moft honourable title was *rabban*; which, they fay, was never conferred on more than feven perfons; *viz.* on R. Simeon, five of his

his descendants, and R. Jochanan, who was of a different family.

Those who belonged to the Jewish schools were divided into three classes or orders. The lowest was that of the disciples or learners; the second, that of the fellows, or companions, who, having made considerable progress in learning, were occasionally employed by the masters in teaching the young students: and the highest was that of the preceptors, or teachers, to whom they appropriated the respectful title of *doctor*, or *rabbi*, differing, as some have said, from *rab* only by the addition of the affix pronoun of the first person. This title *rabbi* was the highest accademical honour. In the gospels, διδασκαλος is given as the Greek translation of the Syriac *rabbi*. (John, i. 38.) Yet this word does not, as the Greek, literally signify *teacher*; but, having been conferred at first, as a mark of respect on actual teachers, and afterwards on other learned men, was justly accounted as apposite a version as the Greek language afforded.

In process of time, the term *rabbi* was used with great latitude; being bestowed on those who were not actual teachers; and yet it always retained, ever since it had been appropriated to the learned, a relation to learning, and denoted that the person who enjoyed it, though not actually employed in teaching, was well qualified for the office. *Rabban*, as some have asserted, is not the name of a degree superior to *rabbi*, though it seems intended for heightening the signification, and may be understood to denote eminent or learned rabbi, but it was very seldom used. The title *rabboni*, which we find to have been twice given to our Lord, (Mark, x. 51. John, xx. 16.) is *rabban*, with the addition of the affix of the first person, and accommodated to the pronunciation of Judea. The use of the term *rabban* does not seem to have extended far beyond Palestine, as we may conclude from the following circumstance. Although the word *rabbi* is very common in the Syriac translation, the Greek διδασκαλε being generally so rendered; yet in the only place where that translator introduces the word *rabboni*, which is that quoted from John, he prefixes *in Hebrew*, that is, in the dialect of Palestine, which was then so called, adding the explanation given by the evangelist, *that is*, *teacher*; which plainly shews that the word *rabboni* was not Syriac. This is the more remarkable, as in the other passage, where the historian interprets, in the same manner, the word *rabbi*, adding (John, i. 38) "ὁ λεγέται ἑρμηνευομενον διδασκαλε," that interpreter omits this explanatory clause as intended only for the Grecian reader, and of no use to those who understood Syriac. In the passage in Mark, where *rabboni* occurs, as the evangelist had added no explanation, his interpreter has not thought it necessary to change their own word *rabbi*; thus regarding the difference in signification between the two words as inconsiderable, to which we may add, that the apostle John explains both by the same Greek word. It may be here observed that it was customary to enhance the import of a title by doubling it. Thus our Lord, speaking of the Pharisees, says, (Matt. xxiii. 7.) "they love to be called of men, *rabbi*, *rabbi*." In this manner he was himself addressed by Judas, at the time when that disciple chose to assume the appearance of more than ordinary regard. (Mark, xiv. 45.) The title κυριε seems to have been used in the same manner. (Matt. vii. 21.) The words Jewish *rabbies* and Jewish *doctors* were commonly used synonimously. In Justin Martyr's dialogue with Trypho the Jew, the rabbies are always called διδασκαλοι. But some may object that this does not account for the application of the title to our Lord. As he did not derive his doctrine from any of those learned seminaries, frequented by such of the youth as were reckoned the flower of the nation, the name *doctor* could not, with propriety, be applied to him. To this objection it may be replied, that as in Judea at that time they spoke not Greek, but a dialect of Chaldee, not differing considerably from what is called Syriac, it is evident that the actual compellation by which our Saviour was addressed, was *rabbi*, equivalent to the Greek διδασκαλος. Besides, though the title *rabbi* could regularly be conferred only by those who had the superintendency of their schools, yet the people would be disposed to give the compellation through courtesy, and on the presumption that it had been conferred, wherever they saw or supposed distinguished abilities in teaching; and this probably was the reason why it was given to John the Baptist. (John, iii. 26.) Moreover, in the Jewish state, a divine commission was conceived to confer all sorts of dignities and honours, in an eminent manner, and thus superseded all ordinary rules and human destinations. Accordingly, some of those who gave the title of *rabbi* to our Saviour, were willing, either sincerely or pretendedly, thus to account for their doing so. Thus Nicodemus assigns the reason why he saluted him *rabbi* (John, iii. 1. &c.), although he knew that he had not been educated in human literature, and had not received from man any literary honours. Upon the whole we may remark, that the term διδασκαλος may be fitly expressed, either by the English term *doctor*, or by the Syriac *rabbi*, which is now so much naturalized among us, that its meaning, as a Jewish title of literary honour, can hardly be mistaken. It must also be allowed, that the rabbi among the Jews of our Saviour's age, was a title in the highest degree respectful; and on that account it was interdicted by their master, even to the apostles themselves. Campbell's Seventh Preliminary Dissertation.

The modern rabbins are entitled to a considerable respect among the Jews: they have the first places in the synagogues; they determine all matters and controversies of religion, and very frequently pronounce upon civil affairs. They have even a power to excommunicate the disobedient.

They retain a vast number of superstitious traditions, from the writings of their predecessors; which they observe as scrupulously as they do the law of Moses.

The ancient rabbins were infinite dealers in allegories. Their writings are almost wholly allegorical, particularly their comments and interpretations of the scripture.

They had a great number of rules, and forms of interpreting and quoting, which some modern writers suppose to have been followed by the apostles, in their interpretation and quotation of the prophecies of the Old Testament, in the New. See QUOTATION.

RABBINICAL *Character*. See HEBREW.

RABBINICAL *Hebrew*. See HEBREW.

RABBINIST, a follower of the doctrine of the rabbins; a term used in contradistinction to Caraite.

Father Simon contends for *Rabbanist*, or *Rabbanite*, instead of *Rabbinist*: in effect, the former readings are apparently preferable to the latter; the word being derived from the Hebrew *Rabbanim*, which is the name of the sect, and which the Jews use to distinguish their doctors from those of the Caraite Jews.

Rabbinist, then, signifies a Jewish doctor who adheres to the traditions of his fathers; not simply a rabbin or doctor; for the Caraites, who oppose those traditions, have their rabbins as well as the other Jews.

RABBIT, CUNICULUS, in *Zoology*, a well-known animal of the hare kind, or the lepus cuniculus of Linnæus, with a short tail and naked ears. In the wild state the colour of the fur is brown; but in a tame state it varies to a black, pied,

pied, and quite white; the eyes are of a fine red. In their wild ſtate they inhabit the temperate and hot parts of Europe, and the hotteſt parts of Aſia and Africa. See Lepus *Cuniculus*.

The female, or doe rabbit, goes with young thirty days, and then ſhe kindles; and if ſhe take not buck preſently ſhe loſes her month, or at leaſt a fortnight, and often kills her young and eats them.

In England they begin to breed at a year old, but in ſome places much ſooner; and they continue breeding very faſt from the time when they begin, four, five, ſix, or ſeven times a year being common with them. They have uſually from four to eight in a litter, and hence it is that a ſmall number at firſt will ſoon ſtock a whole warren, if left to breed a little while undiſturbed. The does cannot ſuckle their young till they have been at buck again; this therefore is to be done preſently, elſe there is a fortnight loſt of the time for the next brood, and the preſent brood alſo probably loſt. When the buck goes to the doe, he always firſt beats and ſtamps very hard with his feet, and when he has copulated with her, he falls backwards, and lies, as it were, in a trance; in this ſtate it is eaſy to take him, but he ſoon recovers from it.

The buck-rabbits, like our boar-cats, will kill the young ones, if they can get at them; and the does in the warrens prevent this, by covering their ſtocks, or neſts, with gravel or earth, which they cloſe ſo artificially up with the hinder part of their bodies, that it is hard to find them out. They never ſuckle the young ones at any other time than early in the morning, and late at night; and always, for eight or ten days, cloſe up the hole at the mouth of the neſt, in this careful manner, when they go out. After this they begin to leave a ſmall opening, which they increaſe by degrees, till at length, when they are about three weeks old, the mouth of the hole is left wholly open, that they may go out; for they are at that time grown big enough to take care of themſelves, and to feed on graſs.

People who keep rabbits tame for profit, breed them in hutches; but theſe muſt be kept very neat and clean, elſe they will be always ſubject to diſeaſes. Care muſt be taken alſo to keep the bucks and does apart till the latter have juſt kindled; then they are to be turned to the bucks again, and to remain with them till they ſhun and run from them.

The general direction for the chooſing of tame rabbits is, to pick the largeſt and faireſt; but the breeder ſhould remember, that the ſkins of the ſilver-haired ones ſell better than any other. The food of the tame rabbits may be colewort and cabbage-leaves, carrots, parſneps, apple-rinds, green corn, and vetches, in the time of the year; alſo vine-leaves, graſs, fruits, oats, and oatmeal, milk-thiſtles, fow-thiſtles, and the like: but with theſe moiſt foods they muſt always have a proportionable quantity of the dry foods, as hay, bread, oats, bran, and the like, otherwiſe they will grow pot-bellied, and die. Bran and grains mixed together have been alſo found to be very good food. In winter they will eat hay, oats, and chaff; and theſe may be given three times a day: but when they eat green things, it muſt be obſerved, that they are not to drink at all, for it would throw them into a dropſy. At all other times, a very little drink ſerves their turn, but that muſt always be freſh. When any green herbs or graſs are cut for their food, care muſt be taken that there is no hemlock among it; for though they will eat this greedily among other things, when offered to them, yet it is ſudden poiſon to them.

Rabbits are ſubject to two principal infirmities. Firſt, the rot, which is cauſed by the giving them too large a quantity of greens, or from the giving them freſh gathered, with the dew or rain hanging in drops upon them. It is exceſs of moiſture that always cauſes this diſeaſe; the greens, therefore, are always to be given dry, and a ſufficient quantity of hay, or other dry food, intermixed with them, to take up the abundant moiſture of their juices. On this account, the very beſt food that can be given them is the ſhorteſt and ſweeteſt hay that can be got, of which one load will ſerve two hundred couples a year; and out of this ſtock of two hundred, two hundred may be eat in the family, two hundred ſold to the markets, and a ſufficient number kept in caſe of accidents.

The other general diſeaſe of theſe creatures is a ſort of madneſs: this may be known by their wallowing and tumbling about with their heels upwards, and hopping in an odd manner into their boxes. This diſtemper is ſuppoſed to be owing to the rankneſs of their feeding; and the general cure is the keeping them low, and giving them the prickly herb, called *tare-thiſtle*, to eat.

The general computation of males and females is, that one buck rabbit will ſerve for nine does; ſome allow ten to one buck: but thoſe who go beyond this always ſuffer for it in their breed.

The wild rabbits are to be taken either by ſmall cur dogs, or by ſpaniels bred up to the ſport; and the places of hunting thoſe who ſtraggle from their burrows is under cloſe hedges or buſhes, or among corn-fields and freſh paſtures. The owners uſe to courſe them with ſmall greyhounds; and though they are ſeldom killed this way, yet they are driven back to their burrows, and are prevented from being a prey to others. The common method of taking them is by nets, called purſe-nets, and ferrets. The ferret is ſent into the hole to force them out, and the purſe-net being ſpread over the hole, takes them as they come out. The ferret's mouth muſt be muffled, and then the rabbit gets no harm. For the more certain taking of them, it may not be improper to pitch up a hay-net or two, at a ſmall diſtance from the burrows that are intended to be hunted: thus very few of the number that are attempted will eſcape. The method by the dog, called the lurcher and tumbler, is alſo a very good one.

Some, who have no ferrets, ſmoak the rabbits out of their holes with burning brimſtone and orpiment. This certainly brings them out into the nets, but then it is a very troubleſome and offenſive method, and is very detrimental to the place, as no rabbit will for a long time afterwards come near the burrows, which have been fumed with theſe ſtinking ingredients.

The teſticle of a rabbit is a very good object for examining the ſtructure of this part of generation in animals. The teſticles of various animals are very variouſly compoſed, but all, in general, of veſſels variouſly rolled and folded together; and even the human teſticles are of the ſame ſort, being compoſed ſolely of rolls of veſſels, without any intermediate ſubſtance, only conſiſting of veſſels and their liquors. Phil. Tranſ. N° 52.

The ſkins of rabbits are a great article of commerce, numbers being exported to China: the fur is of great uſe in the hat-manufactory.

Rabbit, in *Agriculture*, is ſometimes employed as farming ſtock. It is ſufficiently evident, however, that this is a deſcription of farming ſtock that can only be attended to with advantage under particular favourable circumſtances of ſoil and ſituation.

Situations proper for Rabbits.—The practice of forming rabbit warrens, can only be beneficially introduced where the lands are not capable of affording crops of tolerable grain or graſs. The great uncertainty of this ſort of huſbandry

husbandry renders it much more advantageous for the farmer to depend upon such crops, than on it. In hilly tracts of land, where the plough cannot be introduced, and where the soil is of such a light sandy porous nature, as to afford little or no grass for the pasturage of sheep, or in rocky situations, this system of management may take place with profit to the farmer.

And it has been observed by the author of the Rural Economy of Norfolk, that this sort of animal is there confined to the heathlets, and the barren hills upon the coast. A level country is unfit for rabbit-warrens, but convenient for the plough; on the contrary, rabbits delight in the sides of sandy hills; which, where turn-wrist ploughs are not in use, are extremely inconvenient for tillage; and, when cultivated, are generally unproductive. For the rabbit, on level ground, finds it difficult to make its burrow; the excavated mould is all to be dragged upward to the surface; hence a piece of ground altogether level, can seldom be stocked successfully with rabbits; unless it be first laid up by art, at a great expence, into inequalities. While, on the contrary, against the side of a steep hill, the rabbit has no difficulty to encounter; the declivity affords him a ready vent for his mould; his work is all down hill; and, unless the soil be too stubborn, or too rocky, for the rabbits to work freely among, a broken hilly country may generally be stocked with advantage; provided a tolerable market for the carcasses can be had within reach. He thinks there are, perhaps, few sandy or other loose-soiled hills, which would not pay better in rabbit-warrens, than under any other course of husbandry that could be introduced on them. And it is afterwards stated, in a minute, that on a considerable part of a farm which lies towards the coast, being hilly and very badly soiled,—more especially the tops and sides of the hills, which have always been full of rabbits in spite of all endeavours to destroy them,—the tenants last year (1782) applied for leave to convert this part, about ninety acres, into a rabbit-warren. Leave was given, and an allowance made them of half the estimated expence of raising a sod-wall fence round these ninety acres. He adds, that the fence was nearly finished, and the warren had, that year, turned out beyond expectation; it was valued by one who ought to be the best judge of its worth, at forty pounds a year; which is nine shillings an acre. And that, as the part of a farm, these ninety acres were not worth five shillings an acre; at the then present price of barley, they were not worth more than four shillings an acre. It is, therefore, observed, that for ten pounds a real improvement of twenty pounds a-year has been made and secured; for the warrener will, through necessity, hereafter keep the fence in repair for his own advantage. He remarks, that the fence is made about four feet high, and three feet thick; faced with greensward; and capped with furze, so as to project eight or ten inches over the face. Some of it was done for a shilling a rod; but the spring putting in, fourteen or fifteen pence a rod of seven yards was obliged to be given. And a neighbouring warrener, that winter, gave ninepence for the wall without the capping; which he does not mean to put on till the wall be thoroughly settled. This is very judicious; as several rods of that above-mentioned shot down in different places, as is often the case in such sort of work. It is further observed, that there are several patches in the vallies, and some on the tops of the hills which have usually been tilled. Some of these were last year (1781), and some of them ought to be every year, cultivated for the rabbits; thus, when the grass gets foul or mossy it should be ploughed up; fallowed, sowing turnip-seed for present feed, (they will not let rape get up,) and to prepare the soil for barley and grass-feed the ensuing year. Thus a regular succession of feedage might be kept up for the use of these animals. And in the Rural Economy of Yorkshire it is stated, that at Dalby there are two pretty large warrens. At Lockton there is one now (the time of writing) planting. And there are other parts of these heights which might be profitably stocked with rabbits. In general, however, property is too much intermixed to admit of an improvement, which is singularly adapted to the nature of these high grounds. And, that in situations where the ground, as well as the soil, is suitable to rabbit-warrens, and where an extent of it, sufficiently large, can be collected together in one property, there is a very strong reason why it may be profitably stocked with rabbits. It is added, that one of the warrens of this district contains eighteen hundred acres of surface; most of it covered with a black moreland soil; part of it a barren gravel; some little of it a thin lime-stone loam; not worth perhaps, on a par, for the common purposes of husbandry, a shilling an acre; nevertheless, these eighteen hundred acres are let, as a rabbit-warren, for three hundred pounds a-year! He will not pretend to say, that this warren is worth three hundred pounds a-year, nor assert that it is not worth a shilling an acre to a husbandman. If it be worth two hundred and fifty pounds, as a warren, and supposing it to be worth even two shillings an acre, as a farm, it still is sufficient evidence of the profitableness of rabbit-warrens, in proper situations.

And in speaking of the wolds, he observes, that the warrens are numerous, and some of them very extensive. Coldham warren is at present, he believes, the largest upon the wolds; and, probably, the most valuable warren in the island. The Coldham farm contains about nineteen hundred acres; and, speaking generally, it is all warren; not, however, wholly appropriated to rabbits, a flock of from six to eight hundred sheep being kept within the warren walls; principally, however, on one side of the warren, away from the burrowing grounds. And this appears to be a practice peculiar to the wolds of Yorkshire and Lincolnshire, whose hills likewise abound much with rabbit-warrens, and where better soil is appropriated to rabbit-warrens, than is perhaps in any other part of the island. The Coldham warren, in point of soil, is most of it worth from ten to twelve shillings an acre; some of it fifteen or sixteen shillings. But the present bleakness of the situation renders it of little more than half the value. As these better parts become mossy, they are inclosed by a sod-wall, the surface pared and burnt, and the soil broken up for arable crops. Having afforded a succession of crops of corn, turnips, &c. they are sown with grass-seeds, and again thrown open to the rabbits and sheep. In 1783, there were about two hundred acres of this farm under the plough, besides some little sheep-walk which lay without the warren walls. The warren therefore, at that time, contained from fifteen to sixteen hundred acres; and, adjoining to Coldham, are two more considerable warrens; so that there are, perhaps, three or four thousand acres of tolerably good land, lying together, and appropriated principally to rabbits.

But it is remarked in respect to soil, that there is a disadvantage in stocking a *rich* soil with rabbits; a flush of grass, after a dry season, is found to produce a scouring; which sometimes carries off great numbers. With regard to the burrows on the high wolds, they are mostly on the sides of hills; at Coldham, principally in one deep valley; whose sides are steep; giving the rabbits great freedom in working. The soil, in this case, is about eight or ten inches deep, under this a chalky rubble, of some inches thick, lying on a chalk-stone rock. The burrows are in the sub-soil, between the ſoil and the rock, and chiefly towards the tops of the hills. And thouſands of daws build their neſts in the burrows, to the great annoyance of the rabbits. But at Driffieldgreets, near Driffield, where there are two large warrens, the ſurface is a dead flat; nevertheleſs, the warrens are well ſtocked and productive; a proof that a flat ſurface may, in ſome caſes, be profitably ſtocked with rabbits. The ſoil, in this caſe, is a light ſand or gravelly loam, which is very proper for the purpoſe to which it is applied.

In ſome of the very ſouthern diſtricts, rabbits occupy the different ſandy hillocks, and many of the rocky waſtes; but there is nothing of any great importance in the management of them. Both the grey and black ſorts prevail in ſome inſtances. The writer of the Suſſex Report on Agriculture thinks, that this ſort of ſtock is the nuiſance of a county; it increaſes and flouriſhes in proportion to the ſize of the waſtes, and is, of courſe, productive in this county. From Horſham foreſt, Aſhdown, and other parts, very conſiderable quantities of rabbits are ſent to be diſpoſed of in London.

In ſome of the midland counties they are found to be ſufficiently abundant upon the ſandy parts of waſte lands; in incloſed level land, it is thought that they are no better than vermin, and that ſhould the commons be pretty generally incloſed, they muſt be in a great meaſure exterminated to make way for a better ſort of ſtock; in incloſed land, they can only be kept with propriety, either in ſmall warrens near the houſe, well fenced in, for family conſumption; or on ſandy or rocky precipices, impracticable to the plough, where they ſhould alſo be fenced in. It is well known, that in the neighbourhood of commons abounding with them, great pains and expence are often uſed to fence the incloſed adjoining lands from their depredations. Rabbits are certainly a ſort of ſtock unworthy of being cultivated, or bred in any conſiderable numbers, on incloſed and cultivated land; yet doubtleſs deſerving conſiderable attention on impracticable ſandy or rocky ſteeps, which may at the ſame time be planted; and when properly fenced in, and thus ſtocked, ſuch land ſeems in a ſyſtem of the higheſt improvement of which it is capable.

In Cheſhire many doubts have been entertained as to the advantages of encouraging the breed of rabbits, and many farmers are ſo utterly averſe to them, that they would wiſh the whole race to be entirely exterminated. Where land is incloſed, and applied to arable purpoſes, it ſeems agreed that by the injury they do to the fences, by the interfering with the cultivated land, and by the deſtroying of its produce, they are much more detrimental than profitable. It is, however, thought to be a queſtion for conſideration, whether, if a portion of weak ſand, or dry heath land, was ſet apart for a rabbit-warren, well fenced, and kept diſtinct for this purpoſe; it might not, in ſome ſituations, be more profitably employed in this than in any other manner.

By ſome it is ſuppoſed, that it may be occaſionally neceſſary to reſtrain them, on account of their aſtoniſhing fecundity; but that to attempt to exterminate them, if it were poſſible, could not be politic or adviſeable, as they furniſh food for foxes, which would otherwiſe prey on game and poultry.

This ſort of ſtock is frequently met with in many other diſtricts on tracts and ſpots of ſimilar kinds of barren and uncultivable ſorts of land, and is probably the moſt convenient, appropriate, and beneficial deſcription of any by which they can poſſibly be occupied and managed.

Stocking.—In the ſecond of the above diſtricts, it is ſtated, that in ſtocking a warren, whether the ſurface be flat or hilly, artificial burrows are made, to reconcile the rabbits to the ground, and to preſerve them from vermin, until they have time to make their own burrows. And that in making theſe burrows, an improvement has lately, it is obſerved, been hit upon. They are bored with an auger, of a diameter large enough to make a burrow of a ſufficient width. In a level warren, theſe augers may, from time to time, be found uſeful in forming ſuch holes. They, however, in moſt caſes, are capable of making burrows for themſelves without any difficulty.

But in regard to ſtocking in Lincolnſhire, according to the agricultural ſurvey of that diſtrict, ſome of the warren lands are ſtocked in the proportion of three couple only to the acre; while in others, it is in a conſiderably larger proportion. And one buck or male rabbit is ſaid to be there ſufficient for one hundred does, or females; but this is certainly a much larger proportion of the latter ſort, than is allowed in moſt other diſtricts. On the wold warrens of Yorkſhire, according to Mr. Marſhall, *one* male is conſidered as ſufficient for only *ſix* or *ſeven* females, and the nearer they can be brought to that proportion, the greater the ſtock of young ones that may be expected, it being the nature or economy of the males to deſtroy their young, eſpecially when the proportional number is too great.

Fencing.—The fencing in theſe ſituations is ſod-wall, capped with furze, or of late with ſtiff ſtraw, forming a kind of thatch. And it is ſuppoſed, that reed would be found admirable in this intention. The warrens near Driffield are fenced with paling; an expenſive fence in the outſet, and always under repairs. A brook, though ever ſo deep, is found to be inſufficient as a fence againſt rabbits; one ſide of Driffieldgreets warren is bounded by a brook; but it is nevertheleſs fenced with paling. When the rabbits can evade this, they readily ſwim the brook. The neceſſity of good fences is of courſe ſufficiently evident in this view, as well as that of preſerving them from the deſtruction of vermin, and birds of prey, ſuch as eagles, kites, &c. which are taken in ſteel traps, placed on elevated mounds of earth, where they delight to ſit. It is this kind of fencing and coping, or kidding the top, together with food in winter, nets, traps, and other things for taking them, with charcoal for drying the ſkins, warreners' men for killing and carrying, horſes for carrying them to market, &c. that conſtitute the great expence of this ſort of management.

Different Breeds.—There are many different breeds or varieties of theſe animals, but thoſe that are employed as ſtock for warrens are the common grey and ſilver-grey breeds: the former of which is found to be conſiderably more hardy and much better for the purpoſes of food; but the latter has greatly the advantage in the value of the ſkin. In the above warrens, till lately the common grey rabbit, probably the native wild rabbit of the iſland, was the only ſpecies. At preſent, the ſilver-haired rabbit is ſought after, and has, within the few laſt years, been introduced into moſt warrens. The ſkin of the grey rabbit is cut; that is, the wool is pared off the pelt, as a material of hats; whereas, that of the ſilver-haired rabbit is dreſſed as fur; which, the writer underſtands, goes principally to the Eaſt Indies. The colour is a black ground, thickly interſperſed with ſingle white hairs. The ſkins of this variety ſell for about four ſhillings a dozen more than thoſe of the common ſort; a ſufficient inducement for propagating it in preference to the grey ſort in moſt caſes. If the white ſorts could be introduced they might be ſtill more valuable.

Management, Expences, Profits, &c.—This is a ſort of ſtock that on the whole only requires a ſlight attention; it is, however, neceſſary to ſupply the rabbits with additional food in the winter ſeaſon, when the weather is ſevere, ſuch

ſuch as fine green hay, ſainfoin, clover, turnips, and others of the ſame ſort, which muſt be diſtributed over the warrens. It is ſuppoſed that turnips anſwer the beſt in deep ſnows, as the rabbits can diſcover them by the ſcent. This ſort of food is given in the quantity of two or three large cartfuls to a thouſand couple *per* day, and one load of hay in the ſame time during a ſtorm. It is likewiſe ſometimes the practice to diſtribute billets of new cut aſh-boughs, gorſe or whins, and other ſimilar woods in the warrens, the bark and other parts of which is eaten, by which the proportion of hay is leſſened in a conſiderable degree. In great ſnows, it is neceſſary to clear them away from the ditches or fences, to prevent the rabbits from getting over them.

It may be obſerved, that the rabbit is a ſort of ſtock that begins to breed at an early age, as at eight, ten, or twelve months, going only about thirty days with young, the young being a little more than three weeks old before they appear from the burrows, during which time they are ſuckled twice in the day by the mother. It is therefore evident, that they may breed three or four times in the courſe of the year under good keep, as the does take buck almoſt immediately after producing their young. In warrens that are incloſed, it is however ſaid, that they ſeldom breed more than two or three times in the year. The annual produce *per* acre, is moſtly eſtimated at from three or four, to eight or ten couple, yielding a profit of from eight, ten, or even fifteen ſhillings, where they are conducted under a good ſyſtem of management. And the produce is, as has been ſeen, the largeſt on new lands; however, much of the profit muſt always depend on ſituation, ſo as to be near good markets.

Theſe animals are in what is termed ſeaſon from the end of October to the beginning of January, in which period the beſt ſkins are produced: of courſe a large proportion of them is killed in this ſhort time. The farmer often ſuſtains great loſs in what by the purchaſers are called *half* ſkins, *quarter* ſkins, and *racks*, ſixteen of which are only conſidered as a whole ſkin. The rabbits are diſpoſed of by the hundred, ſix ſcore couple being conſidered as an hundred.

The following ſtatements are given in the Agricultural Survey of Lincolnſhire, on this ſort of management. On the authority of Mr. Chaplin, it is ſtated that on 1000 acres it is fair to kill 2000 couple, which are ſold by the hundred, as above; which have ſold at 10*l.* on an average of ten years; laſt year 13*l.*; killing and looking after, 60*l.* for 1000 acres. And on the warrens between Gayton and Tathwell, ſilver ſkins have been from 15*s.* even to 21*s.* a dozen; but the common grey rabbit is ſo much hardier, that if a warren be ſtocked with both, there will, in a few years, be nothing but greys. It is added, that from Louth to Caſtor, 18 miles, 10 of them are warrens, chiefly ſilvers; rent 2*s.* to 3*s.* an acre. They plough a part every year for corn and turnips; and laying down again with ſeeds, let down the fences for the rabbits to enter. Warrens are reckoned profitable, ſo that ſome fortunes have been made on them. It is further ſtated, that in point of ſkins, thoſe bred about May-day undergo no change from their white colour, but from a white rack become a whole ſkin; bred at Lady-day, become black; in June, white; in July, black; in November, white again: then in full ſeaſon, as the carcaſes are alſo. The ſkins ought to have thoſe colours on the inſide, when flayed, or ſtripped off from the rabbits. The writer further ſtates, that from 250 acres of land, that were ſainfoin worn out, and planted with rabbits, the following was the account many years ago; but all prices, rent, &c. &c. are calculated at the preſent rates; and it is to be noted, that the ground being thus new to rabbits was much more productive than old warren land is found to be, as they breed much better on ſuch new than on old land. Uſed to kill about 2000 couple; ſtock left about 700 couple. Sod banks that coſt, thirty-five years ago, 1*s.* 2*d.* a rood of ſeven yards, would now coſt 2*s.*; furze faggots were 7*s.* a hundred, that is, 5*s.* for the furze, and 2*s.* kidding, now doubled. Banks will laſt about ſeven years, in a middling way; from three to twenty: want facing once in ſeven years, at half the firſt expence; want capping in three years with the furze. Laying on, or capping, 3*d.* a rood now. It was then reckoned that 250 acres would clear 100*l.*, beſides rent, which then was 1*s.* an acre. Fencing annually half a mile 800 yards 133 roods at 1*s.*, 6*l.* 13*s.*; for facing furze, a kidd will do a yard; $2\frac{1}{2}$ miles kidding, at a kidd a yard, 4400 yards and kidds, at 15*s.* now, for 120 or 27*l.* 10*s.*, or *per annum* 9*l.* 3*s.* 4*d.* add 6*l.* 13*s.*, it is 15*l.* 16*s.* 4*d.* *per annum*. A warrener 35*l.*, a cow, fuel, and houſe: in all 40*l.* Extra labour, killing 18*s.* a-week for ſixteen weeks, 14*l.* 8*s.* Alſo for a month 18*s.* a-week, 3*l.* 12*s.*: in all 18*l.* Beſides nets and thread, 12 at 60 yards each; laſt ſix or ſeven years; would coſt 1*l.* 11*s.* 6*d.* Traps 5*s.* a-year. The men who kill will carry. Four horſes for ſix weeks, 1*l.* 4*s.* a-week, 7*l.* 4*s.* Charcoal for drying ſkins, 5*s.* A perſon to order ſkins, that is, clear from fat, and drying, five weeks; a uſeful woman will do it, 1*l.* Winter food (after three days ſnow they muſt be ſerved) cannot be leſs than 10*l.* a year on 250 acres.

Recapitulation.

	Per Acre. £	*s.*	*d.*	£	*s.*	*d.*
Rent now - - - -	0	6	0			
Tithe - - - -	0	0	0	87	10	0
Rates - - - - -	0	1	0			
Fencing - - - -	0	1	3	16	16	4
Warrener - - - -	0	3	2	40	0	0
Extra labour - - -	0	1	6	19	0	0
Nets, traps, and charcoal -	0	0	2	2	1	6
Horſes - - - -	0	0	$6\frac{1}{4}$	7	4	0
Winter food - - - -	0	0	0	10	0	0
	0	13	$7\frac{1}{4}$			
Poiſon, powder, and ſhot, and ſundries; fox-ſkins 1*s.* each - - - - -				2	0	0
				184	11	10

Produce.

	£	*s.*	*d.*
2000 couple at 9*d.* - - - - -	75	0	0
Skins 9*d.* to 1*s.* 3*d.*; average 1*s.* -	200	0	0
	275	0	0
Expences	184	11	10
Profit	90	8	2

But it is, notwithſtanding this ſtatement, ſuggeſted, that if he had a warren of his own, he would plough it up for corn, &c.; thinking tillage now more profitable than rabbits. And the author adds, that at Partney fair, meeting with Mr. Grant of Withgul, and diſcourſing with him upon warrens, he informed him that a common ſtock in winter was three couple *per* acre, and the produce five or ſix

 couple

couple killed; that killing, carrying, &c. might amount to fomething more than 1*s.* an acre: the fort *filver fprig*, which will not do well in other counties, where they have been tried. He has now 1000 acres of warren; and upon 1000 acres the ftock is 2600 couple, and kill 5000 couple annually. New land is the moft productive. On fuch a warren, the rabbits muft have two loads of hay a day in a ftorm, or two or three large waggon loads a day of turnips. The warrener has 20*l.* a-year, and two cows; the killers 8*s.* or 9*s.* a-week, and board for ten weeks. Silver fkins now are 10*s.* a dozen; have been 14*s.* to 15*s.* Fences 60 a-year; no crofs ones; no buildings. The immenfe occupation of Mr. Grant and his fons, being much the moft confiderable in the county, with the circumftance of making an ample fortune, made him defirous of feeing him. It is added, that 20 years ago, Driby had a warren of 12 or 1300 acres; and the rent of the farm including it, 300*l.* a-year, which rent has been doubled by ploughing. And Mr. Kerfhaw obferved, that the community received next to nothing from warrens; which is probably the cafe, as has been feen above, where the land is capable of being managed under the plough, or the fyftem of grafs.

And the calculation of Mr. Parkinfon, of a warren of 700 acres under rabbits, in the fame diftrict, ftands thus: rent 5*s.*; ftanding ftock 2000 couple of filver hair, valued to the incoming tenant at 2*s.* 6*d.* a couple ten years ago, and demanding a capital of 1400*l.*; and carefully *typed* to catch all extra bucks, fo as to leave only one-fourth of the total number of bucks.

	£ s. d.
Produce 3000 couples for fale, worth, on an average of feven years paft, 15*l.* a hundred - - - - - - -	450 0 0
But as fome are greys, the price 10*l.* -	300 0 0
	750 0 0
Take the average of the two, that is, filver hair of the Wolds, and greys of Lincoln Heath, it will be on a medium - -	375 0 0

Or about 10*s.* 10*d.* an acre. And add to thefe, 350 fheep, kept by a courfe of tillage; that is, ploughing up 50 acres annually for paring and burning for turnips; then fpring corn and feeds, which feeds fheep-fed one year, and thrown open to the rabbits: the fheep at 2*d.* *per* week for 25 weeks, will amount to 72*l.* 10*s.* This is inferior to the common produce of fheep; but the rabbits will demand hay, &c. to the amount of the difference; and alfo a team of horfes muft be kept for the cultivation of 100 acres of land, and carrying the rabbits to market. Hence,

	£ s. d.
The 50 acres of corn will be confumed by the horfes, and mafter's and warrener's cows, &c. - - - - - -	447 10 0

Expences and Profits of a Rabbit Warren Farm.

Dr.	£ s. d.	£ s. d.	*Per Contra Cr.*		£ s. d.
To rent 700 acres of land, 5*s.* *per* acre -		175 0 0	By flaughter of 3000 couple of rabbits, 15*l.*		450 0 0
To tithe, one-ninth - - - - -		19 8 10	By 300 fleeces of wool, 4 and 5 to tod, about 65 tod, 20*s.* *per* tod, *viz.* 200 ewes and 100 hogs - - - - -		65 0 0
To town charges - - - - -		21 17 4	Sell about 80 he-hogs, from turnips, 24*s.*		96 0 0
To mafter and miftrefs's board and clothing - - -	52 0 0		And about 50 drape-ewes, 21*s.* - -		52 10 0
To four children, 10*l.* *per* year -	40 0 0		By 50 acres barley, 3 qrs. *per* acre, and oats - - - - -	£ 150	
To four fervants, 10*l.* ditto, *viz.* three men and one maid -	40 0 0		Deduct feed and horfe corn -	70	
To extra labourers, carpenters, and other workmen - -	30 0 0		Remains 80 quarters, at 21*s.* - -		84 0 0
Total houfekeeping		162 0 0	By 20 beafts, to fell about five to graziers, 8*l.* *per* head - - - - - -		40 0 0
To Hufbandry.			By fwine, poultry, &c. - - -		20 0 0
A warrener, with houfe, and two cows - - - - -	26 0 0		Profit in breeding foals - - -		20 0 0
To three extra labourers, mowing corn and hay, repairing, fencing, affifting in killing rabbits, &c. - - -	72 0 0		Total - - -		827 10 0
To blackfmith's bill - - -	15 0 0		Expences - -		533 6 2
Carpenter's ditto - - - -	22 0 0		Net gain - -		294 3 10
Extra turnip-hoers and hay-makers in fummer - -	20 0 0				
		155 0 0			
		533 6 2			

It is noticed, that as the family is maintained out of the farm, the intereft of the capital of about 1400*l.* is not charged, becaufe the intereft would be only 70*l.* *per* year, when they are maintained out of the farm, with a profit of 294*l.* 3*s.* 10*d.*

It is ftated by the writer of the above agricultural furvey, that the warren of North Ormfby, occupied by the late Mr. Anfell, is fuppofed to be one of the beft managed in the county. The rabbits chiefly confift of filver-greys; the land of the yearly value from 2*s.* 6*d.* to 8*s.*, and fome little of it 10*s.* the ftatute acre. The occupier was of opinion, that lately his warren lands would have paid him better, had they been applied to the purpofe of growing corn, and grafs feeds for keeping fheep. The rabbit produce he fuppofed to be from 8*s.* to 10*s.*; in fome particular years they have paid from 15*s.* to 21*s.* an acre; but to obtain any extraordinary profit, very great care muft, he thinks, be taken in killing the many different kinds of vermin which depredate, and, without the utmoft vigilance, will

will quite depopulate the warrens. A confiderable expence alfo attends the neceffity there is for night-watchers, to protect them from the infinitely worfe vermin, the poachers. With him the filver-grey fkins have been fold from $8\frac{1}{2}d.$ to 15$d.$ and 16$d.$ *per* fkin: the laft two years they have only brought from 10$d.$ to 11$d.$ *per* fkin; but to obtain even thefe prices, they muft be what is called full feafoned, whole fkins, and of the choiceft colours, with refpect to which the fafhion varies very greatly. The carcafes, of late years, have not averaged net into pocket more than 4$d.$ *per* couple, after the expence of drying them, and by means of light diligence carts, having them carried to markets 30, and fometimes more than 60, miles to obtain even that fum. This inconvenience is occafioned partly by its being neceffary to kill eight or ten parts of a year's flaughter in fo fhort a time, as between the fecond week in November and Chriftmas, on account of their fkins being then only in full prime, and as they are alfo very foon fubject to become putrid, much more fo than hares; and their being obliged to be packed clofe together, very greatly increafes the mifchief.

The eftimate of the warren on the eftate at Thorefway of 1700 acres, as given by the tenant Mr. Holdgate, with the filver fort of rabbits, is this:

	£	s.	d.
Labour, three regular warreners, with extra affiftants at killing	85	0	0
Fences	42	10	0
Winter food	42	10	0
Nets, traps, &c. &c.	14	3	4
Delivery	21	5	0
Rent is faid to be 7$s.$ an acre	595	0	0
	800	8	4
The capital employed is that fum with the addition of ftock paid for; fuppofe this as ftated about three couple an acre at 2$s.$ 4$d.$	595	0	0
	1395	8	4
Intereft on that fum one year at 5 *per cent.*	69	15	5
	1465	3	9

Annual Account.

	£	s.	d.
Expences as above	800	8	4
Intereft	69	15	5
	870	3	9
Produce 10,000 couple, at 2$s.$ 4$d.$	1166	13	4
Expences	870	3	9
Profit	296	9	7

Or about 22$l.$ *per cent.* (the 5 *per cent.* included) on capital employed. This the writer obferves is very great, reckoned on the capital, but fmall reckoned by rent, as it amounts to only half a rent. But fuppofe the grofs produce of 1500, which he takes to be nearer the fact; then the account will ftand thus:

	£.	s.	d.
Produce	1500	0	0
Expences	870	3	9
Profit	629	16	3

or 45 *per cent.* on the capital.

But it is fuppofed that, in whatever way it is taken, it explains the reafon of fo many of thefe nuifances remaining. The inveftment of a fmall capital affords a profit or intereft that nothing elfe will, and of courfe the proprietor will be fure never to convert them to better ufe. But, it is afked, what fays the public intereft? Here are only 200$l.$ expences to 600$l.$ rent, what is the population, the induftry, the improvement! The landlord gets the loweft of rents, the tenant makes a good profit, they divide all, and the reft of the world is little or no better for them.

Rabbit-warrens are met with in moft other diftricts of the kingdom, both towards the fouthern and northern parts of it; but more abundantly in thofe of the north. In the fouth they have in moft places been got quit of from any tolerable fort of land which is capable of affording any other better kind of ufeful produce, but in fome parts of the north they ftill occupy fpaces of ground which are of a good quality, and which might be converted to better purpofes with great advantage to the proprietors, as well as farmers. Warrens of this nature, in fome cafes, in both thefe fituations, however, ftill continue to be well ftocked, and in the latter, are in particular inftances of pretty confiderable extents.

In Chefhire, the principal rabbit-warrens are on Delamere foreft, though on feveral of the heaths and fand-lands thefe animals are frequently met with, but not in fuch numbers together as to conftitute warrens.

In the north riding of Yorkfhire, alfo, a few rabbit-warrens are met with on the detached moors, as well as on the fkirts of the higher moors; but they are not fo extenfive as to make them an object of much attention. The kind of rabbits here are moftly the common grey, with the exception of the ftock on a warren at Nappa, in Wenfley-dale, of about one hundred and fifty or two hundred acres, which confifts of filver-greys, and is the only warren which is known, in this diftrict, to be entirely ftocked with this fort: they are ftated to have been brought fome years fince from a warren in the above noticed diftrict of Lincolnfhire, to which they had been originally introduced from Ireland. The fkins of this kind of rabbits are fuppofed to be worth double thofe of the grey; they are not ufed for felts, as the laft, but dreffed as furs, and ultimately exported in that ftate for the China market, where they are worn by the principal people; an ufe which has been already noticed and confidered in regard to the demand which it creates.

But in the northern parts of Lancafhire, warrens of this kind are more frequent. At Roffall-hall, in the tract called the Fild, one of great extent has exifted for a very great length of time; but the prefent proprietor, B. F. Hifketh, efq. has, with great propriety, lately reduced it very confiderably, by taking two large fine farms from it, fo that it now confifts only of about a hundred acres of the moft fandy barren part.

This warren formerly fupplied a great number of rabbits for fale in the markets and hat manufactories of the neighbourhood, and of courfe became a fource of profit to the owner, though the management was very imperfect. The farms taken from it will, however, become far more advantageous to him.

The ftock here was formerly of the grey rabbit kind, and it is ftill the fame on the warren which remains, which is however far from being fufficiently ftocked.

There was formerly no fort of green food ever cultivated for this fort of ftock; nor has it been yet attempted on the prefent warren, but the proprietor intends to have it done in an effectual manner. Nor have the rabbits ever been fed in the winter feafon with either hay, bark, or any other fort of of food; their being ſo near to the ſea-coaſt perhaps renders it unneceſſary.

The only mode of taking the rabbits here has hitherto been in nets, by what is termed *running* them by means of dogs.

At Heyſham the Rev. Mr. Clarkſon has a tract of coarſe ſtony land above his houſe, of about twenty acres, which has a great number of grey rabbits in it, and is well ſuited for a rabbit-warren, as it is incapable of being converted to any better purpoſe on account of the ſeverity of the weſt winds, and the effects of the ſea-ſpray thrown up by them, as well as its rocky, whiny nature.

The principal rabbit-warrens in this county are, however, thoſe in the ſandy tracts in the ſouth and north ends of the iſle of Walney, and in the neck of land from which it ſeems to have been ſeparated. The rabbit-warren at the north end of this little iſland occupies a conſiderable ſpace of ground of this barren ſandy quality, as well as that at the ſouthern point. The former is ſtocked wholly with rabbits of the grey kind, this ſort being in moſt demand. There is much expence attending theſe warrens in many caſes.

The expence of ſtocking in order to keep them up is ſometimes very conſiderable. In this inſtance the farmer has upwards of two miles of dike fence compoſed of ſod and ſtone to keep up and in repair, which coſts from five to ſix ſhillings the rod of ſeven yards. The expence of a man conſtantly to look after the rabbits, and keep the dike fences in proper order and repair. That of the purchaſe of the traps or types, which coſt 3*l.* a-piece, and eighteen are required; but they laſt long, and coſt little in repairs.

The providing net and dogs, which is annually about 10*l.*

The charge of taking the rabbits to Ulverſton, twice in the week, during ten weeks, which is 5*s.* each time.

The ſale of rabbits is annually from one hundred and fifty couple upwards, at the rate of 2*s.* 6*d.* each couple. They are uſually ſold to Lyons of Preſton, who takes the charge of them after they have been delivered at the above-named place.

Not any ſort of dry or green food is ever given to the rabbits in this warren during the winter ſeaſon; but there is not any ſnow, and very little froſt taking place; in conſequence of the ſituation being ſo ſurrounded by the ſea.

The warren at the ſouth end of the ſame little iſland is of ſimilar extent, and exactly under the ſame ſort of management; but it is ſaid to be earlier, by a month at leaſt, in the breeding of the rabbits, and the quality of their fur; which is ſuppoſed to ariſe from its being more fully expoſed to the influence of the morning ſun, in which the rabbit delights, and by which it is greatly benefited.

The rabbits are here likewiſe aſſerted to ſell for a higher price, as 3*s.* the couple, than in the warren at the north end of it.

The rabbit-warren at Sand Scale is another farm of this ſort in this neighbourhood, under ſimilar regulations, but ſomewhat ſmaller than thoſe in the iſle of Walney; and there is a ſtill ſmaller one attached to a farm at Roanhead, the property of Miles Sandyes, eſq. of Graythwate, which is conducted in much the ſame manner, and with the ſame reſults as in the above caſe.

It may be noticed that this ſort of ſtock is moſtly taken by nets or traps, ſet in the form of a fold between the places where they run, and thoſe where they feed, the rabbits being hunted into them as they return from feeding. But the wold warreners, Mr. Marſhall ſays, have three ways of catching their rabbits: with fold-nets, with ſpring-nets, and with "types;" a ſpecies of trap. The fold-nets are ſet about midnight, between the burrows and the feeding-grounds; the rabbits being driven in with dogs, and kept incloſed in the fold until morning. But the ſpring-net, when uſed, is, he believes, generally laid round a hay-ſtack, or other place, where rabbits collect in numbers. It is added that the trap is a more modern invention. It conſiſts of a large pit or ciſtern, formed within the ground, and covered in with a floor: or with one large falling door, having a ſmall trap-door towards its centre, into which the rabbits are led by a narrow muce. And this trap, on its firſt introduction, was ſet moſtly by a hay-ſtack; hay being, at that time, the chief winter food of rabbits; or on the outſide of the warren wall, where rabbits were obſerved to ſcratch much, in order to make their eſcape. Since the cultivation of turnips, as a winter food for this ſpecies of ſtock, has become a practice, the ſituation of the trap has been changed. Turnips being cultivated in an incloſure within the warren, a trap is placed within the wall of this incloſure. For a night or two, the muce is left open, and the trap kept covered (with a board or triangular rail), in order to give the rabbits the requiſite haunt of the turnips: which having got, the trap is barred, and the required number taken. He adds, that in emptying the ciſtern, the rabbits are ſorted; thoſe which are fat, and in ſeaſon, are ſlaughtered; thoſe which are lean, or out of condition, are turned upon the turnips to improve. And that, at the cloſe of the ſeaſon, the bucks and the does are ſorted, in a ſimilar way; the bucks are ſlaughtered, the does turned looſe to breed. Mr. Marſhall alſo remarks, that great caution is requiſite in the uſe of theſe traps. If too many rabbits be admitted at once, and the ciſtern be kept cloſe covered only for a few hours, ſuffocating and inordinate heat takes place, and the carcaſes, at leaſt, are ſpoiled. Many thouſand carcaſes have been waſted through this means. The traps are therefore watched; and when the required number is caught, the muce is ſtopped, or the trap covered in a proper manner.

And it is obſerved, that ſome notion may be formed of the produce of the wold warrens, from the great numbers which are frequently ſlaughtered at once; five or ſix hundred couple having not unfrequently been ſlaughtered in one night: and, it is ſaid, that when the two Driffield warrens lay together, there was once an inſtance of fifteen hundred couple being killed at one time.

There is often much inconvenience in this ſort of ſtock, from their getting out of their incloſures, and deſtroying the young corn-crops, new ſown graſſes, young turnips, and the quick hedges as well as young plantations of apple-trees that may be in the neighbourhood. This forms a material objection to this ſort of ſtock by the farmer.

Tame Rabbits.—In reſpect to breeding and rearing tame rabbits with the view of profit, thoſe who are engaged in the buſineſs perform it in hutches, which muſt be kept very neat and clean, otherwiſe the rabbits will be ſubject to diſeaſe. Care muſt be taken alſo to keep the buck and does apart, till the latter have juſt kindled, then they are to be turned to the bucks again, and to remain with them till they ſhun and run from them.

And the general direction for the chooſing of tame rabbits, is to pick the largeſt and ſleekeſt: but the breeder ſhould remember, that the ſkins of the ſilver-haired and white ſorts ſell better than any other. The food of the tame rabbits may be colewort and cabbage-leaves, carrots, parſnips, green corn, and vetches in the time of year; alſo parſley, graſs, green leaves, milk, and ſow-thiſtles, and other ſimilar plants, but with theſe moiſt foods they muſt conſtantly have a proportionable quantity of dry food, as hay, bread, oats, bran, and other ſimilar matters, otherwiſe they grow pot-bellied, and die. Bran and grain mixed together have been found

to

to be very good food. In winter they eat hay, oats, and chaff, and thefe may be given them three times a day; but when they eat green things, it muft be obferved that they are not to drink at all, as it throws them into a dropfy. At all other times a very little drink ferves, but it fhould always be frefh. When any green herbs or grafs are cut for their food, care muft be taken that there is no hemlock among it, for, though they will eat this greedily among other things, when offered to them, it is a fudden poifon to them. In this mode of breeding, one male to eight or ten females is fufficient.

It is remarked, that the author of the Treatife on Agriculture and Gardening, has bred thefe animals with much fuccefs and ornamental effect in a fmall artificial warren, in a lawn in the garden, made in the following manner. "Pare off the turf of a circle, about forty feet diameter, and lay it on the outfide; then dig a ditch within this circle, the outfide perpendicular, the inner floping, and throw earth fufficient into the middle to form a little hill, two or three feet higher than the level of the lawn; the reft muft be carried away. Then lay down the turf on the hill, and beat it well to fettle. The ditch at bottom fhould be about three feet wide, and three and a half deep, with two or three drains at the bottom, covered with an iron grate, or a ftone with holes, to carry off the hafty rains, in order to keep the rabbits dry. In the outfide bank fhould be fix alcoves, the fides and top fupported, either by boards or brick-work, to give the rabbits their dry food in; by their different fituations, fome will always be dry; fix boxes, or old tea-chefts, let into the bank, will do very well. If the ground be very light, the outfide circle fhould have a wall built round it, or fome ftakes driven into the ground, and boards or hurdles nailed to them, within a foot of the bottom, to prevent the bank from falling in. The entrance muft be either by a board to turn occafionally acrofs the ditch, or by a ladder. The turf being fettled, and the grafs beginning to grow, turn in the rabbits, and they will immediately go to work to make themfelves burrows in the fides, and in the hill. By way of inducing them rather to build in the fides, to keep the turf the neater, make a fcore of holes about a foot deep, and they will finifh them to their own mind; and if there be a brick-wall round it, it fhould be built on pillars, with an arch from each, to leave a vacancy for a burrow." But there is, he fays, another way that may be practifed, which is, "to dig the ditch only about two feet deep, which will yield about earth enough to make the hill; put fome pales, about a foot high, on the outfide, for that will be a fufficient height to keep the rabbits in. Feed them as other tame rabbits are fed; and in wet weather fprinkle faw-duft at the bottom, by which means the quantity of manure will be increafed; once a week is often enough to take it away: the quantity will be furprifing, nor will the fmell be in the leaft offenfive, even though it be quite clofe to the houfe. In a very large lawn, two or three of thefe hills, with the rabbits feeding on the tops, will not be unpleafing objects. If the bucks happen to be mifchievous in killing the young ones, they muft be chained in an alcove; or elfe have their liberty as in a warren. After a great fnow they will want fome affiftance early next morning; becaufe the ditch will be nearly filled, and perhaps the alcove, where the hay is, will be blocked up."

He adds, that "it is a great improvement to caftrate the young bucks, and keep them till they are full grown, before you kill them; the flefh will be amazingly finer, whiter, and tenderer. But then it will be beft to take them away, and keep them in another warren, left they fhould be too numerous, and difturb the breeding does; or elfe have a few hutches in the alcove to fatten them in."

It is fuggefted, that "as oil-cakes are found of great ufe in fattening cattle, it is probable they would be ufeful in fattening rabbits: and it is afferted, that fome of the oil mixed with the pollard or buck-wheat, is cheaper than the cakes; but having never made the experiment, he cannot afcertain its fuperior advantages."

In this mode, attention fhould be had to the breeding thofe forts of rabbits whofe fkins are in the greateft efteem with the furriers and hatters. Thefe fkins are generally of more value than the flefh, efpecially in the winter, againft which time contrive to have the greateft quantity of thefe fattened bucks.

Profit.—It is remarked, in refpect to profit in this way, that where does are kept in hutches, they are fuppofed to breed fix times a-year, and only five young ones are left to each, which is thirty from each doe: but as thefe are in a more natural way, and the young ones difficult to be gotten at, let us fuppofe about thirty-fix to be produced from each doe, reckoning only feven-pence for each; there is a guinea profit from each doe; as the additional value of the fkins in winter, and the dung, will more than pay the expence of food and attendance on them. And it is quite neceffary that thofe who keep many rabbits in this way, fhould cultivate fome lucern, parfley, and carrots, as no other vegetables are fuch proper food for them as thefe; they fhould alfo be fed upon fome of the beft upland pafture-hay; for if it be coarfe, fo far from eating, they will wafte it. Lucern hay is very proper for them in thefe cafes.

In fome diftricts very confiderable profits and advantages are derived from the breeding and keeping of white tame rabbits. The fkins of this fort having lately been much employed in trimmings, have fold at a much higher price than thofe of the common kinds. Their dung is alfo found of very great utility in the cultivation of large farms.

Difeafes.—When kept in this way, rabbits are fubject to feveral difeafes, as the *rot*, which is caufed by the giving them too large a quantity of green food, or the giving it frefh gathered, with the dew or rain hanging in drops upon it, as it is over-moifture that always caufes the difeafe; the green food fhould, therefore, always be given dry, and a fufficient quantity of hay, or other dry food, intermixed with it, to counteract the bad effects of it. And a fort of *madnefs* often feizes them: this may be known by their tumbling about; their heels upwards, and hopping in an odd manner into the boxes. This diftemper is fuppofed to be owing to the ranknefs of their feeding: and the general cure is the keeping them low, and giving them the prickly herb called tare-thiftle to eat as much as poffible. They are alfo fubject to a fort of fcabby eruption, which is feldom removed. Thefe fhould, however, be directly feparated from the reft of the flock.

It is noticed that the profit in this mode of management cannot, however, be well afcertained, as much will depend on the care which is taken in the feeding, and other management.

Rabbit-*Warren*, the place where thefe animals breed and rear their young. The land for this purpofe fhould be of a light fandy quality, and it is beft to have a hilly fituation, with a funny expofure, being well inclofed by means of fod-walls, or paling-fences: any fort of wafte, craggy, or rocky land, on which nothing elfe can be cultivated, anfwers very well for this purpofe. See Rabbit.

Rabbit-*Warren Farm*, that fort which is chiefly managed under the rabbit fyftem. Thefe forts of farms are now much lefs common than formerly, but in fome inftances, as has been feen, they afford the beft and moft advantageous means by which lands can be turned to any account in the way of cultivation. They, however, in moft cafes require no little capital, exertion, and attention, to manage them in the beft and moft profitable methods. See Rabbit.

Rabbit *Manure*, that which is collected from the dung of thofe animals, and which is faid to be very valuable. See Manure.

It is found beneficial in different modes of application, as by being intimately mixed and blended with the main particles of the foil or mould in arable lands, and by being fown by the hand, only over the furface of it, in the way of a top-dreffing, when they are in a ftate of crop. When ufed in this laft manner, it is likewife highly advantageous on moft forts of grafs land; and in both thefe cafes of top-dreffing with it, there is a very quick and powerful ftate of vegetation produced in the crops, which can hardly be gained in any other way. See Quick *Manure*, and Top-*Dreffing*.

In Oxfordfhire, Mr. Fane has raifed a fmall building for keeping rabbits in hutches, for the fake of the manure; he is faid to have fome hundreds, and to meditate the erection of a fecond building for keeping double the number; the prefent quantity make a load of manure in the courfe of the week; and as two loads manure an acre, they are the means of fully dreffing twenty-fix acres annually: it is not conceived by him that they produce any other profit, nor is it neceffary; for to be able to fell fo much food at home, and pay attendance, the profit of manuring fuch a breadth of land, it is fuppofed, muft be confiderable. Three dozen of rabbits in the week are moftly fent to the London market during the feafon in which they can be ufed.

This is a fort of dung or manure, which has yet been but little fubjected to chemical examination, confequently its real properties, or conftituent principles, are very imperfectly known or underftood; it would appear, however, from the effects which it produces, that it may be employed with the moft advantage, when laid upon the land, in its more raw, crude, or frefh ftate, before it has undergone much decompofition by the procefs of fermentation or putrefaction. It has, perhaps, never yet been kept dry and reduced into a powdery condition, fo as to be put in along with the feed, in the manner of rape-duft, though it feems probable that it would go farther, and be more beneficial, in fome cafes, if ufed in this way. See Dung.

RABCHORCADO, in *Ornithology*, the name of an American bird, defcribed by Nieremberg with many fabulous circumftances. All that feems certainly known is, that its tail is very remarkably forked.

RABDA, in *Geography*, a town of Arabia, in the province of Yemen; 30 miles N.W. of Sana.

RABDIUM, in *Ancient Geography*, *Tur-Rabdin*, a town of Afia, upon a mountain, at fome diftance from the Tigris, fouth of Tigranocerta, and eaft of Nifibis.

RABDOIDES. See Rhabdoides.

RABDOLOGY. See Rhabdology.

RABDOMANCY. See Rhabdomancy.

RABEBOIA, a name given by fome to the roots of the flammula major.

RABELAIS, Francis, in *Biography*, was born about the end of the fifteenth century at Chinon, in Touraine. At an early period he entered himfelf among the Cordeliers, and became well fkilled in the learned languages, and the literature of the age. He acquired a good fhare of popularity as a preacher; and what he gained by his fermons, he expended in the purchafe of a fmall library. His private life was not fo exemplary as his public difcourfes were edifying; and for fome mifconduct, which caufed fcandal in the monaftery, he was imprifoned in his cloifter. By his wit and facetioufnefs he obtained his liberation, with the pope's permiffion to quit his order, and remove to that of St. Benedict. Not being able, however, to bear any kind of reftraint, he laid afide his religious habit, and, in 1530, went to Montpelier to ftudy medicine. After fome time he repaired to Lyons, where he printed a collection of pieces of Hippocrates and Galen. Here he likewife publifhed feveral other works, among which were fome of the books of his Hiftory of Pantagruel, which gave him fo diftinguifhed a place among burlefque writers. In 1535 he went to Paris, and waited on cardinal John du Bellay, to whom he had been known when they refided in the fame convent; and he now made himfelf fo agreeable to his old friend, that he was taken into his houfe in the feveral capacities of phyfician, reader, librarian, and fteward. Du Bellay, in the following year, going out as ambaffador to the court of Rome, took Rabelais with him, where his wit fo much interefted the pope and cardinals, that he very readily obtained a full abfolution for the crime of apoftacy. In 1537 he took his doctor's degree in phyfic at Montpelier; and returning to Paris foon after, his friend the cardinal prefented him with a prebend in the chapter of St. Maur. He was afterwards made the curè of Meudon, which office he held from 1545 to his death, in 1553, being, according to one of his biographers, in the 63d, and according to another, in the 70th year of his age. His Pantagruel, which was finifhed about the time that he accepted the curè of Meudon, brought upon him the hoftility of the monks, whom he had feverely fatirized, and who procured its condemnation by the Sorbonne and the parliament; but it caufed his company to be much fought after, as the wittieft writer of his time. The want of decency was eafily pardoned at that period, and Rabelais had fome eftimable qualities, and poffeffed extenfive and various erudition, with a ready elocution, and an inexhauftible ftore of ludicrous ideas. "The *Pantagruel* and *Gargantua* of Rabelais," fays a critic, "are to be regarded as comic fatires, often concealing, under a whimfical extravagance, attacks upon follies which it would not have been fafe ferioufly to expofe. It is in vain, however, that commentators have attempted to find out the meaning in much that is mere ribaldry and nonfenfe, and even to difcover real hiftory veiled in the allegory of burlefque, where the author meant nothing more than to make his reader laugh or wonder. His fatire, where it is intelligible, is often juft and ingenious; but the obfcurity of his language, and eccentricity of his conceptions, render the perufal of his works, to a modern at leaft, rather a tafk than an amufement." The moft complete editions of his works is that publifhed in Holland, in 5 vols. 8vo., 1715, with notes by Duchat; and that at Amfterdam, in 3 vols. 4to., 1741, with plates by Picart. The letters of Rabelais were publifhed in an octavo volume, with notes by St. Marthe. The memory of Rabelais is perpetuated in the medical fchool of Montpelier, where bachelors are invefted with a fcarlet robe, faid to have been the very robe which that wit himfelf wore.

RABELHORST, in *Geography*, a town of the duchy of Holftein; 5 miles W.N.W. of Cifmar.

RABENAU, a town of Saxony, in the margraviate of Meiffen;

Meiſſen; 8 miles S.S.W. of Dreſden. N. lat. 50° 52′. E. long. 13° 36′.

RABENECK, a town of Bavaria, in the biſhopric of Bamberg; 3 miles S.W. of Weiſchenfeld.

RABENER, Theophilus William, in *Biography*, a celebrated German writer, was the ſon of an advocate at Leipſic, and born at Wachau in 1714. He was educated at home, by tutors employed for the purpoſe; but when he was 14 years of age, he was ſent to the college of Meiſſen, where he had for fellow-ſtudents Grabener, Gærtner, and Gellert, with whom, and particularly with the laſt, he formed a friendſhip which continued through life. In 1735 he went to the univerſity of Leipſic, where he applied himſelf chiefly to the ſtudy of juriſprudence, without entirely neglecting the Muſes. In 1741, profeſſor Schwabe having begun a journal in the German language, entitled "Amuſements of Reaſon and Wit," Rabener became one of his principal coadjutors, and continued to aſſiſt him by his contributions till the year 1744. He is chiefly known as a writer in the firſt volume, by a humorous piece entitled "Proofs of the Neceſſity of employing Rhyme in German Poetry." This periodical work was, for ſome time, carried on with ſpirit and ſucceſs; but at length it became degraded by literary diſputes, which finally put an end to it; and another was eſtabliſhed, under the title of "Contributions of Bremen." The writers engaged in this were all the moſt celebrated perſons who flouriſhed at that period, among whom were Gærtner, Schmidt, and Rabener, to whom were united Gellert, Klopſtock, and others. The Journal of Bremen forms an epoch in the hiſtory of the German literature, as it introduced into the country a better taſte, and tended greatly to improve the language, which, previouſly to this, had been much neglected. Rabener had before this been appointed controller of the taxes in the circle of Leipſic, a place of great labour, and which required an exact knowledge of the laws of the country, and the moſt inflexible integrity. Notwithſtanding, however, the attention which the duties of this office required, he found leiſure to continue his literary purſuits; and towards the end of 1751, compoſed his ſatirical letters, in which he introduces perſons of every ſtate and character, all of whom ſpeak in the language ſuited to their condition. In 1753 he was appointed chief ſecretary to the directors of the taxes at Dreſden; and two years afterwards he publiſhed the fourth and laſt volume of his ſatires, which contains "A burleſque Explanation of the Proverbs of Sancho Panza," the "Firſt of April," and "The Excuſe and Reparation." After this he began to write for the ſtage, and compoſed a comedy in four acts, entitled "The Freethinker," which, with many other papers and letters, were burnt, together with his houſe, during the ſiege of Dreſden, in 1760. He now abandoned his literary labours, but his friends obtained from him a collection of letters, which were afterwards publiſhed by Weiſs. Theſe were never intended for the public, but they are written with ſo much truth and ſincerity, and exhibit a more correct picture of the author than any pen could have drawn. His health began to decline ſoon after his loſs in 1760, and in 1767 he experienced a paralytic ſtroke, which was repeated in 1769; but he lingered out till March 1771, when he died. "He was," ſays his biographer, "among the ſmall number of thoſe privileged men, whom nature has endowed with every quality neceſſary to their ſtate. He thought and ſpoke in a manner peculiar to himſelf: his pleaſantries flowed as from an abundant ſource; he never ſought for them; and they appeared ſo natural, pleaſant, and lively, that it was impoſſible not to be ſtruck by them. But he diſplayed his wit only among his friends: he never laviſhed it on the rich and great; on the contrary, he concealed it, when invited merely for the purpoſe of being heard. He always ſpoke the truth, without regard to perſons or rank." Rabener, ſays he, was the favourite author of Germany, who wrote poetically in proſe, whoſe ſatirical, ſportive genius poſſeſſed ſalt without gall. Rabener's works are generally known throughout Europe, having been tranſlated into the French, Engliſh, Dutch, and Swediſh languages. Gen. Biog.

RABENSPURG, in *Geography*, a town of Auſtria; 8 miles N.E. of Liſterdorff.

RABENSTAIN, a town of Auſtria, on the river Bielach; 8 miles S. of St. Polten.

RABENSTEIN, a town of Bohemia, in the circle of Leitmeritz; 40 miles E. of Prague. N. lat. 50°. E. long. 13° 26′.—Alſo, a town of the duchy of Stiria; 11 miles N.N.W. of Gratz.—Alſo, a town of Bavaria, in the biſhopric of Bamberg; 2 miles S. of Weiſchenfeld.

RABIA Prior, in *Chronology*, is the name of the third month of the Arabic year, conſiſting of thirty days; and *Rabia poſterior* is the name of the fourth month, conſiſting of twenty-nine days.

RABICH, a name given by Leo Africanus to a tree or ſhrub growing very plentifully in many parts of Africa, the fruit of which is much eſteemed by the natives. He ſays that the tree rabich is prickly, and that the fruit is round, and like a cherry, but ſmaller, and of the taſte of the jujube.

RABIEL, a name given by ſome authors to dragon's blood.

RABIES, in *Medicine*, that peculiar ſtate of the nervous ſyſtem, which is produced by the bite of a rabid animal, and which is commonly, but improperly, called *madneſs*. As the dog is the principal ſource of this diſeaſe, the word rabies is commonly united with the epithet *canina*. See Hydrophobia.

RABINAL, in *Geography*, a town of Mexico, in the province of Vera Paz; 40 miles S.S.W. of Vera Paz.

RABINET, a name formerly given to a ſmall piece of ordnance, between a falconet and a baſe. Its dimenſions, &c. ſee under Cannon.

RABIRA, a word uſed by ſome of the chemical writers to expreſs tin.

RABISHI, in *Geography*, a river of the iſland of St. Vincent, forming a bay on the eaſtern coaſt, near the ſouthern extremity, where it runs into the ſea. N. lat. 13° 5′. W. long. 61° 11′.

RABLAY, a town of France, in the department of the Mayne and Loire; 9 miles N. of Villiers.

RABLES, *Iſles aux*, a cluſter of ſmall iſlands at the entrance of lake Superior, in Upper Canada, and at the eaſt end of it, eaſt of White Fiſh iſland, and pretty cloſe to the main land.

RABNABAD, a town of Hindooſtan, in Bengal, at the mouth of the Ganges; 90 miles S.S.E. of Mahmudpour.—Alſo, a ſmall iſland on the coaſt of Bengal, at the mouth of the Ganges. N. lat. 22°. E. long. 90° 30′.—Alſo, one of the mouths of the Ganges, which opens into the bay of Bengal. N. lat. 22°. E. long. 90° 26′.

RABNITZ, a river of Hungary, which runs into the Danube, a little below Raab.

RABOGH, a town of Arabia, in the province of Yemen, near the coaſt of the Red ſea, where the Arabs live in huts; 105 miles S.W. of Medina.

RABOLANE, in *Ornithology*, a name given by many to the lagopus, a bird found on the ſnowy mountains, and called by ſome the white partridge.

RABRI, a name given by some authors to bole armenic.

RABUEL, Claude, in *Biography*, a French Jesuit and able mathematician, was born at Pont-de-Vele, in the county of Bresse, in the year 1668. About the age of 18 he was entered into the society of Jesus, and principally distinguished himself by his proficiency in mathematical learning, of which he became the professor in Trinity college at Lyons, performing its duties with great reputation and success. He died in 1728, in the 60th year of his age. His chief work was "A Commentary on the Geometry of Descartes," which was published after his death in 1730, under the care of father l'Espinasse. This was the first illustration of the whole of that work, which had been given to the public. The labours of Fermat, De Witt, and others, extended only to particular parts of it. Rabuel left behind him other works on algebra, the conic sections, and the geometrical loci of the differential calculus, and of the integral calculus; and he was one of the few instances of persons who, with a passion for the mathematics, had a fine taste for polite literature.

RABUTAH, in *Geography*, a town of Africa, in the kingdom of Sennaar; 35 miles S.S.W. of Sennaar.

RABUTIN, Francis de, in *Biography*, who flourished in the sixteenth century, was of an ancient and noble family in Burgundy, and served in the army with the duke de Nevers, under Henry II. and Charles IX., with a high reputation for valour and fidelity. He was living in 1581, but nothing is known of him beyond that period. He was author of "Commentaires de dernières Guerres du Roi Henri II. et de l'Empereur Charles Quint," first printed in 1555; a continuation was printed afterwards, in 1558; and the whole work together in 11 books, in 1574. It contains a history of the wars in the Low Countries, from 1550 to 1558, and is said to be written in a simple style, with a great appearance of vivacity.

Rabutin, Roger de, count of Bussi, a very distinguished character in the reign of Lewis XIV., was born at Epiry, in the Nivernois, in 1618. He entered very young into the army, in his father's (Leonor Baron of Bussi) regiment, of which he became colonel. After serving in a number of battles and sieges, he rose to the rank of mestre-de-camp of the light horse, and lieutenant-general of the Nevernois. He looked for still higher honours, and being disappointed, engaged in lampoons upon persons about the court, which drew upon him the king's displeasure; and in 1665, in which year he was admitted a member of the French academy, a manuscript history of the amours of two court ladies, of which he was the writer, being handed about, under the title of "Histoire Amoureuse des Gaules," a complaint was laid before his majesty, in consequence of which he was sent to the Bastille. Imprisonment had nearly proved fatal to him, and he was liberated, but was obliged to resign the office which he held under government. After this he was exiled to his country-seat, where he remained 17 years, during which he did not cease to importune the king to be allowed to return, by letters conceived in terms of abject humility and base adulation. In 1682 he was allowed to return to court, but finding himself generally neglected, he retired of his own accord to his estates. He died at Autun in 1693, at the age of 75. He was author of several works, among which were "Discours a ses Enfans, sur le bon Usage des Adversites;" "Memoires," published first at Paris in two, and afterwards at Amsterdam in three volumes, 4to.; "Lettres," 7 vols. 12mo.; and "Histoire Abregée de Louis le Grand." His son the abbè de Bussi became bishop of Luçon in 1723, and was a learned and ingenious member of the French academy. The sister of the bishop, a nun, published an abridgment of the life of Madame de Chantal, and of the life of St. Francis de Sales.

RABY, in *Geography*, a small township of America, in New Hampshire, in Hillsborough county; about 65 miles W. by. S. of Portsmouth; incorporated in 1790. Its name has been since changed.—Also, a town of Bohemia, in the circle of Prachatitz, containing a citadel, at the siege of which, Zisca, general of the Hussites, lost his only remaining eye; 4 miles S. of Horazdiowitz.—Also, a town of Sweden, in Sudermanland; 7 miles N. of Nykoping.

RACA, or Racha, a Syriac term, found in the Gospel of St. Matthew, chap. v. 22. and preserved in most translations.

Father Simon observes, that the Greek translator of St. Matthew's Gospel retained the Syriac raca, which he found in the original, because it was very common among the Jews. And St. Jerom, Luther, the English translators, those of Geneva, Louvain, Port royal, &c. still preserve it in their respective languages.

F. Bouhours chooses rather to express the sense of it in a sort of paraphrase, thus: he that says to his brother, *homme de peu de sens*, *man of little understanding*, shall deserve to be condemned by the tribunal of the council, &c.

Most translators, except the English, and F. Simon, for raca write racha; but the former orthography seems the best founded; all the Latin copies having raca, and all the Greek ones ῥακα, or, with Hesychius, ῥακκα, which is the same; all, we mean, but St. Irenæus, and Beza's copy, now at Cambridge, which have ῥαχα. In effect, the origin of the word shews it should be raca; as coming from the Syriac רקא, *raca*, of the Hebrew *rek*, רק, *empty*, *shallow*.

RACAISBONE, in *Geography*, a town of Hindoostan, in Aurungabad; 30 miles S. of Aurungabad.

RACAM, a town of New Mexico, in the province of Hiaqui; 60 miles S.W. of Riochico.

RACAN, Honorat de Bueil, *Marquis of*, in *Biography*, a French poet, was born in 1589, of a noble family, in Touraine. When very young, he had a place in the king's bed-chamber, under the duke of Bellegarde. From Malherbe, who was at that time domesticated with the duke, he acquired a fondness for poetry, and obtained instructions in the art of versifying. He at first bore arms, as a profession; but after a time he devoted himself to a life of leisure. He was one of the earliest members of the French academy, and though almost wholly without the advantages of education, he obtained reputation as a writer. His most popular work was entitled "Bergeries." He composed in various styles, and wrote translations of Psalms, and many sacred odes taken from the Psalms, and other scriptural poems. In prose he published "The Life of Malherbe;" "A Discourse pronounced before the Academy;" and some "Letters." He died in 1670, at the age of 81. Of his works a new edition was given at Paris, in 1724, in 2 vols. 12mo.

RACCA, Racah, *Rika*, or *Racka-Rica*, in *Geography*, a town of the Persian empire, in the province of Diarbekir, and pashalic of Orfa, the capital of the district named Diar Modzar. It is situated on the eastern bank of the river Euphrates, at the mouth of a small river named Beles, (the ancient Billicha,) and was founded, according to Pliny, by Alexander the Great. It was first called Nicephorium, and afterwards Callinicum and Leontopolis, from Seleucus Callinicus and the Greek emperor Leo. It was the favourite residence of Haroun al Rashid, the ruins

ruins of whofe palace, it is faid, are ftill vifible. The pofition of Racca, in the parallel of 36° N., was afcertained by the celebrated oriental aftronomer Mahomed Ben Jaber, furnamed Al Batani, who paffed many years of his life at this place. The town and adjoining country are inhabited by different tribes of wandering Arabs. N. lat. 36° 1′. E. long. 38° 50′.

RACCAN, a river on the north coaft of Sumatra, which runs into the fea, N. lat. 2° 30′. E. long. 100° 15′.

RACCANATTO, a river of Naples, which runs into the gulf of Tarento, N. lat. 39° 47′. E. long. 16° 42′.

RACCOON, in *Zoology*. See RACKOON.

RACCOON, in *Geography*, an ifland in the Atlantic, near the coaft of South Carolina, nine miles long and one wide. N. lat. 33° 3′. W. long. 79° 22′.

RACCOON *Creek*, a river of Pennfylvania, which runs into the Ohio, N. lat. 40° 38′. W. long. 80° 25′.

RACCOON *Ifland*, a fmall ifland in Offabaw found, belonging to the ftate of Georgia. N. lat. 31° 47′. W. long. 81° 12′.

RACCOON *Key*, a fmall ifland or rock in the gulf of Mexico, near the fouth coaft of Weft Florida. N. lat. 29° 46′. W. long. 89° 21′.

RACCOON *Keys*, a clufter of fmall iflands near the coaft of South Carolina. N. lat. 24° 8′. W. long. 79° 15′.

RACCOURCY, in *Heraldry*, fignifies the fame as *coupé*, that is, *cut off*, or *fhortened;* and denotes a crofs, or other ordinary, when it does not extend to the edges of the efcutcheon, as they always do when abfolutely named, without fuch diftinction.

RACE, in general, fignifies running with others, in order to obtain a prize, either on foot, or by riding on horfeback, in chariots, &c.

Racing was one of the exercifes among the ancient Grecian games, which was performed in a courfe, containing one hundred and twenty-five paces; and thofe who contended in thefe foot-races were frequently clothed in armour. For a particular account of thefe races, fee STADIUM.

There were properly but two kinds of horfe-races at Olympia, namely, the *chariot-race*, introduced into thofe games in the 25th olympiad (for an account of which fee CHARIOT), and the race of riding-horfes, which was not admitted till the 33d. Although chariots were in ufe before riding-horfes, as we may conclude from the teftimony of Homer, among all whofe heroes, Greek and Trojan, no one makes his appearance on horfeback, except Diomedes and Ulyffes mounted upon the horfes of Rhefus (Il. x.), it is neverthelefs plain, from this inftance, that neither the heroes nor the horfes were utter ftrangers to the art of riding; and it is alfo evident, from another paffage in the 15th Iliad, that horfemanfhip was carried even to fome degree of perfection, at leaft in the time of that poet, who lived but in the next generation after the fiege of Troy, according to fir Ifaac Newton. This paffage, extracted from Pope's Homer (Il. xv. v. 822.) is as follows:

> " So when a horfeman from the wat'ry mead
> (Skill'd in the manage of the bounding fteed)
> Drives four fair courfers, practis'd to obey,
> To fome great city, thro' the public way:
> Safe in his art, as fide by fide they run,
> He fhifts his feat, and vaults from one to one:
> And now to this, and now to that he flies:
> Admiring numbers follow with their eyes."

Some authors (fee Rollin's Anc. Hift. tom. v. p. 72. ed. Amft.) have introduced an exercife like this into the Olympic games, though Mr. Weft profeffes himfelf diffatisfied with the authority upon which they depend: and fays that in the books which he has confulted, he can find no mention of any other race of riding-horfes, befides thofe of the *Celes* and the *Calpé*. As to that particular branch of horfemanfhip, above defcribed, Euftathius, in his comment upon Homer, tells us, that in the old fcholia it is written, that Demetrius fays he had feen a man, vaulting in the manner defcribed by the poet, from the back of one horfe to another, holding the bridles at the fame time, and keeping the horfes to their fpeed, without any interruption or incumbrance. This affertion implies that fuch a fight was very uncommon, and confequently that no fuch exercife could ever have been admitted into any of the games of Greece. The word Κελητίζειν, ufed by the poet in the beginning of this fimile, fays Mr. Weft, may poffibly have induced fome people to imagine, that the riders of the horfes called Κέλητες, *celetes*, were accuftomed to leap from one horfe to another, as if that word was a term of the manege, of which the verfes that follow were merely an explanation. It is certain, however, from a paffage in the Odyffey (E. v. 371.) that by ἵππος Κέλης, Homer meant to fignify no more than a riding-horfe, and confequently that by the word Κελητίζειν, which is derived from Κέλης, no more is to be underftood in this place than fimply to ride. This interpretation of Κέλης, *celes*; may be farther confirmed by the authorities of Pindar and Paufanias, and particularly by a ftory related by the laft mentioned author (lib. vi. c. 13.) of a mare, named Aura, belonging to one Phidolas, a Corinthian. This mare, fays the hiftorian, having accidentally thrown her rider foon after fhe had ftarted from the barrier, continued the race of her own accord, and turned round the pillar as if the rider had been ftill upon her back; upon hearing the trumpet, fhe mended her pace, till coming in before her antagonifts, fhe ftopped fhort over-againft the judges of the games, as confcious of having gained the victory. The victory was accordingly adjudged to her mafter Phidolas, who, by erecting in return a ftatue to her honour, intimated to whom the merit of that victory was due. In this ftory, there is no mention of any other horfe or mare, that fhared the victory with Aura, and confequently that, in the race called *Celes*, each competitor made ufe of but one fingle horfe. Moreover, the victorious Aura was of the feminine gender, and hence we may infer, that in all the races, as well of riding horfes as of chariots, mares or horfes were indifferently ufed; excepting in the race named *Calpé*, in which mares only were employed. And further it appears, that though the rider was thrown off in the very beginning of the race, yet the crown was awarded to Phidolas, the mafter of Aura; to whom certainly no lefs was due, than if his mare had conquered under the conduct and difcretion of her rider. It appears alfo, by the circumftance of Aura's mending her pace upon hearing the trumpet, that the trumpet either did not found during the whole race, but at the laft round only, or that it founded differently in different periods of the courfe. There was, however, a meaning in the found of the trumpet, which Aura, probably an old ftager, underftood.

The race of full-aged riding-horfes was inftituted in the 33d olympiad, and that of the Πωλος Κέλης, or under-aged riding-horfes, in the 131ft. It is a well-known fact that chariots were ufed in war above 1000 years before cavalry was introduced among the ancients. They feem to have had a terrible notion of being mounted upon the back of a horfe, and have accordingly made monfters of thofe whom they firft beheld in that attitude, to which they were not very fpeedily reconciled. Their amazement gradually diminifhed: and their intercourfe with other nations not only

 rendered

rendered riding-horfes familiar to them, but convinced them likewife of the advantages accruing from the ufe of cavalry. Hence it came to pafs, that an order of equites, or horfemen, was inftituted in moft of their commonwealths; to whom, as in Athens, was allotted the fecond rank in the ftate. Upon the fame principle, perhaps, the ἵππος Κελης, or riding-horfe, was admitted into the Olympic hippodrome, and held in fuch eftimation, that although the race of riding-horfes was neither fo magnificent nor fo expenfive, and confequently not fo royal, as the chariot-race, yet we find, among the competitors in this exercife, the names of Philip, king of Macedon, and Hiero, king of Syracufe. To the latter is infcribed the firft Olympic ode of Pindar, in which honourable mention is made of the horfe Pherenicus, whofe fleetnefs gained for his mafter the Olympic crown. The race of the Calpé was performed by mares. (See Calpé.) The length of this race, and alfo that of the Celes, are not afcertained; but it is reafonable to fuppofe, that the latter, diftinguifhed, as we have already obferved, into two claffes, one of full-aged, and the other of under-aged horfes, confifted of the fame number of rounds as thofe of the chariots, diftinguifhed in like manner into two claffes. Mr. Weft has not been able to determine the different ages that ranked the horfes in one or the other clafs; nor whether the weight of the riders, or the fizes of the horfes, were taken into confideration. Thefe points feem to have been left to the difcretion of the Hellanodicks, who were appointed to examine the young horfes that were entered to run for any of the equeftrian crowns (Pauf. l. iv. c. 24.), and who were fworn before the ftatue of Jupiter Horcius, to give a true and impartial judgment upon the matters left to their examination, without taking any reward; and not to difcover the reafons which difpofed them to reject fome, and admit others. Weft's Differtation on the Olympic Games. Sect. 14. See Hippodrome.

Race, in *Genealogy*, a lineage, or extraction, continued from father to fon.

The word is French, formed from the Latin *radix*, *root*; as intimating the root of the genealogical tree.

In feveral orders of knighthood, as in that of Malta, &c. the candidates muft prove a nobility of four races or defcents.

In fome republics the magiftrates are to prove themfelves of plebeian race, to be qualified.

The French reckon their kings by races; as, the firft race, the fecond race, the third race. We alfo fay the race of the Ottomans, the Arfacidæ, the Ptolemies, &c.

Race, in *Natural Hiftory*. See Cibdeloplacia.

Race, the mark made on timber, &c. by a tool called a racing-knife.

Race, *Cape*, in *Geography*, a cape on the S.E. coaft of Newfoundland. N. lat. 46° 40'. W. long. 53° 3' 30".

Race *Point*, a cape on the coaft of America, W. of cape Cod. N. lat. 42° 4'. W. long. 78° 12'.

RACEME, in *Gardening*, the long mode of clufter-flowering and fruiting which takes place in fome forts of plants and fruit-trees, as in the grape vine, and the different kinds of currants. See Racemus.

RACEMIFEROUS, in *Botany*, denotes bearing in clufters.

RACEMUS, in *Botany* and *Vegetable Phyfiology*, a clufter, is a mode of inflorefcence, in which feveral flowers, each fupported on its own proper ftalk, are connected by one common ftalk, either fimple or compound. A bunch of Currants is a fimple *racemus*; the inflorefcence of the Woody Nightfhade, *Solanum Dulcamara*, is a compound one. In the American plant called *Actæa racemofa*, the clufters are fimple, but aggregate. A *racemus* differs from a *fpica*, or fpike, in having a partial ftalk, as above defcribed, to each flower; it is moreover generally underftood to be drooping or pendulous, and to have the flowers expand all nearly at one time. On the contrary, a fpike is moft frequently erect; the flowers open in very gradual fucceffion, infomuch that the lowermoft may have partly perfected their feeds, before the uppermoft expand; and efpecially, they are individually feffile, at leaft at the time of their expanfion. To thefe characters may be added, that a fpike is crowded or denfe; a clufter lax or fcattered. It muft be allowed that botanifts, even of the firft rank, are incorrect in the application of thefe terms. The male inflorefcence of *Quercus*, the Oak genus, becaufe drooping and loofely difpofed, with all the flowers in perfection nearly at the fame time, is termed a *racemus*; though it poffeffes the moft effential character of a *fpica*, feffile flowers. On the other hand, *Veronica fpicata*, having a denfe upright feries of flowers, expanding gradually, is faid to be fpiked, though each feparate flower has a partial ftalk. A little latitude muft neceffarily be allowed, though it is very defirable that botanifts fhould be more exact in the ufe of thefe and other terms, than they fometimes are. See Spica and Inflorescence.

RACER, in *Gardening*, a name applied to a fort of fward-cutter, or cutting implement, ufed in racing out or cutting through the furface of grafs fward, and dividing it into proper widths, lengths, and thicknefs, for turf intended to be cut up for laying in pleafure-grounds, or other places, and always neceffary preparatory to the work of flaying or cutting up the turf with the turfing-iron. It is alfo ufeful for cutting and ftraightening the edges of grafs verges in fuch grounds, as well as for many other purpofes.

It is a tool which is very fimple in its conftruction, merely confifting of a ftrong wooden handle, about four feet long, having the cutter fixed at the lower end, in the form of a half moon, with the edge downward, to cut into the fward; the handle fhould be about an inch and a half thick, growing gradually thicker towards the lower end.

In ufing the tool, it is pufhed forward fo as to cut or race out the fward in an expeditious manner. And in cutting turfs with it, it is neceffary firft to mark out on the fward the width of the turf intended, which fhould generally be a foot wide, and a yard long, and about an inch or inch and a half deep; then ftrain a line tight, firft lengthways, ftriking the racer into the fward clofe to the line, running it along expeditioufly, fo as to cut its way, and divide the fward to a proper depth, afterwards placing a line a foot farther, and racing it out as before, and fo on, to as many widths as may be wanted; and then, with the line placed crofs-ways, to race out the fward accordingly in yard lengths. The fward being thus raced out, the turf-cutter with the turfing-iron fhould proceed to cut them up and flay them off from the ground. This fmall implement is likewife very convenient for many other little purpofes about pleafure grounds and gardens, as thofe of cutting the edges of the verges which are laid with turf, and ftraightening the edges of the borders in different parts. See Turf.

RACHA. See Raca.

Racha, in *Geography*, a town of Bohemia, in the circle of Leitmeritz; 8 miles E. of Leitmeritz.

RACHELSDORF, a town of Bavaria, in the bifhopric of Bamberg; 15 miles N. of Bamberg.

RACHETUM, from the Fr. *racheter*, *redimere*, the compenfation or redemption of a thief.

RACHIA,

RACHIA, in *Geography*, a town of Iftria; 7 miles N.E. of Pedena.

RACHIALGIA, in *Medicine*, a term given by Aftruc, and adopted by the nofologifts, to denote certain colicky pains in the bowels, which were fuppofed to originate from the nerves of the fpine, and efpecially the colic from the poifon of lead, or COLICA *Pictonum*; which fee. The word is from ῥαχις, *the fpine*, and αλγν, *pain*. See Sauvages Nofol. Meth. clafs vii. gen. 29.

RACHIS, or rather *Rhachis*, in *Botany*, from ῥαχις, *the back-bone*, is the common ftalk, or receptacle, of the florets, in the fpikelets of graffes; or of the fpikelets themfelves in *Lolium*, *Triticum*, *Secale*, *Hordeum*, *Rottböllia*, &c. The fame term is applied to the rib, or leaf-ftalk, of ferns, which is often winged or bordered. The *Rachis* in both thefe inftances is frequently jointed; by which in the former, the ripe feeds of fuch graffes, wrapped up in their hufks, are the more readily difperfed. The part in queftion being in fome cafes fmooth, in others varioufly hairy or bearded, affords excellent fpecific diftinctions; witnefs the genus *Avena*.

RACHISAGRA, a term ufed by fome phyficians for the gout in the fpine of the back.

RACHITIS, in *Medicine*, from ῥαχις, *the fpine*, (becaufe the fpinal marrow was fuppofed to be the feat of the difeafe,) a malady corruptly termed in Englifh the *Rickets*: which fee.

RACH-KOKE, in *Geography*, one of the Kurilfkoi or Kurilly iflands in the Eaftern or Pacific ocean: diftant from Muffyr, another of the faid iflands, about 120 verfts. Its length is about 20 verfts, and its breadth the fame, and it prefents the appearance of a folitary mountain rifing upwards from the fea. It was formerly covered with verdure, with fhelves of rocks, where fea-fowl in great number made their nefts: but thefe rocky fhelves have been demolifhed by the eruption of fubterraneous fires, which fplit the fummit of the mountain, throwing up vaft quantities of ftones and afhes; and fince that time, the ifland has always continued burning. At this eruption thofe places on the fhore where formerly they had thirteen fathom water, were filled up with rubbifh and afhes into fhoals and banks.

RACHLIN, in *Ancient Geography*, the *Ricina* of Ptolemy, near the N.E. coaft of Ireland, memorable as the retreat of Robert I. of Scotland.

RACHOL, in *Geography*, a town of Hindooftan, in Soonda; 16 miles S.S.E. of Goa.

RACHORE, a diftrict or province of Hindooftan, in Golconda, bounded on the N. by the Kiftnah, on the E. by Canoul, on the S. by Adoni, and on the W. by Sanore.—Alfo, a town of Hindooftan, and capital of the above-mentioned province, on the S. fide of the Kiftnah, and not far above the conflux of the Toombuddra with it, and below that of the Beemah; belonging to the Nizam. It is four days' journey from Adoni, reckoning a day's journey at 22 Britifh miles in road diftance, and 17 or 18 geographical miles; 91 miles S.W. of Hydrabad. N. lat. 16° 24'. E. long. 78° 2'.

RACHOSIS, from ῥακοω, *lacero*, a difeafe, in which the fcrotum is relaxed and excoriated.

RACHOUR, in *Geography*, a town of Hindooftan, in the circar of Gurry Mundella; 20 miles S.S.W. of Gurrah.

RACHOURE, a town of Hindooftan, in Myfore; 20 miles S. of Gurramconda.

RACHOW, a town of Poland; 36 miles S.S.W. of Lublin.

RACINE, JOHN, in *Biography*, an eminent French poet, was born in 1639. He was educated at the convent of Port-Royal, near Paris; after this he went through a courfe of philofophy at the college of Harcourt, and then made his appearance before the public in an ode on the king's marriage. This effort was, through the intereft of Colbert, rewarded with a prefent and a fmall penfion. Elated with the fuccefs that crowned his firft effort, he determined to follow poetry as a profeffion; and, rejecting the offer of an uncle, a prior, who offered to refign his benefice to him, provided he would enter into holy orders, he fixed his refidence at Paris. In 1664 he brought upon the ftage his firft tragedy, entitled "La Thebaide ou les Freres ennemis." It was written in the manner of Corneille, which he foon after quitted for one of his own; a judicious change, fays a critic, fince the characteriftics of thefe two mafters of the French drama were extremely different. He next publifhed his "Alexandre," which was followed by his "Andromaque." About this time he was prefented to the priory of Epinay, but not being in orders, he was, after a law-fuit, obliged to quit. His "Andromaque," which eftablifhed his character as a tragedian, was foon followed by the comedy "Les Plaideurs," which, though it obtained for him the praife of Moliere, and was well received at court, was his only attempt in that walk. Between the years 1670 and 1678, he publifhed his "Britannicus," "Berenice," "Bajazet," "Mithridate," "Ephigene," and "Phædre." His popularity and well-earned reputation excited a ftrong party againft him: the chagrin which he underwent from the artifices of his enemies, and the over-fenfibility to criticifm, which led him to confefs, in the confidence of friendfhip, that the worft critique made upon his works caufed him more uneafinefs than the greateft plaudits had given him pleafure, infpired him with the refolution of renouncing poetry and turning Carthufian. He was, however, perfuaded to change his plan, and to marry: he accordingly formed an alliance with the daughter of a gentleman in the treafury of Amiens, by whom he had feveral children. At the fame time he ceafed to write for the ftage, and thereby reconciled himfelf with his old friends of the Port-Royal. Racine now became a courtier, and obtained the fituation of gentleman in ordinary to the king, to whom he made himfelf very ufeful. He was alfo appointed to the office of hiftoriographer-royal, in conjunction with his friend Boileau, which they made a complete finecure. He was prevailed upon by madame Maintenon to write a dramatic piece on a fcriptural fubject, for the ladies of her foundation of St. Cyr, and his "Efther" was performed by them in 1689, with great applaufe, in the prefence of the whole court. He followed it with "Athalie," acted by the fame ladies in 1691. Madame Maintenon, deeply affected with the miferies of the people in the latter years of Lewis's reign, engaged Racine to draw up a memoir on the fubject. This he did in fo free a manner, as to give great offence to the king, who happened to obtain a fight of it from a lady to whom it had been lent. Racine was excluded from the court, a circumftance that fo preyed upon his mind, that he fell into a ftate of melancholy, of which he died in 1699, at the age of 60. For a character of this writer we fhall be indebted chiefly to the General Biography. He was polite in his manners, with the affected foftnefs of a courtier, which was, however, a mafk to his actual difpofition, for, in reality, he had much gall and fpleen in his character. Religion, however, corrected, in a good meafure, thefe defects, and in all the relations of domeftic life he was exemplary. As a dramatic writer he is fuppofed to have ranked with Corneille, though in many points he even furpaffed him. His characteriftics are tendernefs,

nefs, elegance, correctnefs, good tafte, refined fentiments, and the art of verfifying in a fupreme degree, fo that his countrymen find a charm in his lines, which diftinguifhes them from other French poetry. The criticifms of Boileau contributed much to his excellence in this particular, and he is faid to have taught him, as a great fecret, to write the fecond line of a couplet firft. With refpect to the proper dramatic merit, Racine muft be judged by thofe who are formed to the French fchool, and are not readily wearied with long fpeeches, rather defcriptive of feeling than expreffing it, and all refinements of the tender paffion, often applied to characters, to which it is hiftorically unfuitable. Many parts of his beft pieces, however, prove that his mind was well furnifhed with elevated and dignified fentiments, which he probably derived from an affiduous ftudy of the ancients. Befides his dramatic works, Racine was author of "Cantiques," replete with the unction of tender devotion; "L'Hiftoire de Port-Royal;" "Idylle fur la Paix;" "Epigrams;" Letters;" and fome "Opufcules." He was member of the French academy from 1673, and as director of that inftitution he pronounced the eulogy of Corneille. The beft edition of his works is in feven vols. 8vo. 1768.

Racine, Louis, fon of the preceding, alfo a diftinguifhed poet, was born at Paris in 1692. He was, however, not more diftinguifhed for his poetry than for his piety, and adopted the ecclefiaftical habit. In a ftate of retirement, in 1720, he publifhed his poem "On Grace." The chancellor d'Augeffeau, during his own exile at Frefnes, brought Racine again into the world, and cardinal Fleury afterwards gave him a place in the finances. He married, and lived very happily in his family, till the lofs of an only fon threw him into a deep melancholy. His religious fentiments took full poffeffion of his foul, the fervour of which may be eftimated by the line from Tibullus which he infcribed on the crucifix which ever accompanied him:

"Te fpectem fuprema mihi cum venerit hora,
Te teneam moriens deficiente manu."

He died in 1763, at the age of 71. His poetical writings are "Poems on Religion and Grace;" "Odes," of which the diction is fplendid, and the fentiments elevated; "Epiftles," and a "Tranflation of Milton's Paradife Loft." In profe he wrote "Reflexions fur la Poefie;" "Memoires fur la Vie de Jean Racine;" "Remarques fur les Tragedies de J. Racine:" befides thefe he contributed feveral differtations to the Memoires of the Academy of Infcriptions, of which he was a member. His works were collected and publifhed in 6 vols. 12mo.

Racine, Bonaventure, a learned French prieft and ecclefiaftical hiftorian, was born at Chauny, in the diocefe of Noyon, in the year 1708. He received an excellent education at the Mazarin college at Paris, where he not only ftudied the ancient languages, but entered pretty fully into the different branches of philofophy, divinity, and the ftudies connected with ecclefiaftical hiftory. At the age of twenty-one he was entrufted by the archbifhop of Alby, as a fit perfon, to re-eftablifh the college of Rabaftens, a town in his diocefe. To this defign he devoted his talents with unwearied zeal and affiduity, and was abundantly compenfated by the fuccefs which attended his labours. The inftitution was, in a fhort time, crowded with ftudents, who imbibed from his lectures a tafte for fcience and literature. Thus ufefully engaged, he became an object of the jealoufy of the witty Jefuits, who caufed him to be banifhed from Rabaftens. He retired to Montpelier, where M. Colbert engaged him to undertake the direction of the college of Lunel: from this place he was alfo driven by the fame perfecutors, and he found it neceffary to withdraw fecretly to Paris, where he was invited to undertake the education of certain young perfons at the college of Harcourt, in connection with fome other ecclefiaftics. Here his old enemies the Jefuits purfued him, and an order was obtained from cardinal Fleury, in 1734, to deprive him of his office of tutor. In the following year M. de Caylus, bifhop of Auxerre, nominated him to a canonry in his cathedral, and ordained him prieft; but his new dignity produced no alteration in his manner of living, nor in the diftribution of his time, which was almoft wholly fpent in devotion and ftudy. From this time he fet about preparing to publifh the collections that he had made in ecclefiaftical hiftory, and in 1748 he fent into the world the firft volumes of an "Abridgment of Univerfal Hiftory, containing the principal Events in every Century, with Reflections," in 12mo. Thefe were followed by others, to the number of thirteen, the laft making its appearance in the year 1754. This work, written in a neat, perfpicuous, and fimple ftyle, was well received, and became extremely popular. The labour which it coft him his weak conftitution was unable to fuftain; he funk under his exertions in the 47th year of his age. He was characterifed by the excellence of his manners and the amiablenefs of his temper, and he had an ardent zeal for what he regarded as truth, which approached to enthufiafm. Two other volumes have been added fince his death to the Hiftory, but they are the work of an inferior hand, and unworthy of being placed in conjunction with thofe of Racine. Moreri.

RACING, the riding of heats for a plate or other premium. Horfes for this ufe fhould be as light as poffible, large, long, and well-fhaped, nervous, of great mettle, and good wind, with fmall legs, and neat fmall-fhaped feet.

The firft thing to be confidered in this fort of gaming is the choice of a rider; for it is not only neceffary that he fhould be very expert and able, but he muft alfo be very honeft.

He muft have a very clofe feat, his knees being turned clofe to the faddle fkirts, and held firmly there, and the toes turned inwards, fo that the fpurs may be turned outward to the horfe's belly; his left hand governing the horfe's mouth, and his right the whip. During the whole time of the race, he muft take care to fit firm in the faddle, without waving or ftanding up in the ftirrups. Some jockies fancy this is a becoming feat, but it is certain, that all motions of this kind do really incommode the horfe. In fpurring the horfe, it is not to be done by fticking the calves of the legs clofe to the horfe's fides, as if it were intended to prefs the wind out of his body; but, on the contrary, the toes are to be turned a little outwards, that the heels being brought in, the fpurs may juft be brought to touch the fides. A fharp touch of this kind will be of more fervice toward the quickening of a horfe's pace, and will fooner draw blood than one of the common coarfe kicks. The expert jockey will never fpur his horfe until there is great occafion, and then he will avoid ftriking him under the fore-bowels between the fhoulders and the girt; this is the tendereft part of a horfe, and a touch there is to be referved for the greateft extremity.

As to whipping the horfe, it ought always to be done over the fhoulder, on the near fide, except in very hard running, and on the point of victory; then the horfe is to be ftruck on the flank with a ftrong jerk; for the fkin is the moft tender of all there, and moft fenfible of the lafh.

When a horfe is whipped and fpurred, and is at the top of his fpeed; if he claps his ears in his pole, or whifks his tail, it is a proof that the jockey heats him hard, and then he ought to give him as much comfort as he can, by faw-

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ing the fnaffle backwards and forwards in his mouth, and by that means forcing him to open his mouth, which will give him wind, and be of great fervice. If there be any high wind ftirring in the time of riding, the artful jockey will let his adverfary lead, holding hard behind him, till he fees an opportunity of giving a loofe; yet in this cafe, he muft keep fo clofe behind, that the other horfe may keep the wind from him; and that he, fitting low, may at once fhelter himfelf under him, and affift the ftrength of the horfe. If the wind happen to be in their back, a juft contrary method is to be taken with it; the expert jockey is to keep directly behind the adverfary that he may have all the advantage of the wind to blow his horfe along, as it were, and at the fame time intercept it in regard to his adverfary.

When running on level carpet-ground, the jockey is to bear his horfe as much as the adverfary will give him leave, becaufe the horfe is naturally more inclined to fpend himfelf on this ground: on the contrary, on deep earths he may have more liberty, as he will there fpare himfelf.

In riding up hill the horfe is always to be favoured, by bearing him hard, for fear of running him out of wind; but in running down hill, if the horfe's feet and fhoulders will bear it, and the rider dares venture his neck, he may have a full loofe. If the horfe have the heels of the reft, the jockey muft always fpare him a little, that he may have a referve of ftrength, to make a pufh at the laft poft.

A great deal depends on the jockey's knowing the nature of the horfe that is to run againft him; for by managing accordingly, great advantages are to be obtained: thus, if the oppofite horfe is of a hot and fiery difpofition, the jockey is either to run juft behind him, or cheek by joul with him, making a noife with the whip, and by that means forcing him on fafter than his rider would have him, and confequently fpending him fo much the fooner; or elfe keep juft before him, in fuch a flow gallop, that he may either over-reach, or by treading on the heels of the fore horfe, endanger tumbling over.

Whatever be the ground that the adverfary's horfe runs worft on, the cunning jockey is to ride the moft violently over; that by this means it will often happen, that in following he either ftumbles or claps on the back finews. The feveral corrections of the hand, the whip, and the fpur, are alfo to be obferved in the adverfary, and in what manner he makes ufe of them: and when it is perceived, by any of the fymptoms, of holding down the ears, or whifking the tail, or ftretching out the nofe like a pig, that the horfe is almoft blown, the bufinefs is to keep him on to this fpeed, and he will be foon thrown out, or diftanced. If the horfe of the opponent looks dull, it is a fign his ftrength fails him; and if his flanks beat much, it is a fign that his wind begins to fail him, and his ftrength will foon do fo too.

After every heat for a plate, there muft be dry ftraw, and dry cloths, both linen and woollen, ready to rub him down all over, after taking off the fweat with what is called a fweat-knife; that is, a piece of an old fword-blade, or fome fuch thing. Some advife the fteeping of the cloths in urine and faltpetre the day before, and letting them be dried in the fun for this occafion. After the horfe has been well rubbed with thefe, he fhould be chafed all over, with cloths wetted in common water, till the time of ftarting again. When it is certainly known that the horfe is good at the bottom, and will ftick at the mark, he fhould be rid every heat to the beft of his performance; and the jockey is, as much as poffible, to avoid riding at any particular horfe, or ftaying for any, but to ride out the whole heat with the beft fpeed he can. If, on the contrary, he has a fiery horfe to ride, and one that is hard to manage, hard-mouthed, and difficult to be held, he is to be ftarted behind the reft of the horfes with all imaginable coolnefs and gentlenefs; and when he begins to ride at fome command, then the jockey is to put up to the other horfes; and if they ride at their eafe, and are hard held, they are to be drawn on fafter; and if it be perceived that their wind begins to rake hot, and they want a fob, the bufinefs is to keep them up to that fpeed; and when they are all come within three quarters of a mile of the poft, then is the time to pufh for it, and ufe the utmoft fpeed in the creature's power.

When the race is over, the horfe is immediately to be clothed up, and rode home; and immediately on his coming into the ftable, the following drink is to be given him. Beat up the yolks of three eggs, and put them into a pint and a half of new milk made warm; let there be added to this three pennyworth of faffron, and three fpoonfuls of fallad-oil, and let the whole be given with a horn. After this he is to be rubbed well down, and the faddle-place rubbed over with warm fack, and the places where the fpurs have touched, with a mixture of urine and falt, and afterwards with a mixture of powder of jet and Venice turpentine; after this he fhould have a feed of rye-bread, then a good mafh, and at fome time after thefe as much hay and oats as he will eat. His legs, after this, fhould be bathed fome time with a mixture of urine and faltpetre.

For the preparation of the horfe before running, &c. fee Plate.

We fhall here obferve, that horfe-races were a fpecies of amufement known in England in very early times. Fitz-Stephen, who wrote in the days of Henry II. records the great delight which the citizens of London took in the diverfion. Races appear likewife to have been in vogue in the reign of queen Elizabeth, and to have been carried to fuch excefs as to have injured the fortunes of the nobility. Lord Herbert of Cherbury (fee his Life by Mr. Walpole, p. 51.) enumerates thefe among the fports which he thought unworthy of a man of honour. "The exercife," fays he, "I do not approve of is running of horfes, there being much cheating in that kind; neither do I fee why a brave man fhould delight in a creature whofe chief ufe is to help him to run away." Jarvis Markham, who wrote on the management of horfes in 1599, mentions running horfes; but at this time there were only private matches made between gentlemen, who were their own jockies, and rode their own horfes. However, in the following reign of James I., public races were eftablifhed; and Garterly, in Yorkfhire, Croydon, near London, and fometimes Theobald's, near Enfield-chace, where the king refided, were the courfes in which they were performed. The horfes at this time were prepared for running by the difcipline of food, phyfic, airing, and fweats and clothing, which compofe the prefent fyftem. The weight alfo which each horfe was to carry was rigidly adjufted; the ufual weight of the riders being ftated at ten ftones, who were put into fcales, and weighed before they ftarted. Moft of the celebrated races in the kingdom were called bell-courfes, the prize and reward of the conquering horfes being a bell. To this purpofe, Camden fays, that in 1607 there were races near York, and the prize was a little golden bell. Upon this Berenger offers a conjecture, whether the phrafe of *bearing the bell*, which implies being comparatively the beft or moft excellent, and correfponds with the expreffion of bearing the palm among the ancients, as a reward decreed to the fwifteft horfe in a race, is not more aptly deduced from this cuftom,

cuftom, than from the method of tying a bell round the neck of the fheep, which leads the flock, and is, therefore, counted the beft.

About the latter end of the reign of Charles I. it was cuftomary to have races performed in Hyde Park. See the Comedy of the Merry Beggars, or Jovial Crew, written in 1641, in Dodfley's Collection of Old Plays.

Racing was much encouraged by Charles II. after his reftoration: he gave public rewards and prizes, and appointed races for his own amufement at Datchet Mead, when he refided at Windfor. But the moft diftinguifhed fpot for thefe exercifes was Newmarket, which was at firft frequented for the purpofe of hunting, and feems not to have been deftined to be a horfe-courfe till fome time before the troubles of the reign of Charles I., when races were difcontinued; but they were revived foon after the Reftoration. The king attended in perfon, and eftablifhed a houfe for his accommodation, and kept and entered horfes in his own name. Inftead of bells, a filver bowl or cup, of the value of a hundred guineas, was allotted for a prize; and upon this royal gift the exploits of the fuccefsful horfe, and his pedigree, were generally engraved. The fum of a hundred guineas is now given in lieu of the filver bowl.

When William III. was advanced to the throne, he not only added to the plates given to different places in the kingdom, but founded an academy for riding. Queen Anne continued the bounty of her predeceffors, with the addition of feveral plates. George I., towards the end of his reign, difcontinued the plates, and gave the fum of a hundred guineas in their room.

In the thirteenth year of George II. an act was paffed for the fuppreffion of races by poneys, and other fmall and weak horfes, by which all matches for any prize under the value of 50*l.* are prohibited, under a penalty of 200*l.*, to be paid by the owner of each horfe running, and 100*l.* by fuch as advertife the plate; and by which each horfe entered to run, if five years old, is obliged to carry ten ftone; if fix, eleven; and if feven, twelve. It is alfo ordained, that no perfon fhall run any horfe at a courfe, unlefs it be his own, nor enter more than one horfe for the fame plate, upon pain of forfeiting the horfes: and alfo every horfe-race muft be begun and ended in the fame day. Horfes may run for the value of 50*l.* with any weight, and at any place. 13 Geo. II. cap. 19. 18 Geo. II. cap. 34. Pennant's Brit. Zool. vol. i. p. 6, &c. Berenger's Hift. and Art of Horfemanfhip, vol. i. p. 185, &c.

We fhall here add, that at Newmarket there are two courfes, the long and the round: the firft is exactly four miles, and about three hundred and eighty yards, *i. e.* feven thoufand four hundred and twenty yards. The fecond is fix thoufand fix hundred and forty yards. Childers, the fwifteft horfe ever known, has run the firft courfe in feven minutes and a half, and the fecond in fix minutes forty feconds; which is at the rate of more than forty-nine feet in a fecond. But all other horfes take up at leaft feven minutes and fifty feconds in completing the firft and longeft courfe, and feven minutes only in the fhorteft, which is at the rate of more than forty-feven feet in a fecond, and it is commonly fuppofed that thefe courfers cover, at every bound, a fpace of ground in length about twenty-four Englifh feet.

RACITZA, in *Geography*, a town of Bukovina; 7 miles N. of Czernaucii.

RACK, a fmall ifland near the coaft of Virginia. N. lat. 37° 19′. W. long. 75° 51′.

Rack, *Lower* and *Upper*, two fmall iflands near the coaft of Virginia; the former in N. lat. 37° 20′. W. long. 75° 50′, and the latter in N. lat. 37° 26′. W. long. 75° 45′.

Rack, an engine of torture furnifhed with cords, &c. for extorting confeffion from criminals.

The duke of Exeter, conftable of the Tower under Henry VI., with the duke of Suffolk, and others, having a defign to introduce the civil law into England; for a beginning, the *rack*, or *brake*, allowed in many cafes by the civil law, was firft brought to the Tower, where it is ftill preferved; in thofe days the rack was called the duke of Exeter's daughter. 3 Inft. 35.

It was occafionally ufed as an engine of ftate, not of law, more than once in the reign of queen Elizabeth. (Barr. 92. 496.) But when, upon the affaffination of Villiers, duke of Buckingham, by Felton, it was propofed in the privy-council to put the affaffin to the rack, in order to difcover his accomplices; the judges being confulted, declared unanimoufly, to their own honour, and the honour of the Englifh law, that no fuch proceeding was allowable by the laws of England. The uncertainty of this punifhment, as a teft and criterion of truth, was long ago very elegantly pointed out by Tully (pro Sulla, 28.); though he lived in a ftate in which it was ufual to torture flaves, in order to furnifh evidence. "Tamen," fays he, "illa tormenta gubernat dolor, moderatur natura cujufque tum animi tum corporis, regit quæfitor, flectit libido, corrumpit fpes, infirmat metus; ut in tot rerum anguftiis nihil veritati loci relinquatur."

The marquis Beccaria (ch. 16.), in an exquifite piece of raillery, has propofed this problem, with a gravity and precifion that are truly mathematical: "the force of the mufcles, and the fenfibility of the nerves of an innocent perfon being given, it is required to find the degree of pain neceffary to make him confefs himfelf guilty of a given crime."

Rack, in the *Manege*, a pace in which a horfe neither trots nor ambles, but fhuffles, as it were, between both.

The racking pace is much the fame as the *amble* (which fee); only that it is a fwifter time, and a fhorter tread.

Rack is alfo a wooden frame, made to hold hay or fodder for cattle. There has lately been much improvement made in the forming of all forts of racks, both for the ftable, cattle-fheds, and field. See Cattle-*fheds*, Stable, and Sheep-*houfe*.

Rack, in *Rigging*, a fhort thin plank, with holes made through it, containing a number of belaying-pins, ufed inftead of cleats; it is feized to the fhrouds, and nailed over the bowfprit or windlafs.—Alfo, a long fhell, containing a number of fheaves, formerly fixed over the bowfprit to lead in the running rigging. At prefent, wooden faddles, with holes in them, are nailed on the bowfprit for this purpofe. being more out of the way, and lefs liable to be out of order, See Shot-*rack*, and Shroud-*rack*.

To Rack *Wines*, &c. is to draw them from off their lees, after their having ftood long enough to clear and fettle. Hence,

Rack-*Vintage*, is frequently ufed for the fecond voyage our wine-merchants ufed to make into France for racked wines; whence they ufed to return about the end of December.

Rack-*Holders*, fuch tenants as hold their lands under fuch leafes.

Rack-*Leafes*, are fuch forts of leafes as are granted for one or more lives, at the full rack rents, as in Cornwall, and fome other counties. See Leases *of Land*.

Rack-*Rent*, is the full yearly value of land let by leafe, payable by tenant for life or years, &c. See Rent.

Rack-

Rack, *Sheep*, a fort of long narrow crib, fixed upon wheels, for containing hay for fheep, having a lid or covering on the top. It is very ufeful in bad weather, in the winter feafon, as preventing the hay from being wafted, and admitting the fheep to feed conveniently.

RACKAMA, in *Geography*, a lake of Syria, fouth of Hella and the ancient Babylon, is about 30 miles long, and flows into the Euphrates.

RACKEBY, a town of Sweden, in Weft Gothland; 40 miles N.E. of Uddevalla.

RACKET, a kind of bat for ftriking the ball at tennis; confifting ufually of a lattice, or net-work, of cat-gut, ftrained very tight over a circle of wood, with a handle or fhaft of a moderate length.

The word is formed from the French *raquette*, which Menage derives from the Latin *retetta*, a diminutive of *rete*, *net*; whence alfo *reticum*, and *reticulum*.

Pafquier obferves, that anciently they ufed no rackets at tennis, but played with the palm of the hand: and hence he conjectures it is that the French call tennis play, *jeu de paume*. He adds, that rackets were not introduced till a little before his time.

Racket is alfo a machine which the favages of Canada bind to their feet, to enable them to walk more commodioufly over the fnow; made much in the manner of a tennis-racket.

Its figure is a lozenge, of which the two obtufe angles are rounded off. It is bound about with very fine thongs of leather, and the mefhes of it are much fmaller and clofer than thofe of our rackets.

In the middle is fitted a kind of fhoe, lined with wool, or hair; to be tied on to the ankle: by which means the feet are prevented from finking in the fnow. Rackets oblige the perfon to take very long fteps, and, as we fay, to walk a great pace, to keep them from knocking againft each other.

Racket, in *Geography*, a river of New York, which runs into the St. Lawrence, N. lat. 45° 13′. W. long. 74° 42′.

RACKIBIRN, the name of a fmall ifland on the N.W. coaft of Ireland, fituated near Tiellen head, in the county of Donegal. N. lat. 54° 39′. W. long. 8° 44′.

RACKING, in *Sea Language*, denotes the faftening of two oppofite parts of a tackle together, fo as that any weighty body fufpended by it fhall not fall down, although the rope, which forms the tackle, fhould be loofened by accident or neglect. This expedient is chiefly practifed when the boats are hung up to the fhip's fide in the night, in an open road or bay, left the rope of the tackle fhould be untied by the inattention of fome of the crew, by which accident the boat might be confiderably damaged, and probably loft or dafhed to pieces. Falconer.

Racking *Fruit Liquor*, the operations of fining and drawing it off. See Cyder.

RACKLIA, in *Geography*, a fmall rocky ifland in the Grecian Archipelago, inhabited by two or three poor monks, who take care of a few fheep and goats. N. lat. 36° 53′. E. long. 25° 38′.

RACKNITZ, a town of the duchy of Carinthia; 3 miles S. of Saxenburg.

RACKOON, or Raccoon, the *urfus lotor* of Linnæus, in *Zoology*, the name by which we commonly know an American animal, called *coati* by the Brafilians. It is fomething fmaller than the beaver, and is of the fhape of the beaver in the body, and its legs are as fhort as in that creature. The face, cheeks, and chin are white; the upper part of the body is covered with hair, long, foft, and thick; black at the ends, whitifh in the middle, and afh-coloured at the root. Sometimes from this mixture of colour the back appears plainly grey; and Maregrave mentions another fpecies, which is of a deep yellow or ochre colour.

The head is very like that of the fox in fhape; but that the ears are fhorter, roundifh, and naked, and it has from the forehead to the nofe a dufky line. The eyes are large, and furrounded with two broad patches of black; the nofe is black and fharp-pointed; its tail is very bufhy, and annulated with black. Its feet are each divided into five flender toes; by the help of which it climbs trees as expertly as a monkey, and ufes the fore-feet as hands, to reach up its food to its mouth. It is a very cleanly animal; and if there be water near, it always wafhes its food, be it what it will, before it eats it. It feeds on vegetables, but is alfo very fond of eggs, and will even feize birds if it can catch them. It is alfo very fond of fweet things and ftrong liquors, and will get exceffively drunk: at low-water it feeds much on oyfters, watching their opening, and with its paw fnatching out the fifh, and is fometimes caught in the fhell. It is very common in the warm and temperate parts of America, in the mountains of Jamaica, and in the ifles of Maria in the South fea, and is a creature eafily tamed. It is hunted for its fkin; the fur, next to that of the beaver, being excellent for making hats. Ray and Pennant.

RACLER, Fr., to fcrape, to rafp, or file a hard body. It is faid, in derifion of a bad performer on the violin, or any other inftrument played with a bow, that he fcrapes or rafps the ftrings; becaufe, in fact, he draws a harfh and difagreeable tone from his inftrument, which refembles that produced by fcraping or filing a hard body. Even good players on the violin fometimes fcrape a little in the *forte* parts of their performance. Suppl. to Encycl., 1ft edit.

RACLERGUNGE, in *Geography*, a town of Bengal; 50 miles N.W. of Burdwan.

RACONIGI, a town of France, in the department of the Stura, containing four gates, with as many fauxbourgs, well peopled. The king of Sardinia had a palace here. The police is conducted by fifteen counfellors, from whom two fyndics are chofen every four months, who act as bailiffs or mayors of the town. It has two parifhes, and feveral religious houfes. The inhabitants are induftrious, and much employed in making gauzes and filk ftuffs; 6 miles N. of Savigliano.

RACOPILUM, in *Botany*, from ῥακος, *a rent in a garment*, or *a wrinkle*, and πιλος, *a hat* or *cap*, the name of one of Paliffot de Beauvois's genera of moffes, whofe veil is torn at the fide. It ought to be written *Rhacopilum*.

RACOUBEA, a name of Aublet's, of which we find no explanation. See Homalium.

RACOW, *Catechifm of*, in *Ecclefiaftical Hiftory*, a fyftem of theology compiled by the moft eminent Socinian doctors, and firft publifhed at Racow, or Rakow, in Poland, in the year 1609, with a dedication to our king James I. This catechifm, or a tranflation of it, was committed to the flames in England, in the year 1653, by order of parliament. A new edition of it, corrected and enlarged, was publifhed at Stauropolis, in 1684. The Socinians confider this catechifm as the great ftandard of Socinianifm, and an accurate fummary of the doctrine of that fect. However, Mofheim obferves, that it is, in reality, no more than a collection of the popular tenets of the Socinians, and by no means a juft reprefentation of the fecret opinions and fentiments of their doctors. Hence he fays it never obtained among them the authority of a public confeffion or rule of faith; and hence the doctors of that fect were authorifed to correct and contradict

tradict it, and to substitute another form of doctrine in its place. But to this account it has been replied, that it would have been inconsistent with the liberty, for which they argue in the preface to this catechism, to have limited their religious inquiries to this standard; and by treating it as a rule of faith, they would have violated their express declarations, that they dictated to no one, and assumed no authority. Mosh. Eccl. Hist. See RAKOW.

RACSON-COMPON, in *Geography*, a mountain of Thibet. N. lat. 31° 50'. E. long. 86° 14'.

RADA, a town of Sweden, in Warmeland; 33 miles N. of Carlstadt.—Also, a town of Sweden, in Warmeland; 35 miles S.E. of Carlstadt.—Also, a town of Sweden, in West Gothland; 5 miles W. of Gothenburg.—Also, a river of Westphalia, which runs into the Ocker, 5 miles N.E. of Goslar.

RADANAGUR, a town of Hindoostan, in Bahar; 32 miles E. of Ramgur.

RADANI, a town of Sweden, in West Gothland; 16 miles N. of Uddevalla.

RADAR, a town of Persia, in the province of Chorasan; 48 miles N. of Meschid.

RADASALMI, a town of Sweden, in the province of Savolax; 20 miles N.N.W. of Nyslot.

RADAVITZA, a town of Prussia, in the palatinate of Culm; 22 miles E.S.E. of Culm.

RADAUN, a town of Austria; 6 miles W.S.W. of Vienna.

RADAUTZ, or RADENTZ, a town of Bukovina; 22 miles W.S.W. of Saczava.

RADAWAIR, a town of Hindoostan, in Candeish; 14 miles S.W. of Burhanpour.

RADBUZA, a river of Bohemia, that rises in the S.W. part of the circle of Pilsen, and runs into the Miza, near the town of Pilsen.

RADCLIFFE, JOHN, in *Biography*, an eminent and eccentric physician, was born at Wakefield, in Yorkshire, where his father possessed a moderate estate, in the year 1650. He received the rudiments of his classical education at a school in that town; and at the age of 15, was sent to complete his studies at University college, in Oxford. He took his bachelor's degree in arts in 1669, and removed to Lincoln college, where he was elected to a fellowship. Having determined upon the profession of physic, he went through the courses of botany, chemistry, and anatomy, and was distinguished by the rapidity of his attainments in all these pursuits. Nevertheless he did not apply with zeal or industry to the studies of the closet, and recommended himself rather by his vivacity, acuteness, and wit, than by any extraordinary acquisitions in any department of knowledge. In the prosecution of his medical inquiries, he contented himself with looking into the works of Dr. Willis, who was at that time practising in London with much reputation. He was possessed, indeed, of very few books; insomuch that when Dr. Bathurst, head of Trinity college, asked him once with surprise where his study was? he pointed to a few vials, a skeleton, and a herbal, and said, "Sir, this is Radcliffe's library." He took the degree of master of arts in 1672, and in 1675 he proceeded bachelor of medicine, and immediately began to practise in Oxford. He professed to pay very little regard to the rules which were generally followed, but censured them on many occasions with great freedom and acrimony; a conduct which did not fail to draw upon him the enmity of all the old practitioners. Nevertheless his reputation and his practice rapidly increased; and before he had been two years in the world, he was very generally consulted, even by those of the highest rank. About this time, in consequence of some witticisms, which he had launched with his accustomed freedom against Dr. Marshall, rector of Lincoln college, the latter unkindly opposed his application for a dispensation for taking holy orders, which the statutes required, if he retained his fellowship, and shewed other tokens of incivility; which induced Radcliffe to resign his fellowship, quit the college, and take lodgings in the town. He continued to practise at Oxford, increasing alike in wealth and reputation, until 1684, having taken the degree of doctor in 1682; and he then determined to remove to London, and settled himself in Bow-street, Covent Garden.

His success in the metropolis was unusually rapid; and doubtless his wit and pleasantry, which rendered him a most entertaining companion, contributed scarcely less than his reputed skill in his profession to forward his progress. In less than a year he was in full practice; and in the second year, he was appointed physician to the princess Anne of Denmark. In 1688, when prince George of Denmark joined the prince of Orange, and the princess retired to Nottingham, in a state of pregnancy, he was pressed by bishop Compton to attend her, in quality of his office; but he excused himself on account of the multiplicity of his patients. After the revolution, he was consulted by king William and the nobility about his court; an honour which he must have owed entirely to his high reputation, for he never shewed any inclination to be a courtier. By his rough independence of spirit and freedom of language, indeed, he ultimately lost all favour at court. In 1699, when king William returned from Holland in a state of severe indisposition, he sent for Radcliffe, and shewing him his swollen ankles, while the rest of his body was emaciated, said, "What think you of these?"—"Why truly," replied the physician, "I would not have your majesty's two legs for your three kingdoms." This freedom was never forgiven by the king, and no intercessions could ever recover his favour towards Radcliffe. In 1694, when queen Mary caught the small-pox, and died, Radcliffe was accused, bishop Burnet says, of negligence and unskilfulness. He soon afterwards lost the favour of princess Anne, by neglecting to obey her call from his too great attachment to the bottle, and another physician was appointed in his place. When queen Anne came to the throne, the earl of Godolphin exerted all his endeavours to reinstate him in his former post of chief physician; but she refused, alleging that Radcliffe would send her word again, "that her ailments were nothing but the vapours." Nevertheless he is said to have been consulted in all cases of emergency, in a private way. In 1703 Dr. Radcliffe had an alarming and dangerous attack of pleurisy, which he neglected, and increased in the outset by drinking a bottle of wine: he had, however, 100 ounces of blood taken from him by Mr. Bernard, the serjeant surgeon; and the next day, in spite of all intreaties, was carried to Kensington. His escape was almost miraculous. The queen asked Mr. Bernard how he did? and when he told her that he was ungovernable, and would observe no rules, she answered, that then nobody had reason to take any thing ill from him, since it was plain he used other people no worse than he used himself. During this illness he made a will, by which he disposed of the greater part of his property for charitable purposes, appropriating particularly several thousand pounds for the relief of sick seamen set on shore. He recovered, however, and continued in full occupation in his profession, increasing in wealth and insolence to the end of his days, and waging a perpetual war with his brethren; who, in their turn, represented him as an active, ingenious, adventuring empiric, whom constant practice

practice had brought at length to fome fkill in his profeffion. His caprice in the performance of his profeffional duties appears to have been unbounded; and many anecdotes are related of his refufal to attend on perfons of diftinction, if he happened to be engaged in pleafant company, or had any perfonal pique againft the individuals, or if he conceived himfelf in any way affronted. Thus he fet off fuddenly for Bath in 1704, while attending the lady of fir John Trevor, becaufe that gentleman fent to Oxford for Dr. Breach to confult with him; which he had done as a compliment to Radcliffe, rather than join any of the London phyficians with him. When Mr. Harley was ftabbed by Guifcard, Swift complains, that by the caprice of Radcliffe, who would allow none but his own furgeon to be admitted, "he had not been well looked after;" and adds in another place, "Mr. Harley has had an ill furgeon, by the caprice of that puppy Dr. Radcliffe, which kept him back fo long." On the other hand, he attended the lady of fir John Holt in a bad illnefs, with unufual diligence, out of pique to the hufband, who was not fuppofed to be over fond of her. In the laft illnefs of queen Anne, he was fent for to his country-houfe at Carfhalton about noon, by order, as one account affirms, of the privy council; but he returned an anfwer, that "he had taken phyfic, and could not come." It has been ftated, however, on the other hand, that he was only fent for on this occafion by lady Marfham, without any order from the queen or the council; which is countenanced by the following circumftances. On the 5th of Auguft, four days after the queen's death, a friend of the doctor's moved in the houfe of commons, that he might be fummoned to attend in his place, (Dr. Radcliffe had been elected a member for Buckingham in 1713,) in order to be cenfured for not attending on her majefty. A letter is preferved, faid to have been written by the doctor to one of his friends, on this occafion, in which he fays, "I know the nature of attending crowned heads in their laft moments too well, to be fond of waiting upon them, without being fent for by a proper authority. You have heard of pardons being figned for phyficians before a fovereign's demife; however, ill as I was, I would have went to the queen in a horfe-litter, had either her majefty, or thofe in the commiffion next to her, commanded me to do fo." Whatever was the true ftate of the cafe, it is certain that Dr. Radcliffe became fo much the object of popular refentment, that he was apprehenfive of being affaffinated, as appears from a letter addreffed by him to Dr. Mead, which is extant. "Nor fhall I be at any time from home," he fays, "becaufe I have received feveral letters, which threaten me with being pulled to pieces, if ever I come to London." He furvived the queen but three months, and died at Carfhalton, on the 1ft of November 1714, at the age of 64. It was believed, that the dread which he had of the populace, and the want of company in his retirement, which he did not dare to leave, contributed to accelerate his death. He was carried to Oxford, and buried in St. Mary's church in that city.

It does not appear that Dr. Radcliffe ever attempted to write, and probably he would not have fucceeded as an author. He was believed, indeed, to have been very little converfant with books; which made Dr. Garth humoroufly fay, that "for Radcliffe to inftitute a library, was as if an eunuch fhould found a feraglio." He was often the fubject of the attacks of ridicule from poets and wits, and even was not fpared on the ftage; having been feverely fatirized in a piece acted in 1704, foon after a legal difpute with an apothecary, which was attended by the ladies of the court, and in which the paffages affronting the doctor were much applauded. Swift, in Martinus Scriblerus, and Steele in the Tatler, levelled their ridicule at the doctor; and the following fevere portrait of him was drawn by Dr. Mandeville, in his Effay on Charity Schools. "That a man with fmall fkill in phyfic, and hardly any learning, fhould by vile arts get into practice, and lay up great wealth, is no mighty wonder; but that he fhould fo deeply work himfelf into the good opinion of the world as to gain the general efteem of a nation, and eftablifh a reputation beyond all his contemporaries, with no other qualities but a perfect knowledge of mankind, and a capacity of making the moft of it, is fomething extraordinary. If a man arrived to fuch a height of glory, fhould be almoft diftracted with pride, fometimes give his attendance on a fervant, or any mean perfon, for nothing, and at the fame time neglect a nobleman that gives exorbitant fees; at other times, refufe to leave his bottle for his bufinefs, without any regard to the quality of the perfons that fent for him, or the danger they are in:—if he fhould be furly and morofe, affect to be a humourift, treat his patients like dogs, though people of diftinction, and value no man but what would deify him, and never call in queftion the certainty of his oracles:—if he fhould infult all the world, affront the firft nobility, and extend his infolence even to the royal family:—if, to maintain as well as to increafe the fame of his fufficiency, he fhould fcorn to confult with his betters on what emergency foever, look down with contempt on the moft deferving of his profeffion, and never confer with any other phyfician but what will pay homage to his fuperior genius, creep to his humour, and never approach him but with all the flavifh obfequioufnefs a court flatterer can treat a prince with:—if a man in his life-time fhould difcover, on the one hand, fuch manifeft fymptoms of fuperlative pride, and an infatiable greedinefs after wealth at the fame time; and on the other, no regard to religion, or affection to his kindred, no compaffion to the poor, and hardly any humanity to his fellow-creatures:—if he gave no proofs that he loved his country, had a public fpirit, or was a lover of arts, of books, or of literature:—what muft we judge of his motive, the principle he acted from, when after his death we find that he has left a trifle among his relations, who ftood in need of it, and an immenfe treafure to an univerfity that did not want it."

Whatever may be the motives of the endowers of fplendid inftitutions for the public ufe, the nation is at all events benefited for ages, by fuch noble eftablifhments as the library and infirmary which he founded at Oxford, and which bear his name. He alfo endowed two travelling fellowfhips, with an annual income of 300*l.* attached to each. He had previoufly caufed the beautiful eaft window, over the altar, in Univerfity college, to be put up at his own expence; and likewife given the money, which was paid for the erection of the mafter's lodge there, making one fide of the eaftern quadrangle. He was certainly avaricious to the extent almoft of fpunging, and never could be induced to pay bills without much following and importunity. A piece of waggery would fometimes conquer this difpofition. A pavior, after long and fruitlefs attempts, once caught him juft getting out of his chariot, at his own door, in Bloomfbury fquare, and fet upon him. "Why, you rafcal," faid the doctor, "do you pretend to be paid for fuch a piece of work? Why, you have fpoiled my pavement, and then covered it over with earth to hide your bad work."—"Doctor," faid the pavior, "mine is not the only bad work the earth hides."—"You dog you," faid the doctor, "are you a wit? You muft be poor; come in:" and he paid him. He told Dr. Mead, that the great fecret by which he might make his fortune was to "ufe all mankind ill." Dr. Mead, however, adopted the contrary axiom, and fucceeded even beyond his advifer. Notwithftanding that Radcliffe feems to have literally practifed this principle, in his dealings both with his patients and his brethren; and notwithftanding the fevere accufations of ignorance and empiricifm, which were every where levelled againft him; the univerfal reputation, which he acquired and maintained, feems to fanction the teftimony of Dr. Mead, that "he was defervedly at the head of his profeffion, on account of his great medical penetration and experience." See Atterbury's Epiftolary Correfpondence. The Richardfoniana. Pope's Works, vol. vii. Swift's Works, vol. xix. Hutchinfon's Biographia Medica.

RADDELE, in *Geography*, a town of Ceylon, on the eaft coaft; 5 miles N.E. of Trincoli.

RADDINSDORP, a town of the duchy of Holftein; 6 miles E.S.E. of Eutyn.

RADDLE, in *Agriculture*, a red ochre of iron, which, according to Dr. Darwin, has been found ufeful as a manure in the northern parts of Staffordfhire. Its properties have not, however, been yet chemically examined as they relate to manure. See REDDLE.

RADEBURG, in *Geography*, a town of Saxony, in the margraviate of Meiffen; 10 miles N.E. of Drefden. N. lat. 51° 8'. E. long. 13° 53'.

RADECHAU, a town of Bohemia, in the circle of Konigingratz; 9 miles S.E. of Trautenau.

RADEGATZ, a town of Germany, in the principality of Anhalt-Deffau; 13 miles S.S.W. of Deffau.

RADEGURRY, a town of Hindooftan, in Canara; 24 miles S.S.E. of Mangalore.

RADENTHAL, a town of the duchy of Carinthia; 13 miles E. of Saxenburg.

RADERAN, a town of Bohemia, in the circle of Kaurzim; 3 miles N.E. of Kaurzim.

RADERMACHIA, in *Botany*, a name originally given to the Bread-fruit, (fee ARTOCARPUS,) by Thunberg, in honour of one of his great patrons, Joachim Cornelius Matthew Radermacher, a member of the Dutch council, and Prefident of the Society of Sciences, at Batavia. The author, in his Nova Genera, p. 25, reprefents this gentleman as a moft diftinguifhed Mæcenas, and encourager of Natural Hiftory. Neverthelefs, the above name has, by common confent, given way to the expreffive one of Forfter, *Artocarpus*, which is precifely fynonimous with Bread-fruit.

RADERSBERG, in *Geography*, a town of Germany, in the principality of Culmbach; 7 miles E. of Bayreuth.

RADES, a town of Tunis, on the N.E. coaft; 5 miles S.E. of Tunis.

RADESCHE, or RATSCHACH, a town of Lower Carniola, on the Save; 10 miles N.W. of Gurckfeld.

RADHA, in *Mythology*, is the name of the confort of the Hindoo deity Krifhna. As Krifhna was an avatara, or incarnation of Vifhnu, fo Radha is underftood to be fimilarly an avatara of Vifhnu's confort Lakfhmi; thus incarnated to accompany her lord in this, his moft fplendid terreftrial manifeftation. Under the articles KRISHNA and LAKSHMI fome notice will be found on the fubject of this. Radha is feen very frequently pourtrayed and alluded to in the paintings and writings of India: Krifhna is, indeed, feldom feen without her. She is reprefented of perfect beauty, and is warmly celebrated in the amatory poetics of Hindooftan. In the elegant work of Jayadeva, entitled Gita Govinda, a paftoral drama exhibiting the loves of Krifhna and Radha, the lovely nymph is thus defcribed after a quarrel with her frolickfome and fickle lord, in the morning after the night of reconciliation, when affiction ceafed, and ecftacy crowned the recollection of paft forrows. "In the morning fhe arofe, difarrayed, and her eyes betrayed a night without flumber, when the yellow-robed god, who gazed on her with tranfport, thus, in his heavenly mind, meditated on her charms: 'Though her locks be diffufed at random; though the luftre of her lips be faded; though her garland and zone be fallen from their enchanting ftations; and though fhe hides their places with her hands, looking towards me with bafhful filence; yet, even thus difarrayed, fhe fills me with ecftatic delight.' But Radha, preparing to array herfelf before the company of nymphs could fee her confufion, fpake thus with exultation to her obfequious lover.

'Place, O fon of Yadu! with fingers cooler than fandal wood, place a circlet of mufk on this breaft, which refembles a vafe of confecrated water, crowned with frefh leaves, and fixed near a vernal bower to propitiate the god of love. Place, my darling! the gloffy powder, which would make the blackeft bee envious, on this eye, whofe glances are keener than arrows darted by the hufband of Reti. (See RETI.) Fix, O accomplifhed youth! the two gems, which form part of love's chain, in thefe ears, whence the antelopes of thine eyes may run downwards and fport at pleafure. Place now a frefh circlet of mufk, black as the lunar fpots, on the moon of my forehead; and mix gay flowers on my treffes with peacock's feathers, in graceful order, that they may wave like the banners of Kama. Now replace, O tender hearted! the loofe ornaments of my vefture; and refix the golden bells of my girdle on their deftined ftation, which refembles thofe hills where the god with five fhafts, who deftroyed Sambara, keeps his elephant ready for battle.' While fhe fpake, the heart of Yadava triumphed; and obeying her fportive behefts, he placed mufky fpots on her bofom and forehead; dyed her temples with radiant hues: embellifhed her eyes with additional blacknefs; decked her braided hair, and her neck, with frefh garlands; and tied on her wrifts the loofened bracelets, on her ankles the beamy rings, and round her waift the zone of bells, that founded with ravifhing melody."

But we muft recollect, fays the author of the Hindu Pantheon, whence this article is chiefly taken, that the feemingly amorous conflicts of thefe ardent lovers are mere myftical defcriptions of "the reciprocal attraction between the divine goodnefs and the human foul." This is the emblematical theology that Pythagoras admired and adopted; that the Sufi poets, Hafez, Sadi, and many others among the Perfians, and Solomon alfo, in his fine Song, fo beautifully inculcates. Like the enthufiafts of other days, and in a manner not eafily comprehended by the unenlightened, nor believed by them to be permanently chafte, however innocent its commencement, "they profefs eager defire, but without carnal affection; and circulate the cup, but no material goblet: in their fect, all things are fpiritual, all is myftery within myftery." See fir W. Jones's admirable Effay on the Myftical Poetry of the Perfians and Hindoos, in the third volume of the Afiatic Refearches, in which a tranflation of the Gita Govinda of Jayadeva is introduced. Under the article JAYADEVA of this work is a brief notice of his poem; and under MAHESA is an extract from it, defcriptive of the perfons and loves of this interefting couple. (See alfo PRABHA.) The reader defirous of feeing what has been faid and believed on the curious fubject of myftical or emblematical theology, may confult our articles under MYSTERY, MYSTICS, and thofe thence referred to.

Returning to Radha, we have to obferve that among the fect of Gokalaftha (fee SECTS *of Hindoos*) fhe is deemed a perfonification of religion, and fometimes called *Rukmeni*. (See

(See that article.) There is a fect faid to worfhip her exclufively, and called Radha-ballabhi: they confider her as the Sakti, or active power of Vifhnu or Krifhna. (See SAKTI.) The followers of this fect have afcribed to them the fingular practice of making their own wives perfonate Radha, and of prefenting to or through them the oblations propitiating the goddefs, or Lakfhmi, of whom, as before faid, fhe is an incarnation. There is no end to the whimficalities in the modes of human worfhip, to give them no harfher name, wherever, to ufe an oriental expreffion, we fuffer our necks to flip out of the collar of reafon. Thus in India, as hath been the cafe in other countries, there is, with feveral fects, a *right-handed* and a *left-handed* mode of worfhip; one meaning a decent, the other an indecent mode. Thofe among the fect in queftion, who follow the left-handed path, require their wives to be naked, when attending them at their devotional abominations. She is fometimes called Radhika, and Krifhna, Radhikefwara, or lord of Radhika; and fometimes the name of Kantamati is given both to her and Rukmeni. See RUKMENI and YONI.

In Radha may be recognized the Grecian Juno, and of courfe in her hufband Krifhna, or Vifhnu, the amorous Jove of that imitative race. On this point we fhall quote a paragraph from the Edinburgh Review, N° xxxiv.

"We tranflate a paffage from the Purana, entitled Brahma Vaivartica, to demonftrate the identity of character afcribed to Jupiter and Vifhnu; only premifing, that in conformity to the peculiar tenets of its author, Vifhnu is here ftiled Krifhna, and his goddefs, Rādhā. Gangā (the Ganges) was originally a nymph of wonderful beauty, who inhabited Paradife. She became enamoured of Krifhna, and, concealing her face with her robe, ftood immoveable in his prefence, her eyes fixed on his radiant countenance. The jealoufy of Rādhā (Juno) was excited. Followed by her innumerable attendants, fhe repaired to the prefence of the god, and feated herfelf on her throne of gems. The timid Gangā trembled at her afpect, and diffolved with terror. The goddefs fpeaks: "Who is this nymph, lord of the univerfe, who, with half concealed vifage, and eyes fparkling defire, thus gazes on thy facred perfon? This is not the firft time the fkies have witneffed the infidelity of their lord. When I detected thee dallying in a grove of fandal with Viraja, the figure of a quadruped concealed thy fhame, and fhe was changed into a river. Still purfued by thee fhe became the mother of the mighty ocean. The fame foreft was the fcene of thy amours with the nymph Sobhā, (beauty). Again thou affumedft the form of an animal; whilft her fpirit fled to the moon, and thou divideft her body amongft gems, flowers, and black-eyed damfels. The woods of Vrindavan afforded thee a retreat with the fhepherdefs Prabha (luftre.) On my arrival, her fpirit tranfmigrated to the folar orb; of her body thou madeft a diftribution: the god of fire obtained a part; and fome, as gold, give brightnefs to the crowns of the kings of the earth. When I found thee, unexpectedly, on a bed of vernal buds, reclined in company with the fair Xamā (patience), alarmed at my voice, thou gatheredft as they lay difperfed, thy yellow robes, thy lyre, thy necklace of flowers, and thy creft of gems. Thee I forgave when thou beftowedft a portion of her body on the pious anchoret, a portion on the fick, and a portion on the ftudious."

Such of our readers as have obtained a fhare in the latter portion, may, in the endeavour to expound this folar allegory, be repaid perhaps for ther pains; in perufing the Gita Govinda and the article in which it is comprifed, above referred to, they affuredly will.

RADHIKA, a name of *Radha*, confort of the Hindoo deity *Krifhna*, as fufficiently noticed under thofe articles.

RADHOST, in *Geography*, a mountain of Moravia, in the circle of Prerau; 12 miles E. of Meferitch.

RADHUA, a mountain of Arabia; 30 miles W. of Medina.

RADIÆUS, in *Anatomy*, an epithet applied to parts about the radius, and equivalent to *radialis;* which fee.

RADIAL CURVES. See CURVES.

RADIALIS, in *Anatomy*, a name given to parts in the fore-arm, fituated near the radius. The adjective *radial* is alfo employed to denote the edge, furface, or afpect of any part, which is towards the radius; and in this way, with the term *ulnar*, affords the means of defcribing the organs much more accurately and intelligibly, than the indefinite expreffions of *outer* and *inner*, which vary conftantly in the changing attitudes of the limb.

RADIALIS *Arteria*, is the artery of the wrift, in which the pulfe is commonly felt. See ARTERY.

RADIALIS *Carpi Extenfor*, *Longior & Brevior*. See CARPI.

RADIALIS *Carpi Flexor*. See CARPI.

RADIALIS *Externus*, *Longior & Brevior*, fynonyms of the extenfores carpi radiales, longior & brevior. See CARPI.

RADIALIS *Internus*, a fynonym of the flexor carpi radialis. See CARPI.

RADIALIS *Nervus*. The large nerve which goes behind the humerus, between two heads of the triceps, is called radial by fome anatomifts: others give this name to the nerve which lies parallel to and over the brachial artery. The firft of thefe is called alfo the mufcular fpiral nerve, the fecond the median. See NERVE.

RADIALIS *Vena*, the vein correfponding to the radial artery. See VEIN.

RADIANT HEAT. See HEAT.

RADIANT *Point*, or *Radiating Point*, is any point of a vifible object, whence rays proceed.

Every radiant point diffufes innumerable rays all round; but only thofe radiants are vifible, from which right lines may be drawn to the pupil; becaufe the rays are all right lines.

All the rays proceeding from the fame radiant continually diverge; the cryftalline collects or reunites them again.

RADIATED, in *Botany*, an epithet applied to round flat flowers, confifting of a difk, and a fingle row of longifh pointed leaves, ranged all around it in manner of rays, or fpokes.

Radiated flowers are properly fuch as have feveral femi-florets fet round a difk, fo as to refemble a radiant ftar: fuch are daifies, chamomile-flowers, fun-flowers, &c. Thefe are fometimes alfo called *radiated difcous flowers*.

A radiated flower has two parts; its middle part, which is called the difk, and which is wholly made up of flofcules; and the other part, which is called the circle or border, which is wholly made up of femi-flofcules, or elfe of plain flat leaves; but that is lefs common. The flofcules and femi-flofcules both ufually adhere to the embryos, and to the thalamus of the flower, being contained in one general cup. Thefe embryos finally ripen into feeds; fometimes furnifhed with down, fometimes with foliaceous heads, and fometimes without either, and fometimes marginated. Of thefe feeds fome are wrapped round with a kind of cafe or capfule, others are feparated from one another by fmall perpendicular leaves.

RADIATED *Leaf*. See LEAF.

The word is alfo ufed in fpeaking of medals, and in heraldry,

heraldry, where the ancient crowns are called radiated crowns, coronæ radiatæ. See CROWN.

RADIATION, in *Physics*, the action of a body diffusing rays of light as from a centre.

Every visible body is a radiating body; it being only by means of its rays that it affects the eye.

The surface of a radiating body may be conceived as consisting of radiant points.

RADIATION, *Place of*. See PLACE.

RADIATION, or *Irradiation*, is also used by some authors to express the manner of the motion of the animal spirits; on a supposition that they are diffused from the brain towards all parts of the body, through the little canals of the nerves, as light is from a lucid body. But in lieu of a radiation, the moderns rather incline to the opinion of the circulation of the spirits.

RADICAL, RADICALIS, in *Physic*, &c. something serving as a basis or foundation; or which, like a *root*, is the source or principle whence any thing arises.

The schools talk much of a radical moisture inherent in the seeds of all animals, which nourishes and preserves the vital heat or flame, as oil does a lamp; and which, when exhausted, life is extinguished.

Dr. Quincy observes, that this radical moisture is a mere chimera; unless we thereby mean the mass of blood, which is the promptuary whence all the other juices and humours are derived; and which, while it circulates, sustains life, &c.

In grammar, we use the term, radical words, for roots and primitives; in opposition to compounds and derivatives. In the Hebrew language, the letters of the alphabet are divided into *radical* and *servile*. The first constitute primitive or original words, which, by a significant metaphor, are called roots, שרשים. All the 22 letters of the alphabet may be radicals; *i. e.* primitive words may consist of any of these letters; but the following 11 letters properly claim this title, because they can never be *serviles*; *viz.* ג, ד, ז, ח, ט, ס, ע, פ, צ, ק, ר. Of whatever letters any word consists, it must at least contain one of a radical character. (See ROOT.) For an account of the servile letters, see SERVILE.

RADICAL *Numbers*, *Numeri Radicales*, in the Italian music, are 2, 3, 4, 5, 6, 7, 8, 9, and sometimes 10, which are often met with in musical compositions, to denote the accords of the thorough basses: 2 stands for the second and its duplicates; 3 for the third; 4 for the fourth, &c.

RADICAL *Leaf*, among *Botanists*. See LEAF.

RADICAL *Sign*, in *Algebra*, the sign or character of the root of a quantity.

$\sqrt{}$ is the character of radicality, and expresses the square root;

$\sqrt[3]{}$ the cube root, &c.

RADICANS, in *Botany*, rooting, a term applied to a stem which throws out fibres as it extends itself, whether those fibres be true radicles, by which the plant imbibes nourishment, and is generally increased; or whether they serve only for the support of the stem against walls, rocks, or neighbouring trees. Of the first kind, the Strawberry affords a familiar example; of the latter, the Ivy, the Virginian Creeper (*Hedera*, or rather *Vitis, quinquefolia*), and the *Bignonia radicans*, are instances.

RADICATION, the action by which plants take root, or shoot out roots.

The French Royal Academy of Sciences have made a great number of curious observations on the germination and radication of plants.

RADICLE, in *Agriculture*, that part of the seeds of plants which, upon vegetating, becomes their nascent roots. It is, in fact, the main organ or medium of nutrition, and the means by which food is imbibed or drank up from the surrounding soil or earth. The radicles, together with the leaves, therefore, constitute the *absorbent* organ of plants. See RADICULA, and ROOT.

RADICOFANI, in *Geography*, a town of Etruria, near which are two castles, one built by Didier, last king of the Lombards, and the other by Cosmo I.; 55 miles S. of Florence.

RADICONDOLI, a town of Etruria; 24 miles N.E. of Florence.

RADICULA, in *Botany* and *Vegetable Physiology*, the radicle, or fibre of the root. (See ROOT.) This term is used by Dillenius, in his Nova Genera, 121. t. 6, as a generic name, for a set of plants referred by Linnæus to SISYMBRIUM. See that article.

RADII *Pronator Quadratus*, in *Anatomy*, a muscle of the fore-arm. See PRONATOR.

RADII *Pronator Teres*. See PRONATOR.

RADII *Supinator Brevis*, } muscles of the fore-arm. See
RADII *Supinator Longus*, } SUPINATOR.

RADII *Pinnarum*, in *Ichthyology*, the little slender bones supporting the membrane, forming the fins in fishes, and called by Artedi ossicula radiata pinnarum, from their running from the base to the summit in the form of rays. See FIN, and *Anatomy of* FISH.

RADIMPOUR, in *Geography*. See RADUNPOUR.

RADIOLA, in *Botany*, so called by Dillenius, because the cells of the ripe capsule spread like the rays of a little wheel. The plant having been referred by Linnæus to the genus *Linum*, the above became its specific name; but it is now restored to the rank of a genus by the late professor Gmelin of Gottingen, as well as by the author of Flora Britannica.—Dill. Nov. Gen. 126. t. 7. Gmel. Syst. Nat. Linn. v. 2. 289. Sm. Fl. Brit. 201. Prod. Fl. Græc. Sibth. v. 1. 110. Ait. Hort. Kew. v. 1. 282.—Class and order, *Tetrandria Tetragynia*. Nat. Ord. *Gruinales*, Linn. *Caryophyllaceæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, cut about half down into four equal, permanent, wedge-shaped segments, each of which is three-cleft. *Cor.* Petals four, obovate, about the length of the calyx, alternate, with its principal segments. *Stam.* Filaments four, awl-shaped, erect, the length of the calyx; anthers roundish, of two lobes. *Pist.* Germen superior, roundish, with four grooves; styles four, terminal, very short; stigmas capitate. *Peric.* Capsule roundish, bluntly five-sided, of eight cells and eight valves. *Seeds* solitary, elliptical, compressed, very smooth.

Eff. Ch. Calyx in many segments. Petals four. Capsule superior, with eight valves and eight cells. Seeds solitary.

1. R. *millegrana*. Thyme-leaved Flax-seed. Engl. Bot. t. 893. (R. vulgaris serpyllifolia; Dill. in Raii Syn. 345. t. 15. f. 3. Jacob. Faversh. 92. Linum Radiola; Linn. Sp. Pl. 402. Fl. Dan. t. 178. Linocarpum Serpylli folio, multicaule et multiflorum; Mich. Gen. 23. t. 21. Millegrana minima; Raii Syn. ed. 2. 207. Ger. Em. 569. Chamælinum vulgare; Vaill. Parif. t. 4. f. 6.) — Native of sandy ground, overflowed by clean fresh water, throughout Europe, flowering in July and August; but not a very general English plant. The *root* is annual, small, and fibrous. *Stem* an inch or two high, repeatedly forked, corymbose, spreading, leafy, round, nearly smooth, many-flowered, often reddish. *Leaves* opposite, sessile, ovate, entire, smooth, scarcely a quarter of an inch long. *Flowers* small, white, on short, simple, solitary stalks from the forks of the stem.—Gmelin has erred considerably in

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the generic character and name, as well as in his reference to Linnæus. The *calyx* is many-cleft, not composed of four distinct leaves; the plant has hardly any thing of the aspect of a *Linum*, and therefore cannot properly be called *linoides;* neither has it been published as a genus, under the name of *Radiola*, by Linnæus, as Gmelin's reference to the 12th edition of Syst. Nat. indicates.

RADIOMETER, a name which some writers give to the *radius astronomicus*, or Jacob's staff. See FORE-STAFF.

RADISH, in *Botany*. (See RAPHANUS.) The radish is much grown, according to the author of the Agricultural Survey of the County of Kent, on the best rich loamy soils of the Isle of Thanet, and in East Kent, for the supply of the London seedsmen. The sorts usually cultivated for this use are, the early short top, the salmon, and the turnip-rooted radish.

The land for the growth of this sort of crop should be in a fine state of preparation, by being ploughed to a great depth in the early part of the winter, and broken well down by harrowing, so as to render it perfectly clean from weeds, being previously filled with well reduced manure. The ground being brought into this fine condition, the seed is sown on furrows about ten inches apart, in a dry time in the month of March, about two or three gallons *per* acre. And as soon as the plants appear, every other row is cut up with a horse-hoe, leaving the rows twenty inches apart. When the plants get two or three rough leaves, they are hoed out in rows, and are then kept clean by repeated horse and hand-hoeing, when necessary, leaving the plants at about eighteen inches distance. It is added, in the above Report, that the crop is seldom fit to reap till October, and sometimes is out in the fields till Christmas, without receiving injury from wet weather; it being necessary that it should have much rain to rot the pods, that it may thrash well. In respect to the produce, it is from eight to twenty-four bushels *per* acre: and it is sold to the London seedsmen, who send it to all parts of the kingdom for retailing to the gardeners.

It is probable that this sort of crop might be grown in many other districts near the metropolis, or other large towns, with equal success, where the soil is of a rich loamy nature, as it is very easy in its culture, and requires but little labour or trouble. As it is necessary for it to remain out such a length of time, however, it will be proper, especially in wet seasons, to keep the stems from falling too much upon the ground, as they and the seed may be injured by being too much in contact with it. If kept up in this way, the stalks, seed-husks, and other offal parts, may also form a good cut food for some sorts of live-stock, as is the case with some other similar sorts of crops.

RADISH, *Horse*. See COCHLEARIA *Armoracia*.

RADIUS, in *Anatomy*, that bone of the fore-arm which extends from the humerus to the wrist, in the line carried from the external condyle of the former bone to the thumb. See EXTREMITIES.

RADIUS, *Dislocations and Fractures of*. See FRACTURE and LUXATION.

RADIUS, in *Botany* and *Vegetable Physiology*, means the aggregate marginal florets, of compound flowers, each generally of an oblong form, and all spreading from the centre, or disk, like rays. Such are the white florets of the Daisy, and blue, purple or red ones, for the most part, of the *Aster*. The usual shape of the limb or border of such florets is ligulate; either linear, or elliptical; rarely, as in *Achillea*, short and roundish; the extremity having three or five teeth. In some compound flowers the *radius* consists of tubular florets, as in *Centaurea;* and those are neuter, destitute of organs of fructification. The ligulate radiant florets above-mentioned are either female, producing perfect seed; or they are abortive, with more or less imperfect traces of a pistil. Many of them have no signs of a style or stigma, but none is without so much of a germen, as serves for the basis, that supports the petal itself.

A radius is occasionally assumed by some flowers, naturally destitute of one, as in the genus *Bidens*, each species of which, by such an acquisition, becomes a *Coreopsis*, and changes its order in the *Syngenesia*, from *Polygamia æqualis*, to *P. superflua*. This change is an approach towards a double flower, in that class; being a transformation of a certain number of the perfect, or united, florets into female ones. If such a transformation be total, and all the tubular florets become ligulate, the whole flower is double, and unproductive of seed, like the double Chamomile.

RADIUS, *Ray*, in *Geometry*, the semidiameter of a circle; or a right line drawn from the centre to the circumference.

The word is derived from the Greek ῥαβδος, *rod*. Fleta uses the word radius, for a furrow.

The radius is also called, especially in trigonometry, *sinus totus;* the whole sine.

It is implied in the definition of a circle, and it is apparent from its construction, that all the radii of the same circle are equal.

RADIUS, in the *Higher Geometry*, *Radius of the evolute*, *Radius curvedinis*, or *Radius osculi*, called also the radius of concavity and the radius of curvature, is a right line representing a thread, by whose evolution from off the curve on which it was wound, the curve is formed: or it is the radius of a circle that has the same curvature in a given point of a curve with that of the curve in that point. See CURVATURE and EVOLUTE, under which articles the method of finding this radius may be seen.

RADIUS *Astronomicus*, an instrument usually called Jacob's staff, the cross-staff, or fore-staff.

RADIUS, in *Optics*. See RAY.

RADIUS, in *Mechanics*, is applied to the spokes of a wheel; because issuing like rays from its centre.

RADIUS *Vector*, is also used for a right line drawn from the centre of force in any curve in which a body is supposed to move by a centripetal force, to that point of the curve where the body is supposed to be. See CENTRAL *Force*.

RADIUS, among the Romans, a name given to the iron rod with which the boys rolled the trochus.

RADIUS *Articulatus*, in *Natural History*, a name given by Mellius, Gmelin, and some other authors, to a kind of figured fossils, of which there are a great many very different species, some of which have been described by authors among the belemnitæ, under the names of alveoli belemnitarum. Mr. Gmelin, who has taken great pains to inform himself, as well of the nature and figure of these stones, from the subjects themselves, as of their history, and the various accounts of them from other authors, observes, that the place where they are most frequent is Sweden, and that there they are no where so common as in the isle of Oeland. Volkman figures some also which he found in Silesia, and Helwing others which he collected in Prussia: he also found great numbers of them himself in Russia.

They are usually immersed in lime-stone, and though at first sight they may all appear alike, yet, on a careful examination, they will be found to differ very greatly. The most obvious general distinction, established by Gmelin, is that some of them are straight, and others crooked. The straight ones may be divided into two genera. The first of these comprehend, according to this gentleman, two species; the first smooth, and with a converging alveolus.

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The regular and nice configuration of theſe bodies ſhews very plainly that they cannot be of mineral origin; but the ſeveral patellæ of which each is compoſed, the ſiphunculus of communication, obvious in ſeveral, and the ſhelly matter yet found remaining on many, prove them to have been once ſhell-fiſh of the univalve or tubular concamerated kind; the deſcription of which, ſo far as it can be gathered from theſe remains, muſt have been this. The ſhell muſt have been either cylindric or conic in figure, of a ſmooth ſurface, and divided into ſeveral chambers or cells; but this ſo that the ſepta which form the concamerations are not continued and whole, but in ſome part of the periphery are cut in, in the ſhape of a creſcent. Through theſe creſcents, which, ſtanding all together, make a continued canal, there has paſſed another ſhelly body of a cylindric or conic figure, alſo divided into concamerations, and that in ſuch a manner, that the ſepta which form the cells are pierced with a ſmall aperture on one ſide, which grows gradually ſmaller as the ſhell extends in length; and finally, through theſe apertures, in the concamerations, there paſſes another ſhell pointed at the end, and, like the reſt, divided into its concamerations, and pierces along its middle with a ſiphunculus. Mem. Acad. Petrop. vol. iii. p. 263.

This ſhell is, therefore, a compages of three ſhelly bodies, encloſed one within another; and, it muſt be ſuppoſed, in order to carry an analogy with other ſhell-fiſh, theſe three ſhelly bodies have communication with one another, by means of certain ſtips or perforations. The communication of theſe, one with another, ſeems all evident, from their being all found in their foſſile ſtate, filled with the ſame ſtony matter; this has, doubtleſs, been all received in at the ſiphunculus of the inner ſhell, and thence has been thrown into the ſecond, and from this into the third ſhell, ſo as to fill up all the concamerations of the outer, as well as of the inner parts. This muſt have been the caſe with theſe; and the ſeveral various ſpecies that are at this day found foſſile, muſt have owed their origin to as many different ſpecies of the ſhells. The crooked and twiſted, or wreathed kinds, which have the ſiphunculus uſually placed near the ſide, greatly approach in their ſtructure to ſome of the cornu ammonis.

RADIX, in *Botany* and *Vegetable Phyſiology*. See Root.

Radix is uſed among ſome anatomiſts for the ſole of the foot.

Radix *Carlo Sancto*; this root is found in temperate ſoils, in Mechoacan, a province of America. Its bark is eaſily ſeparated from it, is of an aromatic ſmell, and of a bitter and ſomewhat acrid taſte. The root itſelf conſiſts of very ſlender fibrils, which are eaſily ſeparated from each other. The bark is accounted ſudorific, and corroborates the ſtomach and gums: if chewed, it procures an agreeable breath. It is good for ſcurvies, catarrhs, epilepſies, haſtening deliveries, and removing hernias, and the ſmall-pox, if taken either in powder or in the form of a decoction. The Spaniards have called it by the name of St. Charles, on account of its uncommon virtues.

Radix *Entrochorum*, the root of the entrochi, a name given by ſome authors to a foſſile ſubſtance, uſually found among the entrochi, and ſeeming to have been the baſis from which they have grown. It is plainly a part of the ſtella marina arboreſcens petrified, as thoſe ſtones alſo are. This foſſile is rarely found whole, but the fragments of it are very common. When entire, it is about the ſize of a walnut; the top of it being flat, and in ſome degree reſembling the end of an entrochus, with a central hollow, but not having the leaſt appearance of the rays of thoſe ſtones. Theſe foſſils, though not properly judged of as to their origin, have yet been deſcribed by a great number of authors. Agricola, in particular, compares the form of them to a wheel. The body of this kind well reſembles indeed the nave of a wheel, the ſhape of it being conical toward one end, till you come to the top, and then a little flattened, with a hole in it. There is alſo a like hole in the oppoſite broad end of the ſame foſſil, ſeeming fit for an axle to paſs through; and there are five hollow ſtilts, or feet, iſſuing ſideways, at equal diſtances from the broad bottom, and equally carried on in the ſame direction, ſo as not amiſs to repreſent the ſpokes. At the end of each of theſe rays or ſpokes, there is a hollow, of the ſame nature with thoſe in the middle of the common entrochi, but this is cut acroſs, by a ſeam, or ſtreak of the ſame ſtone, which paſſes directly over its centre, and covers about a third part of it; this goes no farther than the mouth of the hole, but it cuts it into two, and ſhews it in the form of two eyes. Theſe radii or ſpokes are very ſeldom found ſo perfect as here deſcribed. Liſter mentions them as being formed like creſcents at the end, which may very eaſily happen from the breaking off a part of the terminating portion. Phil. Tranſ. N° 129.

Radix *Alba*, a word uſed by Dioſcordes, to expreſs the root of the dracunculus.

Radix, among *Grammarians*. See Radical, and Root.

Radix, in *Mathematics*, the ſame as root; but uſed in a different ſenſe by different authors: we ſay the *root* of an equation, but the *radix* of a ſyſtem of logarithms, the *radix* of a ſeries, the *radix* of notation, &c. meaning in all theſe caſes the fundamental quantity on which the ſyſtem is conſtructed, or that whence it has been derived, or that by means of which all other things of a like kind are compared.

Radix *of a Syſtem of Logarithms*, is that number which involved to the power denoted by the logarithm, is equal to that number. Thus, under the article Logarithms it is ſhewn, that if $r^x = a$, then x is the logarithm of a, and r is called the radix of the ſyſtem. This radix in the common or Briggs's logarithms, is 10, and in the Neperian or hyperbolic logarithms, it is 2.71828128, &c. and generally the radix of any ſyſtem of logarithms, is that number whoſe logarithm in that ſyſtem is unity.

Radix *of a Syſtem of Notation*, is that number which indicates the local value of the figures, and is in all ſyſtems repreſented by a unit and cipher (10), which is *ten* in the common ſyſtem, *two* in the binary ſyſtem, *three* in the ternary, *twelve* in the duodenary, and ſo on. See Notation.

Radix *of a Series* is uſed, by ſome authors, as a term of compariſon between any finite function, and its expanſion or developement: thus, the radix

$$\text{of } 1 - r + r^2 - r^3 + r^4 \text{ \&c. is } \frac{1}{1+r}$$

$$\text{of } 1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} \text{ \&c. is } \frac{1}{1+\frac{1}{2}}$$

$$\text{of } 1 - 1 + 1 - 1 + 1 \text{ \&c. is } \frac{1}{1+1}$$

$$\text{of } 1 - 2 + 4 - 8 + 16 \text{ \&c. is } \frac{1}{1+2}$$

$$\text{of } \frac{1}{2} - \frac{1}{4} + \frac{1}{8} - \frac{1}{16} + \frac{1}{32} \text{ \&c. is } \frac{1}{2+1}$$

$$\text{of } 1 + x + x^2 + x^3 + x^4 \text{ \&c. is } \frac{1}{1+x}$$

of

of $1 + 2x + 3x^2 + 4x^3 + 5x^4$ &c. is $\frac{1}{(1-x)^2}$

of $1 + \frac{x^2}{2} + \frac{3x^4}{8} + \frac{5x^6}{16} +$ &c. $\sqrt{\frac{1}{1-x}}$

See Dr. Hutton's Tracts, vol. i. p. 9. See alfo our article SERIES.

RAD-KNIGHTS. See REDMANS.

RADL, in *Geography*, a mountain of Stiria; eight miles S.S.W. of Landfperg.

RADLER SEE, a lake of Carinthia; fix miles N. of Saxenburg.

RADLSTEIN, a town of the duchy of Carnolia; fix miles W. of Landftrafs.

RADLSTHAL, a town of Auftria; nine miles E. of Krottau.

RADMANS. See REDMANS.

RADMANSO, in *Geography*, a fmall ifland in the Baltic, near the coaft of Sweden. N. lat. 59° 45'. E. long. 18° 44'.

RADNAGUR, a town of Bengal; 32 miles S. of Burdwan.

RADNITZ, a town of Bohemia, in the circle of Pilfen; 10 miles N.E. of Pilfen.

RADNOR, NEW, or *Maes-Yfed*, a borough and market-town in the cwmwd of Swydd Wynogion, Cantref y Clawdd, (now called the liberties of the town of New Radnor,) county of Radnor, South Wales, is fituated near the river Somergill, at the diftance of feven miles N.W. from Kington, and 156 miles W.N.W. from London. In remote times, this town was a place of great importance, as appears from its having given name to the county, but it has now dwindled into comparative poverty and infignificance. Caradog informs us, that about the year 990, Meredydd ab Owain deftroyed Radnor, in a ferocious conteft with his nephew, who had been affifting the Englifh to ravage South Wales. It recovered, however, from this difafter, and continued to flourifh till the union of Wales with England, when it began to decline, in confequence of its ceafing to be fortified and garrifoned as a frontier town. Before that period, it was furrounded by a lofty wall, and a deep moat, fome remains of which are diftinctly vifible on the weft and fouth fides. The walls, when ftanding, are traditionally faid to have been of great height. The area inclofed by them was an oblong fquare, containing about twenty-fix acres of ground, laid out into three longitudinal ftreets, which were interfected by five tranfverfe ones. Of thefe at prefent feveral have no buildings; and others are only foot paths. But though thus decayed, Radnor ftill preferves its privileges as a borough. The corporation confifts of a bailiff, twenty-five capital burgeffes, two aldermen, a recorder, a coroner, a town-clerk, and other inferior officers. The bailiff and aldermen are chofen annually from among the capital burgeffes, and are juftices of the peace. The bailiff of the preceding year is alfo a juftice of the peace; and there are befides three additional perfons nominated out of the capital burgeffes, who are invefted with fimilar authority. The diftrict over which they prefide, and fuperfede the jurifdiction of the county magiftrates, is confiderable; comprehending a circle round the town nearly ten miles in diameter. The bailiff's courts and the petty feffions are regularly held every Monday, when the bailiff, aldermen, and town-clerk attend to tranfact bufinefs relating to the borough, and have power to determine all fuits for fums under forty fhillings. The quarter-feffions for the borough are held on the Mondays after the county quarter-feffions at Prefteigne; and the fheriff's county courts for the recovery of fmall debts, are holden every alternate month here, and at the town laft mentioned. The reprefentative for the borough is chofen by the burgeffes of New Radnor, in conjunction with thofe of the boroughs of Knighton, Rhaiadar, Cefn Llys, and Cnwclas; the bailiff being the returning officer. As nothing but the circumftance of receiving parochial relief difqualifies any perfon from becoming a burgefs, the number of voters is confiderable; thofe of New Radnor are fuppofed to exceed 300, and the whole number, including thofe of the contributary boroughs, is eftimated to be about 1300. To be a capital burgefs of New Radnor, however, actual refidence within the jurifdiction is effential, which is not the cafe as to the contributary boroughs: and if a capital burgefs becomes non-refident he lofes his privileges as fuch. A benefit fociety, eftablifhed here in 1778, at prefent confifts of above 100 members, who hold their annual meetings on the 6th of January.

Weekly markets were formerly held here on Tuefdays, but thefe are, at prefent, only nominal, notwithftanding fome late attempts to reftore them. There are ftill, however, five annual fairs, and there is alfo an annual wake on the third Sunday in the month of Auguft. The parifh of Radnor is divided into three portions, of which the town of New Radnor is the principal, containing, according to the parliamentary returns of 1811, 75 houfes, and 380 inhabitants. The public buildings here are the town-hall, the prifon, and the church. The laft confifts of a nave, fouth aifle, and chancel, with a tower at the weft end.

Radnor caftle ftood on an eminence commanding the town. Of this once majeftic pile, a few fragments of walls only remain, but the entrenchments are ftill entire; the outer ward, called Baili-Glas, or the Green Court-Yard, is yet diftinct from the inner one, or keep, and is nearly in its original form. In 1773, on digging within the area of this caftle, fix or feven fmall "Gothic arches of good mafonry were difcovered," befides a variety of ancient inftruments. The foreft of Radnor extends feveral miles to the north of the town, covering the flope of a lofty eminence, from the fummit of which are very extenfive profpects. The principal feats in the vicinity are Downton-hall, the feat of Percival Lewis, efq. and Harpton-court, a feat belonging to Thomas Frankland Lewis, efq. Both thefe manfions are furrounded by beautiful fcenery, and are highly ornamental to this diftrict. About two miles weftward from the town is a celebrated water-fall, called Water-break-its-neck, feventy feet in perpendicular height; but it is extremely defective in water, except during the time of floods, when the effect produced is truly grand. At the weftern extremity of the parifh is an intrenched dyke, which formerly extended acrofs the whole vale of Radnor. War-clofe, a field to the eaftward of the town, is traditionally faid to have been the fcene of fome military conteft, but no particulars refpecting it are preferved.

Old Radnor, or *Pen-y-Craig*, is a fmall village, fituated about three miles to the fouth of New Radnor. Camden fuppofes it to have been the Magnos of Antoninus, which was garrifoned by the Phacienfian regiment in the reign of Theodofius the younger; and there feems every reafon to believe that it was a place of note in the Romo-Britifh period. The Roman road paffed clofe to the bafe of the hill upon which the village ftands. The church here is a venerable old edifice of ftone, with a maffive fquare tower at one end. A curious fcreen, richly carved in wood, extends acrofs the nave and fide aifles. Here are various monuments to the memory of members of the Lewis family of Harpton. Carlifle's Topographical Dictionary of Wales, 4to. 1813. Lipfcomb's Tour through Wales.

Radnor, a small pleasant town of America, in Delaware county, Pennsylvania. The place was originally called "Amstel" by the Dutch, who began to build here. The number of inhabitants is 925.

Radnor, a town of South Carolina; 10 miles S.W. of Edmondsbury.

RADNORSHIRE, an inland county of South Wales, is bounded on the north by the counties of Montgomery and Salop, on the east by the county of Hereford, and on the south and west by the counties of Brecknock and Cardigan. According to Mr. Clark, it contains 510 square miles, or 346,000 acres, and is politically divided into six hundreds, and fifty parishes; some of which are within the diocese of Hereford, and the remainder within that of St. David's. The parliamentary returns of 1811, state the number of its houses at 4194, and of its inhabitants at 20,900. It sends two members to parliament; one for the county, and one for the borough of New Radnor, with its contributary boroughs. The face of the country is extremely mountainous and bleak in every part of it, but it is intersected by several vallies, which are watered by the Wye, the Teme, the Lugg, the Ithan, the Eddow, and their respective subsidiary streams. These vallies afford a considerable extent both of meadow and arable land; especially the Vale of Wye-Side, and the Vale of Radnor, some portions of which are very fertile, and have a good soil and a congenial climature. In the other parts of the county, however, a barren soil, and a chilly atmosphere, are the predominant characteristics. Nearly two-thirds of its whole extent being either in a state of commonage, or lying wholly waste, agriculture has hitherto made little comparative progress here. Cattle and sheep consequently constitute the chief produce of the county. The number of the latter is indeed very great. Hence Radnorshire is famed for its supply of wool; but notwithstanding this circumstance, singular to say, the manufacture of woollen goods is totally disregarded. The raw material is sold to the manufacturers of the north, by whom the inhabitants of this county are in return furnished with cloth.

Radnorshire contains three market-towns; Presteigne, Rhaiadar, and New-Radnor. The market at the last, however, is only nominal. The county courts are held at Presteigne, which is now the most important and flourishing town in the county. (See Presteigne.) The chief remain of antiquity within its limits is Offa's Dyke, which commencing at the river Wye, near Hay, skirts the counties of Radnor and Hereford, and passes into Montgomeryshire at Pwll-y-Pyod, a hamlet on the road between Bishop's-castle and Newtown. The only religious house in the county was the abbey of Cwm Hir, founded in 1143, for monks of the Cistertian order, by Cadwathelan-ap-Madoc, which, at the dissolution, was valued at 28*l.* 17*s.* 4*d.* *per annum*. Of this monastery a considerable part of the buildings is yet standing, though in a very ruinous and dilapidated condition. Leland, in his Itinerary, (vol. v. p. 13.) speaks of its church as the longest in Wales, and informs us, that it was "spoiled and defaced by Owen Glendowr." The principal castles in Radnorshire were those of Colewine, Tynbont, Aberhedow or Aber-Edwy, Ewenlles, Radnor, Rhaiadar, and Pain's-castle. Several antiquaries, among whom are Camden, Gale, and Ward, place the Roman station Magnos, or Magna, at Old Radnor, as is mentioned above; but Baxter contends that it should be fixed at Ledbury, in Herefordshire, and Harris at Gaer, near Brecknock. In this county, particularly on the summit of Gwastedin hill, are several of those collections of stones called in South Wales *karneu*, in North Wales, *karnedheu*, in Scotland, *cairns*, and in Ireland, *duns*.

Radnor was erected into an earldom by Charles II., in the person of John Robarts, lord Robarts of Truro, but that title became extinct in 1757. It was revived, however, in 1765, in the person of William Bouverie, baron Longford, and viscount Folkstone, whose son Jacob, now earl of Radnor, enjoys his privileges. General View of the Agriculture of the County of Radnor, by John Clark, 4to. Skrine's Tours in Wales. Camden's Britannia. Pennant's Tour in Wales, 8vo.

RADNOTH, a town of Transylvania, on the river Maros; 23 miles W. of Scherburg.

RADOE, a small island in the North sea, near the coast of Norway. N. lat. 60° 35′.

RADOFFIN, a town of Moravia, in the circle of Iglau; 21 miles E. of Iglau.

RADOLFZELL, or Ratolfzell, or *Zell*, a town of Germany, in Austrian Swabia; situated on the Untersee, or lake of Lille; 10 miles N.W. of Constance.

RADOM, a town of Poland, in the palatinate of Sandomirz; 50 miles N.N.W. of Sandomirz.

RADOMISCHL, a town of Bohemia, in the circle of Prachatitz; four miles N. of Strakonitz.

RADOMISL, a town of Poland, in the palatinate of Lublin; 45 miles S. of Lublin.—Also, a town of Poland, in the palatinate of Kiev; 56 miles N.W. of Kiev.

RADOMSK, or Radomiski, a town of Poland, in the palatinate of Siradia; 32 miles S.E. of Siradia.

RADONITZ, a town of Bohemia, in the circle of Saatz; 13 miles W.S.W. of Saatz.

RADOSCHITSCH, a town of Poland, in the palatinate of Sandomirz; 20 miles N.E. of Malogocz.

RADOSKU, a town of Prussia, in the palatinate of Culm; 10 miles W. of Lautenburg.

RADSTADT, a town of the archbishopric of Salzburg; 36 miles S.S.E. of Salzburg.

RADT *vor dem Walde*, a town of the duchy of Berg, where Roman Catholics, Lutherans, and Calvinists, have, each of them, a church; 25 miles E. of Dasseldorp.

RADULA. See Raspatory.

RADUNPOUR, or Radimpour, in *Geography*, a town of Hindoostan, in the country of Agimere, on the river Puddar, or Butlass; 171 miles N. of Surat. N. lat. 23° 58′. E. long. 71° 48′.

RADZANOW, a town of the duchy of Warsaw; 30 miles N.E. of Ploczko.

RADZIECZOW, a town of Poland, in the palatinate of Belcz; 24 miles W. of Belcz.

RADZIEJOW, or Rodschowa, a town of Poland, in the palatinate of Brzestye; 25 miles W. of Brzestye.

RADZIVILOW, a town of Lithuania; 50 miles E.N.E. of Minsk.

RADZYMIN, a town of the duchy of Warsaw; 12 miles N. of Warsaw.

RAEMSDONCK, or Ramsdonck, a small but strong place of Brabant; three miles E. of Gertrudenberg.

RAEPOUR, a town of Hindoostan, in the circar of Gohud, on the Jumnah; 38 miles E.N.E. of Lahaar.

RAERDORP, a town of Holland; five miles N.E. of Amsterdam.

RÆTVIK, a calcareous mountain of Sweden, the height of which is estimated by Bergman at 6000 feet above the sea, observing also, as a singularity, that upon this mountain, and that of Rodaberg, are found vast blocks of reddish felspar, mingled with quartz and brown mica.

RAFAEL, Cape, a cape on the E. coast of the island of Hispaniola. N. lat. 19° 2′. E. long. 69° 46′.

Rafael, *St.*, a town of South America, in the province of of Caraccas; 40 miles S. of Caraccas.—Alſo, a town of South America, in the province of Moxes; 210 miles E. of Santa Cruz de la Sierra la Nueva.—Alſo, a town of New Navarre; 105 miles S.W. of Caſa Grande.

RAFAH, a town of Egypt; 57 miles N.E. of Catieh.

RAFALSO, a ſmall iſland in the gulf of Finland. N. lat. 60° 20′. E. long. 26° 12′.

RAFFAELLE DA URBINO, in *Biography*. See RAPHAEL.

RAFFLING, a ſort of game with three dice, in which he who throws the greateſt pair, or pair royal, in three caſts, wins the prize or ſtake.

The word probably comes from the baſe Latin, *rieſlare, to rifle, plunder, take all away*.

The raffle is properly the doublet or triplet: a raffle of aces, or duces, carries it againſt mere points.

RAFFLING is alſo uſed when a company of perſons club to the purchaſe of a commodity, or make ſmall depoſits, amounting in the whole to its full value; and he that throws the higheſt on three dice, or who has the higheſt number by means of balls thrown on a bagatelle or porto-bello table, takes it.

RAFICA, in *Geography*, a town of Aſiatic Turkey, in the government of Diarbekir; three miles S. of Raca.

RAFLUNDA, a town of Sweden, in the province of Skone; 17 miles S. of Chriſtianſtadt.

RAFNIA, in *Botany*, a genus of plants, ſeparated from the Linnæan *Crotalaria* and *Liparia*, augmented with ſeveral new ſpecies from the Cape, and named by its author, profeſſor Thunberg, in the ſecond part of the preface to his Prodromus Plantarum Capenſium. De Theis is completely in the dark as to the perſon commemorated in this name, who can be no other than Mr. C. G. Rafn of Copenhagen, author of a Flora of Denmark and Holſtein, in the Daniſh language, publiſhed in the years 1796 and 1800, in octavo, making two volumes, which include the firſt ten claſſes of the Linnæan ſyſtem. We know not whether any more has appeared. The ſame botaniſt has written a work on the phyſiology of plants; and ſeveral papers for the Academy of Sciences at Copenhagen. See Sims and Konig's Ann. of Bot. v. 1. 6.—Thunb. Prodr. 123. præf. n. 48. Willd. Sp. Pl. v. 3. 949. Ait. Hort. Kew. v. 4. 261.—Claſs and order, *Diadelphia Decandria*. Nat. Ord. *Papilionaceæ*, Linn. *Leguminoſæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, of one leaf, bell-ſhaped, five-cleft, ringent; the upper lip in two broadiſh diſtant ſegments; lower divaricated, in three acute ones, the middle one ſmalleſt. *Cor.* Papilionaceous. Standard large, heart-ſhaped, acute, ſpreading, depreſſed at the ſides. Wings ovate, about half as long as the ſtandard. Keel acute, the length of the wings. *Stam.* Filaments ten, all united into a linear tube, ſplit along the baſe; five of them rather the ſhorteſt; anthers ſimple. *Piſt.* Germen ſtalked, linear; ſtyle ſimple, bent upwards at nearly a right angle; ſtigma obtuſe. *Peric.* Legume ſtalked, oblong-lanceolate, compreſſed, of one cell and two valves. *Seeds* ſeveral, ſtalked, roundiſh-kidney-ſhaped.

Eſſ. Ch. Stamens all united. Calyx ringent; upper lip divided; lower divaricated, in three ſegments, the middle one ſmalleſt. Legume ſtalked, lanceolate, compreſſed.

Obſ. The firſt ſpecies in Willdenow, *perfoliata*, *Crotalaria perfoliata* of Linnæus, figured in Smith's Inſects of Georgia, v. 2. t. 67, is *Baptiſia perfoliata* of Brown, in Ait. Hort. Kew. v. 3. 5, a genus adopted from Ventenat, and belonging to the *Decandria Monogynia*.

1. R. *amplexicaulis*. Orbicular Rafnia. Thunb. Prodr. 123. Willd. n. 2. (Crotalaria amplexicaulis; Linn. Sp. Pl. 1003. Geniſta perfoliata, orbiculatis foliis; Seb. Theſaur. v. 1. t. 24. f. 5. *Linn.*)—Leaves reticulated, orbicular, claſping the ſtem, alternate; the floral ones oppoſite, coloured.—Native of the Cape of Good Hope. A ſmooth, handſome, branched *ſhrub*, clothed with entire *leaves*, from one to two inches acroſs, finely reticulated with innumerable veins; the upper ones, which accompany the *flowers*, ſmaller, and pale yellowiſh. *Flowers* ſolitary, nearly ſeſſile, yellow, ſmaller than the floral leaves.

2. R. *elliptica*. Elliptical Rafnia. Thunb. ibid. Willd. n. 3, excluding the reference to Andrews.—Leaves ſlightly veined, elliptic-ovate, acute, alternate; the floral ones oppoſite, not longer than the flowers.—Native of the Cape. Confounded by Linnæus with the foregoing, from which it differs in having much ſmaller *leaves*, ſeſſile, not claſping the ſtem, quite deſtitute of reticulated veins. *Flowers* of a deeper yellow, as long as the floral leaves.

3. R. *cuneifolia*. Wedge-leaved Rafnia. Thunb. ib. Willd. n. 4. (Spartium ovatum; Berg. Cap. 197.)—Leaves obovate, ſomewhat wedge-ſhaped. Branches angular. Flowers racemoſe, terminal.—From the ſame country. *Stem* arboreſcent. *Branches* rather angular, ſtriated, ſmooth. *Leaves* numerous, alternate, ovate, pointed, ſucculent, ſmooth, above an inch long; contracted at the baſe, and tapering down into broad *footſtalks*. *Flowers* purpliſh-yellow, in terminal, corymboſe cluſters. *Bergius.*

4. R. *triflora*. Three-flowered Rafnia. Thunb. ib. Willd. n. 5. Ait. n. 1. Venten. Malmaiſ. t. 48. (Crotalaria triflora; Linn. Sp. Pl. 1004. Curt. Mag. t. 482. Borbonia cordata; Andr. Repoſ. t. 31, excluding the ſynonym.)—Leaves ovate, ſmooth. Branches angular. Stalks ſingle-flowered, three together. Native of the Cape, where it was gathered by Sparrmann and Thunberg, and from whence its ſeeds were ſent to Kew garden, in 1786, by Mr. Francis Maſſon. The plant is biennial, requiring to be ſheltered in winter, and flowering in June and July. *Stem* branched, about a yard high, moſt leafy in the upper part, ſmooth, and of a glaucous green, as well as the *leaves*, which are numerous, alternate, almoſt ſeſſile, more or leſs ovate, but varying in ſize and breadth. *Flowers* abundant at the ſummits of the branches, large, yellow, axillary, ſtalked, three together, the floral leaves ſmaller than the reſt, and often tinged with purple.

5. R. *oppoſita*. Oppoſite-leaved Rafnia. Thunb. ib. Willd. n. 6. (Crotalaria oppoſita; Linn. Suppl. 322. Liparia oppoſita; Linn. Syſt. Veg. ed. 13. 554. Spartium capenſe; Sp. Pl. 995. Cytiſus capenſis; Berg. Cap. 217.)—Leaves elliptic-lanceolate; the upper ones moſtly oppoſite. Flowers lateral, on ſhort ſolitary ſtalks.—Native of the Cape, apparently unknown in our gardens. Linnæus and his ſon confounded many different things under this ſpecies, ſome of which being marked in their herbarium as having been gathered by Thunberg, we preſume to be among thoſe he has defined; yet it is not poſſible to determine them all by his ſhort characters, ſeveral of which unfortunately contradict the ſpecific names. The *ſtem* of the preſent is deſcribed by the younger Linnæus as ſimple, he conſidering as *flower-ſtalks* the copious, alternate, leafy *branches*, three or four inches long, on which one or two pair of the lower *leaves* are oppoſite; the proper floral leaves, like thoſe of the ſtem, being alternate: all the *leaves* are elliptic-lanceolate, or ſomewhat obovate, acute, entire, ſingle-ribbed, an inch or more in length. *Flowers* either lateral or axillary, among the uppermoſt leaves, ſolitary, each on a ſimple *ſtalk* about the length of its *calyx*. *Corolla* yellow, not half ſo large as the laſt ſpecies.

6. R. *axillaris*. Axillary Rafnia. Thunb. ib. Willd. n. 7.

n. 7.—"Leaves lanceolate, alternate or oppofite. Flowers terminal."—This and all the following were gathered by profeffor Thunberg, at the Cape. In the Linnæan herbarium is a fpecimen, by whom gathered does not appear, which feems to anfwer to the above character, (except the *leaves* being linear-lanceolate,) and which may perhaps explain the paradoxical contrariety between the fpecific name and character. In this fpecimen the *flowers* are really *terminal*, being folitary at the ends of copious, fhort, leafy, lateral *branches*, which are *axillary*. The whole *foliage* has a Hyffop-like afpect.

7. R. *angulata*. Angular Rafnia. Thunb. ib. Willd. n. 8.—"Leaves lanceolate, alternate. Flower-ftalks lateral. Stem angular."

8. R. *fpicata*. Spiked Rafnia. Thunb. ib. Willd. n. 9.—"Leaves lanceolate, alternate. Flowers axillary, racemofe."—Of this fpecies alone, it feems, Willdenow had feen a dried fpecimen, and we regret that he did not give us fome account of it.

9. R. *anguftifolia*. Narrow-leaved Rafnia. Thunb. ib. Willd. n. 10.—"Leaves lanceolate, alternate. Flower-ftalks lateral. Stem round."

10. R. *filifolia*. Thread-leaved Rafnia. Thunb. ib. Willd. n. 11.—"Leaves linear-lanceolate, alternate. Flowers axillary."—The Linnæan herbarium contains two fpecimens, fpecifically different, which we prefume belong to this and the laft, but no human fagacity can appropriate them; except that one of them, with large and feemingly purplifh *flowers*, having rather the narroweft *leaves*, may be taken for *filifolia*. This is marked as gathered by Thunberg. The other has much fmaller and yellow *flowers*. The *ftem* is round in both.

11. R. *retroflexa*. Bent Rafnia. Thunb. ib. Willd. n. 12.—"Leaves obovate. Branches reflexed backwards and forwards."—A fpecimen from Thunberg anfwers to the above name and character, except the *leaves* being rather linear-lanceolate than obovate. Their colour is fomewhat glaucous. *Flowers* moftly terminal, folitary, on fhort *ftalks*, with an awl-fhaped *bractea*, or abortive leaf, at the bafe of each ftalk.

12. R. *erecta*. Upright Rafnia. Thunb. ib. Willd. n. 13.—"Leaves oblong. Flowers lateral. Stem erect."

13. R. *diffufa*. Proftrate Rafnia. Thunb. ib. Willd. n. 14.—"Leaves ovate, fmooth. Stem decumbent."

All the fpecies turn more or lefs black in drying. For *Rafnia retufa* of Ventenat, Malmaif. t. 53, fee TEMPLETONIA hereafter, and Ait. Hort. Kew. v. 4. 269.

RAFSO, in *Geography*, a fmall ifland on the E. fide of the gulf of Bothnia. N. lat. 61° 37′. E. long. 21° 12′.

RAFSUND, a town of Sweden, in the province of Jamptland; 28 miles S.E. of Frofon.

RAFT, in *Sea Language*, a fort of float formed by an affemblage of various planks, or pieces of timber, faftened together fide by fide, fo as to be conveyed more commodioufly to any fhort diftance in a harbour or road, than if they were feparate. The timber and planks, with which merchant-fhips are laden in the different parts of the Baltic fea, are attached together in this manner, in order to float them off to the fhipping.

This means of conveying timber to navigable fituations may be advantageoufly practifed in many places. It is found of great utility in many of the northern parts of the ifland as well as others, near canals and waters, where a cheap conveyance for fuch articles is required.

The balfa or catamaran ufed by the Indians and Spaniards in South America, is only a raft made of the trunks of the balfa; for an account of which, fee the article BOAT. They have one maft, on which is hoifted a large fquare fail; and a pair of fheers, whofe heels reft on each fide the raft. When a fore-ftay fail is fet, a pair of fheers is rigged forward. Thefe rafts were the firft conveyance by water, no doubt, long before veffels of a better conftruction were thought of; and what is rather furprifing, they are made to fail with foul winds, and fteer, as well as any other kind of veffel, by means of an invention fimilar to, and perhaps the original of, that which is now called "a fliding-keel." They have for this purpofe planks about ten feet long, and fifteen to eighteen inches wide, which flide vertically in the fpaces between the trunks which form the raft. It is only neceffary to immerge them more or lefs, and put down a greater or lefs number at the fore or after part of the raft, to make it either luff-to, or fall-off from the wind, tack, veer, lie-too, and perform every neceffary manœuvre. The number of thefe planks is five or fix, and if one of thefe planks be drawn up forward, the raft will keep away; and, if one is raifed abaft, it will come to the wind. This fort of raft, from the fimplenefs of its conftruction, might perhaps be well adapted to many cafes of emergency, after fhipwreck upon coafts, deftitute of all other materials for fhipbuilding.

RAFT-*Port*, in a *Ship*, a fquare hole cut through the futtocks of fome fhips, immediately under the counter, to receive the planks or pieces of timber which are brought to lade her for tranfportation; and which, on account of their great length, could not be received aboard otherwife.

RAFTERING, in *Agriculture*, a provincial term ufed for a fort of ploughing in narrow ridges, or fmall ridglets. It is ufeful for expofing a large furface of earth to the influence of the atmofphere.

RAFTERS, in *Building*, are pieces of timber, which, ftanding by pairs on the reafon-piece or raifing-piece, meet in an angle at the top, and form the roof of a building.

It is a rule in architecture, that no rafters fhould ftand farther than twelve inches from one another.

For the fizes or fcantlings of rafters, it is provided by act of parliament, that *principal* rafters from 12 feet 6 inches to 14 feet 6 inches long, be 5 inches broad a-top, and 8 at the bottom, and 6 inches thick. Thofe from 14, 6, to 18, 6 long, to be 9 inches broad at the foot, 7 a-top, and 7 thick. And thofe from 18, 6, to 21, 6, to be 10 inches broad at the foot, 8 a-top, and 8 thick.

Single rafters, 6 feet 6 inches long, to be 4 and 3 inches in their fquare.

RAFTY, a provincial term fignifying damp and mufty, as corn or hay in a wet feafon.

RAG, or RAKE, among *Hunters*, denotes a company or herd of young colts.

RAG, or *Ragg*, *Rowley*, in *Mineralogy*. See FERRILITE.

RAG, a torn piece of cloth of any fort. See the next article.

RAGS, *Woollen*, as well as the clippings of pitch marks upon fheep, are good manure. The rags fhould be chopped fmall, about an inch or two fquare, and fcattered on the earth at the fecond ploughing; for being thereby covered they will begin to rot by feed-time. They imbibe the moifture of dews and rain, retain it long, and, according to Dr. Home, keep loofe dry foils in a moift ftate. They formerly coft about fourpence a bufhel at London, from whence many loads were fent every year to Dunftable, which is thirty-three miles, where they are laid on even ftiff lands, juft after the fowing of the corn, allowing to the acre four facks, of fix bufhels each; they are much higher now, at more than double

double this price, and no quantity of any great account to be procured. See MANURE, and TOP-*dressing*.

The farmers in Oxfordshire make use of rags of this sort, procuring them from London and other places, at the rate of from eight to nine pounds the ton, which, with the carriage, stand them in upon the farms from nine pounds ten shillings to ten pounds. By some they are spread upon the clover lands, lays or layers for wheat, in the proportions of from three or four to six hundred weight to the acre. Tried with dung in this way, in the quantity of seven hundred weight to the acre, the dung is found the better dressing. They are also applied for turnips, for which crop they are ploughed in before the winter, as soon as the wheat-sowing is over: if ploughed in at the time of sowing turnips, they will not work for that crop. Some for this crop give half a coat of rags, and half a coat of sheep-fold. When applied on the clovers they seldom last longer than two years. Others think that half a coat of rags, and half a coat of dung, is the most beneficial method of applying this sort of manure. Some think rags are more durable than any other manure. Rags are occasionally brought from Whitney to this district, at from seven shillings and sixpence to eight shillings and sixpence the hundred weight, and five hundred weight spread upon the acre: they commonly last only one crop, but sometimes for two, and are found superior to any thing for wheat. They are ploughed in; and if the season be very dry, do not answer so well. They are supposed to do best on a summer fallow for that crop.

In Sussex rags are chiefly of service in the hop grounds, for which they are thought an excellent manure. Very great benefit is said to have been derived from the application of these rags, in contributing to preserve this sort of plantation in a state of constant moisture and vegetation in the driest seasons, when grounds which have been manured with dung, have been dried up, and the hop crops have failed. Rags have likewise been found very useful on the mowing grounds in some parts of Lancashire, when laid upon them in a pretty full proportion. When cut or chopped sufficiently small, they readily sink down upon the surface of the land, and do not afford any sort of interruption to the scythe, while they absorb and keep in the moisture, which is of material benefit to such grass lands as are inclined to be dry.

RAG, in a *Ship*. See BOLTS.

RAGAL, in *Geography*, a town of Germany, in the county of Pludentz; 10 miles E. of Pludentz.

RAGALBUTO, a town of Sicily, in the valley of Demona; 23 miles S. of Cefalu.

RAGALMATO, a town of Sicily, in the valley of Mazara; 8 miles N. of Naro.

RAGAMMEE, a town of Ceylon, near the W. coast; 58 miles S. of Columbo.

RAGANELLO, a river of Naples, which runs into the gulf of Tarento, near Civita Mandonia.

RAGAPILLY, a town of Hindoostan, in Golconda, near the left bank of the Godavery; 5 miles S.E. of Badrachillum.

RAGATZ, a town of Switzerland, in the county of Sargans; 5 miles S.S.E of Sargans.

RAGAY, a town on the S. coast of the island of Luçon. N. lat. 13° 50′. E. long. 122° 40′.

RAGGED, in *Heraldry*. See RAGULED.

RAGGED *Hawk*, in *Falconry*, is a hawk that hath its feathers broken.

RAGGED *Robin*, in *Botany*. See LYCHNIS.

RAGGED *Harbour*, in *Geography*, a bay on the E. coast of Newfoundland, being a part of Catalina bay; 2 leagues N. of Catalina harbour. N. lat. 49° 45′. W. long. 53° 40′.

RAGGED *Helmet*, a small island in the Mergui Archipelago. N. lat. 10° 9′.

RAGGED *Island*, a small island in the East Indian sea, near the island of Paraguay. N. lat. 11° 24′. E. long. 119° 30′. —Also, a small island among the Bahamas. N. lat. 22° 27′. W. long. 77° 16′.

RAGGED *Point*, a cape on the E. coast of the island of Borneo. S. lat. 2° 13′. E. long. 116° 40′.—Also, a cape on the N. coast of the island of St. Christopher. N. lat. 17° 30′. W. long. 62° 42′.

RAGGIVOLO, a town of Italy, in the department of the Mincio; 19 miles S. of Mantua.

RAGHU, in *Hindoo Mythology*, is the name of the ancestor of Rama, one of their deified heroes, who is hence sometimes called Raghuva, or son of Raghu. Budha, or Boodha, another of the Indian deities, is said to have had a son also of this name.

RAGHUVA, a name of the Hindoo deified hero Rama, signifying a descendant of Raghu, a warlike character. All these names are still very common among Hindoos: whether confined to the sect who, as chiefly worshipping Rama, are called Ramanuj, or more extensively given, we are not informed. See RAMA.

RAGIAN, in *Geography*, a town of Persia, in the province of Farsistan; 130 miles N.W. of Schiras. N. lat. 30° 40′. E. long. 50° 8′.

RAGLAND, a small village of Monmouthshire, here mentioned on account of its castle, the ruins of which evincing its grandeur and magnificence, command the attention of travellers. During the rebellion it was held for the king, and defended to the last extremity by the marquis of Worcester; 8 miles W. of Monmouth.

RAGMAN'S ROLL, or *Ragimund's Roll*. See ROLL.

RAGNIT, in *Geography*, a town of Prussian Lithuania, on the river Memel, endowed with the privileges of a town in the year 1722. Its ancient castle was famous even in the times of Paganism. The knights of the Teutonic order rebuilt it, with additional works, in 1255; but being destroyed in 1355, it was rebuilt a second time, and called Landshuth; but afterwards it obtained the name of Ragnit from the river which passes by it; 56 miles E.N.E. of Konisberg. N. lat. 55° 5′. E. long. 22° 18′.

RAGOGNA, a town of Italy, in Friuli; 16 miles N.W. of Udina.

RAGOOGUR, a town of Hindoostan, in the Malwa country, and circar of Kitchwana; 116 miles N.E. of Ougein. N. lat. 24° 23′. E. long. 77° 30′.

RAGOTSKI, FRANCIS, in *Biography*, the second of the name, prince of Transylvania, distinguished by his courage and patriotism, was born in 1676, at the castle of Borshi, in Hungary. When he was only a year old he lost his father, prince Francis, and was left to the care of his mother, Helena Sereni, who afterwards married count Tekeli. During his education he was carefully watched by the house of Austria, and his correspondence with his mother, who had retired to Constantinople, was entirely broken off. He was now suffered to travel to most of the courts of Europe, and to contract a marriage with the princess of Hesse Rhinfelds. Zealously attached to the independence of his country, which was kept in a state of great degradation by the Imperialists, he secretly entered into a negociation with the French king, Lewis XIV., but being betrayed by one of his confidents, he was arrested, and a charge of treason was preferred against him. The sentence of guilty was soon pronounced, and he was committed to the custody of an officer,

officer, who, however, connived at his efcape, and he arrived in a dragoon's habit at the frontiers of Poland. Here he received affurances of affiftance from France, and immediately publifhed an eloquent manifefto, calling upon the nation to free itfelf from the Auftrian yoke. Numbers joined him; being, however, but half armed, he was fearful of trufting his caufe in their hands, and withdrew to the frontiers of Poland, where he was joined by frefh recruits. With thefe he ventured to make fome progrefs; ftormed feveral fortreffes; and took a fevere revenge upon the Imperialifts, who had given no quarter to the Hungarian infurgents.

At this period the crown of Poland was vacant, through the depofition of Auguftus by Charles XII. of Sweden, and the Polifh chiefs were defirous of placing it upon the head of Ragotfki. But he had no fuch ambitious views: his great object was to liberate his country, and he refufed to defert its caufe for any other profpects. He accordingly purfued his fucceffes, and by the reduction of Tokay, obtained the fubmiffion of almoft the whole of Lower Hungary. So high was his reputation, that the diet of Alba Julia, in 1704, proclaimed him prince of Tranfylvania, with which dignity he was afterwards folemnly invefted. He obtained likewife the title of protector of Hungary, and Lewis XIV. fent to him a public embaffy. He foon began to feel the difficulty of fupporting a popular infurrection againft the arms and policy of a powerful fovereign, as well by the abandonment of fome of his allies, as by the defertion of his troops. He had another opportunity of giving a refufal to the crown of Poland, which was offered him by the czar Peter, fhewing thereby his fincere attachment to the caufe of his country, and he employed all the refources of valour and good conduct to fupport a declining caufe. In 1711, a treaty was concluded between the Hungarian ftates and the emperor, into which he refufed to enter, although the firft article fecured his life and property, with the title of prince of Tranfylvania. Mortified by the failure of his patriotic exertions, he withdrew to Turkey, renouncing his great eftates, and preferring an honourable poverty to a fplendid fervitude. He afterwards paffed fome time in France, then returning to Turkey, he fixed his final refidence at the caftle of Rodofto, on the fea of Marmora. "There," fays his biographer, "a Chriftian among Mahometans, and a philofopher among barbarians, he tranquilly clofed his life in 1733, at the age of 61." He left "Memoirs of his Life," which were publifhed in the "Revolutions de Hongrie," printed at the Hague in 1739. In 1751 there appeared a work, entitled "Teftament politique et moral du Prince Ragotfki," the authenticity of which is doubted. Moreri.

RAGOUT, or Ragoo, a fauce or feafoning, intended to increafe or recover the appetite when languifhing, or loft.

The term is French, but naturalized. It is alfo ufed for any high-feafoned difh, prepared of flefh, fifh, greens, or the like, by ftewing them with the addition of bacon, falt, pepper, cloves, and the like high-flavoured ingredients.

We have ragoos of beef, of cray-fifh, of giblets, of afparagus, of endive, of cocks-combs, of gammon, of celery, &c.

The ancients had a ragout, called *garum*.

RAG-PAVING. See Paving.

RAG-STONE, a name given by our artificers to a kind of ftone, which they ufe for fetting an edge upon knives, chiffels, and other tools. It is a greyifh-coloured ftone, containing a large quantity of talcky particles, and fplits eafily into thin flakes. It is a foft ftone, and is ufed only to finifh the fetting an inftrument after the edge has been prepared by grinding or rubbing the tool upon fome other ftone of a coarfer texture. We have this from Newcaftle and many other parts of the north of England, where there are very large rocks of it in the hills. This kind of ftone is in fome diftricts confiderably blended and intermixed with the fubfoil, rendering it of a more barren and unfertile quality.

RAGUENET, l'Abbe, in *Biography*. In 1702 the publication of a pamphlet, entitled "Paralele des Italiens et des François en ce qui regarde la Mufique et les Operas," by this author, a man of tafte and intelligence, who had refided fome time at Rome, gave birth to a long, but ineffectual controverfy, concerning the degrees of perfection, and fuperiority of French and Italian mufic. The book was licenfed by Fontenelle, who faid in his teftimony, that "he thought it would be very agreeable to the public, provided they were capable of equity." This declaration, however, did not prevent Freneufe, the continuator of Bonnet's "Hiftoire de la Mufique," from attacking the author and Italian mufic in a moft furious manner, treating both with equal contempt and obloquy.

The French, after this period, feem to have enjoyed their lyric *fommeils* in great comfort and tranquillity till 1752; when the performance of Pergolefi's "Serva Padrona" at Paris, by a company of burletta fingers from Italy, fet the mufical republic in a flame which has not yet been extinguifhed.

There had, indeed, been a *fenfation* excited, that was rather turbulent, and tending to a civil war, on the firft appearance of Rameau as a dramatic compofer in 1733, who, by new harmonies and accompaniments, had given offence to the true believers in the worfhip of Lulli; but this foon fubfided, and the nation not only heard his compofitions with rapture, but reverenced him as "a theorift, to whom mufic was as much indebted as phyfics and philofophy to Newton."

This little work was publifhed in Englifh in 1709, and has been faid to be tranflated by Galliard. If this worthy profeffor was the tranflator, it was before he [illegible] himfelf fo completely mafter of the Englifh [illegible] appeared to be afterwards, in his tranflation [illegible] Song." The Englifh of [illegible] *para*[illegible]; many of the notes, ho[illegible] a perfon who had been in Italy, and well [illegible] in that country, as well as in England, at the [illegible] of the laft century, during our firft attempts at operas, before the arrival of Handel.

RAGUIER, Le, the name given by the French failors to a wind peculiar to the gulf of Alexandretta or Scanderoon, which, rufhing from the fnowy fummits of the mountains, frequently forces fhips to drag their anchors feveral leagues.

RAGULED, or Ragged, in *Heraldry*, is applied to an ordinary, *e. gr.* a crofs, whofe outlines are jagged or knotted.

He beareth fable, a crofs raguled, or, by the name of *Sloway*.

Ragged differs from indented, as the latter is regular, and the former not.

The bearing is very ancient: Julius Cæfar gave for his badge, a boar's head, on a ragged ftaff.

Raguled is fometimes alfo ufed in the fenfe of truncated, or couped, and applied to a branch that is fawed from the tree; or a ftock fawed from its root.

RAGUN, in *Geography*, a town of Germany, in the principality of Anhalt-Deffau, on the Mulda; 9 miles S. of Deffau.

RAGUNDA, a river of Sweden, which rifes in the lake

lake Storfio, and in the province of Medelpadia, changes its name to Indal.

RAGUSA, a fmall republic, fituated on the eaftern fhore of the Adriatic, and neverthelefs regarded as an Italian ftate. It has a population of about 56,000 perfons, on an extent of 352 fquare miles. As this ftate is adjacent to the territory formerly belonging to the Venetians in Dalmatia, its government was formed on the model of the Venetian ariftocracy. Its religion is the Catholic, and its language the Slavonic, though moft of the inhabitants fpeak Italian. The fee is archiepifcopal, with fix fuffragans, and its commerce is confiderable. The chief magiftrate of the ariftocracy in this ifland, called the "rector," is changed every month. Here is alfo a council of ten, and a great council compofed of all the nobles above twenty years of age, and thefe nominate the "Pregadi," a fenate of fixty, which fuperintends all ftate affairs, receives and deputes ambaffadors, and confers offices. The revenue of Ragufa was formerly eftimated at a ton of gold, or about 10,000*l.* fterling. This fmall republic has found it neceffary to engage the protection of the Turks, for which it pays a tribute of about 20,000 fequins; though the commerce is beneficial to the Ottomans, in fupplying them with ammunition. Jealoufy of their neighbours induces the Ragufans to fhut the gates of their city, except for a few hours in the day. The capital is Ragufa; and it has been lately annexed, together with Dalmatia, to the kingdom of Italy. It now (1814) probably waits for a new allotment. The Ragufans have many country-houfes at Gravofa, another fea-port town. Stagno is another little town, fubject to Ragufa. Of the Ragufan ifles, the chief is Milet, or Melada, fertile in oranges, lemons, and good wine. On the north there is a tolerable haven, with a town of the fame name. Three or four little ifles in that neighbourhood alfo acknowledge the fovereignty of Ragufa.

RAGUSA, the capital of the above-mentioned ifland, is an ancient city, being the Ragufium of the Romans, and in the tenth century it became the metropolis of Dalmatia. In the 13th century it was conquered by the Venetians, and afterwards for a time fubject to the crown of Hungary. It is a well-built city, and its commerce is not inconfiderable. The harbour might be rendered capable of a firm defence; and the circumjacent ifles are beautified by nature and art. Earthquakes, however, have been terrible; and that of 1667 deftroyed 6000 perfons; 248 miles N.W. of Saloniki. N. lat. 42° 58′. E. long. 18° 18′.

Ragufa keeps accounts in ducats of 40 groffetti, each groffetto being divided into 6 foldi; but at the public offices accounts are moftly kept in perperi of 12 groffetti. Formerly the ducat reprefented a real coin ftruck at Ragufa, and had a fixed value; but fince it has become a money of account, it is always equivalent to the Turkifh piaftre, and therefore liable to a change of value. At Ragufa no gold coins are ftruck; its filver are the old tallari or dollars, commonly called Viflini or Ragufine, weighing 1 oz. 7 car. (Ragufa wt.), containing 17 parts of pure filver to 13 of alloy, and reckoned at $1\frac{1}{2}$ ducat, or 60 groffetti; but on account of the depreciation of the ducat, the value of the tallari has been proportionably raifed in weight. The new tallari, called libertine, weighing 1 oz. 10 car. and containing 9 parts of pure filver to 6 of alloy, was valued at 80 groffetti. But fince the year 1796, ducats have been coined of 40 groffetti, weighing $\frac{1}{2}$ an ounce; alfo perperi of 12 groffetti, weighing 20 carats, and half perperi in proportion: thefe three coins contain 9 parts of pure filver, and 11 of alloy. The groffetti, none of which have been lately coined, are ftill in circulation: they weigh the 60th part of an ounce, and bear the fame value with the paras of Conftantinople. The ducat of 1796 is worth $13\frac{1}{4}d.$ fterling, which is nearly the value of the Turkifh piaftre. The tallaro, or Ragufina of 1759, is worfe than the Englifh ftandard 4 oz. 2 dwt.; its weight is 18 dwt. $7\frac{1}{2}$ gr., content in pure filver 256.4 gr., and its value in fterling 2*s.* $11\frac{3}{4}d.$ That of 1794 is worfe 3 oz. 19 dwt., its weight 18 dwt. $17\frac{1}{4}$ gr.; its content in pure filver 267.6 gr., and value in fterling 3*s.* $1\frac{1}{4}d.$ The ducat of 1797 worfe 5 oz. 11 dwt.; its weight 8 dwt. $17\frac{3}{4}$ gr., content in pure filver 97 gr., and value in fterling 1*s.* $1\frac{1}{2}d.$ The tallaro or Ragufina has upon it the head of the chief magiftrate, or rector; legend RECTOR REIP. RHACUSIN: reverfe, arms of the city, legend, DUCAT. ET SEM. REIP. RAC., *i. e.* ducat and half of the republic of Ragufa. Pieces of 1794, &c. bear the head of a woman, with RESPUBL. RHACUS., reverfe, a fhield, with the word LIBERTAS, inclofed by two branches, over which is a crown, legend, DUCE DEO FIDE ET JUST. The ducat bears the whole length of a bifhop, legend, AUSPICIIS TUIS A DEO: reverfe, arms of the city, legend, DUCAT REIP. RHACUSINÆ.

The pound with which gold and filver are weighed at Ragufa confifts of 12 ounces; the ounce is divided into 6 faggi; the faggio into 22 carats, and the carat into 4 grains. But the pound of commercial weight is equal to 5607 Englifh grains, or 12 oz. 13dr. avoirdupois; the former being $5062\frac{2}{3}$ Englifh grains. The ell of Ragufa meafures $227\frac{1}{2}$ French lines, or $20\frac{1}{5}$ Englifh inches. Kelly's Un. Cambift.

RAGWORT, in *Botany*. See OTHONNA, SENECIO, and SOLIDAGO.

RAGWORT, in *Agriculture*, a very pernicious plant of the weed kind, which is fometimes termed feagrim. It has a green ftalk in its early ftate, but, as it advances in age, inclining to violet or purple, efpecially downwards. Its flowers are yellow, and thick-fet, and compofed each of a number of fmall pointed leaves. It runs to feed in the latter end of fummer. The fmell, both of the ftalk and leaves, which are jagged, as well as the flower itfelf, are fo offenfive to animals, as that hardly any will feed upon it, except when almoft ftarved.

It has been propofed to deftroy it by picking out the roots, and feeding the land clofe with fheep. It moftly affects meadows and pafture lands when the foils are good.

RAHA, in *Geography*. See JERICHO.

RAHABAH, or RABBA, town of Arabia Deferta, near the Euphrates, on the road by which caravans travel from Syria to the Arabian Irak; 110 miles S.W. of Moful. N. lat. 35° 5′. E. long. 40° 21′.

RAHABAH *Melik Ben Tauk*, a town of Afiatic Turkey, in the province of Diarbekir, on the Euphrates; 50 miles S. of Kerkifieh.

RAHABY, a town of the defert of Syria, containing about five or fix thoufand inhabitants, fituated on a plain, furrounded with date-trees; 70 miles N. of Mefghid Ali.

RAHANPOUR, a town of Bengal; 42 miles N.W. of Nattore.

RAHAPA, a fmall ifland in the Eaft Indian fea, near the E. coaft of Borneo. N. lat. 4° 58′. E. long. 114° 4′.

RAHAS, in *Ichthyology*, a name given by fome authors to the torpedo, or cramp-fifh.

RAHEINA, in *Geography*, a bay on the W. coaft of Mowhee, one of the Sandwich iflands. N. lat. 20° 50′. E. long. 203° 19′.

RAHEMAT, a large lake in the Arabian Irak, 90 miles in circuit, near Mefghid Ali.

RAHENSTEIN, a town of Bohemia, in the circle of Saatz; 19 miles S.W. of Saatz.

RAHMANIE′, a town, or rather village, of Egypt, built

built on the W. bank, at the entrance of the canal of Damanhour, which is navigable only at the rise of the Nile; 9 miles S. of *Faoué*; which fee.

RAHMETABAD, a town of Perfia, in the province of Irak; 20 miles N.E. of Confar.

RAHNIS, or RANIS, a town of Saxony, in the circle of Neuftadt; 10 miles S.W. of Neuftadt. N. lat. 50° 33'. E. long. 11° 40'.

RAHNY, a town of Bengal; 25 miles N.W. of Dinagepour.

RAHON, a town of France, in the department of the Jura; 6 miles S. of Dôle.

RAHOON, a town of Hindooftan, in the fubah of Lahore; 108 miles S.E. of Lahore. N. lat. 31° 7'. E. long. 75° 42'.

RAHU, in *Aftronomy*, is the Hindoo name of the planet of the afcending node, or dragon's head. Ketu is the name of the other node; and a fable, in the ufual ftyle of mythological allegory, is given under that article, of their origin and mifhap. The malignant Rahu was decapitated, and Ketu was his head. In one painting of the Hindoo zodiac, the headlefs Rahu is reprefented of a black colour, in red clothing, mounted on an owl, and holding a lotos in his hand: in another, he holds a fpear, and ftands on a tortoife. In the fable given under Ketu it is related that Vifhnu was the decapitator of Rahu: other accounts affign that office to Narayana. Among the Hindoos, as we have had occafion to remark in feveral articles, their fciences, as well as their hiftory and religion, are enveloped in a mafs of mythological allegory: a farther inftance of which, connected with the fubject of this article, is feen under ECLIPSE (*Note.* A reference being made from the article KETU to this, we take the opportunity of correcting two typographical errors in that article. In its early part, for *Karyapa*, read *Kafyapa*; and in the fourth line of the fecond column, for *or* read *a*.)

RAHWAY, in *Geography*. See RAWA.

RAI, or RAE, an ancient town of Perfia, in the province of Irak, before Ifpahan the capital of Perfia. This was once a grand and proud city; and its ruins ftill cover a great extent of country. It holds a diftinguifhed place in the annals of Perfia: it is mentioned by Arrian and Diodorus Siculus, as the capital of the province of Rhages, fo called from the calamities brought upon this part of the empire by the earthquakes to which it formerly was, and is ftill fubject. It is frequently mentioned in the wars of the renowned Haroun al Rafhid; it was the capital of this part of Perfia, in the reign of Alp-Arflan, and continued to flourifh until it was facked by the generals of Jenghis Khan. Its ruins are fituated five miles S. of Tehraun, the prefent capital of Perfia; and in the centre of them is a village, called Sheik Abdul Azzeem, from a fon of the feventh Imam, to whofe memory a noble mofque and maufoleum have been erected.

RAJA, denoting *king*, an appellation given in Hindooftan, or the empire of the Mogul, to princes defcended from thofe that ruled there before the conqueft of the Moguls; who exercifed all rights of fovereignty, only paying a tribute to the Great Mogul, and obferving the treaties by which their anceftors recognized his fuperiority.

There are fome rajahs who ftill retain a more independent fovereignty in the mountains: the Indians call them *rai*; the Perfians, plurally, *raian*: our travellers *rajahs*, or *ragias*. Thefe have under their command foldiers, called *rajapoots*, or perfons defcended from rajahs, who are a robuft and brave people, and who enter into the fervice of thofe who will pay them. The Great Mogul has feveral of thefe rajahs in his fervice.

The chief lords of the Moguls, *viz.* the vice-roys, governors of provinces, and chief minifters of ftate, F. Catrow obferves, are called *ombras*; and the idolatrous rajahs, or Indian lords who governed petty ftates before the conqueft of their country, held the fame rank at court with the omhras.

All the difference was, that the children of the rajahs fucceeded their fathers in the fhow of the fovereignty left them; whereas the children of the Mahometan lords lofe all in lofing their fathers.

The Indians account four ages from the beginning of the world: and in the fecond, which lafted 1,296,000 years, they hold the rajas or kchatrys had their rife; a noble caft, though inferior to the Bramins. Vice then, they fay, began to creep into the world; men only lived to 300 years, and their ftature was reduced, &c.

RAIA, the *Ray*, in *Ichthyology*, a genus of fifhes of the order Chondropterygia, of which the generic character is, that it has five oblique fpiracles on each fide, placed beneath the neck; the head is fmall, pointed, and not diftinct from the body; the mouth is beneath tranfverfe, toothed; the body is broad, thin, and flat.

The individuals of this genus are all inhabitants of the fea only: they keep at the bottom, and in winter cover themfelves with fand and mud: they feed on teftaceous animals, fifh, or any animal fubftances which they may happen to meet with. They grow to a large fize, fometimes exceeding 200lbs. in weight. The females are the larger, and produce their young alive, only one at a time, which, like the fhark tribe, are inclofed in a quadrangular, black, horny fhell, the corners of which end in flender incurved points, but not extending into long filaments, like thofe of the fhark: the eyes are half covered with a thin membrane, oblong, placed on the upper part of the head: above thefe, in the place of noftrils, is a broad fulcus or groove, divided by a reticulate membrane, confifting of crefted folds, and clofed with a valve: behind this fulcus are two fmall femilunar orifices: the tongue is very broad, fhort, and fmooth. The ventral fins are covered with a thick fkin, and furrounding the body; the ventral at the bafe are connected with the anal; the flefh is generally eatable; the liver is large, and producing a great quantity of pure oil.

Of this genus there are nineteen fpecies, divided into three fections: *viz.* A, comprifing the electric ray, or torpedo and fkates: thefe have fharp teeth. B, including the fting-ray and thornbacks, having obtufe teeth. And C, which are denominated uncertain, comprifing five fpecies, which inhabit the Red fea, or about the Cape of Good Hope, but which have not yet been fufficiently examined.

Section A.—*With fharp Teeth.*

Species.

* TORPEDO; Electric Ray. The body of this fifh is entirely fmooth and flat. The fpecies inhabits the Mediterranean, and grows to a large fize: fome have been taken that have weighed from 60 to 80lbs. each, but the average weight is lefs than 20lbs. It is of a dirty clayifh colour; the head and body are round, and but indiftinctly feparated. The body is extremely thin; behind the eyes are two wide foramina, which have been fuppofed to be intended by nature for conveying found; they are befet with fix cutaneous fingers on their inner circumference, and communicate with the mouth. The torpedo can live about twenty-four hours out of the fea, and a fhort time longer, if put into frefh water;

water; it inhabits thofe places where the bottom is fandy, and buries itfelf fuperficially by flinging the fand over its back with a fort of vibration, which it gives to its extremities. It is in this fituation that the torpedo aftonifhes and terrifies the unwary paffenger, who inadvertently treads upon it, by the exertion of its electrical or benumbing faculty. This power is ferviceable to the animal in two important refpects; as a means of defence againft voracious fifhes, and as a method by which he is enabled to procure his fubfiftence from among the fmaller tribes; for the former, when electrified, are deprived of all poffibility of feizing their prey; and the latter, after having unwarily approached the torpedo, and received the fhock, are incapable of making their efcape. (See TORPEDO.) The food of the torpedo is furmullets and plaife; the former are fo fwift, that it is impoffible for the torpedo to take them by purfuit, and as this fifh has been found in its ftomach, it is prefumed that it was taken by means of the electrical fhock. The torpedo has been taken off Pembroke, at Torbay, and near Waterford in Ireland. It is caught like other flat fifh, with the trawl, and is commonly found in water forty fathom deep, in company with other fpecies of this genus.

* BATIS; the Skate. This fpecies is varied; the middle of the back is fmooth; the tail is befet with a fingle row of fpines. It inhabits the European ocean, and is thought to be the largeft fifh of the genus: the body above is cinereous, fometimes with a few black lines, beneath white, with waved lines of black dots; round the eyes are numerous fmall, hooked fpines; in the males the fins are full of fpines. Of all the larger fifhes, the fkates are the moft numerous, and their numbers are in a great meafure owing to their fize, and to the protection afforded them by thofe frightful fpines which nature has afforded them. There is not one of the rapacious tribes, excepting, perhaps, the cachalot and white fhark, that has a fwallow fufficiently large to receive them, and even thefe are probably deterred from their purpofes of deftruction by the armour with which their prey is covered. Of fome the fize is fuch as to defy all powers of deftruction which even the fhark himfelf poffeffes. In England fome of the fpecies have been taken, weighing upwards of two hundred weight, but even this is far inferior to their enormous bulk in other parts of the world. Near the ifland Guadaloupe, a ray was killed more than twenty-five feet long, and almoft fourteen broad. After all, the fifhes of this tribe probably attain a much larger fize than that of any individual which has ever yet been examined. It is only the fmalleft of the kind that approach the fhores; the largeft continue for ever prowling at the bottom in the unfathomable caverns of the ocean, where they continue perhaps to grow for a century.

The fifhes generate in March and April, at which time they fwim near the furface of the water, feveral males purfuing one female. The females caft their *purfes*, as they are called, in May, and continue to produce till September: they are very prolific, not lefs than three hundred eggs having been found in the body of a fingle female. The rays generally frequent thofe parts of the fea where the bottom is black and muddy, where they devour every thing indifcriminately, but they are more delicate with regard to a baited hook. They devour any putrid fubftances whatever, but if the bait has been taken up and fuffered to lie for any time in the open air, they will not touch it; they appear to perceive the line, and to dread it; but the impulfe of hunger overcomes their caution, and even though they perceive the danger, if thoroughly hungry, they devour the bait, as if regardlefs of the confequences. See SKATE.

OXYRINCHUS; Sharp-nofed Raia. Varied; middle of the back with ten fpinous tubercles. This is fimilar in fhape to the fkate, but with a longer and fharper fnout: the colour of the whole upper part is cinereous, with feveral pale or whitifh fpots, intermixed with a few flight dufky ftreaks or variegations; beneath it is white, with dufky or blueifh ftreaks; down the back and tail runs a fingle row of fpines, and a few others are placed about the region of the eyes: the fides of the tail are alfo fometimes furnifhed with a row of fmaller or weaker fpines than thofe on the upper part; the eyes are large, as is alfo the mouth. This fpecies, like the fkate, fometimes, but not often, is taken of a very confiderable fize. It is a native of the Mediterranean and Northern feas.

MIRALETUS. This fpecies has a fmooth belly and back: it has fpines near the eyes, and a triple row of them on the tail. It inhabits the Mediterranean; the body above is marked with an occellate fpot.

* FULLONICA; the Fuller Ray. The back is covered with fpines; the eyes with a fingle row; pectoral fins and tail with a triple row. It inhabits the European feas; grows to a large fize; the body above is cinereous, with numerous black fpots; beneath it is white. The fnout of this fifh is fhort and pointed; the nictitant membrane is fringed; the teeth are fmall and fharp; and the tail is flender. It has been thought by fome authors that this is only a variety of the next fpecies.

* RUBUS; Rough Ray. The back of this fpecies has a fingle fpine; and the tail is befet with a triple row of fpines. This is greatly allied to the thornback, but covered with more numerous fpines, every part of the fkin on the upper furface being muricated with fharp curved aculei of different fizes: of thefe, one row of the largeft runs down the middle of the back, and three, or fometimes five, along the tail; others are difperfed about the eyes and the flaps of the pectoral fins: the general colour is a yellowifh or whitifh-grey, fometimes variegated with dufky or brownifh clouds and ftreaks; the under fide is white, and befet with very numerous fcattered fpines, but lefs ftrong than thofe on the upper fide. It is about the fize of a thornback. Mr. Pennant mentions one that meafured nearly three feet from the nofe to the tip of the tail. It is a native of the Mediterranean and other feas.

B.—*Teeth obtufe.*

Species.

SEPHEN. Body nearly round; tail twice as long as the body, winged beneath, and with two long fpines above, ferrate on each fide. It inhabits the Red fea, and is fometimes fo large, as to reach three yards acrofs; body above brown, with three rows of large hemifpherical tubercles down the middle of the back; beneath it is quite flat and fmooth, and it is of a reddifh-white. It is from the fkin of this fpecies that the beautiful fubftance called *Galuchat* is prepared by the French, and which, being coloured with blue, green, or red, according to the fancy of the article, and afterwards polifhed, is fo frequently ufed for various kinds of cafes, telefcope tubes, &c. For this purpofe the fmaller or younger fpecimens are preferred; the tubercles in the more advanced or full-grown animals being too large.

There is a variety of this fpecies: the length of the fpecimen defcribed by Dr. Ruffell was about $9\frac{1}{2}$ inches; the tail is about two feet nine inches long; the colour of the whole animal is a dull leaden above, with a deep blue tail; beneath it is dufky white; on the middle of the back there are only two pearl-formed tubercles inftead of three; the tail is furnifhed with a fharp fpine and a fin beneath. It is a native of the Indian feas.

Aquila. The body is ſmooth ; the tail is pinnate, with a long ſerrate ſpine. This ſpecies is of a rhomboidal ſhape, but with a conſiderable dilatation : the pectoral fins approach to a ſubfalcated form : the colour is cinereous above ; pale or whitiſh beneath : the head is rather large, and the ſnout produced : the eyes are large and prominent, with yellow irides : the tail is long, ſlender, ſharp-pointed, and furniſhed about the middle with a ſpine ſimilar to that of the ſting-ray. This ſpecies grows to a very great ſize, ſometimes meaſuring ten, twelve, or even fifteen feet in length, and weighing upwards of three hundred pounds. It is found in the Mediterranean, Atlantic, and Indian ſeas, and is ſaid to ſwim in a ſlower manner than moſt other rays ; it preys on ſmaller fiſhes, and is ſuppoſed to ſtrike and kill, or at leaſt diſable its prey with the caudal ſpine : when taken, it is obſerved to vibrate the tail with great ſtrength and rapidity in all directions. It is not reckoned among the edible fiſhes ; but the liver, which is very large, is ſaid ſometimes to be eaten, though it is more frequently uſed for the purpoſe of preparing from it a clear oil, which it affords in great plenty.

* Pastinaca ; Sting-ray. The body of this ſpecies is ſmooth ; its tail has a long ſharp ſpine, ſerrate on the fore part, and another on the back : there are two other varieties, of which the one has a ſmooth body ; the back is beſet with two ſpines, ſerrate on the fore part ; the body of the other is covered with ſpots.

This ſpecies is deſcribed as having a body ſomewhat approaching to the ovate, the pectoral fins leſs pointed than in ſome other ſpecies of this diviſion. The ſnout is pointed ; the body more convex than uſual ; the colour of the whole animal above of a yellowiſh-olive, but the back is ſometimes found to approach to a blueiſh-brown ; beneath it is whitiſh ; the tail is of a conſiderable length, and without a fin, very thick at the baſe, and gradually tapering to the extremity, which is very ſlender : near the middle it is armed, on the upper part, with a very long, flattened, and ſharp-pointed bone or ſpine, finely ſerrated in a reverſed direction on both ſides : with this the animal is capable of inflicting very ſevere wounds on ſuch as incautiouſly attempt to handle it ; and it anſwers the purpoſe both of an offenſive and defenſive weapon. This weapon is annually caſt, and as it frequently happens that the new ſpine has arrived at a conſiderable ſize before the old one has been caſt, the animal is occaſionally found with two, in which ſtate it has been ſometimes erroneouſly conſidered as a diſtinct ſpecies. This fiſh is ſaid not to grow to a very large ſize. It is found in the Mediterranean, Atlantic, and Indian ſeas, and is numbered among the edible rays. On account of the danger attending the wounds inflicted by the ſpine, it is uſual with the fiſhermen to cut off the tail as ſoon as the fiſh is taken. In ſome countries it is ſaid to be illegal to ſell the fiſh with the tail adhering to it.

It was formerly thought that the ſpine of the fiſh poſſeſſed a venomous quality, by infuſing into a wound made by it ſome very active poiſon ; this is now proved to be completely erroneous, and the effects ſometimes produced by it ariſe entirely from the deepneſs of the puncture and laceration, which, if taking place in a tendinous part, or among the larger nerves and blood-veſſels, have often proved fatal. It may not be amiſs to obſerve, that ſome ancient writers have deſcanted upon the effects of this animal's powerful weapon in terms of conſiderable luxuriance ; it was ſuppoſed to be not only poiſonous in the living animal, but to preſerve its poiſon when taken from the fiſh, and affixed to the head of an arrow or a ſpear ; it was ſaid even to deſtroy the moſt healthy and flouriſhing plant by its touch, and even to cauſe trees to die by ſtriking the bark with its point. It formed the head of the fatal ſpear preſented by Circe to her ſon Telegonus, by which he was rendered ſuperior to his enemies, and with which he, at length, unconſciouſly, ſlew his father Ulyſſes. The general habits of this ſpecies are ſimilar to thoſe of the reſt of the genus, often lying flat, and in ambuſcade on the ſoft mud at the bottom of the ſhores which it frequents, and ſeizing its prey by ſurprize ; at other times it will purſue it through the depths of the ocean.

* Clavata ; Thornback. The body of this ſpecies is ſpinous ; the teeth tuberculate ; acroſs the belly is a ſtrong ſemilunar cartilage. This ſpecies grows to a very conſiderable ſize, though rarely equal in magnitude to the ſkate already deſcribed ; in its general appearance it reſembles that fiſh, but is ſomewhat broader in proportion, and is readily diſtinguiſhed from the ſkate by the very ſtrong, curved ſpines with which its upper ſurface is covered ; theſe are moſt conſpicuous down the middle and on each ſide of the back, where four or ſix, of much larger ſize than the reſt, are generally ſeen ; the remaining parts being furniſhed with many ſcattered ſpines of a ſmaller ſize, intermixed with ſtill more minute ones, and the whole ſkin is of a rough, or ſhagreen-like ſurface ; the back is marked with an uncertain number of pale or whitiſh round ſpots of different ſizes, and which are commonly ſurrounded with a blackiſh or dark coloured edge ; theſe ſpots are ſaid to be cauſed by the ſhedding of the ſpines at different intervals ; along the middle of the back runs a ſingle row of ſtrong ſpines, continued to the tip of the tail ; the colour of the ſkin is a browniſh-grey, with irregular blackiſh or duſky variegations ; the under part is white, with a light caſt of fleſh-colour, and about the middle of the body, as well as on the fins, are diſpoſed ſeveral ſpines ſimilar to thoſe on the upper ſide, but leſs ſtrong. The thornback is an inhabitant of the Mediterranean and other ſeas, and is held in ſome eſteem as food, though not conſidered equal to the ſkate in goodneſs.

Rhinobatos. Body long, tapering ; ſnout lengthened. This is reckoned a very remarkable ſpecies, and is thought to connect in ſome degree the genera of raia and ſqualus, the body being much longer than in the preceding kinds of ray ; the ſnout is lengthened, but not very ſharp ; and the body, which is moderately convex above, and flat beneath, gradually tapers from the ſhoulder to the tail, which is furniſhed above with two fins, of an oblong ſhape, and ſituated at a conſiderable diſtance from each other : the tip of the tail is alſo dilated into an oblong fin. The colour of the whole fiſh is of a dull earthy brown, paler beneath, and the ſkin is every where roughened by minute tubercles. This fiſh is ſaid to grow to the length of about four feet, and is a native of the European ſeas. It is very frequently ſeen about the coaſts of Naples.

Djiddensis. Tail-fin two-lobed ; ſpines in a triple row at the beginning of the back, and afterwards in a ſingle row ; the firſt dorſal fin is above the ventral. It inhabits the Red ſea, and is about two yards long. The body is a little rough, and of a pale aſh colour ; above it is varied with whitiſh ſpots ; beneath it is whitiſh ; behind the vent are a few brown and white ſtripes.

Lymma. Body oval, ſmooth, teſtaceous, with blue ſpots ; pinnate tail with a ſingle ſpine. It inhabits the Red ſea ; is hardly a foot long ; the ſpots oval, unequal, beneath whitiſh. It is much allied to the eagle-ray, and is of a reddiſh-brown colour above ; the tail is ſomewhat longer than the body, marked above, for half its length, with two longitudinal blue ſtripes, and is furniſhed about the middle with one, and ſometimes with two, large and ſerrated ſpines,

which

which are covered at their base by a blueish-brown skin; the under part of the body is pale or whitish.

Arnak. Body orbicular, silvery; tail round, without a fin, and furnished with two spines. It inhabits the Red sea; the teeth are granulate.

C. *Uncertain.*

Ommesscherit. Tail round and spotted. It inhabits the Red sea, and very much resembles the R. pastinaca.

Tajara. Tail round; body beneath snowy. It inhabits the Red sea. When just taken, it beats violently with its fins.

Schoukir. Body with a few remote spines. It inhabits the Red sea. The Arabians make scabbards for their swords out of its skin.

Mula. Beneath snowy; tail round, variegated. It inhabits the Red sea, and approaches the shores by night. The spine on its tail inflicts a dangerous wound.

Rapensis. Back with a single fin; the tail is short, pinnate at the end; the body is smooth and unarmed; and the snout is a little obtuse. It inhabits near the Cape of Good Hope, is shaped something like the torpedo, except that it has a fin on the back. The body is small and orbicular; above it is convex, beneath flat.

RAJABARRY, in *Geography*, a town of Bengal; 10 miles S. of Dacca. N. lat. 23° 24'. E. long. 90° 36'.

RAJACOTTY, a town of Thibet; 60 miles N.N.W. of Sirinagur.

RAJAGUNGE, a town of Assam; 16 miles S. of Gentiah.

RAJAGUR, a town of Hindoostan, in Bahar; 35 miles W.S.W. of Gayah.—Also, a town of Hindoostan, in Guzerat; 10 miles N.E. of Champaneer.

RAJAHUN, a town of Hindoostan, in the circar of Cicacole; 12 miles W. of Cicacole.

RAJAKERA, a town of Hindoostan, in the province of Agra.

RAJAMUNDRY, a circar of Hindoostan, bounded on the N. by the circar of Cicacole and Golconda, on the E. by the bay of Bengal, on the S. by the circar of Ellore, and on the W. by Golconda. It is crossed by the Bain Gonga from N. to S.—Also, the capital of the above-mentioned circar, situated between Ellore and Cicacole, on the Godavery. Its principal riches consist of forests of teak-wood. N. lat. 17°. E. long. 81° 57'.

RAJANAGUR, a town of Bengal; 25 miles S. of Dacca.—Also, a town of Hindoostan, in the circar of Rajamundry; 7 miles N.E. of Rajamundry.

RAIANIA, in *Botany*, so called in honour of our immortal naturalist, the Rev. John Ray, the most accurate in observation, the most philosophical in contemplation, and the most faithful in description, amongst all the botanists of his own, or perhaps any other, time. His life will be given hereafter, in its proper place. Plumier, who established this genus, finding the name *Raia* preoccupied by zoologists, contrived to call the plant *Jan-Raia;* which Linnæus turned about into *Rajania*, still retaining the idea of the Christian name, combined with the other. But such an idea is ludicrous to English ears, and is happily not, in general, perceived. We presume to alter the orthography in one letter, writing the word as it is always pronounced, and deducing it regularly from the Latin *Raius*, by which name the person commemorated is known all over the literary world.—Plum. Gen. 33. t. 29. Linn. Gen. 525. Schreb. 692. Willd. Sp. Pl. v. 4. 788. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 391. Juss. 43. Lamarck Illustr. t. 818. Gærtn. t. 14.—Class and order, *Dioecia Hexandria.* Nat. Ord. *Sarmentaceæ*, Linn. *Asparagi*, Juss.

Gen. Ch. Male, *Cal.* Perianth bell-shaped, in six deep, oblong, pointed segments, most spreading in their upper part. *Cor.* none. *Stam.* Filaments six, bristle-shaped, shorter than the calyx; anthers simple.

Female, *Cal.* Perianth superior, of one leaf, bell-shaped, in six deep segments, permanent, withering. *Cor.* none. *Pist.* Germen inferior, compressed, with a prominent border at one side, three-celled; styles three, the length of the calyx; stigmas obtuse. *Peric.* Capsule membranous, of three cells, without valves, crowned by the calyx; two of the cells barren, almost obliterated, without wings; the third fertile, compressed, extended into a very large, half-ovate, membranous wing. *Seed* solitary, nearly elliptical, compressed.

Ess. Ch. Male, Calyx in six deep segments. Corolla none. Female, Calyx in six deep segments. Corolla none. Styles three. Capsule membranous, with one wing. Seed solitary.

Section 1. *Leaves simple.*

1. R. *hastata.* Halberd-leaved Raiania. Linn. Sp. Pl. 1461. (Jan-Raia scandens, folio oblongo, angusto et auriculato; Plum. Gen. 33. Bryonia fructu alato, foliis auriculatis; Plum. Amer. 84. t. 98.)—Leaves hastate; somewhat heart-shaped at the base.—Gathered by Plumier, about Port-de-paix in the island of Hispaniola. *Root* perennial, sometimes large and ovate; sometimes four or five inches long, and two thick, round at each end, like a sausage. Its substance resembles that of a radish, without any internal fibres; the bark thin, ash-coloured, a little rugged and warty; the flesh very white, tasting like a bean. This root throws up only one very slender, long, climbing, smooth, knotty *stem*, thickest at the base, where it is accompanied by several fibrous radicles. We presume it to be annual. *Leaves* scattered, spreading, on short stalks, smooth and membranous, about three inches long; heart-shaped, dilated, abrupt, and seven-ribbed at the base; then suddenly elongated into a nearly linear, entire, central, three-ribbed lobe, bluntish, with a small point; the under side paler, and rather downy. *Stipulas* in pairs, awl-shaped, minute. *Flowers* small, whitish, in simple, axillary, drooping clusters. *Bracteas* minute, ovate, acute, solitary at the base of each partial stalk. *Fruit*, as Plumier says, like half that of a maple-tree, of a silvery hue when young, but afterwards tawny.

2. R. *cordata.* Heart-leaved Raiania. Linn. Sp. Pl. 1461. Ait. n. 1. (Jan-Raia scandens, foliis tamni; Plum. Ic. 148. t. 155. f. 1.)—Leaves ovate; somewhat heart-shaped at the base; seven-ribbed.—Native of the West Indies, from whence it was sent to Kew garden, in 1786, by Mr. Alexander Anderson. It flowers in the stove in July, and we cannot but wish some accurate botanist would publish a good figure and description of the plant, out of respect to its name. Plumier represents the habit of the *root*, *stem*, &c. much like the foregoing; but the *leaves* are regularly ovate, pointed, more or less heart-shaped at their base, and furnished with seven ribs continued from that part to the point. These ribs are connected by numerous transverse veins. *Inflorescence*, *flowers*, and *fruit*, much as in *R. hastata*, but having seen no specimen, we can say nothing respecting the *stipulas* or *bracteas*, none of which are noticed in the plate.

3. R. *ovata.* Ovate-leaved Raiania. Swartz Ind. Occ. v. 1. 638. Mart. Mill. Dict. n. 4.—"Leaves ovate, pointed, three-ribbed."—Native of bushy places, on the hills of Hispaniola. *Stem* shrubby, twining, thread-shaped,

 subdivided;

ſubdivided; with ſlender, ſmooth, leafy *branches*. *Leaves* rather diſtant, ſtalked, ſmooth on both ſides, pointed, entire, three-ribbed, veiny; ovate at the baſe. *Footſtalks* round, ſmooth, often as long as the leaves. *Cluſters* axillary, numerous, longer than the leaves, ſlender, many-flowered, rather zigzag. *Flowers* dioecious; the males in compound *cluſters;* females in ſimple ones, all ſtalked, and turned toward one ſide. *Corolla* very minute, yellowiſh-green in the male, reddiſh in the female bloſſoms. *Capſule* compreſſed, with an ovate, falcate, membranous wing. *Swartz.*

4. R. *anguſtifolia.* Narrow-leaved Raiania. Swartz Ind. Occ. v. 1. 639. Mart. n. 3.—"Leaves linear-lanceolate; rounded at the baſe, three-ribbed.—Native of extremely dry buſhy places, in the weſt part of Hiſpaniola, where it climbs upon high trees, flowering in May. *Root* annual. *Stem* thread-ſhaped, round, twining, flaccid, ſubdivided, ſmooth. *Leaves* nearly a ſpan long, entire, three-ribbed, veiny, ſmooth. *Footſtalks* ſmooth, red, twiſted according to the direction of the ſtem. *Cluſters* axillary, in pairs, the length of the leaves, pendulous, ſlender, many-flowered; the *flowers* very minute, nearly ſeſſile, red, polygamous, five or ſix on each of the alternate partial ſtalks, all leaning one way. *Bracteas* very minute, acute, blood-red, under the flowers. On ſome plants the latter are entirely male, with ſix nearly ſeſſile *anthers;* on others all hermaphrodite, with ſix perfect *ſtamens*, a triangular oblique *germen*, no *ſtyle*, but three minute *ſtigmas*. *Capſule* as in the reſt of the ſpecies. *Swartz.*

5. R. *quinquefolia.* Five-leaved Cluſtered Raiania. Linn. Sp. Pl. 1462. (Jan-Raia ſcandens quinquefolia; Plum. Ic. 149. t. 155. f. 2.)—Leaves five together at each joint, elliptic-oblong. Cluſters lateral, between the joints.—Native of the Weſt Indies, but hitherto obſerved by Plumier only. This ſeems to have the habit of all the foregoing, except that the *ſtem* has tumid joints, at each of which ſtand five elliptic-oblong, obtuſe, entire, three-ribbed *leaves*, about three inches long, on ſhort *footſtalks*. The *cluſters* are repreſented not axillary, as in the others, but lateral and alternate, from the ſpaces of the *ſtem* between the joints.

Section 2. *Leaves compound.*

6. R. *quinata.* Five-leaved Umbellate Raiania. Thunb. Jap. 148. Mart. n. 6.—Leaves five on a common ſtalk, emarginate. Umbels axillary.—Obſerved by Thunberg about Nagaſaki and in Koſido, in Japan, flowering in April and May. The Japaneſe call this plant *Fagi Kadſura*, and *Akebi*. *Stem* twining, round, ſmooth, aſh-coloured, branched. *Leaves* ſeveral together, axillary, ſtalked, ſmooth, of five ſeparately ſtalked, umbellate, ovate, entire *leaflets*, each from three-quarters of an inch to an inch and a half long, emarginate with a point. *Common footſtalks* thread-ſhaped, ſmooth, two inches or more in length; *partial* half as long as the finger nail. *Flowers* in umbels, from the ſame buds as the leaves, on ſlender ſtalks as long as the footſtalks; partial ſtalks capillary, the length of the nail. This ſpecies differs from the laſt in having compound *leaves*, and umbellate *flowers*. *Thunberg.*

7. R. *hexaphylla.* Six-leaved Cluſtered Raiania. Thunb. Jap. 149. Mart. n. 7.—Leaves ſix on a common ſtalk, oblong, acute. Flowers racemoſe.—Native of the country of Fakoñia, in Japan, among buſhes, flowering in April. Its vernacular names are *Akebi*, *Mbe Kadſura*, and *Tſu So*. The *ſtem* is round, ſtriated, ſmooth, climbing. *Leaves* alternate, ſmooth, ſix on a ſtalk, umbellate, on ſlender partial ſtalks, oblong, acute, entire, veiny, two inches long; pale at the back. *Common footſtalks* round, bent, three or four inches long, ſwelling at each extremity. *Flowers* in axillary cluſters, ſnow-white. Differs from *R. quinata* in having moſtly ſix leaflets on a ſtalk, which are acute, reticulated with veins at the back, and larger than in that ſpecies. The *flowers* moreover grow in cluſters, not umbels.

RAJAPILLA, in *Geography*, a town of Hindooſtan, in Myſore; 16 miles N.N.E. of Anantpour.

RAJAPORUM, a town of Hindooſtan, in Barramaul; 35 miles S. of Darempoury.

RAJAPOUR, a town of Hindooſtan, in the circar of Hiſſar; 48 miles W. of Hiſſar.—Alſo, a town of Hindooſtan, in the circar of Gohud; 10 miles W. of Janſi.—Alſo, a ſea-port of Hindooſtan, in Concan, where the Engliſh and French had formerly factories. The place has a good harbour, but it is not now frequented; 6 miles N. of Geriah.—Alſo, a town of Bengal; 16 miles S. of Silhet.—Alſo, a town of Bengal; 50 miles N.W. of Burdwan.—Alſo, a town of Hindooſtan, in Bahar; 27 miles W. of Arrah.

RAJARAJESWARI, in *Mythology*, a name of the Hindoo goddeſs Parvati. It means, in Sanſcrit, conſort of the lord of the king of kings. In the maſculine it is Rajrajeſwara, and is then a name of her lord Siva. See that article.

RAJARSHI, is one deſcription of ſaint or ſage, of whom four ſorts are comprehended in the more general term of Riſhi. Rajarſhi means a royal ſage, and is the loweſt of the four; the Devarſhi, or divine ſage, being, as may be ſuppoſed, where Brahmans are the givers of dignity, the firſt. See more hereon under MAHARSHI and RISHI.

RAJASEE, in *Geography*, a town of Hindooſtan, in the circar of Gohud; 10 miles S.W. of Datteah.

RAJASERAI, a town of Hindooſtan, in the circar of Sirhind; 17 miles E.S.E. of Sirhind.

RAIBACH, a town of Bavaria, in the territory of Rothenburg; 7 miles S. of Rothenburg.

RAIBAUG, a town and circar of Hindooſtan, in Viſiapour; 23 miles S. of Maſritch. N. lat. 16° 35′. E. long. 74° 52′.

RAIBOLINI, FRANCESCO, in *Biography*. See FRANCIA, IL.

RAJBULHAUT, in *Geography*, a town of Bengal; 30 miles S. of Burdwan. N. lat. 22° 45′. E. long. 88° 7′.

RAICAN, a town of Perſia, in the province of Irak; 15 miles N.E. of Hamadan.

RAICZ, a town of Hungary; 6 miles S.S.E. of Boleſko.

RAIDURGAM, a town of Hindooſtan, in the Carnatic; 15 miles W. of Tricolore.

RAIDY, a town of Bengal; 25 miles S.W. of Doeſa.

RAIE, a town of Aſiatic Turkey, in the province of Diarbekir; 118 miles S.W. of Diarbekir.

RAJEEATA, a town of Hindooſtan, in Guzerat; 78 miles W. of Gogo.

RAJEE-BEDUROO, a town of Hindooſtan, in Lahore; 27 miles E. of Jummoo.

RAJEGAUT, a town of Bengal; 24 miles S.S.E. of Iſlamabad.

RAJEGUR, a town of Bengal; 26 miles S. of Burdwan.—Alſo, a town of Hindooſtan, in the circar of Gangpour; 23 miles S.W. of Gangpour.—Alſo, a town of Hindooſtan, in Mewat; 20 miles E. of Cotputly.—Alſo, a town of Hindooſtan, in the circar of Gohud; 27 miles S.W. of Narwa.—Alſo, a town of Hindooſtan, in the circar of Bundelcund; 22 miles S.E. of Chatterpour.—Alſo, a town a town of Hindooftan; 20 miles E.S.E. of Allahabad. N. lat. 24° 49′. E. long. 80° 17′.

RAJEGUSDAR, a town of Hindooftan, in Lahore; 35 miles E.N.E. of Behnbur.

RAJEHAUT, a town of Bengal; 16 miles N.W. of Biffunpour. N. lat. 23° 13′. E. long. 86° 40′.

RAJEMAL, a circar of Bengal, bounded on the N. by Purneah, on the E. by Purneah, Mauldah, Dinagepour, and Raujefhy, on the S. by Sultanabad, and on the W. by Hindooa and Boglipour.—Alfo, the capital of the above circar, lying on the W. bank of the Ganges, nearly in the parallel of Mauldah, and about 20 miles from it; at the foot of the chain of hills which projects into the river at Sicly-gully and Terriagully. It is in a ruinous ftate, although not above 1½ century ago the refidence of the viceroy; and has hardly the population of an ordinary market-town at prefent. Its fituation is romantic, but not pleafant; for in Hindooftan, the hills and eminences being always covered with wood, that beautiful fwelling of the ground, which is fo juftly admired in European landfcapes, is loft; and the fancy is prefented at beft with nothing beyond a wild fcene; which can only be relifhed by being contrafted with foft and beautiful ones. It is more than thirty miles above the head of the delta of the Ganges, and therefore M. d'Anville placed it erroneoufly by affigning its fituation at this place. N. lat. 25° 2′. E. long. 87° 56′.

RAJEMATCHY, a town of Hindooftan, in Vifiapour; 37 miles N.W. of Poonah.

RAJEMUNGALUM, a town of Hindooftan; 16 miles S. of Tinevelly.

RAJETEA, one of the South-fea iflands, named alfo *Ulietea;* which fee.

RAJETPOUR, a town of Bengal; 15 miles S. of Rogonatpour.

RAJEWICE, a town of Lithuania; 42 miles S.S.E. of Brzefc.

RAIGIRI, a town of Hindooftan, in Golconda; 10 miles S.E. of Beder.

RAIGUR, a town of Hindooftan, in the circar of Sumbulpour; 15 miles N. of Sumbulpour.

RAJIK, a town of Syria, on the Euphrates; 18 miles S. of Bembig.

RAIL, in *Architecture*, is applied varioufly; particularly to thofe pieces of timber which lie horizontally between the pannels of wainfcot, and over and under them.

The word is alfo applied to thofe pieces of timber which lie over and under ballufters in balconies, ftaircafes, &c.

Alfo, to the pieces of timber that lie horizontally from poft to poft in fences, with pales or without. See FENCE.

RAILS, in a *Ship*, are long narrow pieces of fir, or oak, with mouldings of regular members of architecture ftruck on them, which are faftened, or fometimes wrought from the folid plank, as ornaments to the fhip's fides. The former are now difcontinued in the navy, as they were found to rot the fides very much; the latter, wrought from the folid plank, are ufed in merchant fhips. The rails of the head and ftern are pieces of oak timber handfomely wrought with mouldings. The lower rail along the fide is named the *waift-rail*, and the next above it the *fheer-rail*, which are generally placed parallel to the top timber line, the fheer-rail with the top of the fide amidfhips, and the waift-rail about twenty inches below it; the rails next above and parallel to the fheer-rail are called *drift-rails*, and the rails above the plank-fheer, if any, the *fife-rails*. The rails of the head are diftinguifhed by the *upper* or *main-rail*, the *middle* and the *lower-rail;* and the rails of the ftern take their names from the parts to which they are fixed, as the *tuck-rail*, *lower counter-rail*, *upper counter-rail*, *foot fpace-rail*, *breaft-rail*, *taffarel-rail*, and *taffarel fife-rail*. (See *Plate* I. *Ship-building*.) To thefe may be added the thwartfhip pieces of the framing of the great cabin bulk-heads.

RAILS of the *head* are certain curved pieces of timber, extending from the bows on each fide to the continuation of the fhip's ftem, to fupport the knee of the head, and the ornamental figure fixed upon it.

RAIL, or *Water-Rail*, in *Ornithology*, the name of the *rallus aquaticus* of authors, which is a bird of a long flender body, with fhort concave wings. The bill is flender, flightly incurvated, and one inch three quarters long: the upper mandible black, edged with red, the lower orange-coloured; the irides red; the head, hind-part of the neck, the back and covert of the wings and tail are black, edged with an olive-brown; the bafe of the wing is white; the quill-feathers and fecondaries dufky; the throat, breaft, and upper part of the belly, are afh-coloured; the fides under the wings, as far as the rump, finely varied with black and white bars; the tail is very fhort, confifting of twelve black feathers; the ends of the two middle tipt with ruft colour; the feathers immediately beneath the tail white; the legs are placed far behind, and are of a dufky flefh colour; the toes very long, and divided to their origin: though the feet are not webbed, it takes the water, will fwim on it with much eafe, but is often obferved to run along the furface. It delights lefs in flying than in running, which it does very fwiftly along the edges of brooks covered with rufhes. When it runs, it every now and then flirts up its tail, and in flying hangs down its legs. Pennant.

This bird, fays Mr. Pennant, is properly *fui generis*, agreeing with no other, but forming a feparate tribe; though M. Briffon and Linnæus place it with the land-rail, and Mr. Ray with the water-hens. It is a well-tafted bird.

RAIL, *Land*, the *rallus crex* of Linnæus, is a migrating bird, with a fhort, ftrong, thick bill; always found among corn, grafs, broom, or furze. It leaves this kingdom before winter. They have long legs, and a fingular note, refembling the word *crex*, often repeated. The feathers on the crown of the head, hind part of the neck, and the back, are black edged with bay colour; the coverts of the wings of the fame colour, but not fpotted; the tail is fhort and of a deep bay, the belly white, and the legs afh-coloured. They are in greateft plenty in Anglefea, where they appear about the 20th of April, fuppofed to pafs over from Ireland, where they abound. They are found in moft of the Hebrides, and the Orkneys. Pennant.

RAILING, in *Rural Economy*, a fort of fence conftructed with pofts and rails. It is often made ufe of in protecting young hedge fences, from the cropping of cattle or other animals. Any fort of coarfe timber does very well for this laft purpofe, fuch as outfide planks, and the boughs or loppings of timber plantations. See FENCE.

RAILLERY, as Dr. Johnfon hath defined it, denotes flight fatire, or fatirical merriment; and a beautiful writer compares it to a light which dazzles, and which does not burn. It is fometimes, what it always ought to be, innocent and pleafant, but it is too frequently offenfive. Raillery is of various kinds; ferious, fevere, and good-humoured; there is a kind which perplexes, a kind which offends, and a kind which pleafes.

It has been juftly obferved, that in order to rally well, kindnefs fhould prevail in every thing that is faid, as the character of a friend fhould be maintained to warrant freedom with a perfon who is addreffed, efpecially in this way. Allufions to paft follies, and hints that tend to revive what a perfon wifhes for ever to forget, fhould never be introduced

as

as subjects of raillery. It is below the character of persons of humanity and good breeding, to indulge mirth, while any one in the company is suffering, as the effect of that mirth, pain and mortification.

RAILWAY, *Tram* or *Dram-road*, or *Waggon-way*, in *Rural Economy*, a track constructed of iron, stone, timber, or other material, upon the level surface of an inclined plane, or other situation, for the purpose of diminishing friction, and thus serving for the easy conveyance of heavy loads of any kind of articles. See *Plate* IV. *Canals*, *figs.* 31 to 35. See also CANAL.

It has been remarked, that railways have hitherto been confined, almost exclusively, to coal-works, and other mines; and that inventions, whose only recommendations are simplicity and usefulness, are often suffered to lie long in a state of public neglect; while others, perhaps, of no real utility, but of more imposing aspect, and being pertinaciously blazoned forth by interested or blinded partisans, are readily adopted; and bask, for a while, in the sunshine of public favour. The time has, however, at length arrived, when carriages moving on level surfaces, or on gently inclining planes, with little friction, and *without* obstructions, are fast spreading over the face of the country. It has been observed that there may be many lime-works, as well as other sorts, from which railways may be laid, in different directions, with great benefit to their proprietors and the surrounding neighbourhoods in general.

With the view of diminishing horse labour, it has been suggested by Dr. Anderson, in his Recreations in Agriculture, that where internal canals cannot be established, this may be effected, and intercourse facilitated, by means of railways, which have not yet been introduced into general practice. It is further stated, that they were first solely employed for transporting coals to a moderate distance from the pits, to the places where they could be shipped, being universally made of wood. And long, says he, had they been applied to this use, without any idea having been entertained that they could be employed for more general purposes. By degrees they were, however, carried to a farther extent; the scarcity of wood, and the expence of their repairs, suggested the idea of employing iron for the purpose of improving these roads. At the first, flat rods of bar-iron were nailed upon the original wooden rails, or as they were technically called, *sleepers;* and this, though an expensive process, was found to be a great improvement. But the wood on which these rested being liable to rot and give way, some imperfect attempts were made to make them of cast iron, but these were found to be liable to many objections, until the business was taken in hand by Mr. Outram, engineer, at Butterly Hall, Derbyshire, who contrived at the same time, so far to diminish the expence, and improve the strength of the road, as to bring them to a degree of perfection, that no one who has not seen them can easily conceive could have been done. And it is added, that this having been carried into execution in a few cases, and found to answer, has been improved upon and simplified by practice, till it is now brought to such a state of perfection as to have given proofs, that it admits of being carried much beyond the limits of what was for many years conceived to be possible, and to afford demonstrative evidence, that it may be in future employed to a wider extent still, to which no limits can be at present assigned or foreseen.

There are a great number of railways in Derbyshire, Shropshire, Lancashire, and many other parts of the country.

In the first of the above counties, there are railways of very different lengths; one of five miles in length, leading from the town of Derby to the collieries in the vicinity; another, from the lime-stone rocks on the Cranford canal, called the Crick railway, which is about one mile and a half in length; a third from the Beggarlee colliery to the same canal, denominated Barber and Walker's railway, of similar length; a fourth from the lime-works in the neighbourhood of Boston, to the canal near Whaley bridge, termed the Peak-forest railway, which is about six miles in length; a fifth called the Marple railway, of about one mile and a half long, on the Peak-forest canal; sixthly, railways over Blisworth-hill near Nottingham, on the Grand Junction canal, which are three miles and a half in length, and constructed in a double manner; a seventh, which has the name of the Ashby de la Zouch railway, has four miles of double and eight miles of single rails. Some of these railways are formed in a very complete manner, especially those which have been made since the various improvements of them were introduced. They have been of prodigious utility and advantage to the county, both in regard to its agricultural improvements and its manufacturing interests and concerns.

These sorts of railway roads have likewise been introduced into many parts of the county of Salop, with vast benefit and success to the different interests of the district. They have here had a new application, in being employed for the purpose of conveying heavy weights from different levels on canals.

Speaking of the great utility of canals in the carriage of various articles in this county, it is observed by Mr. Telford, an able engineer, that another mode of conveyance has frequently been adopted to a considerable extent; which is that of forming roads by means of iron rails laid along them, upon which materials are carried in waggons, which contain from six to thirty hundred weight; experience, he thinks, has now convinced us, that in countries the surfaces of which are rugged, or where it is difficult to obtain water for lockage, where the weight of the articles of the produce is great in comparison with their bulk, and where they are mostly to be conveyed from a higher to a lower level, that in those cases, iron railways are in general preferable to canal navigation.

It is supposed, that on a railway well constructed, and laid with a declivity of fifty-five feet in a mile, one horse will readily take down waggons containing from twelve to fifteen tons, and bring back the same waggons with four tons in them. This declivity, therefore, suits well, when the imports are only one-fourth part of what is to be exported. If the empty waggons only are to be brought back, the declivity may be made greater; or an additional horse applied on the returning journey will balance the increase of declivity. If the length of the railway were to be considered, it may, it is supposed, without much inconvenience, be varied from being level to a declivity of one inch in a yard, and by dividing the whole distance into separate stages, and providing the number of horses suitable for each portion of railway, according to the distance and degree of declivity, the whole operation may be carried on with regularity and dispatch.

It is upon the whole believed, that this useful contrivance may be varied so as to suit the surface of many difficult countries, at a comparatively moderate expence. It may be constructed in a much more expeditious manner than navigable canals; it may be introduced into many districts where canals are wholly inapplicable; and in case of any change in the working of mines, pits, or manufactories, the rails may be taken up and laid down again in new situations, at no very great expence or trouble.

It is also further noticed, that some parts of this and the neighbouring counties, in which canals had once been intended

intended to be formed, have ſince been looked over and examined with the view of having iron railways inſtead of navigable cuts; and in many caſes this may be the moſt adviſable and proper, particularly in all ſituations where difficulties ariſe in the conſtructing of navigable canals, or other ſorts of works for water carriage.

The county of Lancaſter, too, has a great many of theſe iron railways for the convenience, accommodation, and advantage of the different collieries, manufactories, and other works, where heavy loads are to be tranſported. The coal work near St. Helens, in the vicinity of Liverpool, has a double railway ſome miles in length; and at the iron-works of lord Belcarras, near Wigan, as well as his cannel coal pits near the ſame place, there are double railways of very conſiderable length. To the ſouth of the town of Preſton, at a ſmall diſtance from Bamber bridge, there is likewiſe one communicating with the Lancaſter and Kendal canal, which is alſo double and of great length; ſerving to convey the coals from the ſouthern parts of the county to that canal, in order to their diſtribution in the northern parts, and the adjoining diſtricts.

On the eaſt ſide of the ſame county they alſo prevail in many places, and are found of the greateſt uſe, being the means of diſpatching much buſineſs in a ready manner and without much expence of labour.

The utility of theſe railways has been found to be extremely great in other coal-works and canals, where they are at preſent very extenſively employed; and it has been ſuggeſted, that they may be applicable in other caſes, as for ſhortening the team labour of a farm ſo as to bring it within one day's journey, where more than one were formerly neceſſary, by which a great ſaving in labour and expence may be made. Alſo, in rendering the buſineſs of lime works more eaſy and expeditious in different inſtances. It has likewiſe been hinted by Mr. Beatſon, in the firſt volume of Communications to the Board of Agriculture, that they might be had recourſe to on roads where there are unavoidable riſes or falls, for taking up or letting down heavy loaded waggons or other carriages. It is obſerved, that near Colebrook Dale there is one at a ſmall diſtance from the iron bridge, upon which loaded boats are drawn up to a canal, two hundred and twenty feet above the level of the river Severn, and let down in a ſimilar manner into it, by which means twenty-two locks are ſaved, and the work executed in an expeditious manner. It is ſuppoſed, that this is the greateſt inclined plane in Europe, or perhaps in the world, for though they are much uſed in China in the place of locks, he has never heard of any of them being equal in height to this. The rails are beſt made of iron. It is added, that they have been found uſeful in improving ſoft, moſſy, boggy lands, on which horſes cannot travel; a rail road of this ſort having been formed through a peat moſs near Mancheſter by Mr. Wakefield, while it was under improvement, at the expence only of about three hundred pounds a mile, on which a ſingle horſe was capable of drawing with the greateſt facility ſeven waggons at once, each being loaded with about ſeven hundred weight of marle, bearing in the whole forty-nine hundred weight, and with the weight of the waggons upwards of three tons. This was performed, it is obſerved, over a place where a few months before a dog could hardly venture without the danger of being *ſwamped.* On the Ketley and other canals in the county of Shropſhire, vaſt advantages have been derived from laying railways upon inclined planes, and letting down and drawing up the different articles by means of machinery, as may be ſeen in the very able Agricultural Report of that diſtrict, where excellent repreſentations of them are given.

Beſides theſe different caſes of railways, another has been ſuggeſted by the writer of the Annals of Agriculture, which is that of having them laid from the ſtack-yards to the thraſhing machines, by which the grain may be conveyed to them at any time with eaſe and convenience, as well as any particular ſtack that may be wanted.

It is further ſtated by the ingenious Dr. Anderſon, that the beſt idea he can give of the benefit that may reſult to the community from the uſe of this kind of railways, will be from ſtating ſome facts reſpecting them, which were lately communicated to the Society of Arts by Mr. Wilkes, of Meaſham, near Loughborough, in Leiceſterſhire; a ſpirited and judicious agriculturiſt. He had a railway of this ſort made, which was about five miles in extent, leading from a coal-mine to a market. He found it ſo fully to anſwer his expectations after it was finiſhed, that he communicated to the above ſociety an account of ſome trials he had made of it, requeſting that ſuch of the members of that reſpectable inſtitution as were deſirous of information on that head, would do him the honour to witneſs ſome experiments that he wiſhed to make upon it, for the information of the public. A committee of the members was accordingly deputed for that purpoſe, and before them he ſhewed that a moderate ſized horſe, of about twenty pounds value, could draw upon it with eaſe down hill (the deſcent being one foot in a hundred) thirty-two tons, and without much difficulty forty-three, and ſeven tons up hill, independent of the carriages. The doctor concludes from theſe facts, that upon a perfect level a horſe could draw with eaſe from ten to twenty tons. It is obſerved, that Mr. Wilkes's railway, on which the experiments were made, was, from local circumſtances, laid upon wooden ſleepers, and is not ſo perfect as thoſe done upon ſtone. But it is added, that twenty tons are the load which ſuch a horſe could draw with eaſe, travelling at the uſual waggon rate, in boats upon a canal; ſo that the number of horſes required in this way will not be much, if at all, greater than on a canal. Certain advantages attach to this mode of conveyance, which do not ſo well apply to a canal, and *vice verſâ*; but it is not his intention to draw a parallel between theſe two modes of conveyance. Nobody can entertain any doubt, he thinks, about the utility of canals where they are eaſily practicable. He only wiſhes to point out this as an eligible mode of conveyance where canals cannot be conveniently adopted.

It is further remarked, that it was cuſtomary at the firſt, to put the whole load to be drawn by one horſe upon railways into one waggon; but now, when the load is ſo much augmented, it has been found eligible to divide it into many parts, ſo that no one waggon ſhall carry more than one or two tons; by this method the weight is ſo divided, that the preſſure is never ſo great upon one point as to be in danger of too much cruſhing the road; the carriages can be made much more limber and light in all their parts, and they are much more eaſily moved, and more manageable in all reſpects than they otherwiſe would have been. And another advantage of this arrangement, which deſerves to be particularly adverted to, is, that it admits of ſhifting the carriages ſo as to leave a load, as it were, in parcels at different places where they may be required, without trouble or expence. This, when it comes to be fully underſtood and carried into practice, will, he thinks, be a convenience of ineſtimable value, a thing that has been always wanted, and never yet has been found though it has been diligently ſought for. The able writer has here endeavoured to illuſtrate its importance and utility in tranſporting goods from the wet docks now forming on the Iſle of Dogs to London, and in carrying roads to different diſtant parts of the country; in which caſes, cafes, and in all where there is much bufinefs to be done, they would require to be double, one for going, and the other for coming upon, to prevent interruption and interference.

And he afterwards offers a few remarks, tending to fhew the practicability of the meafure, and to guard againft fetting out upon a bad plan, which might, he fuppofes, in time to come, fruftrate the good that might have refulted from the undertaking; merely premifing, that he propofes thefe railways folely for the purpofe of conveying weighty loads, leaving the roads, as at prefent, open for coaches and light carriages.

Alfo with a view to difcover how far it may be practicable to introduce thefe iron railways into general ufe, he has made fome inquiries refpecting the expence of making them; and although this muft vary according to the abundance and goodnefs of materials, and other circumftances, the following ftatement may ferve to give fome general notions on that head. In the moft eligible fituation, where materials are abundant and good, and circumftances favourable, the loweft expence at which a *fingle* railway of this fort can be made, will be about one thoufand pounds a mile. But as a fingle railway muft be liable to great inconveniencies, unlefs under very particular circumftances, double railways ought to be confidered as the only ufeful fort. Thefe, for public purpofes, according to the opinion of the inventor, fhould be very fubftantially made. The metal ufed fhould be of the ftouteft fort, and of fubftance enough, not merely to carry the weights propofed, but to be equal to bear almoft any blow or fhock that they may be likely to experience; and, thus made, what they will lofe by ruft or wear, will be long ere it materially weakens them. Made after fuch a manner, in favourable fituations in the country, a double railway may, he thinks, coft about two thoufand pounds a mile, but in the neighbourhood of London, where the charge of every thing is high, and where they fhould be of the ftrongeft fort, we fhould fuppofe they might coft nearly three thoufand pounds a mile. It is bad economy, he thinks, to fave on articles of this fort at the firft; for the little expence thus laid out then will fave much in repairs: how fmall thefe repairs are, may be imagined from this circumftance, that when a road is thus made, the undertaker does not fcruple to fupply all that are broken, free of charge, for the firft three years. Say then that fuch a road coft three thoufand pounds a mile, this would bring a charge upon the turnpike of 150*l.* a-year; fay 50*l.* more for annual repairs; this is, in all, 200*l. per annum.* Compare this with the expence of keeping the prefent roads in repair. It has been fuggefted to him, that there is annually laid out in repairs upon the road from Hyde Park Corner to Hounflow, confiderably above one thoufand pounds a mile; fo that the difference of expence is, even at the beginning, very much in favour of railways: and were the money thus at firft expended to be gradually paid off, the tolls might thus be lowered almoft to nothing. And, he thinks, that a turnpike road cannot be made in almoft any fituation for lefs, as he is told, than 1000*l. per* mile; but where it is of confiderable width, as near great towns, it will run from 1500*l.* to 2000*l. per* mile; and in annual repairs, including the purchafe price of materials, carting them on the road, fpreading, raking off, and carting away again, from 100*l.* to 1000*l.* a mile. Say 1500*l.* prime coft, the intereft is 75*l.* and 150*l.* for repairs, the annual charge of fuch road will be 225*l.* This is an expence of 100*l.* a-year more than the other. But for the prefent, let us fuppofe that they will be equal, the extra charge for purchafing ground for a new waggon-way, &c. being equal to that furplus; let us now fee what would be the difference of charge to the employers of thefe waggons in the two cafes. Suppofing the road to be fo much employed as that 100 waggons (or loaded carriages to the fame amount) pafs each day, carrying fix tons each, drawn by eight horfes; thefe, at one fhilling each waggon for toll (or two-pence a ton), would produce 5*l.* a day, or 1825*l* a-year; which, at the rate of eight miles for each turnpike, would be 228*l. per* mile, the furplus being produced by road horfes and light carriages. The charge then to the employer, for this ftage, muft be 1825*l.* and the keep of 800 horfes, befides fervants, incidental charges, and owner's profits for the tranfporting of 600 tons of goods a day. Say that the fame horfes travel two ftages a day, the turnpike money would be doubled; that is, 3650*l. per annum;* the keep of 800 horfes, at 2*s.* each *per diem*, is 29,200*l.* Thefe fums added make 32,850*l.*; owner's profit and incidental charges, fay 10 *per cent.*, 3285*l.*; in all 36,135*l.*, or, on 219,000 tons (being 600 tons a day), about one-fourth *per* ton. And fuppofing the fame quantity of goods carried on the railway, and the fame turnpike money paid, and that each horfe drew only fifteen tons, this would require only, he thinks, forty horfes; the keep of which, at 2*s.* a day, would be 1460*l.*, add the toll, 1825*l.* is 3285*l. per annum.* Owner's profit, &c. upon this fum 10 *per cent.* as above, 328*l.*; in all 3613*l.*, or about four-pence a ton, juft one-tenth part of the charge in the other cafe. He thinks, that when the object comes to be confidered in this point of view, few meafures that can be propofed will hold forth fuch an important national improvement as this would be. Confidered with regard to the confumption of the produce of the earth (an object at prefent deferving the fulleft attention, as this improvement can be applied to almoft every part of the country), it would, he fuppofes, reduce the number of heavy road horfes to one-eighth part of what they are at prefent, and of courfe augment the number of cattle or other confumeable provifions in a proportionate degree, fo as greatly to lower the price of the neceffaries of life. It would, in the next place, lower the price of the carriage of goods of all kinds to an amazing extent; and laftly, as a confequence of that, it would give fuch encouragement to agriculture, as no other meafure that can be contrived could ever effect, and that without cofting one fhilling expence to any one individual, or to the ftate. On the contrary, by inducing cheapnefs of provifion, and affording fuch efficacious encouragement to manufactures and to agriculture, it would produce a general profperity, which, by augmenting the confumption of taxable commodities, would augment the public revenue; while, at the fame time, every individual would feel himfelf relieved from the preffure of many taxes that prove diftrefsful to him at prefent. After juftly reprobating every fort of gambling fpeculations by monied men in undertakings of this nature, and fhewing the numerous evils that attend them, he advifes it, as highly neceffary to prevent thefe railways from ever becoming private property, on any account, to keep them open and patent alike, to all who fhall choofe to employ them as a king's highway, under fuch regulations as it fhall be found neceffary to fubject them to by law. In fhort, they fhould, he thinks, be put upon the fame footing, in all refpects, as public roads are at prefent, only under the direction of a diftinct fet of commiffioners, who fhould have the fuperintendance of every thing that concerns this fpecies of roads only. Thefe commiffioners fhould be vefted with authority under an act of parliament, to erect turnpikes upon them, to levy certain ftipulated tolls, and to mortgage the produce of thefe tolls for the purpofe of raifing money to be applied in the neceffary purchafes of land, and making the roads. In the act it fhould ſhould be expreſsly ſtipulated, that the produce of theſe tolls ſhould be applied ſolely to keeping the road in repair, paying the intereſt of ſums borrowed, and clearing off the principal as faſt as the collections would admit; and when the whole money borrowed was thus paid off, the tolls ſhould be ſo lowered as only to produce money ſufficient to keep the roads in a ſtate of continually good repair. Thus would the expence of tranſporting goods be annually diminiſhing, and the proſperity of the country be thereby augmenting from day to day. He adds, that he is particularly earneſt in this buſineſs, as he has not been an unconcerned obſerver of the effects that have reſulted from the eſtabliſhment of turnpike roads in Scotland, which were begun within his recollection; and theſe effects have been ſuch as no man who had not ſeen it would have believed could ever have taken place. Diſtance may be ſaid to be thus diminiſhed from place to place; lands that were originally far beyond the influence of the town as a market for any thing elſe than live-ſtock, are thus brought, as it were, cloſe to its gates; and the value of the produce of many articles is thus to them augmented fourfold, while they are at the ſame time diminiſhed to the public. Not only is the value of produce raiſed, but the quantity alſo of that produce is augmented exceedingly by means of manures which become then acceſſible. Foſſile manures, ſuch as chalk, lime, and marle, which were formerly confined to a narrow ſpot, expand themſelves as if it were by a magical power, and by that expanſible influence diffuſe around fertility, riches, and plenty. Coals and other weighty articles that may be uſeful in arts or manufactures of various kinds, which never were, nor ever could have been of any value to the owners of them, ſo long as the expence of tranſportation exceeded a certain ſum, find a ready market to any extent as ſoon as the price falls below that rate, thus contributing not only towards the enriching of the owners, but to the furniſhing of employment to the various perſons who muſt be engaged in preparing or tranſporting them to market, and the univerſal accommodation of the whole. Around every market you may ſuppoſe a number of concentric circles drawn, within each of which certain articles become marketable which were not ſo before, and thus become the ſource of wealth and proſperity to many individuals. Diminiſh the expence of carriage but one farthing, and you widen the circle; you form, as it were, a new creation, not only of ſtones, and earth, and trees, and plants, but of men alſo, and what is more, of induſtry, of happineſs, and joy. It is added, that by making theſe roads the property of the public, and free to every perſon to bring his own waggons upon them wherever he pleaſed, farmers, when near them, would make bye roads of the ſame ſort leading into theſe from their reſpective premiſes; the inhabitants of villages and country diſtricts would join together, and at one common expence make roads of the ſame ſort leading to a greater diſtance inwards, as they now make bye roads for themſelves. Thus would all be accommodated; thoſe who had buſineſs enough to furniſh a ſufficient load for one horſe might go to market with it when they pleaſed: thoſe who had dealings on a ſmaller ſcale could have one, two, or more waggons of their own conjoined with thoſe of others to make up a load for one horſe: and thoſe of ſtill ſmaller means could have one waggon loaded with the joint articles belonging to two, three, or more. A ton weight might then be puſhed before a man to market for many miles, as a wheelbarrow is now. It is ſcarcely poſſible, he ſuppoſes, to contemplate an inſtitution from which would reſult a greater quantum of harmony, peace, and comfort, to perſons living in the country, than would naturally reſult from this arrangement. In fact, he knows, he ſays, no *one* meaſure, that would tend ſo effectually to lower the price of the neceſſaries of life, and reſtore abundance.

In what regards the method of forming and conſtructing theſe railways, it is obſerved by the ſame writer, that the following has been given by the inventor as the moſt improved plan: firſt, that the beſt line the country affords ſhould be traced out, having regard to the direction of the carriage of articles or trade to be expected; and if ſuch trade be both ways in nearly equal quantities, a line as nearly horizontally level as poſſible ſhould be choſen. If the trade is all in one direction, as is generally the caſe between mines and navigation, then the moſt deſirable line is one with a gentle gradual deſcent, ſuch as ſhall make it not greater labour for the horſes employed to draw the loaded waggons down, than the empty ones back; and this will be found to be the caſe on a railway deſcending about one foot vertical in one hundred feet horizontal. Or, if the railway and carriages are of the very beſt conſtruction, the deſcent vertical may be to the length horizontal as 1 to 50, where there is little or no upgate loading. In caſes between mines and navigations the deſcents will often be found greater than could be wiſhed. On a railway on the improved plan, where the deſcent is more than as 1 to 50, ſix or eight waggons, loaded with thirty or forty hundred weight each, will have ſuch a tendency to run downwards, as would require great labour of one horſe to check and regulate, unleſs that tendency was checked by ſledging ſome of the wheels. On ſuch, and ſteeper roads, iron ſlippers are applied, one or more to a gang of waggons, as occaſion may require. Each ſlipper being chained to the ſide of one of the waggons, and, being put under the wheel, forms a ſledge. Where the deſcent is very great, ſteep inclined planes, with machinery, may, it is obſerved, be adopted, ſo as to render the other parts of the railway eaſy. On ſuch inclined planes the deſcending loaded waggons being applied to raiſe the aſcending empty, or partly loaded ones, the neceſſity of ſledging the wheels is avoided; and the labour of the horſe greatly reduced and leſſened.

In order to obtain the deſired levels, gentle deſcents, or ſteep inclined planes, and to avoid ſharp turns, and circuitous tracks, it will often be found prudent to croſs valleys by bridges and embankments; to cut through ridges of land; and in very rugged countries ſhort tunnels may, he thinks, ſometimes be neceſſary. The line of railway being fixed, and the plans and ſections by which the ſame is to be executed and ſettled, the ground for the whole muſt be formed and effectually drained. The breadth of the bed for a ſingle railway, ſhould be, in general, four yards; and for a double one ſix yards, excluſive of the fences, ſide drains, and ramparts.

That the bed of road being ſo formed to the proper inclination, and the embankments and works thereof made firm, the ſurface muſt be covered with a bed of ſtones broken ſmall, or good gravel, ſix inches in thickneſs or depth. On this bed muſt be laid the ſleepers, or blocks to faſten the rails upon. Theſe ſhould be of ſtone in all places where it can be obtained in blocks of ſufficient ſize. They ſhould be not leſs than eight, nor more than twelve inches in thickneſs; and of ſuch breadth (circular, ſquare, or triangular,) as ſhall make them 150lbs. or 200lbs. weight each. Their ſhape is not material, ſo as they have a flat bottom to reſt upon, and a ſmall portion of their upper ſurface level, to form a firm bed for the end of the rails. In the centre of each block ſhould be drilled a hole, an inch and a half diameter, and ſix inches in depth, to receive an octagonal plug of dry oak, five inches in length; for it ſhould not reach the bottom of the hole; nor ſhould it be larger than ſo as to put in eaſily, eafily, and without much driving; for if too tight fitted it might when wet burft the ftone. Thefe plugs are each to receive an iron fpike or large nail, with a flat point and long head, adapted to fit the counter-funk notches in the ends of two rails, and thereby to faften them down in the proper pofition, or fituation in which they are to lie.

With regard to the rails, they fhould be of the ftouteft caft-iron, one yard in length each, formed with a flanch on the inner edge, about two inches and a half high at the ends, and three and a half in the centre; and fhaped in the beft manner to give ftrength to the rails, and keep the wheels in their track. The foles of the rails, for general purpofes, fhould not, he thinks, be lefs than four inches broad; and the thicknefs proportioned to the work they are intended for. On railways for heavy burdens, great ufe, and long duration, the rails fhould be very ftout, weighing 40lbs., or, in fome cafes, nearly half an hundred weight each. For railways of lefs confequence, lefs weight of metal will do; but it will not be prudent to ufe them of lefs than 30lbs. weight each, in any fituation expofed to breakage above ground. But it is obferved that in mines, and other works under ground, where very fmall carriages only can be employed, very light rails are ufed, forming what are called train roads, on a fyftem introduced by Mr. Carr; and thefe kinds of light railways have been much ufed above ground in Shropfhire, and other counties where coals and other minerals are obtained.

It is added, that in fixing the blocks and rails great attention is required to make them firm. No earth or foft materials fhould be ufed between the blocks and the bed of fmall ftones or gravel, on which the rails muft all be fixed by an iron gage, to keep the fides at a regular diftance, or parallel to each other. The beft width of road for general purpofes is four feet two inches between the flanches of the rails; the wheels of the carriages running in tracks about four feet fix inches afunder. Rails of particular forms are neceffary where roads branch out from or interfect each other; and where carriage roads crofs the railways; and, at turnings of the railways, great care is required to make them perfectly eafy. The rails of the fide forming the inner part of the curve fhould be fixed a little lower than the other; and the rails fhould be fet a little under the gage, fo as to bring the fides nearer together than in the ftraight parts: thefe deviations in level and width to be in proportion to the fharpnefs of the curve. The blocks and rails being fixed and fpiked faft, nothing more remains to be done than to fill the horfe-path, or fpace between the blocks, with good gravel, or other proper materials; a little of which muft alfo be put on the outfide of the blocks to keep them in their proper places. This gravel fhould always be kept below the furface of the rails on which the wheels are to run, to keep the tracks of the wheels free from dirt and obftructions. The form of the rails muft be fuch as will free them from dirt if the gravelling is kept below their level.

And in the conftructing of the carriages great attention to avoid friction is neceffary, particularly in the formation of the wheels and axles, which muft be adapted to the fort of railways and kind of loading; but for which general directions cannot be given in a narrow compafs. It is probable that this valuable invention may alfo be applicable to many other purpofes in agriculture or manufactures, as it becomes more fully underftood, and the facilities which it affords are better known. See CANAL.

RAIMALPOUR, in *Geography*, a town of Hindooftan, in Vifiapour; 15 miles E. of Sattara.

RAIMONDI, IGNATIUS, in *Biography*. This worthy mufical profeffor, whofe performance, character, and private virtues, are well known to our country, after a refidence in it of more than thirty years, is honourably mentioned by Ernft Ludwig Gerber, the continuator of Walther's Mufical Lexicon, in 2 vols. 8vo., 1792. He fays, that this expreffive and pleafing performer on the violin, and agreeable compofer for his inftrument, was born in Italy, a fcholar of Barbella, fettled at Amfterdam in 1772, where he remained the principal violin during twelve years, having fucceeded the famous Locatelli. He had publifhed nine different works for violins at Berlin and Amfterdam, before the year 1785. About the year 1773 he arrived in London, fince which time he has publifhed many pleafing compofitions, particularly his "Battaglia," which is the beft imitative inftrumental mufic of that kind that has come to our knowledge.

RAIMPOUR, in *Geography*, a town of Hindooftan, in Rohilcund; 30 miles S. of Bereilly.

RAIN, a town of Hindooftan, in Guzerat, on the gulf of Cutch; 45 miles W. of Noanagur.—Alfo, a town of Bavaria; 16 miles N. of Augfburg. N. lat. 48° 37'. E. long. 10° 52'.

RAIN, or *Old Rain*, a town of Scotland, in Aberdeenfhire, near which are the remains of a palace of the former bifhops of Aberdeen; eight miles S.E. of Inverary.

RAIN, the diftillation of water which defcends from the atmofphere in drops of various fizes. By this circumftance rain is diftinguifhed from dew or fog; in the former of which the drops are fo fmall, that they are quite invifible; and in the latter, though they are of a larger fize, they feem to have little more fpecific gravity than the atmofphere itfelf, and may therefore be reckoned hollow fpherules rather than drops.

Rain is, apparently, a precipitated cloud; as clouds are nothing but vapours raifed from moifture, waters, &c.

And vapours are demonftratively nothing elfe but little bubbles or veficulæ detached from the furface of the terraqueous globe by the power of the folar or fubterraneous heat, or fome other caufe. Thefe veficulæ, being fpecifically lighter than the atmofphere, are buoyed up by it, until they arrive at a region where the air is in a juft balance with them; and here they float, till by fome new agent they are converted into clouds, and thence either into rain, fnow, hail, mift, or the like.

But the agent in this formation of the clouds into rain, and the vapours into clouds, has been much controverted. Some philofophers have fuppofed that the cold, which conftantly occupies the fuperior regions of the air, chills and condenfes the veficulæ, at their arrival from a warmer quarter; congregates them together, and occafions feveral of them to coalefce into little maffes: and by thefe means their quantity of matter increafing in a greater proportion than their furface, they become an overbalance to the thin air, and accordingly defcend in rain.

Dr. Derham accounts for the precipitation thus; that the veficulæ being full of air, when they meet with a colder air than that they contain, this internal air is contracted into a lefs fpace; and confequently the watery fhell, or cafe, is rendered thicker, fo as to become heavier than the air, &c.

It has, however, been objected to this hypothefis, that rain often happens in very warm weather; and though it be allowed, that the condenfation may be owing to the cold of the upper regions, yet the drops acquire a confiderable increafe of fize as they defcend. *E. G.* On the fummit of a hill they are fmall and occafion only a drizzling fhower; but in defcending the hill it becomes more confiderable, and at the bottom of the hill the drops are much larger, and the

the rain is impetuous. Hence it appears that the vapours are condenfed when the atmofphere is warm as well as when it is cold.

Others only allow the cold a part in the action, and afcribe a fhare of it to the winds, alleging, that a wind blowing againft a cloud will drive its veficulæ upon one another, by which means feveral of them, coalefcing as before, will be enabled to defcend; and the effect will be ftill more confiderable, if two oppofite winds blow together toward the fame place. To which they add, that clouds already formed, happening to be augmented by frefh acceffions of vapour, continually afcending, may on this account be enabled to defcend.

Againft the above ftated hypothefis of Derham, it has been objected that the veficulæ of vapour, if they be fuch, are filled, not with air, but fire or heat in a latent ftate, and till they part with this heat, the vapour cannot be condenfed. Cold is not always fufficient to produce this effect, for in the moft fevere frofts the air is ferene, and parts with little or none of its vapours, for a confiderable time. It is alfo alleged, that the winds have no confiderable agency, fince blowing upon vapour is fo far from condenfing it, that it unites more clofely with the air; and wind is known very much to promote evaporation. See VAPOUR.

Yet the grand caufe, according to Rohault, ftill remains: that author conceives it to be the heat of the air, which after continuing for fome time near the earth, is at length carried up on high by a wind, and there thawing the fnowy villi, or flocks of the half-frozen veficulæ, reduces them into drops; which coalefcing, defcend, and have their diffolution perfected in their progrefs through the lower and warmer ftages of the atmofphere Others, as Dr. Clarke, &c. afcribe this defcent of the clouds rather to an alteration of the atmofphere than of the veficulæ; and fuppofe it to arife from a diminution of the fpring, or elaftic force of the air.

This elafticity, which, as they fay, depends chiefly or wholly on the dry terrene exhalations, being weakened, the atmofphere finks under its burden, and the clouds fall, on the common principle of precipitation.

Now, the little veficulæ, by any or all thefe means, being once upon the defcent, will perfift therein. notwithftanding the increafe of refiftance they every moment meet with in their progrefs through ftill denfer and denfer parts of the atmofphere. For, as they all tend toward the fame point, *viz.* the centre of the earth, the farther they fall, the more coalitions will they make; and the more coalitions, the more matter will there be under the fame furface; the furface only increafing as the fquares; but the folidity as the cubes; and the more matter under the fame furface, the lefs friction or refiftance there will be to the fame matter.

Thus if the cold, the wind, &c. happen to act early enough to precipitate the afcending veficulæ, before they are arrived at any confiderable height, the coalitions being few in fo fhort a defcent, the drops will be proportionably fmall: and thus is formed what we call *dew*. See DEW.

If the vapours prove more copious, and rife a little higher, we have a *mift* or *fog*; which fee refpectively.

A little higher ftill, and they produce a fmall rain, &c. If they neither meet with cold, nor wind enough to condenfe or diffipate them, they form a heavy, thick, dark fky; which lafts fometimes feveral weeks. This hypothefis of the diminution of the atmofphere's elafticity, requires a more fatisfactory explication of the caufe of this diminution. By afcribing it to terrene exhalations, we only folve one difficulty by introducing another; for we are totally unacquainted with the nature and operation of thefe exhalations. But let the caufe be what may be fuppofed, if it act equally, and at once, upon all the vapour in the air, all that vapour muft be at once precipitated; and the confequence muft be, that, inftead of gentle fhowers continuing for a confiderable time, we muft have copious water-fpouts, lafting only for a few minutes or feconds, which, inftead of refrefhing the earth, would drown and lay it wafte.

Thofe who admit either of the above hypothefes, account for many of the phenomena of the weather; *e. gr.* why a cold is always a wet fummer, and a warm a dry one; becaufe the principle of precipitation obtains in the one cafe, and is wanting in the other. Why we have ordinarily moft rain about the equinoxes; becaufe the vapours arife more plentifully than ordinary in the fpring, as the earth becomes loofened from the brumal conftipations; and becaufe, as the fun recedes from us in autumn, the cold increafing, the vapours that had lingered above during the fummer heats, are now difpatched down, &c. Why a fettled, thick, clofe fky fcarcely ever rains till it have been firft clear; becaufe the equally diffufed vapours muft firft be condenfed, and congregated into feparate clouds, to lay the foundation of rain; by which means the reft of the face of heaven is left open, and pervious to the rays of the fun, &c.

For other phenomena of rain, as they relate to the weather-glafs, fee BAROMETER, and WEATHER.

It cannot be doubted, that there is a connection between the defcent of the barometer and the fall of rain; but no fatisfactory reafon has yet been affigned for the circumftance; nor is it poffible to foretell with certainty that rain will follow any changes in the height of the barometer that have been obferved. The immediate dependence of rain, or of any other atmofpherical phenomena, on the influence of the moon, appears to be rendered highly improbable, not only by mathematical calculations of the effects of the moon's attraction, but alfo by the irregularity of the obfervations which have been adduced in favour of a fuch a connection. (See *Influence of the* MOON.) But however uncertain the ultimate caufes of rain may be in general, their effects in fome places are fufficiently conftant, to be attributed to permanent local circumftances, and in particular to the periodical recurrence of fimilar winds.

For a more particular account of other theories, for explaining the afcent of vapours, the formation of clouds, and the fall of rain, fee VAPOUR.

Befides the caufes of rain, mentioned above, Defaguliers thinks it owing to the lofs of electricity in the vapours of which they were formed.

Other writers, in the progrefs of this part of philofophical fcience, have confidered rain as an electrical phenomenon: or at leaft they have fuppofed, that the powers of electricity may concur with other caufes in producing it. Signior Beccaria, whofe obfervations on the general ftate of electricity in the atmofphere have been more extenfive and accurate than thofe of any other perfon, reckons rain, hail, and fnow, among the effects of a moderate electricity in the atmofphere. Clouds that bring rain, he thought, were produced in the fame manner as thunder clouds, only by a moderate electricity. He defcribes them at large, and the refemblance which all their phenomena bear to thofe of thunder-clouds is very ftriking. He notes feveral circumftances attending rain without lightning, which render it probable, that it is produced by the fame caufe as when it is accompanied with lightning. Light has been feen among the clouds by night in rainy weather; and even by day rainy clouds are fometimes feen to have a brightnefs evidently independent of the fun. The uniformity with

which

which the clouds are fpread, and with which the rain falls, he thought, were evidences of an uniform caufe like that of electricity. The intenfity alfo of electricity in his apparatus generally correfponded very nearly to the quantity of rain that fell in the fame time. Sometimes all the phenomena of thunder, lightning, hail, rain, fnow, and wind have been obferved at one time; which fhews the connection they all have with fome common caufe. Signior Beccaria, therefore, fuppofes, that, previous to rain, a quantity of electric matter efcapes out of the earth, in fome place where there was a redundancy of it; and in its afcent to the higher regions of the air, collects and conducts into its path a great quantity of vapours. The fame caufe that collects, will condenfe them more and more; till, in the places of the neareft intervals, they come almoft into contact, fo as to form fmall drops; which, uniting with others as they fall, come down in rain. The rain will be heavier in proportion as the elafticity is more vigorous, and the cloud approaches more nearly to a thunder-cloud. He imitated the appearance of clouds that bring rain, by infulating himfelf between the rubber and conductor of his electrical machine; and with one hand dropping colophonia into a fpoon faftened to the conductor, and holding a burning coal, while his other hand communicated with the rubber. In thefe circumftances the fmoke fpread along his arm, and, by degrees, all over his body, till it came to the other hand that communicated with the rubber. The lower furface of this fmoke was every where parallel to his clothes, and the upper furface was fwelled and arched like clouds replete with thunder and rain. In this manner, he fuppofes, the clouds that bring rain diffufe themfelves from over thofe parts of the earth which abound with electric fire, to thofe parts that are exhaufted of it; and by letting fall their rain, reftore the equilibrium between them. Signior Beccaria alfo thought, that the electricity communicated to the air, which both receives and parts with it flowly, would account for the retention of vapours in a clear fky; for fmall disjointed clouds, not difperfed into rain; for the fmaller and lighter clouds in the higher regions of the air, which are but little affected by electricity; and alfo for the darker, heavy, and fluggifh clouds in the lower regions, which retain more of it. He even imagined that fome alteration in the weight of the air might be made by this electricity of it: the phenomena of rain, he thought, favoured the fuppofition, that the electric matter in the air did, in fome meafure, leffen its preffure: for when the electric matter is actually in the air, collecting and condenfing the vapours, the barometer is loweft. When the communication is made between the earth and the clouds by the rain, the quickfilver begins to rife; the electric matter, which fupported part of the preffure, being difcharged. Lettere dell Elettricifmo. Prieftley's Hift. &c. of Electricity, vol. i. p. 427, &c. 8vo.

Dr. James Hutton's theory of rain is ftated and amply illuftrated in the 1ft volume of the Edinburgh Tranfactions, p. 47, &c. It is well known that atmofpheric air is capable, with a certain degree of heat, of diffolving a given quantity of water. (See Vapour.) Dr. Hutton afcertains the ratio of the diffolving power of air, in relation to water, with different degrees of heat; and thus, by mixing a portion of tranfparent humid warm air with a portion of cold air, the mixture becomes opaque, and part of the water will be precipitated; or, in other words, the vapour will be condenfed into rain. Hence he obferves, that fince the capacity of air for moifture increafes fafter than the temperature, there muft be a depofition of moifture when two faturated portions of air at different temperatures are mixed. Dr. Hutton fuppofes that heat and folution do not increafe by equal increments; but that, in reality, if heat be fuppofed to increafe by equal increments along a ftraight line, folution will be expreffed by ordinates to a curve, whofe convex fide is turned towards that line. That the power of folution is not increafed in the fame ratio with heat is, however, hypothetical, except when we rife pretty high in the fcale, when its proportional increafe is fomewhat doubtful; nor has our author fupported it by experiment. The condenfation of the breath in air is not to the purpofe, unlefs we fuppofe the air to be already faturated with vapour. In any view, it can only amount to this, that to render it vifible, the heat muft be diminifhed in a greater proportion than can be compenfated by the power of folution in the body of air, in which the portion expired is at firft immerfed. In order to explain the origin of rain from this caufe, we muft always fuppofe a conftant diminution of heat to take place at the moment of the condenfation of the vapour; but we actually find, that the change from a ftate of vapour to the fluid ftate is attended with heat; fo that rain muft at once oppofe its own caufe, and continued rains would be impoffible without the aid of other caufes. Dr. Hutton endeavours, from his own fyftem, to explain the regular and irregular feafons of rain, with regard either to the generality of its appearance, or the regularity of its return. And to obviate the apparent exceptions of the theory, from the generality of rain, he explains the proportional quantities of rain, and adds a comparative eftimate of climates, in relation to rain with the meteorological obfervations made in our own climate. As our limits will not allow our doing full juftice to our author's reafoning, we muft refer to his own paper on the fubject.

Mr. Dalton, in his "Meteorological Effays," (Eff. vi.) expreffes his approbation of Dr. Hutton's theory in general; to this purpofe, he fays, "the principles of none appear to me to be more plaufible and confiftent with facts." Dr. Hutton, as we have above fhewn, confiders the varieties of heat and cold, affecting the folvent power of the atmofphere, as the fole caufes of rain; and Mr. Dalton obferves, when we confider that evaporation and the precipitation of vapour are diametrically oppofite, it is reafonable to fuppofe that they fhould be promoted by oppofite caufes: and as heat and dry air are favourable to evaporation, fo cold, operating upon air replete with vapour, promotes its precipitation. Dr. Hutton, however, feems to confider water as chemically combined with the atmofphere, and that cold produces precipitation in a manner fimilar to what it does in water faturated with falt, or in other chemical proceffes; whereas Mr. Dalton fuppofes, that a portion of the vapour, confidered as a diftinct and peculiar fluid, is condenfed into water by cold; but the effects refulting from the two theories will be the fame. See Meteorology, and Vapour.

M. de Luc, in the 2d volume of his "Thoughts on Meteorology," has directed particular attention to the various circumftances that attend rain. He has alfo examined the feveral hypothefes of different authors, and concludes, that they are altogether infufficient to account for the formation of it. In this inquiry the grand queftion under difcuffion is, what becomes of the water that rifes in vapour into the atmofphere? or what is the ftate in which it fubfifts there, between the time of its evaporation, and its falling down in rain? If it continues in the ftate of watery vapour, or fuch as is the immediate product of evaporation, it muft poffefs the diftinctive characters effential to that fluid; it muft make

make the hygrometer move towards humidity, in proportion as the vapour is more or lefs abundant in the air: on a diminution of heat, the humidity, as fhewn by the hygrometer, muft increafe; and on an increafe of the heat, the humidity muft diminifh; and the introduction of other hygrofcopic fubftances, drier than the air, muft have the fame effect as an augmentation of heat. Thefe are the properties of vapour, on every hypothefis of evaporation; and, therefore, all the water that exifts in the atmofphere, without poffeffing thefe properties, is no longer vapour, but muft have changed its nature. M. de Luc fhews, that the water which forms rain, though it has ever been confidered and reafoned upon as producing humidity, does not poffefs this property, and muft, therefore, have paffed into another ftate. As he thinks that the vapour paffes into an invifible ftate in the interval between evaporation and its falling again in rain, and that in this ftate it is not fenfible to the hygrometer, he confiders the laws of hydrology as infufficient for explaining the formation of rain; but he does not pretend to have difcovered the immediate caufe of the formation of clouds and rain. If it is not in the immediate product of evaporation that rain has its fource; if the vapours change their nature in the atmofphere, fo as no longer to be fenfible to the hygrometer, or to the eye; if they do not become vapour again till clouds appear; and if, when the clouds are formed, no alteration is perceived in the quality of the air; we muft acknowledge it to be very probable, that the intermediate ftate of vapour is no other than air, and that the clouds do not proceed from any diftinct fluid contained in the atmofphere, but from a decompofition of a part of the air itfelf, perfectly fimilar to the reft. For other obfervations on the afcent and nature of vapour, and the fubfequent formation of rain, we refer to the articles METEOROLOGY, and VAPOUR.

As to the general quantity of rain that falls, and its proportion in feveral places at the fame time, and in the fame place at feveral times, we have many obfervations, journals, &c. in the Memoirs of the French Academy, the Philof. Tranf. and many other publications; from which we fhall make the following extracts.

Upon meafuring the rain falling yearly, its depth, at a medium, is found as in the following table.

Depth of Rain falling yearly, and its Proportion in feveral Places.

	Inches.
At Townley, in Lancafhire, obferved by Mr. Townley	42½
Upminfter, in Effex, by Dr. Derham - - - -	19¼
Zurich, in Swifferland, by Dr. Scheuchzer - - -	32¼
Pifa, in Italy, by Dr. Mich. Ang. Tilli - - -	43¼
Paris, in France, by M. de la Hire - - - - -	19
Lifle, in Flanders, by M. de Vauban - - - - -	24

	At Upminfter.	At Paris.
	Inches.	Inches.
1700	19.03	21.37
1701	18.69	27.77
1702	20.38	17.45
1703	23.99	18.51
1704	15.80	21.20
1705	16.93	14.82
Mediums	19.14	20.19

From the Meteorological Journal of the Royal Society, kept by order of the prefident and council, it appears that the whole quantity of rain at London, in each of the years fpecified below, was as follows: *viz.*

	Inches.
1774 - - - - - - - -	26.328
1775 - - - - - - - -	24.083
1776 - - - - - - - -	20.354
1777 - - - - - - - -	25.371
1778 - - - - - - - -	20.772
1779 - - - - - - - -	26.785
1780 - - - - - - - -	17.313
Medium of thefe feven years	23.001

Proportion of the Rain of the feveral Seafons to one another.

1708.	Depth at Pifa.	Depth at Upminfter.	Depth at Zurich.
	Inches.	Inches.	Inches.
January	6.41	2.88	1.64
February	3.28	0.46	1.65
March	2.65	2.03	1.51
April	1.25	0.96	4.69
May	3.33	2.02	1.91
June	4.90	2.32	5.91
July	0.00	1.11	3.50
Auguft	2.27	2.94	3.15
September	7.21	1.46	3.02
October	5.33	0.23	2.44
November	0.13	0.86	0.62
December	0.00	1.07	2.62
Half Year	36.76	19.24	32.66

See Philof. Tranf. abr. vol. iv. pt. ii. p. 81, &c. and alfo Meteorological Journal of the Royal Society, publifhed annually in the Phil. Tranf.

As rain-gages have been fixed of late years in almoft every part of the kingdom, we are enabled to determine, with confiderable exactnefs, the depth of water which the rain yields in any given place. It may be obferved, however, that inland counties have lefs rain than maritime ones, efpecially thofe which border on the weftern feas. But ftill a greater difference feems to take place between a mountainous country, and a champaign or flat country. In the former there often falls double or triple the quantity of rain in a year that there does in the latter, and never lefs than an equal quantity. It is alfo obferved, that thofe winds bring moft rain that blow from the quarter in which is the moft and neareft fea; as are weft and fouth-weft winds. The rain-gage alfo fhews, that more rain is collected in the inftrument, as it is placed nearer the ground; without any appearance of a difference, between two places, on account of their difference of level above the fea, provided that the inftrument is as far from the ground at the one place, as it is at the other. Thefe effects are noticed in the Phil. Tranf. for 1769 and 1771, the former by Dr. Heberden, and the latter by Mr. Daines Barrington. Dr. Heberdeen fays, "A comparifon having been made between the quantity of rain which fell in two places in London, about a mile diftant from one another, it was found that the rain in one of them conftantly exceeded that in the other, not only every month, but almoft every time that it rained. The apparatus ufed in each of them was very exact, and both made by the fame artift; and upon examining every probable caufe, this unexpected variation did not appear to be owing to to any miftake, but to the conftant effect of fome circumftance which, not being fuppofed to be of any moment, had never been attended to. The rain-gage in one of thefe places was fixed fo high, as to rife above all the neighbouring chimnies; the other was confiderably below them; and there appeared reafon to believe, that the difference in the quantity of rain in thefe two places was owing to this difference in the placing of the veffel in which it was received. A funnel was, therefore, placed above the higheft chimnies, and another upon the ground of the garden belonging to the fame houfe, and there was found the fame difference between thefe two, though placed fo near one another, which had been between them, when placed at fimilar heights in different parts of the town. After this fact was fufficiently afcertained, it was thought proper to try whether the difference would be greater at a much greater height; and a rain-gage was therefore placed upon the fquare part of the roof of Weftminfter Abbey. Here the quantity of rain was obferved for a twelvemonth, the rain being meafured at the end of every month, and care being taken that none fhould evaporate by paffing a very long tube of the funnel into a bottle through a cork, to which it was exactly fitted. The tube went down very near to the bottom of the bottle, and therefore the rain which fell into it would foon rife above the end of the tube, fo that the water was no where open to the air except for the fmall fpace of the area of the tube: and by trial it was found that there was no fenfible evaporation through the tube thus fitted up.

The following table fhews the refult of thefe obfervations.

From July the 7th, 1766, to July the 7th, 1767, there fell in a Rain-gage, fixed

1766.	Below the top of a houfe.	Upon the top of a houfe.	Upon Weftminfter Abbey.
	Inches.	Inches.	Inches.
From the 7th to the end of July	3.591	3.210	2.311
Auguft	0.558	0.479	0.508
September	0.421	0.344	
October	2.364	2.061	1.416
November	1.079	0.842	0.632
December	1.612	1.258	0.994
1767, January	2.071	1.455	1.035
February	2.864	2.494	1.335
March	1.807	1.303	0.587
April	1.437	1.213	0.994
May	2.432	1.745	1.142
June	1.997	1.426	1.145
July 7	0.395	0.309	
	22.628	18.139	12.099

By this table it appears, that there fell below the top of a houfe above a fifth part more rain than what fell in the fame fpace above the top of the fame houfe; and that there fell upon Weftminfter Abbey not much above one-half of what was found to fall in the fame fpace below the tops of the houfes. This experiment has been repeated in other cafes with the fame refult. What may be the caufe of this extraordinary difference, has not yet been difcovered; but it may be ufeful to give notice of it, in order to prevent that error, which would frequently be committed in comparing the rain of two places without attending to this circumftance."

Such were the obfervations of Dr. Heberden on firft announcing this circumftance, *viz.* of different quantities of rain falling at different heights above the ground. Two years afterward, Daines Barrington, efq. made the following experiments and obfervations, to fhew that this effect, with refpect to different places, refpected only the feveral heights of the inftruments above the ground at thofe places, without regard to any real difference of level in the ground at thofe places.

Mr. Barrington caufed two other rain-gages, exactly like thofe of Dr. Heberden, to be placed, the one upon mount Rennig, in Wales, and the other on the plane below, at about half a mile's diftance, the perpendicular height of the mountain being 450 yards, or 1350 feet; each gage being at the fame height above the furface of the ground at the two ftations.

The refults of the experiment are as below:

1770.	Bottom of the mountain.	Top of the mountain.
	Inches.	Inches.
From July 6 to 16 - -	0.709	0.648
July 16 to 29 - -	2.185	2.124
July 29 to Aug. 10 -	0.610	0.656
Sept. 9, both bottles had run over.		
Sept. 9 to 30 - -	3.234	2.464
Oct. 17, both bottles had run over.		
Oct. 17 to 22 - -	0.747	0.885
Oct. 22 to 29 - -	1.281	1.388
Nov. 20, both bottles were broken by the froft.	8.766	8.165

"The inference to be drawn from thefe experiments, Mr. Barrington obferves, feems to be, that the increafe of the quantity of rain depends upon its nearer approximation to the earth, and fcarcely at all upon the height of places, provided the rain-gages are fixed at about the fame diftance from the ground.

"Poffibly alfo a much controverted point between the inhabitants of mountains and plains may receive a folution from thefe experiments; as in an adjacent valley, at leaft, very nearly the fame quantity of rain appears to fall within the fame period of time as upon the neighbouring mountains."

Dr. Heberden alfo adds the following note. "It may not be improper to fubjoin to the foregoing account, that, in places where it was firft obferved, a different quantity of rain would be collected, according as the rain-gages were placed above or below the tops of the neighbouring buildings; the rain-gage below the top of the houfe into which the greater quantity of rain had for feveral years been found to fall, was above fifteen feet above the level of the other rain-gage, which, in another part of London, was placed above the top of the houfe, and into which the leffer quantity always fell. This difference, therefore, does not, as Mr. Barrington juftly remarks, depend upon the greater quantity of atmofphere through which the rain defcends: though this has been fuppofed by fome, who have thence concluded that this appearance might readily be folved by the accumulation of more drops, in a defcent through a great depth of atmofphere."

In the examination of the refults from meteorological tables, it fhould be obferved, that feveral years' account of the rain at any place is required, before a medium yearly quantity can be obtained with fufficient accuracy. The following table, formed by Mr. Dalton, and publifhed in the firft part of the fifth volume of Manchefter Memoirs, gives us the largeft collection of accounts of rain fallen in different places in England that has to our knowledge hitherto appeared. They are chiefly taken from the Tranfactions of the Royal Society, and of other focieties.

CUMBERLAND

Counties (Maritime).	Places.	Mean annual Depth in Inches.
Cumberland	Kefwick, 7 years	67.5
	Carlifle, 1 year	20.2
Westmoreland	Kendal, 11 years	59.8
	Fell-foot, 3 years	55.7
	Waith Sutton, 5 years	46
Lancashire	Lancafter, 10 years	45
	Liverpool, 18 years	34.4
	Manchefter, 9 years	33
	Towi ley	41
	Crawfhawbooth, near Hafslingden, 2 years	60
Gloucestershire	Briftol, 3 years	29.2
Somersetshire	Bridgewater, 3 years	29.3
Cornwall	Ludguan, near Mount's Bay, 5 years	41
	Another place, 1 year	29.9
Devonshire	Plymouth, 2 years	46.5
Hampshire	Selbourne, 9 years	37.2
	Fyfield, 7 years	25.9
Kent	Dover, 5 years	37.5
Essex	Upminfter	19.5
Norfolk	Norwich, 13 years	25.5
Yorkshire	Barrowby, near Leeds, 6 years	27.5
	Garfdale, near Sedburgh, 3 years	52.3
Northumberand	Widdrington, 1 year	21.2

Counties (Inland).	Places.	Means.
Middlesex	London, 7 years	23
Surrey	South Lambeth, 9 years	22.7
Hertfordshire	Near Ware, 5 years	25
Huntingdonshire	Kimbolton, 7 years	25
Derbyshire	Chatfworth, 15 years	27.8
Rutlandshire	Lyndon, 21 years	24.3
Northamptonshire	Near Oundle, 14 years	23
	General mean	35.2

The general mean of 35.2 inches is, as our author apprehends, a little above the medium for England and Wales, as the greater number of places are thofe where much rain falls. If we take up a mean for each of the above-mentioned counties, (where more than one place in a county is given,) and then a general mean from the counties, the refult is a reduced mean of 31.3. Even then it may be objected, that the greater part of the counties are maritime; but it muft be obferved, that there is no account of rain in Wales: and we may fafely conclude, that the rain in Wales would exceed the laft-mentioned mean as much as the inland counties of England, not in the above lift, would fall fhort; becaufe Wales is both a mountainous country, and expofed to the fea.

We will, therefore, conclude, that the mean annual depth of rain in England and Wales, deduced from thefe twenty counties, is 31 inches: a quantity which fubfequent obfervations, our author is confident, will not diminifh, and probably not increafe much.

The editors of the Encyclopedia, under the article *Weather*, from 16 places of obfervation, make the annual mean for Great Britain 32.53 inches; and M. Cotte, in the Journal de Phyfique for 1791, gives a mean derived from 147 places, in different parts of the world, equal to 34.7 inches.

If we take the dew (fee Dew) at 5 inches annually, we fhall have 36 inches of water at a medium annually, on the furface of the earth, in England and Wales, reckoning 31 for rain and 5 for dew. Admitting the computation of Guthrie, the area of England and Wales is 46,450 fquare miles. This, reduced to fquare feet, gives 1,378,586,880,000; which, multiplied by 3 feet, the annual depth of rain and dew, gives 4,135,760,690,000 cubic feet of water, = 153,176,320,000 cubic yards, or 28 cubic miles = 115 thoufand millions of tons in weight, nearly. This immenfe mafs of water is difpofed of partly by the fupply of rivulets, and the foaking into the earth a fmall way, fo as to break out again in lower ground in the form of fprings, and thence make its way to fome river, by which it is conveyed to the fea; and partly by being raifed into the atmofphere in the procefs of evaporation. The decompofition of water by vegetables is not noticed, becaufe it is prefumed, that in the courfe of nature the principles are combined, and water formed again. See River, Spring, Evaporation, and Vapour.

As to the ufe of rain, we may obferve that it moiftens and foftens the earth, and thus fits it for affording nourifhment to plants: by falling on high mountains, it carries down with it many particles of loofe earth, which ferve to fertilize the furrounding vallies, and purifies the air from noxious exhalations, which tend in their return to the earth to meliorate the foil; it moderates the heat of the air; and is one means of fupplying fountains and rivers. However, vehement rains in many countries are found to be attended with barrennefs and poornefs of the lands, and mifcarriage of the crops in the fucceeding year: and the reafon is plain; for thefe exceffive ftorms wafh away the fine mould into the rivers, which carry it into the fea, and it is a long time before the land recovers itfelf again. The remedy to the famine, which fome countries are fubject to from this fort of mifchief, is the planting large orchards and groves of fuch trees as bear efculent fruit; for it is an old obfervation, that in years, when grain fucceeds worft, thefe trees produce moft fruit of all. It may partly be owing to the thorough moiftening of the earth, as deep as their roots go, by thefe rains, and partly to their trunks ftopping part of the light mould carried down by the rains, and by this means furnifhing themfelves with a coat of new earth. Phil. Tranf. N° 90.

The water afforded by rain is found highly refrefhing to almoft all forts of vegetable crops, and to promote their growth in a rapid manner, when not produced in too great abundance at a time. This effect, which may often be perceived to take place in a fudden manner, after warm fhowers in the early fpring months, is probably caufed by the large proportion of oxygen that is contained in rain-water, as well as from the neceffary moifture being afforded to the fibres of the roots of the plants. Too much rain may be injurious, however, by leffening the neceffary cohefion and compactnefs of foils, by which they may not afford proper firmnefs to the roots of growing vegetables. And another injury may be produced by the too frequent occurrence of hafty fhowers, by which a large proportion of the decompofing vegetable and animal materials of lands, which are foluble or diffufible in water, may be conveyed away into the ditches, rivers, and ultimately into the fea, and of courfe prove the caufe of infertility. In hilly fituations, this effect may arife from even flight fhowers; on which account, they have been advifed to be ploughed in a flanting direction, as by that means the rains may be more perfectly detained in the foils. And it has been fuggefted by Dr. Darwin, that as the foliage or buds of plants require more moifture for their vigorous growth than their flowers, in this climate, continued rains may be liable not only to wafh off the farina from

from the burfting anthers, and in that way prevent the impregnation of the piftillum, but alfo delay the ripening of the feeds or fruit, from the want of a due evaporation of their perfpirable matter, as well as from the lefs folar light in cloudy feafons. On this account it is, he fuppofes, that in the north of Scotland the oats are faid feldom to ripen till the froft commences, with the dry feafon which accompanies it.

Thus, as the effects of rain are fo very confiderable on vegetation, it would be highly ufeful to afcertain the quantity or depth of rain that falls annually in different diftricts, and the difference in the effects which are produced by it. See WATER and WEATHER.

The vaft quantities of rain which fall in fome diftricts, from the peculiar nature of their fituations, efpecially where they are of the grazing or pafture kind, as thofe of Chefhire, Lancafhire, and fome others, are often highly beneficial to their general fertility; the natural grafs paftures of which diftricts, though frequently of inferior qualities to thofe in many other places, are, in confequence of this circumftance, rendered fuperior in their abundance of grafs, the ftrength of its vegetation, and the richnefs of its quality. The former of the above counties may indeed, without any impropriety, be reckoned one of the moft productive grafsland diftricts in the kingdom, as is fully evinced by the great abundance and fuperiority of its dairy products. The grafs lands in this tract of country moftly retain their full verdure during the moft fultry and parching feafons, except where they are of a fandy or gravelly nature in their under ftrata. Where they are near to the fea, however, in this as well as other parts, they are liable to become moffy, or be covered with the mofs plant, either in confequence of fo much of the fpray from it falling in the manner of flight rain, or fome other caufe of that kind.

The quantity of rain falling upon land has much influence upon its temperature, or ftate of heat, and, of courfe, great effect on vegetation in that way; and the nature of its mixture with it, or the manner in which it is diftributed through its parts, or combined with its different earthy materials, is another means by which it becomes of great importance, as it relates to the fupplying of nourifhment and fupport to vegetables as crops.

Rain falling in large quantities, on particular forts of retentive foils, is a frequent caufe of that kind of injurious wetnefs, which ftands fo much in need of furface-draining to remove it. See SURFACE-*Draining*.

The nature and caufes of fhowers and rain are extremely curious and interefting in feveral different points of view, both to the agriculturift and the philofophical inquirer.

RAINS, *Preternatural.* We have numerous accounts in hiftorians of preternatural rains, fuch as the raining of ftones, of duft, of blood, nay, and of living animals, as young frogs, and the like. We are not to doubt the truth of what thofe who are authors of veracity and credit relate to us of this kind, fo far as to fuppofe that the FALLING *of Stones* (which fee) and duft never happened; the whole miftake (if it be fo with regard to the firft inftance) is the fuppofing them to have fallen from the clouds; but as to the blood and frogs, it is very certain that they never fall at all, but the opinion has been a mere deception of the eyes. Men are extremely fond of the marvellous in their relations; but the judicious reader is to examine ftrictly whatever is reported of this kind, and is not to fuffer himfelf to be deceived.

There are two natural methods by which quantities of ftones and duft may fall in certain places, without their having been generated in the clouds, or fallen as rain. The one is by means of hurricanes: the wind which we frequently fee tearing off the tiles of houfes, and carrying them to confiderable diftances, being equally able to take up a quantity of ftones, and drop them again at fome other place. But the other, which is much the moft powerful, and probably the moft ufual way, is for the eruptions of volcanos, and burning mountains, to tofs up, as they frequently do, a vaft quantity of ftones, afhes, and cinders, to an immenfe height in the air; and thefe being hurried away by the hurricanes and impetuous winds, which ufually accompany thofe eruptions, and being in themfelves much lighter than common ftones, as being half calcined, may eafily be thus carried to vaft diftances, and their falling in places where the inhabitants know nothing of the occafion, they cannot but be fuppofed by the vulgar to fall on them from the clouds. It is well known, that in the great eruptions of Ætna and Vefuvius, fhowers of afhes, duft, and fmall cinders, have been feen to obfcure the air, and overfpread the furface of the fea for a great way, and cover the decks of fhips; and this at fuch a diftance, as it fhould appear fcarce conceivable that they fhould have been carried to; and probably, if the accounts of all the fhowers of thefe fubftances mentioned by authors be collected, they will all be found to have fallen within fuch diftances of volcanos; and if compared, as to the time of their falling, will be found to correfpond in that alfo with the eruptions of thofe mountains. We have known inftances of the afhes from Vefuvius having been carried thirty, nay forty leagues, and peculiar accidents may have carried them yet farther.

The raining of blood has been ever accounted a more terrible fight, and a more fatal omen, than the other preternatural rains already mentioned. It is very certain that nature forms blood no where but in the veffels of animals, and therefore fhowers of it from the clouds are by no means to be credited. Thofe who fuppofe that what has been taken for blood, has been actually feen falling through the air, have had recourfe to flying infects for its origin, and fuppofe it the eggs or dung of certain butterflies difcharged from them as they were high up in the air. But this feems a very wild conjecture, as we know of no butterfly whofe excrements, or eggs, are of fuch a colour, or whofe abode is fo high, or their flocks fo numerous, as to be the occafion of this.

It is moft probable that thefe bloody waters were never feen falling, but the people feeing the ftanding waters blood-coloured, were affured, from their not knowing how it fhould elfe happen, that it had rained blood into them. A very memorable inftance of this there was at the Hague in the year 1670. Swammerdam, who relates it, tells us, that one morning the whole town was in an uproar, on finding their lakes and ditches full of blood, as they thought, and having been certainly full of water the night before, they agreed it muft have rained blood in the night; but a certain phyfician went down to one of the canals, and taking home a quantity of this blood-coloured water, he examined it by the microfcope, and found that the water was water ftill, and had not at all changed its colour, but that it was full of prodigious fwarms of fmall red animals, all alive, and very nimble in their motions, whofe colour and prodigious number gave a red tinge to the whole body of the water they lived in, on a lefs accurate infpection. The certainty that this was the cafe, did not however perfuade the Hollanders to part with the miracle; they prudently concluded, that the fudden appearance of fuch a number of animals was as great a prodigy as the raining of blood would have been; and are affured at this day, that this portent foretold the fcene of war and devaftation which Lewis XIV. afterwards brought into that country, which had before enjoyed forty years uninterrupted peace.

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The animals, which thus colour the water of lakes and ponds, are the *pulices arborefcentes* of Swammerdam, or the water-fleas with branched horns. Thefe creatures are of a reddifh-yellow, or flame colour; they live about the fides of ditches, under weeds, and among the mud, and are therefore the lefs vifible, except at a certain time, which is in the end of May or beginning of June: it is at this time that thefe little animals leave their receffes to float loofe about the water, to meet for the propagation of their fpecies, and by that means become vifible in the colour they give the water. This is vifible, more or lefs, in one part or other of almoft all ftanding waters at this feafon; and it is always at this feafon that the bloody waters have alarmed the ignorant.

The raining of frogs is a thing not lefs wonderful in the accounts of authors who love the marvellous, than thofe of blood, or of ftones; and this is fuppofed to happen fo often, that there are multitudes who pretend to have been eye-witneffes of it. Thefe rains of frogs always happen after very dry feafons, and are much more frequent in the hotter countries than the cold ones. In Italy they are very frequent; and it is not uncommon to fee the ftreets of Rome fwarming both with young frogs and toads in an inftant, in a fhower of rain; they hopping every where between the people's legs, as they walk, though there was not the leaft appearance of them before. Nay, they have been feen to fall through the air down upon the pavements. This feems a ftrong circumftance in favour of their being rained down from the clouds, but when ftrictly examined, it comes to nothing; for thefe frogs, that are feen to fall, are always found dead, lamed, or bruifed by the fall, and never hop about as the reft; and they are never feen to fall, except clofe under the walls of houfes, from the roofs and gutters of which they have accidentally flipped down.

To the raining of frogs we ought to add the raining of grafs-hoppers and locufts, which have fometimes appeared in prodigious numbers, and devoured the fruits of the earth. There has not been the leaft pretence for fuppofing that thefe animals defcended from the clouds, but that they appeared on a fudden in prodigious numbers. The naturalift, who knows the many accidents attending the eggs of thefe, and other the like animals, cannot but know that fome feafons will prove particularly favourable to the hatching of them, and the prodigious number of eggs that many infects lay, could not but every year bring us fuch abundance of the young, were they not liable to many accidents, and had not provident nature taken care, as in many plants, to continue the fpecies by a very numerous ftock of feeds, of which perhaps not one in five hundred need take root, in order to continue an equal number of plants.

The raining of fifhes has been a prodigy alfo much talked of in France, where the ftreets of a town at fome diftance from Paris, after a terrible hurricane in the night, which tore up trees, blew down houfes, &c. were found in a manner covered with fifhes of various fizes. Nobody here made any doubt of thefe having fallen from the clouds; nor did the abfurdity of fifh, of five or fix inches long, being generated in the air, at all ftartle the people, or fhake their belief in the miracle, till they found upon enquiry that a very well-ftocked fifh-pond, which ftood on an eminence in the neighbourhood, had been blown dry by the hurricane, and only the great fifh left at the bottom of it, all the fmaller fry having been toffed into their ftreets.

Upon the whole, all the fuppofed marvellous rains have been owing to fubftances naturally produced on the earth, and either never having been in the air at all, or only carried thither by accident.

Rain, *Freezing.* See Freezing.

Rain-*Bird*, in *Ornithology.* See Cuculus *Pluvialis.*

Rain-*Fowl*, an Englifh name given by many to the common green woodpecker, or *picus viridis*, from an obfervation that it is always moft clamorous when rainy weather is coming on. The Latins have, for the fame reafon, called it the *pluvialis avis.* See Picus.

Rain-*Gage*, called alfo *Ombrometer* and *Pluviameter*, an inftrument for meafuring the quantity of rain that falls. That which is mentioned under the article Ombrometer, confifts of a tin funnel *d* (*Plate* XXIV. *Mifcellany*, *fig.* 2.), whofe furface is an inch fquare, a flat board *a a*, and a glafs tube *b b*, fet into the middle of it in a groove, and an index with divifions *c*, *c*; the board and tube being of any length at pleafure. The bore of the tube is about half an inch, which, fays Mr. Pickering, the inventor, is the beft fize. This machine is fixed in fome free and open place, as the top of the houfe, &c.

The rain-gage employed in the houfe of the Royal Society, is defcribed by Mr. Cavendifh in the Phil. Tranf. for 1776, p. 384. The veffel which receives the rain is a conical funnel, ftrengthened at the top by a brafs ring, twelve inches in diameter. The fides of the funnel, and inner lip of the brafs ring, are inclined to the horizon, at an angle of above 65°, and the outer lip at an angle of above 50°, which are fuch degrees of fteepnefs, that there feems to be no probability either that any rain which falls within the funnel, or on the inner lip of the ring, fhould dafh out, or that any which falls on the outer lip fhould dafh into the funnel. A vertical fection of the funnel appears in *Plate* XXIV. *Mifcellany*, *fig.* 3; A B C and *a b c* being the brafs ring, B A and *b a* the inner lip, and B C and *b c* the outer. This veffel is placed on fome flat leads, on the top of the fociety's houfe. It can hardly be fcreened from any rain by the chimnies, as none of them are elevated above it in an angle of more than 25°, and as it is raifed $3\frac{1}{2}$ feet above the roof, there feems no danger of any rain dafhing into it by rebounding from the lead.

In fixing rain-gages care fhould be taken that the rain may have free accefs to them, without being impeded or overfhaded by buildings, &c. and therefore the tops of houfes are to be preferred. Alfo, when the quantities of rain collected in them, at different places, are compared together, the inftruments ought to be fixed at the fame height above the ground at both places; becaufe at different heights the quantities are always different, even in the fame place. And hence alfo, any regifter or account of rain in the gage ought to be accompanied with a note of the height at which the inftrument is placed above the ground. Dalton found the rain of a gage 50 yards high, in fummer two-thirds, and in winter one-half as much as that of a gage below. Mr. Dalton obferves, that a ftrong funnel, made of fheet iron, tinned and painted, with a perpendicular rim, two or three inches high, fixed horizontally in a convenient frame, with a bottle under it to receive the rain, is fufficient for this purpofe.

The rain-gage is an invention which fhould be in the poffeffion of every correct farmer in every part of the kingdom, and which would thereby have much tendency to the improvement of agriculture as contributing to the knowledge of the degree of moifture which prevails in the foils, after fhowers or heavy rains, with greater accuracy and correctnefs than has been hitherto the cafe.

It is noticed by Mr. Naifmith, in his Agricultural Survey of Clydefdale, that profeffor Anderfon, of the univerfity of Glafgow, has invented, perhaps, the moft ingenious and accurate rain-gage of any that has yet been known. It receives the

the rain at a little more than one hundred feet above the level of the fea ; accounts of which have been regularly kept fince the year 1781 ; but previoufly to that period the rain was meafured by an old rain-gage. It is to be regretted, however, that the exact nature of this invention is not more fully explained ; and that other cheap plain inventions of this nature are not better known to the farmer.

RAIN-*Water*. See WATER.

RAINS, in the *Sea Language*, denote all that tract of fea to the northward of the equator, between four and ten degrees of latitude ; and lying between the meridian of Cape Verde and that of the eafternmoft iflands of the fame name.

It takes its name from the almoft continual calms, conftant rains, and thunder and lightning, to a great degree, always found there. The winds, when they do blow, are only fmall uncertain gufts, and fhift about all round the compafs ; fo that fhips are fometimes detained here a long while, and can make but very little way.

RAINANGBONG, in *Geography*, a town of the Birman empire, fituated near a river in which there are feveral wells of petroleum, whence its name fignifying a town through which flows a river of earth-oil. N. lat. 20° 26′. E. long. 94° 46′.

RAINBOW, *Iris*, or, fimply, the *bow*, a meteor in form of a parti-coloured arch, or femicircle, exhibited in a rainy fky, oppofite to the fun, by the refraction of his rays in the drops of falling rain.

There is alfo a fecondary, or fainter bow, ufually feen invefting the former at fome diftance. Among naturalifts, we alfo read of *lunar* rainbows, *marine* rainbows, &c.

The rainbow, fir Ifaac Newton obferves, never appears but where it rains in the fun fhine ; and it may be reprefented artificially by contriving water to fall in little drops, like rain, through which the fun fhining, exhibits a bow to a fpectator placed between the fun and the drops ; efpecially if a dark body, *e. gr.* a black cloth, be difpofed beyond the drops.

That the rainbow is oppofite to the fun, has always been obferved. It was, therefore, natural to imagine, that the colours of it were produced by fome kind of reflection of the rays of light from drops of rain or vapour. The regular order of the clouds was another circumftance that could not have efcaped the notice of any perfon. But though mere reflection had in no other cafe been obferved to produce colours, and it could not but have been obferved that refraction is frequently attended with that phenomenon, fo that fome of the ancients, as we learn from Ariftotle's tract on meteors, knew that the rainbow was caufed by the refraction of the fun's light in drops of falling rain ; yet no perfon feems to have thought of having recourfe to a proper refraction in this cafe before one Fletcher of Breflaw, who, in a treatife which he publifhed in 1571, endeavoured to account for the colours of the rainbow by means of a double refraction, and one reflection. But he imagined that a ray of light, after entering a drop of rain, and fuffering a refraction, both at its entrance and exit, was afterwards reflected from another drop, before it reached the eye of the fpectator. He feems to have overlooked the reflection at the farther fide of the drop, or to have imagined that all the bendings of the light within the drop would not make a fufficient curvature, to bring the ray of the fun to the eye of the fpectator. Antonio de Dominis, bifhop of Spalato, whofe treatife, " De Radiis Vifus et Lucis," was publifhed by I. Bartolus, in 1611, was the firft perfon who advanced, that the double refraction of Fletcher, with an intervening reflection, was fufficient to produce the colours of the rainbow, and alfo to bring the rays that formed them to the eye of the fpectator, without any fubfequent reflection. He diftinctly defcribes the progrefs of a ray of light entering the upper part of the drop, where it fuffers one refraction, and after being thereby thrown upon the back part of the inner furface, is from thence reflected to the lower part of the drop ; at which place undergoing a fecond refraction, it is thereby bent fo as to come directly to the eye. To verify this hypothefis, he procured a fmall globe of folid glafs, and viewing it when it was expofed to the rays of the fun, in the fame manner in which he had fuppofed that the drops of rain were fituated with refpect to them, he actually obferved the fame colours which he had feen in the true rainbow, and in the fame order. The theory of A. de Dominis was adopted, and in fome degree improved, by Defcartes. Philofophers were, however, for a long time at a lofs when they endeavoured to affign reafons for all the particular colours, and for the order of them. Indeed, nothing but the doctrine of the different refrangibility of the rays of light, which was a difcovery referved for the great fir Ifaac Newton, could furnifh a complete folution of this difficulty.

Dr. Barrow, in his " Lectiones Opticæ," (Lect. 12. n. 14.) fays, that a friend of his, meaning Mr. Newton, communicated to him a method of determining the angle of the rainbow, which was hinted to Newton by Slufius, without making a table of the refractions, as Defcartes did. The doctor fhews the method, with other curious particulars. But the fubject was given more perfectly by Newton afterwards, in his " Optics," prop. 9 ; where he makes the breadth of the interior bow to be nearly 2° 15′, that of the exterior 3° 40′, their diftance 8° 25′, the greateft femidiameter of the interior bow 42° 17′, and the leaft of the exterior 50° 42′, when their colours appear ftrong and perfect.

RAINBOW, *Theory of the*. To conceive the origin of the rainbow, let us confider what will befall rays of light coming from a very remote body, *e. gr.* the fun, and falling on a globe of water, fuch as we know a drop of rain to be.

Suppofe, then, A D K N (*Plate* XVIII. *Optics*, *fig.* 1.) to be a drop of rain, and the lines E F, B A, O N, to be rays of light coming from the centre of the fun ; which, on account of the immenfe diftance of the fun, we conceive to be parallel.

Now the ray B A being the only one that falls perpendicularly on the furface of the water, and all the reft obliquely, it is eafily inferred, that all the other rays will be refracted towards the perpendicular. (See REFRACTION.) Thus the ray E F, and others accompanying it, will not go on ftraight to G ; but as they arrive at H I, they will deflect from F to K ; where fome of them, probably, efcaping into the air, the reft are reflected upon the line K N, fo as to make the angles of incidence and reflection equal.

Farther, as the ray K N, and thofe accompanying it, fall obliquely upon the furface of the globule, they cannot pafs out into the air, without being refracted, fo as to recede from the perpendicular L M ; and, therefore, they will not proceed ftraight to Y, but will deflect to P.

It may be here obferved, that fome of the rays, arriving at N, do not pafs out into the air, but are again reflected to Q ; where being refracted, like the reft, they do not proceed right to Z ; but, declining from the perpendicular T V, are carried to R ; but fince we here only regard the rays as they may affect the eye placed a little below the drop, *e. gr.* at P, thofe which deflect from N to Q, we fet afide, as ufelefs ; becaufe they never come to the eye. On the contrary, it is to be obferved, that there are other rays,

rays, as 2 3, and the like; which, being refracted from 3 to 4, and reflected to 5, and from 5 to 6, may at length, by refraction at 6, arrive at the eye 7, placed beneath the drop.

Thus much is obvious; but to determine precisely the quantities of refraction of each ray, there must be a calculation; by such calculation it appears, that the rays which fall on the quadrant A D, are continued in lines, like those here drawn in the drop A D K N; wherein there are three things very considerable: first, that the two refractions of the rays, in their ingress and egress, are both the same way; so that the latter does not destroy the effect of the former. Secondly, that of all the rays passing out of A N, N P, and those adjoining to it, are the only ones capable of affecting the sense, as being sufficiently close and contiguous, and because they come out parallel; whereas the rest are diverging, and dispersed too far to have any sensible effect, at least to produce any thing so vivid as the colours of the bow. Thirdly, that the ray N P has shade or darkness under it; for, since there is no ray comes out of the surface N 4, it is the same thing as if the part were covered with an opaque body. We might add that the same ray N P has darkness above it; since the rays that are above it are ineffectual, and signify no more than if there were none at all.

Add to this, that all the effectual rays have the same point of reflection, *i. e.* the parallel and contiguous rays, which alone are effectual after refraction, will all meet in the same point of the circumference, and be reflected thence to the eyes.

Farther, it appears, that the angle O N P, included between the ray N P, and the line O N drawn from the centre of the sun, is the angle by which the rainbow is distant from the opposite point of the sun, and which makes the semidiameter of the bow. The method of determining it will be seen in the sequel of the article. But since, besides those rays coming from the centre of the sun to the drop of water, there are many more from the several points of its surface; there are a great many other effectual rays to be considered, especially that from the uppermost, and that from the lowest part of the sun's body.

Since, then, the apparent semidiameter of the sun is about 16 minutes, it follows, that an effectual ray from the upper part of the sun will fall higher than the ray E F by 16 minutes: thus does the ray G H (*fig.* 2.) which, being refracted as much as E F, deflects to I, thence to L, and at length emerging equally refracted with the ray N P, proceeds to M; and makes an angle O N M with the line O N. In the like manner, the effectual ray Q R coming from the lowest part of the sun, falls on the point R, 16 minutes lower than the point F on which the ray E F falls; and this, being refracted, declines to S, whence it is reflected to T; where, emerging into the air, it proceeds to V; so that the line T V, and the ray O T, contain an angle whose magnitude will be ascertained. Again, upon computing the deflections of the rays, which like that 23 (*fig.* 1.) coming from the centre of the sun, and being received into the lower part of the drop, we have supposed to be twice reflected, and twice refracted, and to enter the eye by lines like that 67 (*fig.* 3.) we find that which may be accounted effectual, as 67 with the line 86 drawn from the centre of the sun, contains an angle 867; whence it follows, that the effectual ray from the highest part of the sun, with the same line 86, includes an angle less by 16 minutes; and that from the lowest part of the sun, an angle greater by 16 minutes.

Thus, since A B C D E F is the path of the efficacious ray from the highest part of the sun to the eye in F, the angle 86 F becomes of a certain magnitude ascertained below. In like manner, since G H I K L M is the way of an effectual ray from the lowest part of the sun to the eye, the angle 86 M becomes greater than the former by 16 minutes.

Since, then, we admit several rays to be effectual, besides those from the centre of the sun, what we have said of the shade will need some alteration; for of the three rays described (*figs.* 2 and 3.), only the two extreme ones will have a shadow joined to them, and that only on the outer side. Hence it is evident, that these rays are perfectly disposed to exhibit all the colours of the prism.

For the great quantity of dense or intense light, *i. e.* the bundle of rays collected together in a certain point, *v. gr.* in the point of reflection of the effectual rays, may be accounted as a lucid or radiant body, terminated all around by shade. But the several rays, thus emitted to the eye, are both of different colours; that is, they are fitted to excite in us the ideas of different colours; and are differently refracted out of the water into the air, notwithstanding their falling alike upon the refracting surface.

Hence it follows, that the different or heterogeneous rays will be separated from one another, and will tend separate ways; and the homogeneous rays will be collected, and tend the same way; and, therefore, this lucid point of the drop in which the refraction is effected, will appear fringed or bordered with several colours; that is, red, green, and blue colours will arise from the extremes of the red, green, and blue rays of the sun, transmitted to the eye from several drops, one higher than another, after the same manner as is done in viewing lucid or other bodies through a prism.

Thus, adds sir Isaac Newton, the rays that differ in refrangibility, will emerge at different angles; and, consequently, according to their different degrees of refrangibility, emerging most copiously at different angles, they will exhibit different colours in different places.

A great number, then, of these little globules being diffused in the air, will fill the whole space with these different colours; provided they be so disposed as that effectual rays may come from them to the eye; and thus will the rainbow, at length, arise.

Now, to determine what that *disposition* must be, suppose a right line drawn from the centre of the sun through the eye of the spectator, as the line V X (*fig.* 2.) called the *line of aspect*, or *axis of vision*; being drawn from so remote a point, it may be esteemed parallel to all other lines drawn from the same point; but a right line, falling on two parallels, makes the alternate angles equal.

If, then, an indefinite number of lines be imagined drawn from the spectator's eye to a part opposite to the sun where it rains; which lines make different angles with the line of aspect, equal to the angles of refraction of the differently refrangible rays, these lines, falling on drops of rain illumined by the sun, will make angles of the same magnitude with rays drawn from the centre of the sun to the same drops. And, therefore, the lines thus drawn from the eye will represent the effectual rays that occasion the sensation of any colour.

Now it is known, that the eye, being placed in the vertex of a cone, sees objects upon its surface, as if they were in a circle; and the eye of our spectator is here in the common vertex of several cones, formed by the several kinds of efficacious rays, with the line of aspect. Now in the surface of that whose angle at the vertex, or eye, is the greatest, and in which the others are included, are those drops, or parts of drops, which appear red; and in the furface of that cone whofe angle is leaft, are the purple drops; and in the intermediate cones, are the green, blue, &c. drops. Hence, then, feveral kinds of the drops muft appear as if difpofed into fo many circular coloured fafciæ, or arches, as we fee in the rainbow. (Rohault's Syftem of Nat. Phil. vol. ii. part iii. cap. 17.) This part of the folution fir Ifaac Newton expreffes more precifely, thus: fuppofe O (*fig.* 4.) the eye, and O P a line parallel to the fun's rays; and let P O E, P O F, be angles of 40° 17′, and 42° 2′. And fuppofe the angles to turn about their common fide O P, with their other fides O E and O F, they will defcribe the bounds, or verges, of the rainbow.

For if E, F be drops placed any where in the conical furface defcribed by O E, O F, and be illuminated by the fun's rays S E, S F; the angle S E O being equal to the angle P O E, or 40° 17′, fhall be the greateft angle in which the moft refrangible rays can, after reflection, be refracted to the eye; and, therefore, all the drops in the line O E fhall fend the moft refrangible rays moft copioufly to the eye, and therefore ftrike the fenfes with the deepeft violet colour in that region.

And in like manner the angle S F O being = to the angle P O F = 42° 2′, fhall be the greateft in which the leaft refrangible rays after one reflection can emerge out of the drops; and thefe rays fhall come moft copioufly to the eye from the drops in the line O F, and ftrike the fenfes with the deepeft red colour in that region.

And, by the fame argument, the rays which have intermediate degrees of refrangibility, fhall come moft copioufly from drops between E and F, and fo ftrike the fenfes with the intermediate colours, in the order which their degrees of refrangibility require; that is, in the progrefs from E to F, or from the infide of the bow to the outfide, in this order; violet, indigo, blue, green, yellow, orange, red; though the violet, by the mixture of the white light of the clouds, will appear faint, and incline to a purple.

Here it may be obferved, that all the rays but the violet in the line S E will emerge from E in a greater angle than S E O made by the violet, and confequently will pafs below the eye; and all the rays but the red in the line S F will emerge from F in a lefs angle than S F O made by the red, and confequently will pafs above the eye; by which means only red will appear in the line S F, and only violet in the line S E.

And, fince the lines O E, O F, may be fituated any where in the above-mentioned conical furface; what is faid of the drops and colours of thefe lines, is to be underftood of the drops and colours throughout the whole fuperficies. Thus is the *primary* or *inner bow* formed.

Rainbow, *Secondary*, or *Outer*. As to the fecondary, or fainter bow, ufually furrounding the former, in affigning what drops would appear coloured, we excluded fuch as lines drawn from the eye, making angles a little greater than 42° 2′, fhall fall upon, but not fuch as fhould contain angles much greater.

For, if an indefinite number of fuch lines be drawn from the fpectator's eye, fome of which make angles of 50° 57′, with the line of afpect, *e. gr.* O G; other angles, of 54° 7′, *e. gr.* O H; thofe drops on which thefe lines fall muft of neceffity exhibit colours; particularly thofe of 50° 57′.

E. gr. The drop G will appear red; the line G O being the fame with an effectual ray; which, after two reflections, and two refractions, exhibits a red colour. Again, thofe drops which receive lines of 54° 7′, *e. gr.* the drop H, will appear purple; the line O H being the fame with an effectual ray; which, after two reflections and two refractions, exhibits purple.

Now there being a fufficient number of thefe drops, it is evident there muft be a fecond rainbow, formed after the like manner as the firft.

Thus, according to fir Ifaac Newton, in the leaft refrangible rays, the leaft angle at which a drop can fend effectual rays after two reflections, is found by computation to be 50° 57′; and in the moft refrangible, the leaft angle is found 54° 7′.

Suppofe, then, O the place of the eye, as before, and P O G, P O H, to be angles of 50° 57′, and 54° 7′; and thefe angles to be turned about their common fide O P; with their other fides O G, O H, they will defcribe the verges, or borders, of the rainbow C H D G.

For, if G, H be drops placed any where in the conical fuperficies defcribed by O G, O H, and be illuminated by the fun's rays, the angle S G O, being equal to the angle P O G, or 50° 57′, fhall be the leaft angle in which the then leaft refrangible rays can, after two reflections, emerge out of the drops; and, therefore, the leaft refrangible rays fhall come moft copioufly to the eye from the drops in the line O G, and ftrike the fenfes with the deepeft red in that region.

And the angle S H O being equal to P O H, 54° 7′, fhall be the leaft angle in which the moft refrangible rays, after two reflections, can emerge out of the drops; and, therefore, thofe rays fhall come moft copioufly to the eye from the drops in the line O H, and fo ftrike the fenfes with the deepeft violet in that region.

And, by the fame argument, the drops in the region, between G and H, fhall ftrike the fenfes with the intermediate colours, in the order which their degrees of refrangibility require; that is, in the progrefs from G to H, or from the infide of the bow to the outer, in this order: red, orange, yellow, green, blue, indigo, violet.

And fince the lines O G, O H, may be fituated any where in the conical furface; what is faid of the drops and colours in thefe lines is to be underftood of the drops and colours every where in this fuperficies.

Thus are formed two bows, an *interior* and ftronger, by one reflection; and an *exterior* and fainter, by two; the light becoming weaker and weaker by every reflection.

Their colours will lie in a contrary order to one another; the firft having the red without, and the purple within; and the fecond, the purple without, and red within; and fo of the reft.

Rainbow, *Artificial*. This doctrine of the rainbow is confirmed by an eafy experiment; for upon hanging up a glafs globe, full of water, in the fun-fhine, and viewing it in fuch a pofture as that the rays, which come from the globe to the eye, may, with the fun's rays, include an angle either of 42°, or 50°; if, *e. gr.* the angle be about 42°, the fpectator, fuppofed at O, will fee a full red colour in that fide of the globe oppofite to the fun, as at F. And if that angle be made a little lefs, fuppofe by depreffing the globule to E, the other colours, yellow, green, and blue, will appear fucceffively, in the fame fide of the globe, alfo exceedingly bright.

But if the angle be made about 50°, fuppofe by raifing the globule to G, there will appear a red colour in that fide of the globe towards the fun, though fomewhat faint; and if the angle be made greater, fuppofe by raifing the globe to H, this red will change fucceffively to the other colours, yellow, green, and blue.

The fame thing is obferved in letting the globe reft, and raifing or depreffing the eye fo as to make the angle of a juft magnitude.

magnitude. Newton's Optics, part ii. prop. 9. prob. 4. p. 147, ed. 3.

RAINBOW, *Dimenſion of the*.—Deſcartes firſt determined its diameter by a tentative and indirect method; laying it down, that the magnitude of the bow depends on the degree of refraction of the fluid; and aſſuming the ratio of the ſine of incidence to that of refraction to be in water as 250 to 187.

But Dr. Halley has ſince, in the Philoſophical Tranſactions, N° 267, given us a ſimple direct method of determining the diameter of the rainbow from the ratio of refraction of the fluid being given; or, *vice verſâ*, the diameter of the rainbow being given, to determine the refractive power of the fluid.

The principles of Dr. Halley's conſtruction for this purpoſe, illuſtrated and facilitated by Dr. Morgan, biſhop of Ely, will be underſtood from the following view of them. Let S N, *s n*, (*Plate* XVIII. *Optics*, *fig.* 5.) be two of the efficacious rays incident upon a drop of rain; theſe, when refracted to the ſame point F, and thence reflected to G, *g*, will have the parts within the drop on one ſide N F, *n* F, equal to thoſe on the other ſide F G, F *g*, from the nature of the circle, and becauſe the angles of incidence C F N, C F *n*, are equal to the angles of reflection C F G, C F *g*. And ſince the parts within the drop are equal and alike ſituated, they will be ſimilarly ſituated with regard to the drop itſelf; and, conſequently, as the incident rays S N, S *n*, are ſuppoſed to be parallel, the emergent rays G R, *g r*, will be alſo parallel. From C, the centre, draw the radii C N, C *n*, C F, then will C N F = C F N be the angle of refraction, and the ſmall arc N *n* is the naſcent increment of the angle of incidence B C N; and as it meaſures the angle at the centre N C *n*, it is double of the angle at the circumference upon the ſame arc, *viz.* N F *n*, which is the naſcent increment of the angle of refraction N F C. Farther, let the ray S N (*fig.* 6.) enter the lower part of the drop, and be twice reflected within the drop at F and G; then is the ray N F equal to the ray F G, and the arc N F = the arc F G. Draw *f g* parallel to F G, and it will be the reflected part of ſome ray *s n*, whoſe obliquity to the drop makes it croſs the ray N F in its refraction; then will the part *n f* = *f g*, and the arc *n f* = *f g*, and the ſmall arc F *f* = G *g*. Therefore, 2 F *f* = (F *f* + G *g* = the arc F G − *f g* = N F − *n f* =) N *n* − F *f*; conſequently N *n* = 3 F *f*, *i. e.* the naſcent increment of the angle of incidence is equal to three times that of the angle of refraction. After a like manner it may be ſhewn, that after three, four, five, &c. reflections, the increment of the angle of incidence will be four, five, ſix, &c. times greater than that of the angle of refraction. Hence, in order to find the angle of incidence of an efficacious ray, after any given number of reflections, we are to find an angle whoſe naſcent increment has the ſame ratio to the increment of its correſponding angle of refraction, generated in the ſame time, as the given number of reflections (*n*) increaſed by unity has to unity; *i. e.* as *n* + 1 to 1. But theſe increments are as the tangents of the reſpective angles directly. For, let A C D, A B D (*fig.* 7.) be the angles of incidence and refraction propoſed; and if we ſuppoſe the line A C to move about the point A in the plane of thoſe angles, the extremity of it, C, will deſcribe the circular arc C *c*; and when A C is arrived at the ſituation A *c*, the line B D will be thereby removed into the ſituation B *d*. Draw *c* D, then is the angle A C D = A B C + C A B, and the angle A *c d* = A B *c* + *c* A B; therefore the exceſs of A *c d* above A C D, or the increment of A C D, is equal to both the angles C B *c* and C A *c*. But ſince the angle A *c* C differs infinitely little from a right one, a circle deſcribed on the diameter A C ſhall paſs through the points D and *c*; and, therefore, the angles C A *c*, C D *c*, (inſiſting on the ſame arc C *c* of the ſaid circle) will be equal; and, therefore, the increment of the angle A C D is equal to C B *c* + C D *c* = D *c d*. But the naſcent angles D *c d* and D B *c* are as their ſines, that is, as their oppoſite ſides B D and D *c* = D C, the angle C D *c* being infinitely ſmall; but B D : C D :: D E : D A (the line B E being parallel to A C) :: tangent of the angle E B D = A C D : tangent of the angle A B D. Therefore the increment D *c d* of the angle A C D is to the increment C B *c* of the angle A B D (generated in the ſame time) as the tangent of the former to the tangent of the latter directly. Hence the praxis is as follows:

Firſt, *The ratio of the ſine of incidence* I, *to the ſine of refraction* R, *being given; to find the angles of incidence, and refraction of a ray, which becomes effectual after any given number* (*n*) *of reflections.*—Suppoſe any given line, as A C (*fig.* 8.) which divide in D; ſo as that A C : A D :: I : R; and again divide it in E, ſo that A C may be to A E as the given number of reflections, increaſed by unity, is to unity; *i. e.* as *n* + 1 : 1. Upon the diameter C E deſcribe a ſemicircle C B E, and from the centre A, with the radius A D, deſcribe an arc D B interſecting the ſemicircle in B; then drawing A B, C B, and letting fall the perpendicular A F on C B produced; A B C, or its complement to two right angles, A B F, will be the angle of incidence; and A C B the angle of refraction required. For, drawing B E parallel to A F, the triangles A C F and E C B are ſimilar. Now, the ſine of the angle A B C, or A B F, is to the ſine of A C B as A C to A B = A D, *i. e.* as I to R; therefore if A B F be the angle of incidence, A C F will be the angle of refraction. Moreover, the naſcent increment of A B F is to that of A C B (generated in the ſame time) as C F : B F :: C A : A E, on account of the ſimilar triagles; *i. e.* as *n* + 1 to 1, by conſtruction. The ratio, therefore, of the naſcent increment of the angle of incidence A B F to that of the angle of refraction A C B, is that which is required in the angles of incidence and refraction of an efficacious ray, after a given number of reflections; conſequently the angles A B F and A C F are thoſe required. From this conſtruction we may eaſily deduce ſir Iſaac Newton's rule for finding the angle of incidence A B F. See his Optics, p. 148, 149.

For $AC : AB :: I : R$; whence $AC = \frac{I}{R} \times AB$; and $CF : BF :: n + 1 : 1$; therefore $CF = \overline{n+1} \times BF$; or (putting $n + 1 = m$) $CF = m \times BF$; and, on account of the right angle at F, $AC^2 - CF^2 = AB^2 - BF^2$, *i. e.* $\frac{II}{RR} AB^2 - m^2 BF^2 = AB^2 - BF^2$; and, therefore, $m^2 BF^2 - BF^2 = \frac{II}{RR} AB^2 - AB^2$; and, conſequently, $\frac{BF}{AB} = \sqrt{\frac{II - RR}{m^2 R^2 - R^2}}$. Hence, becauſe in the firſt bow, the ray emerges after one reflection, we have $n = 1$, $m = 2$, $m^2 = 4$, and $m^2 - 1 = 3$; therefore, $\sqrt{3RR} : \sqrt{II - RR} :: AB : BF ::$ radius : coſine of the angle of incidence. In the ſecond bow, where there are two reflections, $m^2 - 1 = 8$; whence $\sqrt{8RR} : \sqrt{II - RR} :: AB : BF$. In the third bow, after three reflections, $m^2 - 1 = 15$; and $\sqrt{15RR} : \sqrt{II - RR}$ :: A B

× A B : B F, and so on for any given number of reflections. Wherefore, supposing the ratio of refraction to be, as sir Isaac Newton has determined it, *viz.* as 108 to 81 in the red rays, and as 109 to 81 in the violet rays; we shall have I (in the least refrangible rays) = 108, I I = 11664; and R = 81, and R R = 6561, and $I^2 - R^2 = 5103$, $\sqrt{3 R R} = 140.3$, and $\sqrt{I^2 - R^2} = 71.4$: therefore,

As $\sqrt{3 R R} = 140.3$, whose logarithm is	2.147045
Is to $\sqrt{I^2 - R^2} = 71.4$ - -	1.853913
So is radius - - - -	10.000000
To the cosine of the angle of incidence, B A F = 30° 37′ - -	9.706868

Hence the angle of incidence A B F is 59° 23′ in the red rays.

Secondly, *Having given the angle of incidence, and the ratio of* I *to* R, *or of refraction; to find the angle which a ray of light emerging out of a refracting sphere, after a given number of refractions, makes with the axis of vision, or an incident ray; and, consequently, to find the diameter of the rainbow.* The angle of incidence, and the ratio of refraction, being given, the angle of refraction is given; which angle being multiplied by double the number of reflections increased by 2, and double the angle of incidence subtracted from the product, the angle remaining is the angle sought.

In order to find the angle of refraction, say

As I = 108, whose logarithm is -	2.033424
Is to R = 81 - - -	1.908485
So is the sine of incidence 59° 23′ -	9.934798
To the sine of the angle of refraction 40° 12′	9.809859

Then, making the angle C N F (*fig.* 9.) = 40° 12′, N F will be the refracted ray, which at F is reflected into F G, and at G emerges in G R. Produce the incident and emergent rays S N and R G, till they intersect each other at X, and as C F bisects the angle N F G, it will, if produced, bisect the angle S X R. Then C F N = C X N + F N X; but F N X = C N X − C N F, or C F N; therefore C F N = C X N + C N X − C F N; that is, 2 C F N − C N X = C X N; or 80° 24′ − 59° 23′ = 21° 1′ = C X N; therefore 2 C X N = S X R = 42° 2′, which is the measure of the angle that the incident and emerging rays, which are the least refrangible, contain with each other. If instead of the ratio 108 to 81, we take that of 109 to 81, we shall find the values of $\sqrt{3 R R}$, and $\sqrt{I^2 - R}$, such as will give the angle of incidence B C N, and the arc B N = 58° 40′, and the angle S X R = 40° 17′, for the most refrangible, or extreme violet rays.

If the ray be twice reflected, *viz.* at F and G, as in the production of the extreme bow, and emerges at H in the direction H A, interfecting the incident ray S N in Y, we may find the angle A Y S thus: produce A H till it meets G X, produced in R; then in the triangle H G R, the external angle H G X = H R G + G H R. But because of equal angles of reflection at F and G, G H R = F G X, therefore H G X − F G X = H G F = H R G = 2 C G F, or C N F. But S X R = 4 C N F − 2 C N X; therefore in the triangle Y X R we have the two internal angles R + X = 6 C N F − 2 C N X = the external angle at Y, *viz.* A Y N. In this case, to find the angles of incidence and refraction, we have $\sqrt{8 R R} : \sqrt{I - R^2}$ :: radius : cosine of the angle of incidence; whence the said angle will be found 71° 50′ = C N X. And as 108 : 81 :: sine of 71° 50′ : sine of 45° 27′ = C N F, the angle of refraction; therefore $\overline{6 \times 45° 27'} - \overline{2 \times 71° 50'}$ = 129° 3′ = A Y N; and, therefore, its complement A Y S = 50° 57′, the angle required for the least refrangible rays. But for the most refrangible rays, where I : R :: 109 : 81, we have the angle of incidence 71° 26′, and the angle of refraction 44° 47′; and, therefore, the angle A Y S = 54° 7′. In the same manner the same angles are calculated after three or four reflections.

From the preceding problems we obtain the following results, *viz.*

I. Rainbow,	Red	42°	2′	The spectator's back being turned to the sun.
	Violet	40	17	
II. Rainbow,	Red	50	57	
	Violet	54	7	

If the angle made by a ray, after three or four reflections, were required, and therefore the diameters of the third and fourth rainbow (which are scarcely ever seen, on account of the great diminution of the rays, by so many repeated reflections) they will be found,

III. Rainbow,	Red	41°	37′	The spectator being turned towards the sun.
	Violet	37	9	
IV. Rainbow,	Red	43	52	
	Violet	49	34	

Dr. Morgan's Dissertation upon the Rainbow, among the notes upon Rohault's System of Philosophy, part iii. chap. xvii.

Hence, the breadth of the rainbows is easily found: for the greatest semi-diameter of the first bow, *i. e.* from red to red, being 42° 2′, and the least, *viz.* from violet to violet, 40° 17′, the breadth of the fascia or bow, measured across from red to violet, will be 1° 45′; and the greatest diameter of the second bow being 54° 7′, and the least 50° 57′, the breadth of the fascia will be 3° 10′. And hence the distance between the two will be found 8° 55′.

In these measures the sun is only esteemed a point; wherefore, as his diameter is really about 30′, or 32′, so much must be added to the breadth of each fascia or bow, from red to violet, and so much must be subtracted from the distance between them.

This will leave the breadth of the primary bow, 2° 15′; that of the secondary bow, 3° 40′; and the interval between the bows, 8° 25′; which dimensions, deduced by calculation, sir Isaac Newton assures us from his own observations, agree very exactly with those found by actual mensuration in the heavens. Optics, p. 153. ed. 3.

Rainbow, *Particular Phenomena of the.* From this theory of the rainbow, all the particular phenomena of it are easily deduced: hence we see why the iris is always of the same breadth; because the intermediate degrees of refrangibility of the rays between red and violet, which are its extreme colours, are always the same. See *Apparent* Magnitude.

Secondly, Why it is more distinctly terminated on the side of the red than on that of the violet? there being no efficacious rays in the space adjoining to the red drops, *i. e.* to the space between the bows, whence it terminates abruptly; whereas, in the space on the side of the violet ones, there are some rays emitted to the eye, which, though too feeble to affect it strongly, yet have this effect, that they soften the violet edge insensibly, so that it is difficult to determine precisely where it terminates.

Thirdly, Why the bow shifts its situation as the eye does; and, as the popular phrase has it, *flies from those who follow it; and follows those that fly from it?* the coloured drops being disposed under a certain angle about the axis of vision, which is is different in different places: whence alfo it follows, that every different fpectator fees a different bow.

Fourthly, Why the bow is fometimes a larger portion of a circle, fometimes a lefs? its magnitude depending on the greater or lefs part of the furface of the cone, above the furface of the earth, at the time of its appearance; and that part being greater or lefs, as the line of afpect, or axis of vifion, is more inclined or oblique to the furface of the earth; which inclination, or obliquity, is greater as the fun is higher: whence, alfo, the higher the fun, always the lefs the rainbow.

Fifthly, Why the bow never appears when the fun is above a certain altitude? the furface of the cone, in which it fhould be feen, being loft in the ground, at a little diftance from the eye, when the fun is above 42° high.

Sixthly, Why the bow never appears greater than a femicircle, on a plane? fince be the fun ever fo low, and even in the horizon, the centre of the bow is ftill in the line of afpect; which, in this cafe, runs along the earth, and is not at all raifed above the furface.

Indeed, if the fpectator be placed on a very confiderable eminence, and the fun in the horizon, the line of afpect, wherein the centre of the bow is, will be notably raifed above the horizon (confidering the magnitude of the circle whereof the bow ufes to be a part). Nay, if the eminence be very high, and the rain near, it is poffible the bow may be an entire circle.

Seventhly, How the bow may chance to appear inverted, *i. e.* the concave fide be turned upwards? *viz.* a cloud happening to intercept the rays, and prevent their fhining on the upper part of the arch: in which cafe, only the lower part appearing, the bow will feem as if turned upfide down; which, probably, has been the cafe in feveral prodigies of this kind, related by authors.

Indeed the bow may appear inverted from another caufe: for, if when the fun is 41° 46′ high, his rays fall upon the fmooth furface of fome fpacious lake, in the middle of which a fpectator is placed; and if, at the fame time, there be rain falling, to which the rays may be reflected from the lake, it will be the fame as if the fun fhould fhine below the horizon, and the line of view be extended upwards: thus the furface of the cone, wherein the coloured drops are to be placed, will be wholly above the furface of the earth.

But fince the upper part will fall among the unbroken clouds, and only the lower part be found among the drops of rain, the arch will be inverted.

Eighthly, Why the bow fometimes appears inclined? the accurate roundnefs of the bow depending on its great diftance, which prevents us from judging of it exactly; if the rain, which exhibits it, chance to be much nearer, we fhall fee its irregularities; and if the wind, in that cafe, drive the rain fo that the higher part be farther from the eye than the lower, the bow will appear inclined.

Ninthly, Why the legs of the rainbow fometimes appear unequally diftant? if the rain terminate on the fide of the fpectator, in a plane fo inclined to the line of afpect as to make an acute angle on the left hand, and an obtufe angle on the right, the furface of the cone, which determines what drops will appear, will fall upon them in fuch manner as that thofe on the left hand will appear farther from the eye than thofe on the right. For the line of afpect being perpendicular to the plane of the bow, if you fuppofe two rectangular triangles, a right and left, the cathetus of each to be the line of view, and the bafe of the femi-diameter of the bow, inclined as above; it is evident, fince thofe angles of the triangles, next the eye, muft always be the fame (*viz.* 43° in the inner bow), the bafis of the right-hand triangle will, in this cafe, appear much longer than that of the left.

Dr. Langwith, in the Phil. Tranf. N° 375, defcribes a remarkable rainbow, in which he obferved feveral feries of colours, which increafed the bow to a breadth far exceeding what had been determined by calculation. The colours of the primary rainbow, he fays, were as ufual; under this was an arch of green, and then alternately two arches of reddifh-purple, and two of green, and under all a faint appearance of another arch of purple. The order of the colours was, 1. Red, orange, yellow, green, light blue, deep blue, and purple. 2. Light green, dark green, and purple. 3. Green and purple. 4. Green, and faint vanifhing purple.

M. Bouguer frequently faw a phenomenon of this kind, when he was upon the mountains of Peru, where the fky is often extremely ferene. Similar appearances have been alfo obferved by others. Dr. Pemberton has attempted to explain them by means of the Newtonian doctrine of fits of eafy reflection and tranfmiffion; but he goes upon the fuppofition that the differently-coloured rays have their feparate fits, on their arrival at the furface of any medium, without any regard to the thicknefs of it; whereas it is plain, that, in fuch a cafe, all kinds of rays are reflected or tranfmitted promifcuoufly. It is moft probable that thefe colours are formed in very minute drops of water or vapour, intermixed with the larger drops, that their formation depends upon the fame principle with the colours of thin plates, and that they are fimilar to thofe of feveral kinds of halos. Dr. Pemberton himfelf obferves, that it is moft likely that thefe additional rings of colours are formed in the vapour of the cloud, which the air, being put in motion by the fall of the rain, may carry down along with the large drops. This, he fays, may be the reafon why thefe colours appear under the upper part of the bow only, this vapour not defcending very low. As a farther confirmation of this, thefe colours, he obferves, are feen ftrongeft when the rain falls from very black clouds, which caufe the fierceft rains; by the fall of which the air will be moft agitated. Phil. Tranf. abr. vol. vi. p. 140. Prieftley on Light and Colours, p. 593.

It has been a fubject of controverfy among biblical critics, whether the antediluvian atmofphere prefented any fuch phenomenon as a rainbow. The occafion of this debate is a paffage in Genefis, ch. ix. 12—17. Mr. Whitehurft, in his "Inquiry into the original State and Formation of the Earth, &c." attempts to eftablifh the probability that the antediluvian atmofphere was fo uniformly temperate, as to be fubject to no ftorms, tempefts, or rain. The opinion is by no means probable, nor does the above-cited paffage warrant any fuch conclufion. The rainbow was then made the fign or token of God's covenant with Noah, that no fuch calamity fhould again take place. אות denotes a fign or token, and in this fenfe it is ufed in the cafe of Cain, Gen. iv. 15. The mark fet upon Cain was, as Shuckford conceives, a fign or token (אות) given to him, that he fhould be preferved from the evil which he deprecated.

Rainbow, *Lunar.* The moon fometimes alfo exhibits the phenomenon of an iris, or bow, by the refraction of her rays in the drops of rain in the night-time.

Ariftotle fays, he was the firft that ever obferved it; and adds, that it never happens, *i. e.* is never vifible, but at the time of the full moon; her light, at other times, being too faint to affect the fight after two refractions, and one reflection.

The lunar iris has all the colours of the folar, very diftinct and pleafant; only faint, in comparifon of the other; both

both from the different intenſity of the rays, and the different diſpoſition of the medium.

In that mentioned, Philoſophical Tranſactions, N° 331, Mr. Thoreſby obſerves, the largeneſs of the arch was not ſo much leſs than that of the ſun, as the different dimenſions of their bodies, and their diſtances from the earth, ſhould ſeem to require; but as to its entireneſs, and the beauty of its colour, it was admirable. This continued about ten minutes before the interpoſition of a cloud hindered its obſervation.

Rainbow, *Marine*. The marine or ſea-bow is a phenomenon ſometimes obſerved in a much agitated ſea; when the wind, ſweeping part of the tops of the waves, carries them aloft; ſo that the ſun's rays, falling upon them, are refracted, &c. as in a common ſhower, and paint the colours of the bow.

F. Bourzes, in the Philoſophical Tranſactions, obſerves, that the colours of the marine rainbow are leſs lively, leſs diſtinct, and of leſs duration, than thoſe of the common bow; that there are ſcarce above two colours diſtinguiſhable, a dark yellow on the ſide next the ſun, and a pale green on the oppoſite ſide.

But theſe bows exceed as to number, twenty or thirty being ſometimes ſeen together: they appear at noon-day, and in a poſition oppoſite to that of the common bow, *i. e.* the concave ſide is turned upwards, as indeed it is neceſſary it ſhould be, from what we have ſhewn in accounting for the phenomena of the ſolar bow. A coloured bow is always to be ſeen in the ſcattered water of a jet, a broken caſcade, and the like, when the ſun and the ſpectator are in proper ſituations.

To this claſs of bows may be referred a kind of white or colourleſs rainbows, which Mentzelius, and others, affirm to have ſeen at noon-day. M. Mariotte, in his fourth Eſſai de Phyſique, ſays, theſe bows are formed in miſts, as the others are in ſhowers; and adds, that he has ſeen ſeveral, both after ſun-riſing, and in the night.

The want of colours he attributes to the ſmallneſs of the vapours which compoſe the miſt; but we ſhould rather account for it from the exceeding tenuity of the little veſiculæ of the vapour; which being, in effect, only little watery pellicles bloated with air, the rays of light undergo but little refraction in paſſing out of air into them; too little to ſeparate the differently-coloured rays, &c.

Hence, the rays are reflected from them, compounded as they came, that is, white.

Rohault mentions coloured rainbows on the graſs, formed by the refractions of the ſun's rays in the morning dew. Trait. de Phyſ.

Rainbows have been alſo produced by the reflection of the ſun from a river; and in the Philoſophical Tranſactions, vol. l. p. 294. we have an account of a rainbow, which muſt have been formed by the exhalations from the city of London, when the ſun had been ſet twenty minutes, and conſequently the centre of the bow was above the horizon. The colours were the ſame as in the common rainbow, but fainter.

The beſt way of forming a reſemblance of a rainbow is to faſten a number of ſmall ſolid glaſs balls, or a number of ſmall glaſs bubbles full of water, upon a dark board, and to preſent the board thus furniſhed to the ſun at a proper inclination, which experience eaſily finds, whilſt you turn your back to the ſun, and look at the board.

RAINFELDEN, in *Geography*, a town of Auſtria; 2 miles W. of Hainfelden.

RAINHAM, a townſhip of Norfolk county, in Upper Canada; being the firſt townſhip fronting on lake Erie, weſt of the grand river Lands.

RAINSBRON, a town of Germany, in the margraviate of Anſpach; 3 miles N. of Creglingen.

Rainy Lake. See *Le Plue*.

RAJODE, a town of Hindooſtan, in Malwa; 30 miles E. of Tandla.

RAJOORA, a town of Hindooſtan, in Dowlatabad; 18 miles W.N.W. of Kondur.—Alſo, a town of Bengal; 65 miles N. of Dacca.

RAJOUR, a town of Hindooſtan, in Lahore; 36 miles N.W. of Jummoo.

RAJOWLY, a town of Hindooſtan, in Bahar; 30 miles S. of Bahar.

RAJPOOTANA, a country of the Rajpoots, generally denoting *Agimere* (which ſee), and the original country of the founder of the Mahratta ſtate, whoſe rulers, about half a century ago, aſpired at univerſal empire in Hindooſtan; but they have been reduced to their preſent low ſtate, by the depredations of Mahratta detachments, which, being compoſed of light horſe, and accuſtomed to ſeparate into ſmall parties, have, by their deſultory movements, at once ſpread deſolation, and eluded the attacks of the inhabitants. This is the fact with regard to the open parts of Rajpootana; the mountainous parts remaining free from their incurſions.

Rajpootana was divided into three great principalities, under the names of Oudipour, Joodpur, and Ambeer (or Amere), now better known by that of Joinagur, or Jyenagur. (See each reſpectively.) In Acbar's diviſion of the empire, theſe principalities were claſſed as belonging to the ſoubah of Agimere, ſometimes called Marwar. It is not eaſy to aſſign the preciſe limits and dimenſions of theſe principalities, which occupy the ſpace between the weſtern confines of Agra and the north-eaſt part of Guzerat, and between the ſandy deſert (or Regiſtan) and Malwa; that is, an extent of 330 Britiſh miles from N.E. to S.W., and 200 broad in the wideſt part. Jyenagur or Jyepour lies to the N.E., Oudipour to the S.W., and Joodpour to the N.W., bordering angularly on the other two. Pere Wendell's MS., cited by Rennell, ſtates the revenues of Oudipour at 10 lacks of rupees, Marwar at 40, and Jyenagur at 40, *per annum*, in the year 1779. The whole revenue of the ſoubah of Agimere, in the time of Acbar, appears to have been only about 75 lacks. Aurungzebe is ſaid to have doubled the land-tax on the Rajpoots, and accordingly in Mr. Fraſer's account, Agimere is ſtated at 163 lacks of rupees. The two former, *viz.* Oudipour and Marwar, are very mountainous, with a ſandy ſoil in the vallies; the latter is the moſt fertile, and was, about the middle of the laſt century, in a high ſtate of improvement, under the government of the celebrated rajah Jyeſing, or Jeſſing, who founded the new capital of Jyepour, whence the name of the province was changed to that of the capital. Jyepour was a place of great wealth and commerce in 1779, being the entrepot of the principal part of the goods that are brought from every quarter of India. The rajah built an obſervatory in his capital; but the confuſions that have ſo long prevailed in this province, muſt have greatly reduced the wealth and importance of the capital. Sindia, as Rennell informs us, received the tribute of all the three Rajpoot provinces, and converted it to his uſe; and he alſo made conſiderable conqueſts in them, particularly in Jyenagur. In early times the whole Rajpootana probably conſtituted one entire kingdom, or empire, under the rana or prince of Oudipour, the head of the Rajpoot ſtates; the antiquity of whoſe houſe may be inferred from the name

Rhanna

Rhanna appearing in Ptolemy, nearly in its proper pofition, as a province. See Oudipour.

The province of Agimere in general (fee Agimere) has ever been the country of the Rajpoots; that is, the warrior tribe among the Hindoos, and which are noticed in Arrian and Diodorus; and Cheitore, or Oudipour, (confidered by Rennell as fynonimous,) is, in his opinion, reckoned the firft among the Rajpoot ftates. (See Cheitore.) From the Ayin Acbaree we derive fome new ideas refpecting the divifion of the foubah of Agimere. It confifted at that time of three grand divifions, Marwar, Meywar, and Hadowty (or Nagore); and thefe contained feven circars or fubdivifions, Agimere, Cheitore, Rantampour, Joudypour, Sirowy, Nagore, and Beykeener (or Bicaneer). Marwar, as including the circar and fortrefs of Agimere, has become almoft fynonimous with Agimere, in common acceptation. The extent of this province, as given by the fame book, is 168 coffes, or about 320 Britifh miles, from E. to W.; and 150 coffes, or 285 Britifh miles, from N. to S. Such is the province of the Rajpoots. From the indulgence granted to this tribe throughout India, *viz.* that of feeding on goats' flefh, it may be inferred, fays Rennell, that the cuftom originated in this mountainous country. The grain cultivated there is chiefly of the dry kind. The taxes amounted, in the time of Acbar, to no more than a feventh or eighth of the produce of the harveft. Rennell's Memoir.

RAJPOOTS, the inhabitants of *Rajpootana;* which fee. They were not confined entirely to the foubah of Agimere; as fome inferior tribes of them are fettled in Bundelcund, and in Gurry-Mundella. Others, according to Thevenot, are fettled in Moultan; and indeed he reprefents Moultan as the original country of the Kuttries, from whom the Rajpoots fprung.

The Kuttries or Catries, who formed a particular fect of Hindoos at Moultan, were the Catheri of Diodorus, and the Cathei of Arrian, with whom Alexander carried on war, on the borders of the Malli. The Rajpoots are ordinarily divided into two tribes or claffes, *viz.* thofe of Rathore, and Chohan or Seefodya. Marwar, or the N.W. divifion of Agimere, is the proper country of the former; and Meywar, or Oudipour, of the latter. The Rathore tribe were originally the moft numerous of the two; and it has been faid by colonel Dow, among others, that the Mahratta chiefs had their origin from the Rathore tribe: and in proof of this it has been alleged, that the etymology of the name Mahratta has been deduced from Rathore, prefixing to it "maha," or great. (See Mahratta.) The Rajpoots are reprefented by Thevenot as having fpread from Moultan, their proper country, over all the Indies. Diodorus Siculus diftinguifhes them by the cuftom of their women burning themfelves alive, on the funeral piles of their hufbands; which is indeed a cuftom among them, as well as fome other Hindoos, at this day. Rennell.

RAJPOUR, a town of Bengal, on the bank of the Ganges; 10 miles N.N.E. of Curruckdeagh.

RAISE, in the *Manege*, is ufed for working. See Raising.

Raise is likewife ufed for placing a horfe's head right, and making him carry well, and hindering him to carry low, or to arm himfelf.

Raise *Tacks and Sheets*, in *Sea Language*, the order to let them go in the article of tacking, that the fails may be fet on the contrary tack they were on before.

To Raise *a fiege.* See Siege.

RAISED Airs. See Air.

Raised *Plan.* See Plan.

RAISEEN, in *Geography*, a town of Hindooftan, in Malwa; 15 miles S. of Bilfah. N. lat. 23° 16′. E. long. 77° 49′.

RAISER, in *Building*, a board fet on edge under the forefide of a ftep, a ftair, &c. See Stair, &c.

RAISIN, in *Geography*, a river of America, which runs into lake Michigan, N. lat. 43° 12′. W. long. 85° 42′. —Alfo, a river of America, which runs into lake Erie, N. lat. 43° 20′. W. long. 82° 55′.

Raisin *Ifland*, a fmall ifland in lake St. Francis. N. lat. 45° 6′. W. long. 74° 27′.

Raisin, or *Raifen*, *Market*, a fmall market-town in the eaft divifion of the wapentake of Walfhcroft, parts of Lindfey, and county of Lincoln, England, is fituated on the banks of the river Raifen, whence it derives its name, at the diftance of 15 miles N.E. from Lincoln, and 149 miles N.W. from London. According to the population returns of 1811, it contains 164 houfes, and 964 inhabitants. Here is a weekly market on Thurfday, and there are fairs every alternate Tuefday, after Palm Sunday, and on the 25th of September. The church is an ancient ftructure, and is remarkable for the peculiar form of the upper windows in its embattled tower. Thefe have a pointed arch, divided into two pointed lights, and a quaterfoil head. Up the centre runs a ftrong mullion, croffed by a tranfom, terminating at the impofts, as happens in the church of Yarborough, near Louth, which renders it probable that both edifices were erected by the fame architect. The living is a vicarage in the gift of the crown; and by the endowment the vicar is entitled to the unufual tythe of ale. Befides the church, there are in Raifin a Roman Catholic chapel, and a Methodift's meeting-houfe; alfo a free-fchool, and an hofpital for poor old men.

At a fhort diftance from Market-Raifin, are the villages of Middle and Weft Raifin. Middle Raifin was formerly divided into two parifhes, called Drax and Tupholm, but thefe are now united. At Tupholm ftood an abbey of Premonftratenfian canons, which was founded in the reign of Henry II., by Alan de Neville, and his brother Gilbert. Previous to the diffolution, it was inhabited by nine monks, whofe annual income, according to Speed, amounted to 119*l.* 2*s.* 8*d.* The church is a fmall, but ancient building, confifting of a nave and chancel, which are feparated by elegant fcreen work, beneath a pointed arch, fupported by circular columns. The nave appears to have had fide-aifles, as the pillars and pointed arches ftand in relief from the prefent wall.

The principal feats in this vicinity are Willingham-houfe, a feat of the Boucherett family; and Thurgundy, the property of lord Middleton. The latter anciently belonged to the Willoughbys. The houfe is fituated on an eminence, commanding an extenfive view over the vale to Swinhop, and is furrounded by pleafure-grounds, finely varied by wood and lawn. Beauties of England and Wales, vol. ix. by John Britton, 1807.

RAISING, in the *Manege*, one of the three actions of a horfe's legs; the other two being the ftay, and the tread. The raifing or lifting up of his legs in caprioles, curves, &c. is efteemed good, if he perform it hardily, and with eafe; not croffing his legs, nor carrying his feet too much out or in; yet bending his knees as much as is needful.

Raising *the Land*, in *Sea Language*. See *Laying the* Land.

Raising *a Purchafe*, denotes the act of difpofing certain inftruments or machines in fuch a manner, as that, by their mutual efforts, they may produce a mechanical force fuffi- cient

cient to overcome the weight, or refiftance, of the object to which the machinery is applied.

RAISING-*Pieces*, or *Reafon-pieces*, in *Architecture*, are pieces that lie under the beams, and over the pofts or puncheons: thofe lying on the brick-work are called plat-bands.

RAISINS, grapes prepared by drying them in the fun, or in the air; to fit them for keeping, and for fome medicinal purpofes.

Of thefe there are various kinds: as, raifins of Damafcus, thus called from the capital city of Syria, in the neighbourhood of which they are cultivated. They are much ufed in the compofition of ptifans, together with jujubes and dates; they are brought flat, and feeded, of the fize of the thumb; whence it is eafy judging of the extraordinary bulk of the grape, when frefh. Travellers tell us of bunches weighing twenty-five pounds. Their tafte is faintifh and difagreeable.

Raifins of the fun are a kind of raifins brought from Spain, of a reddifh or blueifh colour, feeded, and very agreeable to eat.

There are various other forts, denominated either from the place where they grow, or the kind of grape, &c. as raifins of Calabria, Mufcadine raifins, &c.

The fineft and beft raifins are thofe called in fome places Damafcus and jube raifins. Thefe are the fruit of the *vitis Damafcena*, and are diftinguifhable from the others by their largenefs and figure; they are flat, and wrinkled on the furface; foft and juicy within, near an inch long, and femipellucid, when held againft a good light; they have a fweet, agreeable, and vinous tafte; and when frefh, and growing on the bunch, are of the fize and fhape of the large olive.

The common raifins are the fruit of feveral fpecies of grape, which are better or worfe, according as they have been more or lefs carefully cured. The raifins of the fun, or jar-raifins, fo called, becaufe they are imported in jars, are all dried by the heat of the fun; and thefe are the forts ufed in medicine.

The common way for drying grapes for raifins is to tie two or three bunches of them firmly together, while yet on the vine, and dip them into a hot lixivium of wood-afhes, with a little olive oil in it. This difpofes them to fhrink and wrinkle; and after this they are left on the vine three or four days, feparated on fticks in an horizontal fituation, and then dried in the fun at leifure, after being cut from the tree. Some raifins are dried by the heat of an oven; and the difference between thefe and fuch as are dried in the fun, is obvious; the latter are fweet and pleafant, but the former have a latent acidity with the fweetnefs, that renders them much lefs agreeable. See CURRANTS.

All the kinds of raifins have much the fame virtues; they are nutritive and balfamic, but they are very fubject to fermentation with juices of any kind; and hence, when eaten immoderately, they often bring on colics. They are allowed to be attenuant, and are given in cafes where the humours are too thick and vifcid, and they are faid to be very good in nephritic complaints; they are, however, too familiar in our foods, to be much regarded at prefent as a medicine. They are an ingredient, indeed, in our pectoral decoctions, and in fome other medicines of that intention; in which cafes, as alfo in others where aftringency is not required of them, they fhould have the ftones carefully taken out. The are ufed in fome compofitions rather with an intent of taking off the naufeous tafte of other ingredients, and for obtunding their acrimony, than of doing any extraordinary fervice themfelves

RAISIN-*Brandy*, a name given by our diftillers to a very clean and pure fpirit, procured from raifins fermented only with water. Thus treated, they yield a fpirit, fcarce at all diftinguifhable from fome of the wine-fpirits; for there are as many kinds of wine-fpirits as there are of grapes. The coarfer the operation of diftilling is performed in this cafe, the nearer will be the refemblance of the wine-fpirit; that is, there will be moft of this flavour in the fpirit, when as much as can be of the oil is thrown up with a galloping heat.

The diftillers are very fond of the wine-fpirit, with which they hide and difguife the tafte of their naufeous malt, and other fpirits; and in defect of that fpirit, this of raifins, made in this coarfe manner, will go almoft as far. It is indeed furprizing how extenfive the ufe of thefe flavouring fpirits is, ten gallons of raifin-fpirit, or fomewhat lefs of the wine-fpirit, being often fufficient for a whole pipe of malt-fpirit, to take off its native flavour, and give it an agreeable vinofity. It is no wonder, therefore, that the diftillers, and ordinary rectifiers, are fo fond of this, as it is a good cloak for their defects, and the imperfection of their proceffes.

When raifin-brandy is intended for common ufe, the fire fhould be kept flower and more regular in the diftillation; and the fpirit, though it hath lefs of the high flavour of the grape, will be more pleafant and more pure.

RAISIN-*Wine*. See WINE.

RAIT, in *Rural Economy*, a term ufed to fignify the procefs or operation of diffipating the fap of vegetables, by expofure to moifture, or the influence of the atmofphere. It is moftly applied to hemp, flax, or other fimilar fubftances, and fometimes to hay, when it has been much expofed to alternations of wet and dry weather.

When the procefs is performed by means of water, as is moftly the cafe with hemp, frequently but not always with flax, and occafionally with other articles of the fame nature, it is ufually denominated water-raiting, and the article is faid to be *water-raited;* but where it is effected by expofure to the air, upon the ground, when fpread out, it is generally called ground-raiting, and the fubftance is faid to be *ground-raited*. In the performance of thefe operations or proceffes with hemp, flax, and fuch like fubftances, there is great nicety and attention required to fee that they are carried to a fufficient length, without going too far, fo as to injure the textures of the fubftances in their cortical parts. This may probably be accomplifhed with the greateft certainty by the frequent examination of the materials themfelves; keeping them perfectly under the water in the former cafe, and frequently turned with new furfaces to the atmofphere in the latter, never having the graffy furface on which they are fpread out of too great a length. The effects of heavy rains, when long continued, muft likewife be carefully attended to in this latter inftance. See FLAX, HEMP, and WATER-*raiting*.

RAITAPOUR, in *Geography*, a town of Hindooftan, in the circar of Rajamundry; 12 miles N. of Rajamundry.

RAITCH, in *Rural Economy*, a term fignifying a line or lift of white, down the face of a horfe. It is a very common mark in the faces of horfes.

RAITENBACH, in *Geography*, a town of Germany, in the principality of Culmbach; 8 miles E.N.E. of Wonfiedel.—Alfo, a town of Bavaria, in the bifhopric of Aichftadt; 8 miles N. of Aichftadt.

RAITENBURG, a town of the duchy of Carniola; 3 miles N. of Rudolfswerth.

RAITING, GROUND, in *Rural Economy*, that method of raiting or accomplifhing the feparation of the barks or coverings of the ftems of flax, hemp, and other fimilar plants, by by means of fpreading them out in a thin manner upon clofe graffy furfaces, inftead of putting them into ponds or pools of ftagnant water, in order that they may be expofed to the atmofphere. It is occafionally employed for flax and other fmall ftalked plants, but feldom or never for hemp and thofe which have large ones. It is a practice which ftands in need of confiderable attention and management. See RAIT.

RAJUAPOUR, in *Geography*, a town of Mocaumpour; 18 miles S. of Bargao.

RAIVATA, in *Hindoo Mythological Hiftory*, one of the faints or fages included in the denomination of Menus. Raivata is faid to have been the fon of Agni, the regent of fire, alfo called *Pavaka*, (which fee), and *Menu*.

RAJYA, in *Geography*, a town of Hindooftan, in Bahar; 20 miles E.S.E. of Bahar.

RAKAPORAH, a town of Hindooftan, in the circar of Jufhpour; 10 miles N.E. of Odeypour.

RAKAS, a town of Tranfylvania, on the Alaut; 16 miles N.W. of Cronftadt.

RAKE, in *Agriculture*, a tool of the toothed kind, made ufe of for many purpofes of hufbandry, as for collecting together hay, corn, ftubble, roots, leaves, and other fimilar forts of materials. It is a very ufeful and convenient kind of tool in all fuch intentions. There are many defcriptions of this fort of implement.

RAKE, *Bean-Stubble*, a tool of the rake kind, conftructed for the purpofe of clearing bean-ftubbles. It is employed on fome farms in Effex, as by Mr. Ketcher, at Burnham, where it is found to be well adapted to this ufe, and to do its work in a perfect manner. The head, which is feven feet eight inches in length, is formed with a very flight curve, having teeth fet in it in rather a clofe manner, which are one foot and a half in length, bending or curving a little forwards at the points. It is attached by a frame to the axle of the wheels, which is three feet two inches long; and the wheels are two feet fix inches in their diameter. The hooks and fhafts for the horfe are four feet in length. This is a very fimple conftruction of this nature, and one which is capable of eafy application. The teeth fhould be made ftrong, whether they are of wood or iron. This is an implement which wants to be better known in other diftricts.

RAKE, *Corn*, a large ftrong rake, made ufe of in different diftricts for bringing together the mown grain crops. It is fometimes conftructed with wooden teeth, but a better mode is to have them of iron, being a little bent forward, having the length of feven or eight inches. As it requires much exertion to perform the work with them, they fhould always be made as light as poffible, fo as to have fufficient power to perform the work. It has been ftated by Mr. Somerville, in his Agricultural Survey of the Diftrict of Eaft Lothian, that though the common hay-rake is moftly ufed there, a different kind for grain has been partially tried, and found to anfwer the purpofe much better. In this, the length of the head is from ten to fifteen feet, the handle about feven feet, with a piece of wood acrofs the end of it, by which it is drawn by two men. The teeth are of wood or iron; the laft are the beft, as well as the moft durable, and are a little bent forward at the point, which gives them the power of retaining and carrying the ears along with them, much better than they would otherwife do. To make clean work, efpecially if the ridges are gathered, the field is raked acrofs: in that way, every thing is taken up. But when it is preferred to draw the rake in the direction of the ridges, it may be confiderably improved, by cutting the head into two or three lengths, and joining them with hinges, which will allow it to bend and accommodate itfelf to the curvature of the ridges. The advantage of this kind of rake has been found confiderable, even in cafes where every poffible attention has been paid to the cutting of the crop; but it frequently happens, that, owing to the dampnefs, greennefs of the ftraw, or a foul graffy bottom, it is neceffary to leave the crop unbound for a day or two, during which, if it be overtaken by a high wind, much of it will be fcattered and loft, unlefs confiderable pains are taken to gather it by hand-raking, or otherwife. Where the long rake is ufed for that purpofe, the expence will in no inftance, he thinks, exceed four-pence fterling *per* acre. An experiment made on a field of 30 acres, will convey fome idea of the benefit that may be derived from the ufe of that inftrument. The field was in barley, and the rakings, when threfhed, yielded

	£	s.	d.
$7\frac{1}{2}$ bolls, fold at 28*s. per* boll - -	10	10	0
150 ftones ftraw, fold at 6*d. per* ftone -	3	15	0
Total produce	14	5	0
Expence of raking 31 acres, at 4*d. per* acre	0	10	4
Bread and beer to the rakers - -	0	1	6
Carting from the field, ftacking, &c. -	0	2	6
Threfhing - - - - - - -	0	7	6
Total expence	1	1	10

Which deducted from 14*l.* 5*s.*, leaves a profit of 13*l.* 3*s.* 2*d.* fterling. It is neceffary to obferve, that about ten acres of the field were left unbound, and a good deal difordered by a high wind; but as confiderable pains were taken in the binding, the proportion obtained from thefe ten acres did not greatly exceed what was got from the reft of the field, the whole of which was cut with a great deal of care.

But though this mode of working the rake affords confiderable profit and advantage, they would be a great deal more, by having recourfe to horfes in the draught of them. One horfe in each would do as much labour as feveral men, in a given time; and by having fhafts and low wheels fixed to the tool, it could be readily adapted to this method of being wrought.

RAKE, *Couching*, a large fort of ftrong horfe-rake, with long round tines or teeth, crooked or bent forward in a gentle manner, and placed about two inches diftant from each other; and a fmall beam in the middle, with fide pieces, and an apparatus for attaching the horfe to it. It is found very ufeful in bringing together the roots of couch, and other weeds, in order to their being burnt, or carried off the land, and in other ways deftroyed. See COUCH-*Rake*, QUITCH-*Rake*, and RAKE-*Twitch*.

RAKE, *Dew*, a fort of large rake, or hand drag, fo named from being ufed before the dew is off the ground, or other fort of harveft work can be begun. It is a powerful convenient fort of implement for harveft work.

RAKE, *Garden*, a well-known fort of tool for raking the ground, as well as for putting in feeds, &c. In order to fuit every kind of gardening work with rakes, there fhould be three or four different fizes, from about fix to eighteen inches long in the head, having handles from fix to eight feet in length, and the heads toothed with iron teeth two or three inches long, being placed from one to two inches afunder, according to their refpective fizes. The firft or largeft rake fhould have the head about fifteen to eighteen inches long, the teeth three inches, and placed two inches afunder, which is proper for raking ftubborn or rough dug ground, and for putting in large kinds of feeds, raking off large weeds after hoeing, and many other pur-

 pofes

poses in large gardens. The next size should have the head twelve inches long, the teeth three inches, being placed one inch and half asunder, which is proper for all common raking in ordinary light ground, and for raking in most kinds of small seeds, as well as other purposes. A third sort of small rake should have the head about nine inches long, the teeth two and a half, being placed one inch asunder; proper for fine-raking beds, borders, &c. and raking in some particular fine seeds; as well as between rows, &c. of certain plants occasionally, where larger rakes cannot be introduced. And the smallest sort should have the head six inches long, the teeth two and a half, and placed one inch asunder; being very useful for raking between small plants in beds and borders, and other small parts, where the plants stand close, as well as several other purposes of that kind.

It may be noticed, that all these sorts of rakes are constructed both with wooden heads and iron teeth, and with the heads and teeth wholly of iron in both; of which the teeth are generally flattened, the back edge rounded off, and narrowing gradually to the point; the other straight, and placed on the heads edgeways across, with the back edge outward, and with the points all inclining very moderately inward, in a regular manner: the wooden-headed rakes having each end of the head hooped with a thin flat iron ring, to secure it from splitting. It is very seldom that wooden teeth are employed in this way, or for these uses.

Those of the first sort are generally the lightest and cheapest, being proper for any kind of garden raking; but the latter, or iron-headed rakes, when made neat and as light as possible, with the teeth well set, in a proper position, and firmly fastened, are equally proper, and in some cases preferable, as in some wettish or moist soils, as not being liable to clog so much as wooden rakes, and at the same time more durable. They are, however, more proper for middling and small rakes than for large ones; as, in strong raking, the teeth are more liable to get loose than in the wooden-headed rakes. Both the sorts, in their different sizes, are sold at the principal ironmongers' shops, both with and without handles.

And rakes having the heads, teeth, and handles, wholly of wood, may sometimes be used for particular purposes; such as raking in light kinds of kitchen-garden seeds in light ground, and taking off large hoed-up weeds in wide clear spaces, raking up swarths of mowed short grass before the sweepers, also fallen leaves of trees in autumn, and clippings of hedges, &c. as well as several other uses about the pleasure-garden.

Rake, *Hay*, a well-known tool, with short teeth and a long handle, made use of in making hay. It is usually made of willow, or some other similar wood, in order that it may be light and handy. The teeth should not be too long, as, when that is the case, they are apt to hang and pull among the stubs of the grass in raking with them, and thereby retard the operation, as well as cause much fatigue to the labourer.

Different improvements have been made on this implement. A late useful alteration is the making the teeth to screw into the head, and fasten with screw nuts, by which the inconvenience of their dropping out in dry seasons is obviated. It has been observed, that with the spring-toothed rake, the operator is capable of performing much more work than by the common one. They are likewise capable of being conveniently made use of both for hay and corn. They were originally made and sold by Mr. Cort, of Leicester.

Another improvement is mentioned in Young's Agricultural Report of Norfolk, which is the addition of wheels. It is stated, that the "hand wheel-rake" of Fleg is an excellent implement for both hay and corn: it is to answer the purpose of the common hay-rake, and is about four feet long in the rake; and the two wheels, of nine inches diameter, so fixed, that the teeth are kept in any posture, at the will of the holder.

In some parts of Lancashire, they make use of a large horse-rake for collecting the hay together, and raking it up from the ground, which is found to be highly convenient and beneficial; as one horse, in one of these rakes, will perform as much labour as a great number of men, in a certain space of time; and besides the expedition, the work is considerably better done, in consequence of the greater weight of the implement.

The head of the rake has something of a large easy half circular form, into which two strong pieces of wood are fastened, which constitute the shafts for the horse. There are two low wheels behind, and the head has long teeth, curving a little forward, fixed into it at two or three inches from one another. The teeth may be made either of wood or iron, and should have considerable strength. The whole has no very great weight, though it must obviously be considerably heavier than the common rake; which is found of much advantage in its working, as has been hinted at above.

Rake, *Horse*, an implement used in Norfolk and Suffolk, on the large and middling-sized farms, and, from its great utility, extending itself into other districts. It is employed for barley and oat crops, being drawn by a horse. And it has been stated by Mr. Young, that one man and a horse, driven by means of a line or rein, are capable of clearing from twenty to thirty acres, in a moderate day's work; the grain being deposited in regular rows or lines across the field, by simply lifting up the tool, and dropping it from the teeth, without the horse being stopped. It cost from four to five pounds.

Figures of it may be seen in the above Agricultural Reports. Horses have now been employed for working other sorts of rakes, and found of great advantage, as has been already seen.

Rake, *Horse Stubble*, a large heavy kind of horse-rake, having strong iron teeth, fourteen or fifteen inches in length, placed at five or six inches from each other, and a beam four inches square, and eight or ten feet in length. In drawing it, two horses are mostly made use of, by which it is capable of clearing a considerable quantity of stubble in a short time. Tools of this sort are highly useful on corn farms, for collecting this useful material, and should be much more frequently employed than they are at present.

Rake, *Twitch*, a large horse-rake, employed in certain cases for clearing lands from the roots of couch, twitch, or quitch-grass, as well as those of other sorts. It is constructed in different ways, as with one or two rows of teeth; but the latter is probably the best method, as by placing one row opposite the intervals of the other, it must be rendered a very effective tool.

Rake *of a Ship*, is so much over her hull as overhangs at both ends of her keel.

That part of it which was before, is called the *rake forward-on;* and that part which is at the setting on of the stern-post, is called her *rake-aft*, or *afterward-on*.

When a ship hath but a small rake forward-on, but is built with her stern too straight up, she is called *bluffe-headed*.

Rake *of the Rudder*, is the hindermost part of it.

Rake, among *Hunters*. See Rag.

Rake, in the *Manege*. A horse rakes, when being shoulder-splaid, or having strained his fore-quarter, he goes so lame, that he drags one of his fore-legs in a semicircle; which

which is more apparent when he trots, than when he paces.

RAKE, or *Vein*, in *Geology*, the moſt common repoſitory of metallic ores. Theſe veins interſect mountains nearly vertically, or more or leſs inclined from the perpendicular. They are filled with ores, intermixed with the peculiar minerals accompanying each kind of metal. They vary from a few inches to ſome feet or yards in width, and extend to a very conſiderable depth and diſtance. The upper ſide of the vein is provincially called the *hanger*, and the lower ſide the *ledger*; and the inclination from the perpendicular is called the *hade* of the vein. For a particular account of the ſtructure and formation of veins, ſee VEINS, *Metallic*.

RAKEL, in *Geography*, a town of Dobruzzi Tartary, on the Danube; 15 miles W. of Iſakzi.

RAKESBURG, or RAKELSPURG, a town of the duchy of Stiria, ſituated on an iſland in the Muehr; the inhabitants of which carry on a conſiderable trade with Hungary and Croatia; 36 miles S.E. of Gratz. N. lat. 46° 45′. E. long. 15° 36′.

RAKING ſignifies ſloping or winding, as when a wall is not built up right or ſtraight.

RAKING, in *Agriculture*, the operation of performing work with a rake. It is a ſort of work that requires little art or trouble in its execution; but whether performed with the common or horſe-rakes, it ſhould always be done in an effectual manner. In the buſineſs of hay-making, clean raking not only affords a neatneſs in the appearance, but, over a great extent of ſurface, a conſiderable ſaving of hay. See HAY-*Making*.

In raking hay lands, where horſes are employed, ſome degree of care is neceſſary in directing the work, and driving the animals, in order that no inconvenience of delay may be experienced, and that every part of the land may be gone over in the moſt regular manner. Small boys may ſerve to direct the horſes by riding upon them, and ſome ſaving be made in that way.

In raking cut corn crops with horſe-rakes, eſpecially thoſe of oats and barley, it is ſometimes the beſt method to proceed in a croſs direction of the ridges, drawing up the produce into long rows at ſuitable diſtances; the horſes being driven by the men, who know the management of the handles of the rakes, by means of whip reins brought from the horſes to the ſtilts of the implements. It ſeldom happens that ſo good work can be made in going the lengthways of the lands, particularly where they are much rounded, and of a ſmall ſize in breadth, as the tools will not fit well to their rounded form, unleſs where they are conſtructed in ſeparate parts in their heads, ſo as to admit of motion by means of joints. In this mode of raking, the corn may ſometimes be readily tied up into ſheaves.

But in the raking of ſtubbles, it is more uſual to paſs in the direction of the ridges, though the contrary method is not unfrequently had recourſe to. In thoſe caſes, as well as in the others, the ſtrawy grains or ſtubbles are always brought together into lines or rows, in order to be more readily taken up by the carts either bound or unbound.

In the raking of the roots of weeds together upon lands, it is conſtantly the beſt practice to perform the work in both directions; as, by ſuch means, the whole of them may be laid hold of in a more complete and effectual manner than could otherwiſe be done. See RAKE.

RAKING, in *Gardening*, a neceſſary operation in the garden, to break the ſurface of the ſoil ſmall, and render it fine for the reception of particular ſorts of ſmall ſeeds and plants, previous to ſowing and planting, as well as to render it neat and even to the eye. It is alſo employed in raking in ſeeds, as being an expeditious mode of covering them in. In all kinds of ſmall ſeeds, or hardy plants, the ground being dug, &c. and the ſurface remaining rough after the ſpade, the ſeed is ſown, and then raked in with an even hand, once or twice in a place, as a back and a fore ſtroke, or more as may be neceſſary.

And this operation is uſeful alſo among growing plants, that ſtand diſtant enough to admit the rake, particularly where the ſurface is inclinable to bind, or where numerous ſmall ſeed-weeds appear, as it looſens the ſoil, and retards the growth of the weeds, and promotes the growth of the young plants. It is alſo good culture at particular ſeaſons, to annoy ſlugs, eſpecially in kitchen-gardens, to rake between the rows of ſmall plants in autumn and winter, &c. The raking of the beds, borders, and other compartments of pleaſure-grounds, now and then, ſmooth and even, likewiſe gives an air of culture and neatneſs to the whole.

It may be obſerved, that this ſort of work ſhould generally be performed in dry weather, and when the ground is alſo moderately dry; as when done in rainy weather, or when the ground is very moiſt and cloggy, the ſurface is apt to cake and bind hard. This ſhould be well attended to in ſowing ſeeds. Rough dug ground does not rake well, when it is become very dry at top, eſpecially if it was dug wet, and ſuffered to lie till the clods have become very dry and hard; in which caſe it will not rake well, until mellowed or pulverized by a ſhower of rain. But common light garden ground generally rakes beſt when freſh dug, perhaps the ſame day, or day after at the fartheſt, before dried too much by the ſun and wind, or rendered wet by rain, &c. The operation ſhould, however, be performed when the ground is in ſuch order as the clods will readily break and fall to pieces under the rake, without clogging much to it, or the mould become even without running into lumps.

RAKING *of a Horſe*, is the drawing his ordure with the hand out of the fundament, when he is coſtive, and cannot dung. In order to do this, the hand muſt be anointed with ſallad-oil, or butter.

RAKING *a Ship*, is the act of cannonading a ſhip on the ſtern or head, ſo that the balls ſhall ſcour the whole length of her decks, which is one of the moſt dangerous incidents that can happen in a naval action, ſo much ſo, that the men are ordered to lie down at their quarters. This is frequently called raking fore and aft, being the ſame with what is called enfilading by engineers. See ENFILADE.

RAKING-*Knees*. See KNEES.

RAKING-*Table*, or *Raked Table*, among *Architects*, a member hollowed in the ſquare of a pedeſtal, or elſewhere. See CAVETTO, and SCOTIA.

RAKOKIE, in *Geography*. See RACH-KOKE.

RAKONITZ, or RAKOWNITZ, a town of Bohemia, and capital of a circle of the ſame name, which is mountainous and covered with foreſts, but fertile in corn, and affording ſome excellent horſes. It was made a royal town in 1588. It is celebrated for its beer, which is the principal article of its commerce; 22 miles W. of Prague. N. lat. 50° 5′. E. long. 13° 57′.

RAKORA, a town of European Turkey, in Bulgaria; 40 miles S.S.E. of Viddin.

RAKOW, or RACOW, a town of Auſtrian Poland, in the palatinate of Sandomirz, formerly populous; the Socinians had a college and printing-houſe here, but were expelled in 1643; 40 miles W. of Sandomirz. See RACOW.

RAKOWEENA, a harbour on the coaſt of Kamtſchatka, in Awatſka bay, three miles long, and one and a half

half broad, with water from thirteen to three fathoms, and a bar at its entrance: it runs at firft in a fouth-eaft and afterwards in an eafterly direction; three miles S. of St. Peter and St. Paul.

RAKSHA, in *Hindoo Mythology*, a fpecies of malignant demon, of whom great ufe is made in their epic machinery and popular tales. They are of various fhapes and colours, and fuppofed to be animated by the fouls of bad men of earlier exiftence, receiving punifhment in thefe forms as enemies to the gods, and obftructors of their beneficent intentions towards mankind. Another clafs of thefe evil genii comprehends thofe called Yakfha. Rakfhafa and Yakfhafa are the plurals, and Rakfhni and Yakfhni the feminine; for thefe evil doings are not confined to fex. Ravena, the giant king of Lanka, or Ceylon, who oppofed Rama, aided by the gods in the invafion of his kingdom, is fometimes called the lord of Rakfhafas. See RAVENA.

RAKULSKOI, in *Geography*, a town of Ruffia, in the province of Ufting, on the Dwina; 20 miles N. of Krafnoborfk.

RALEGH, *Sir* WALTER, in *Biography*, a diftinguifhed character in the reigns of queen Elizabeth and James I., was fecond fon of a gentleman of an ancient family in Devonfhire. Few names, fays fir Walter's biographer, Mr. Cayley, vary fo much in the manner of writing it. By fir Robert Naunton and lord Bacon it is written *Rawleigh;* in fome old deeds the orthography is *Rale* or *Ralega;* while king James, Hooker, and other refpectable writers, adopt the mode of fpelling which is ftill common in this country, *viz. Raleigh;* but the original letters of fir Walter himfelf, wherever the fignature is preferved, have *Ralegh,* and on that account we choofe to adopt it in this work. Sir Walter, of whom we are treating, was born at a farm called Hayes, in that part of Devonfhire that borders on the fea, in the year 1552. By his mother he was related to thofe famous knights, fir John, fir Humphrey, and fir Adrian Gilbert. After he had received the ufual fchool education, he was fent to Oriel college, Oxford, where he diftinguifhed himfelf by a proficiency in learning far beyond his age; but the active difpofition and martial ardour with which he was endowed, foon put an end to his learned career. About the year 1569, he, in company with many young gentlemen of the beft families in the country, went into France, as well to inftruct themfelves in the art of warfare, as to affift the Proteftants in that kingdom, who were then grievoufly oppreffed. In this fchool he was employed five or fix years, but by what means he efcaped the horrible maffacre of Paris, and the provinces, on the famous St. Bartholomew's day, we have no knowledge. He returned to England in 1575, and it fhould feem he immediately became a refident in the Middle Temple, whence a commendatory poem of his, prefixed to a work of George Gafcoigne's, is dated in 1576. That he was not a ftudent in the law, at this time, he has himfelf declared, and he fhortly after paffed into the Netherlands, where he ferved fome time againft the Spaniards. In this, and other tranfactions of the fame kind, he followed the fafhion of the times. France and the Netherlands were in thofe days the fchools of Mars; to which all were obliged to refort who meant to purfue the fortune of arms. Many young men returned to their native country ruined in their fortunes, their conftitution, and morals; but Ralegh had made a good ufe of his time, gained a large ftock of ufeful knowledge, and was fo completely polifhed in his manner of addrefs, that he was now confidered as one of the beft bred and moft accomplifhed gentlemen in England.

On his return in 1578, he found his half-brother, fir Humphrey Gilbert, engaged in a defign of making difcoveries in North America, for which he had obtained a patent, and for the furtherance of which he had procured the affiftance of many friends. Ralegh was delighted with the defign, and embarked in it cordially. This project proved very unfortunate to the adventurers, but it gave young Ralegh an introduction to the fea fervice, in which he afterwards fo much diftinguifhed himfelf. From this unlucky adventure, Mr. Ralegh arrived fafe in England in the fpring of the year 1579, and very foon after he appears to have offered his fervices to the queen to go to Ireland, to the inhabitants of which, pope Gregory VIII. and the Spaniards had fent men, money, and other affiftance, to enable them to take arms againft the eftablifhed government. He obtained a captain's commiffion, and ferved in Munfter under the earl of Ormond. In this petty warfare he difplayed fo much good conduct, vigour, and courage, that he was afterwards made governor of Cork; and as a reward for his fervices, he received from the crown the grant of a confiderable eftate in Ireland. A mifunderftanding with the lord-deputy Grey put a ftop to his farther rife in the army; he returned to England, and was quickly introduced to the queen's notice, and by his own merits attained a large fhare in her favour. As he was forward to diftinguifh himfelf in all public fervices, fo on the return of the duke of Anjou into the Netherlands, he was one of thofe who accompanied him out of England, by the exprefs command of queen Elizabeth, and on his coming to England in 1582, he brought over the prince of Orange's letters to her majefty. Some months after this he refided at court, and was honoured with the favour and protection even of contending ftatefmen, who were proud of fhewing the true judgment which they had of real merit, by becoming patrons to Ralegh. In 1583 he was concerned in his brother Gilbert's fecond attempt, and though he did not venture in perfon, yet he built a new fhip, called the bark Ralegh, and furnifhed it completely for the voyage; "the unfuccefsful end of which," fays Campbell, "it feemed to predict, by its untimely return in lefs than a week to Plymouth, through a contagious diftemper which feized on the fhip's crew."

While at home Ralegh was not negligent of pufhing his fortune as a courtier. He had a good perfon and addrefs, made an elegant appearance, and put on that air of gallantry which was fo meritorious in the eyes of Elizabeth. It is faid, that he was once attending the queen in a walk, when fhe came to a fpot, that by its mire obftructed her courfe; he immediately took off his rich cloak, and fpread it on the ground for her to walk on. Pleafed with this attention, it is obferved, that the facrifice of a *cloak* obtained for him many a *good fuit.* The enterprifing fpirit of Ralegh was fhewn in the year 1584, in a fcheme which he formed of making difcoveries and fettlements in thofe parts of North America which had not been fubjected to any European power. His intereft at court, and his ability in ftating and fetting forth his plans to the beft advantage, obtained for him an extenfive patent for executing his purpofe; and, in confequence, with the help of a fociety of his friends, he fitted out fhips under the command of captains Amadas and Barlow, which failed from Plymouth in that year, and took poffeffion of an ifland near the mouth of Albemarle river, in what is now called North Carolina. From the terms of the patent, it appears, that the great object of thefe adventurers, as it was of all others in that reign, was the fearch after mines of the precious metals. Ralegh was not himfelf in this expedition: the fhips returned in the autumn with fome commodities which fold fo well, that the company was encouraged to fit out a fleet of feven veffels for the following year, of which the command was given to fir Richard

Richard Greenville, Ralegh's relation. During this voyage they took posseſſion of that tract of country which has been ſo famous, by the name beſtowed upon it by queen Elizabeth, and not given, as it has been generally ſuppoſed, by Ralegh, of Virginia. After expending a large ſum in repeated attempts to repair the misfortunes that had happened to the newly eſtabliſhed colony, he aſſigned over his patent to a company, reſerving to himſelf only a portion of the expected gold and ſilver ore. This enterpriſe probably made England firſt acquainted with tobacco, and alſo conferred upon it the much greater benefit of introducing the culture of the potatoe, firſt practiſed on Ralegh's eſtate in Ireland.

About this time he was choſen knight of the ſhire for the county of Devon, and very ſoon after the queen conferred upon him the honour of knighthood, an honour which ſhe did not render cheap by proſtituting it. In the year 1585 he fitted out another fleet for Virginia, in which he had good ſucceſs, his ſhips, in their return, taking a prize worth 50,000*l*. He was likewiſe concerned in captain Davis's undertaking for the diſcovery of the north-weſt paſſage, on which account a promontory in Davis's ſtreights was called Mount Ralegh. For theſe public-ſpirited and expenſive projects, the queen was pleaſed to make him ſome profitable grants; particularly two, the firſt giving him authority to licenſe the retailers of wine throughout the kingdom, and the other of a ſeigniory in Ireland, conſiſting of twelve thouſand acres, which he planted at his own expence, and many years after ſold to Richard Boyle, the firſt earl of Cork. In 1586 he was appointed ſeneſchal of the duchies of Cornwall and Exeter, and lord-warden of the ſtannaries; and ſo high did he ſeem riſing in the queen's favour, that the favourite miniſter, the earl of Leiceſter, took the alarm, and brought forward the earl of Eſſex as his competitor. But her majeſty's partiality was fully juſtified; it was, in this inſtance, extended to a man, who at all times purſued whatever appeared to him conducive to the public good, how little ſoever it turned to his private advantage. "With juſtice, therefore," ſays Campbell, "was the wiſe queen Elizabeth liberal to ſuch a man, who, whatever he received from her bounty with one hand, beſtowed it immediately in acts glorious to the nation with the other." In the year preceding the attempt of the famous Spaniſh armada, ſir Walter was captain in the queen's guard, and her lieutenant-general for Cornwall. In the latter capacity he was active in diſciplining the militia of the county; and he was one of the council of war to whom the conſideration of the beſt means of oppoſing the dangers of that momentous period was committed. When the armada appeared in the Channel, he was one of the gallant volunteers who nobly joined the Engliſh fleet with ſhips of their own, and had a ſhare in the defeat of the enemy. In 1589 he was among thoſe who accompanied the expelled king of Portugal in his attempt to reinſtate himſelf. The queen ſhewed her continued approbation of his ſervices, by making him gentleman of her privy-chamber, and augmenting the profits of his other places. This laſt was no ſmall favour in Ralegh's eſtimation, for though in many reſpects of an elevated mind, fond of glory, ſplendid and liberal, he was likewiſe intent upon gain, and neglected no ſource of emolument which his court intereſt placed within his reach. He did not ſcruple, we are told by ſome of his biographers, though the fact is not noticed by Campbell and others, to take direct bribes for the exertion of his influence; and he is ſaid to have received no leſs than ten thouſand pounds for procuring a pardon for Mr. Littleton. See Biog. Brit. article *Littleton.*

On his return from his Portugal voyage he viſited his Iriſh eſtates, and there either formed or renewed his acquaintance with the poet Spencer, who celebrates him under the title of the "Shepherd of the Ocean," and acknowledges the obligation of having firſt made him known to the queen. To his Fairy Queen he likewiſe prefixed a letter to Ralegh, explanatory of its plan and deſign. The patronage of literature was one of the beſt traits in the public characters of an age, in which meanneſs was ſingularly mixed with heroiſm. The naval enterprizes of the reign of Elizabeth were for the moſt part predatory expeditions, ſet on foot by individuals for their private benefit, and encouraged, though but feebly aided, by the crown. In 1592 ſir Walter Ralegh engaged in a conſiderable undertaking of this kind, with a view of attacking Panama, and intercepting the Spaniſh Plate fleet. He fitted out thirteen ſhips, by himſelf and his aſſociates, which were joined by two of the queen's men of war, and he was appointed general of the whole fleet. Scarcely had he ſet ſail when he was recalled by his ſovereign; proceeding, however, to Cape Finiſterre, he divided his fleet into two ſquadrons, with cruizing orders, and then returned. One of the ſquadrons fell in with a rich carrack, the capture of which was the only inſtance of ſucceſs which attended the expedition. His ardour for war was ſhewn by his ſupport in parliament of a motion, that certain ſubſidies granted to the crown ſhould be for the expreſs purpoſe of carrying on a war offenſive and defenſive againſt Spain. To undermine his credit with the queen, Parſons, a Jeſuit, publiſhed a libel againſt him, charging him with Atheiſm; the queen is ſaid to have imbibed ſome prejudice againſt him on this account, but he incurred her heavy diſpleaſure by an intrigue with one of her maids of honour, the daughter of ſir Nicholas Throgmorton. The conſequences of this amour brought a ſcandal upon the court of the virgin queen; and though he made the beſt reparation in his power, by marrying the lady, his offence was puniſhed by an impriſonment in the Tower of ſome months, and a ſubſequent baniſhment from the queen's preſence.

During his impriſonment he projected an expedition for the diſcovery of the empire of Guiana, which had already been viſited by the Spaniards, and the extent and opulence of which had been the ſubject of many marvellous tales. Having obtained ſome preliminary information, from an old navigator whom he diſpatched for the purpoſe, he embarked in perſon, in the month of February 1595, with a ſquadron of ſhips fitted out at a great expence, and ſailed to the iſland of Trinidad, where he made himſelf maſter of the town of St. Joſeph; he then proceeded up the great river Oroonoko, but was obliged by the heat of the weather, and the difficulties of the navigation, to return, with doing nothing more than merely taking poſſeſſion of the country in her majeſty's name. Unwilling to return without appearing to have done ſomething, he publiſhed a work, entitled "Diſcovery of the large, rich, and beautiful Empire of Guiana:" which was evidently the reſult of a fertile imagination rather than of real obſervation, and which Hume ſtigmatizes as a production "full of the groſſeſt and moſt palpable lies that were attempted to be impoſed on the credulity of mankind."

Sir Walter had ſo far regained the good opinion of the queen, that he had a naval command in the expedition againſt Cadiz, in 1596, under the earl of Eſſex and lord Effingham. In the attack he was one of the leaders of the van, and by his valour and prudence contributed a full ſhare to the ſucceſs of the glorious action. In the following year he ſailed as rear-admiral in the expedition of which Eſſex was commander-in-chief, and the purpoſe of which was to intercept the Spaniſh Weſt India fleet. Arriving firſt with

his

his squadron at Fayal, after waiting some time for Essex, he thought it expedient to make an attack on the place by himself, which proved successful. The commander-in-chief was mortified with this action, thinking it was designed to rob him of the glory due to him, and would have cashiered Ralegh, if lord Thomas Howard had not interposed his services to effect an apparent reconciliation. On their return lord Essex published some remarks upon what had happened in the course of the voyage, in which he questioned every body's conduct but his own. "The queen, however," says Campbell, "taking time to inform herself, made a right judgment of the whole affair; in consequence of which she paid a due respect to every man's merit, and greater to none than to that of sir Walter Ralegh."

During the remainder of this reign Ralegh chiefly appears as a member of parliament, and as an assertor of the privileges and interests of the people in the west, over whom his authority extended. That he was completely restored to the favour of his royal mistress is evident from the circumstance, that in 1661 he attended her in a progress through part of the kingdom. He was likewise appointed by her to receive the duke of Biron on his arrival as ambassador from France, and conferred with him on the subject of his mission. In the queen's last parliament sir Walter was a very active member, and distinguished himself upon all occasions, by opposing such bills as, under colour of deep policy, were contrived for the oppression of the middle and lower ranks of society. He witnessed the ruin of his great antagonist the earl of Essex, whose execution he indecently urged upon the minister Cecil; and he was even an eye-witness of the deed. Campbell, endeavouring to justify him in every thing, is evidently, in some instances, a panegyrist rather than a faithful historian. The decease of the queen, which soon followed the execution of her former favourite lord Essex, and which was probably hastened by it, gave a final, and to Ralegh a very unexpected, blow to his own prosperity.

When James came to the crown it was a sort of contest between sir Walter Ralegh and sir Robert Cecil, who should obtain the confidence of his majesty; the latter, however, was admitted to the royal councils, to the exclusion of sir Walter Ralegh. In truth, James had a prepossession against Ralegh, as having been the enemy of Essex, and still more, as having, with some others, entertained a design of forcing the king to agree to certain limitations with respect to the number of his countrymen whom he was to bring with him. Sir Walter's martial and enterprising spirit was also obnoxious to a prince of a pacific disposition. He was, therefore, received, barely with civility, a circumstance which preyed upon his high spirit, and was probably the means of throwing him into the party of the discontented. A conspiracy, for the purpose of placing upon the throne lady Arabella Stuart, was at this time formed, in which Ralegh in some measure participated. He was apprehended, and brought to trial on a charge of high treason; but, says the historian, his condemnation, upon the evidence produced, was one of the most disgraceful instances on record, of the base subservience of an English jury to the vindictive wishes of a court. His only accuser was lord Cobham, a man of bad character, and one who was deeply implicated in the plot, to whose proposals he had given ear, but probably without entering into, or even approving them. In his defence he displayed so much eloquence, temper, and force of argument, that some, who had been highly prejudiced against him, were brought to regard him as an innocent victim, and, it should seem, from the testimony of contemporary historians, that all parties were ashamed of the injustice of his condemnation. It is said that even Coke, the attorney-general, who treated Ralegh on his trial with all the abuse that belonged to his character, and was thought authorised by his office, expressed surprize at the sentence, and declared that he had charged him with no more than misprision of treason. Three were executed for this plot, two were pardoned, and Ralegh was only reprieved and committed to the Tower. His wife, at her own earnest solicitation, was permitted to become his fellow-prisoner, and his youngest son was born in the Tower.

In Mr. Cayley's life of sir Walter Ralegh, published in London in 1806, we have a curious letter of lord Cecil, then secretary of state, to sir Thomas Parry, the English ambassador in France, in which he gives an account of the conspiracy just referred to, and of the motives which led the different persons to take a part in it. Sir Walter was indicted for conspiring to deprive the king of his government, to raise up sedition within the realm, to alter the religion and bring in the Roman superstition, and to procure foreign enemies to invade the kingdom. The principal overt act laid in the indictment was, that sir Walter had a conference with lord Cobham, as to the best means of advancing Arabella Stuart to the crown and throne of this kingdom, and that they should apply to the king of Spain to procure his assistance in this cause. Sir Walter made an able stand in his trial against the legality of conviction upon the evidence of a single witness, but the judge, rendered infamous by his conduct on the trial, over-ruled the objections.

The active mind of sir Walter Ralegh was now left to exert itself within the walls of a prison, and its employment conduced more to his honour than his liberty perhaps would have done. Here he composed the greater part of his works, especially his "History of the World." Prince Henry, a youth of most amiable qualities, and as unlike his father as possible, contracted a generous admiration for the splendid talents of Ralegh, and cheered him in his solitary confinement by his friendship and correspondence. "No king," said the royal youth, "but my father would keep such a bird in a cage." Henry, however, died, and with him the hopes of deliverance vanished from the mind of the state prisoner. At length, however, after twelve years' confinement, sir Walter obtained his liberation, but probably not without the use of bribes, applied to the new favourite Villiers. For the purpose of repairing his fortunes, he planned a new expedition to Guiana, and his report of a rich gold mine existing in that country was a sufficient inducement for a number of adventurers to engage in the scheme. He obtained a patent under the great seal from the king, for making a settlement in Guiana. James, however, in order to retain his hold upon him, did not grant him a pardon of the treasons of which he had been convicted. There is no doubt but sir Walter might have *purchased* a pardon, and, at one time, had thoughts of doing so. He even consulted sir Francis Bacon, whether it would not be adviseable for him to give a round sum of money for a pardon in common form; to which the learned lawyer answered; "Sir, the knee timber of your voyage is money; spare your purse in this particular, for, upon my life, you have sufficient pardon for all that is past already, the king having under his broad seal made you admiral of your fleet, and given you power of the martial law over your officers and soldiers." Ralegh having employed all his resources in fitting out the expedition, sailed for Guiana with twelve armed vessels in July 1617. He had not set sail long before he was obliged to put into the harbour of Cork, by stress of weather, where he remained till the 19th of August. In November he arrived at Guiana,

Guiana, where he was received with the utmost joy by the Indians, who not only rendered him all the service in their power, but endeavoured to persuade him to end all his labours there, and take upon himself the sovereignty of the country, which, however, he steadily refused. A violent and long continued sickness prevented him from undertaking the discovery of the mine in person. This important affair he entrusted to one of his captains, Keymis: the scheme, however, proved abortive, the Spaniards having been before hand with him in the search of gold. Hume, for the purpose of exculpating James, endeavours to shew that the real intention of sir Walter Ralegh was to plunder the Spanish settlements, and neither to colonize, nor to work the mines. He assumes that Ralegh was a wilful deceiver in the expectations he had raised of vast subterraneous riches; but considering his character, it is surely more reasonable to believe that he was carried away by some vague ideas of this kind, and Hume admits that the Spaniards were at the very time working some mines. It will be readily admitted, that James did not imagine he was giving Ralegh a commission of hostilities against Spain, yet he must have known that the exclusive claims of that crown in South America rendered every interference with its dominion hostile in its eyes. The fact seems to be, that the expedition was undertaken with an intention to make the most of it, by any means within the power of the armament, and that the commander trusted to its success for justification before a court where bribery to favourites was omnipotent.

In this expedition Ralegh's eldest son lost his life, of which, and of the unfortunate issue of Keymis's undertaking, he reproached his captain very severely, who, without hesitation, put an end to his own life. Ralegh, with a heavy heart, steered homewards. In July 1618 he arrived at Plymouth, and in his journey to London he was arrested, and carried back to Plymouth. Twice he attempted to escape, but was secured and committed a prisoner to the Tower. James was exasperated at the injury which had been inflicted on Spain, a power then in amity with England, and which had been complained of by the Spanish court in very strong terms. He was, moreover, about to enter into a more intimate connection with that court, and therefore, without hesitation, determined to sacrifice Ralegh to its resentment. Though his death had been determined on, it was difficult to take away his life. His conduct in the late expedition, though the want of success had rendered it criminal in the eyes of the court, was far from being so in the sight of the nation; and though judges might have been found who would pronounce it treason, yet even in those days it was not easy to find a jury who would, without evidence, have found him guilty. The commissioners therefore, who had been appointed to enquire into the matter, and who had frequently examined him, finally reported, that no ground of legal judgment could be drawn from what had passed in the expedition. Upon this, it was resolved to call him down to judgment upon his former sentence, which, says Campbell, was done, with all the circumstances of iniquity and brutality that can well be conceived. Being brought before the court of king's bench, his plea of an implied pardon, by his having acted under the king's commission since sentence had been pronounced, was over-ruled, and he was not permitted to enter into a vindication of his conduct in the late voyage. Execution was accordingly awarded, and the king's warrant for it produced, which had been signed and sealed before-hand.

"That this judgment was illegal," observes Dr. Campbell, "and that sir Walter was really murdered, has often been said, and, I believe, seldom doubted; but I think it has not been made so plain as it might be, and, therefore, in respect to his memory, I will attempt it, by shewing that the judgment was absolutely illegal, as well as manifestly iniquitous.

"It is a maxim in our law that the king can do no wrong; and most certain it is, that no king can do legal wrong, that is to say, can employ the law to unjust purposes. Sir Walter Ralegh, after his conviction, was dead in law, and, therefore, if king James's commission to him had not the virtue of a pardon, what was it? Did it empower a dead man to act, and not only to act, but to have a power over the lives and estates of the living? It either conveyed authority, or it did not. If it did convey authority, then sir Walter was capable of receiving it; that is, he was no longer dead in law: or, in other words, he was pardoned. If it conveyed no authority, then this was an act of legal wrong. I cannot help the blunder; the absurdity is in the thing, and not in my expression. A commission under the privy seal, if not under the great seal, granted by the king, with the advice of his council, to a dead man; or, to put it otherwise, a lawful commission given to a man dead in law, is nonsense not to be endured; and, therefore, to avoid this, we must conceive, as sir Francis Bacon, and every other lawyer did, that the commission included, or rather conveyed, a pardon. Indeed, the same thing may be made out in much fewer words. Grace is not so strong a mark of royal favour as trust; and, therefore, where the latter appears, the law ought, and, indeed, does, presume the former. This judgment, therefore, did not only murder sir Walter Ralegh, but, in this instance, subverted the constitution, and ought to be looked upon, not only as an act of the basest prostitution, but as the most flagrant violation of justice that ever was committed."

The sentence of death was pronounced on him one day, and put in execution on the following, Oct. 29, 1618, in Old Palace Yard. His behaviour on the scaffold was calm and manly. He addressed the people at some length: he said he never feared death, and much less at that time; that as to the manner of it, though to others it might seem grievous, yet for himself, he had rather die in this way than in a burning fever. He desired to see the axe, and feeling the edge of it, said to the sheriff, "this is a sharp medicine, but a sure remedy for all evils." Being asked which way he chose to place himself on the block, he replied, "so the heart be right, it is no matter which way the head lies," and giving the signal, he received the stroke with the most perfect composure. Such was the end of the illustrious sir Walter Ralegh, in the 66th year of his age, by a sentence which was regarded as one of the most dishonourable measures of an odious administration. The panegyric upon his character by Dr. Campbell is much too highly coloured: sir Walter Ralegh was not faultless, though in extent of capacity and vigour of mind he had few equals in an age that abounded with great men. His imprisonment was the occasion of his obtaining a high reputation as an author. His writings were on various topics, and are classed as poetical, geographical, political, philosophical, and historical. They are now but little known. His "History of the World," though not much read, is regarded with respect, as one of the best specimens of the English language of that time: the style is pure, nervous, and without pedantry. It is the style of a man of business as well as of a scholar. It has been many times reprinted, but the best edition is that of Oldys, in 1736. He brought down his history no farther than the overthrow of the Macedonian empire. Of his miscellaneous works, a collection in two volumes 8vo. was printed in 1748. Biog. Brit. Hume. Campbell. Cayley.

RALEIGH, or RAYLEIGH, in *Geography*, a market-town and

and pariſh in the hundred of Rochford, and county of Eſſex, England, is ſituated at the diſtance of 14 miles S.E. by S. from Chelmsford, and 34 miles E. by N. from London. This place appears to have been anciently of conſiderable note. It was the head of the barony of Swene, and had a caſtle adjoining to it, of which ſome fragments and earth-works ſtill remain. Theſe conſiſt of a mount, with an oval-ſhaped baſe, ſurrounded by a double ditch and rampart, and ſeveral outworks, particularly on the eaſt ſide. The ſummit of the mount is divided; the weſtern diviſion being of a circular form, and 100 feet high; and the eaſtern one of an oval form, and lower: the principal ditch varies in width from 36 to 50 feet, and the interior vallum is 50 feet high. The church here is an acient edifice, and contains an old tomb, greatly mutilated, but diſplaying the remains of very beautiful workmanſhip in the pointed ſtyle. The perſon whoſe memory it was intended to preſerve is now unknown; the upper part, to which the inſcription was probably affixed, being totally deſtroyed. The market at Raleigh is held on Sadurday, weekly; and there is an annual fair on Trinity Monday. Hearne, in his edition of Leland's Itinerary (vol. iii. p. 8.), informs us that a cuſtom-court is kept here, yearly, the Wedneſday next after Michael's day. "The court," ſays that author, "is kept in the night, and without light, but as the ſkye gives, att a little hill without the town, called the King's hill, where the ſteward writes only with coales, and not with incke; and many men and mannors of great worth hold of the ſame; and do ſuite unto this ſtrange court, where the ſteward calls them with as low a voice as poſſible he may; giving no notice when he goes to the hill to keepe the ſame court; and he that attends not is deeply amerced, if the ſteward will. 'Tis commonly called *Lawleſs-Court.*" Weever, in his "Funeral Monuments," adds, reſpecting this cuſtom, that he was informed, "that this vile attendance was impoſed at the firſt upon certaine tenants of divers mannors hereabouts, for conſpiring in this place, at ſuch an unſeaſonable time, to raiſe a commotion." According to the parliamentary returns of 1811, Raleigh pariſh contains 162 houſes, and 1131 inhabitants. Beauties of England and Wales, vol. v. By E. W. Brayley and John Britton, F.S.A. 1810.

Raleigh, a townſhip of Eſſex county, in Upper Canada, W. of Harwich, bounded on the N. by the Thames, and S. by lake Erie.

Raleigh, a town of America, in Wake county, North Carolina, the preſent ſeat of government, about ten miles from Wake court-houſe. The general aſſembly of the ſtate in December 1791, appropriated 10,000*l.* towards erecting public buildings, and named it after the celebrated ſir Walter Raleigh, under whoſe direction the firſt ſettlement in North America was made at Roanoke iſle and in Albemarle ſound. The ſtate-houſe is a large handſome building, and coſt 6000*l.* The plan of the town is regular; the ſtreets interſecting each other at right angles. It is, however, ſubject to the diſadvantage of being remote from navigation; 61 miles N.E. of Fayetteville, 147 from Peterſburg in Virginia, and 448 S.W. of Philadelphia.

RALEMO, a river of Chili, which runs into the Pacific ocean, S. lat. 37° 55′.

RALENDORF, a town of the duchy of Carinthia; 12 miles S. of Saxenburg.

RALESTEDE, a town of the duchy of Holſtein; 8 miles E. of Hamburg.

RALICOTTA, a town of Hindooſtan, in Viſiapour; 31 miles N. of Anamſagar.

RALLENTANDO, Ital., a muſical term of late invention, for relaxing the meaſure at particular parts of a compoſition, which, when done by a great maſter, manifeſts feeling and intelligence; but when attempted by mean performers, it has no other effect upon an audience than that of breaking time: and we think that this refinement is often abuſed. It has been chiefly practiſed in France, and favours of affectation, and that *overcharged tenderneſs* which renders the national *airs tendres* ſo diſagreeable, or ſo ridiculous, to the natives of all other countries.

RALLUS, the *Rail*, in *Ornithology*, a genus of birds of the order Grallæ: the generic character is, that the bill is thickiſh at the baſe, attenuated on the back towards the tip, compreſſed, a little incurved, pointed; the tongue is rough at the tip; the body is compreſſed; the tail is ſhort; the feet have four cleft toes. There are ſeventeen

Species.

* Crex; land rail, crake, corn crake, daker hen, &c. Of this ſpecies the wings are of a ruſty red; the bill and legs of a browniſh-aſh; the irides are of a hazel colour; the feathers of the body are of a reddiſh-brown; the upper ones are black in the middle; the chin is very pale, and the belly is of a whitiſh-yellow. It is about nine or ten inches long, and inhabits the ſedgy parts of Europe and Aſia. From the circumſtance of its appearing at the ſame time with the quail, and frequenting the ſame places, it has been denominated the king of the quails. Its well-known cry is firſt heard as ſoon as the graſs becomes long enough to ſhelter it, and continues till the graſs is cut. The bird, however, is ſeldom ſeen, as it ſkulks in the thickeſt parts of the herbage, and runs ſo nimbly through it, winding and doubling in every direction, that it is difficult to come near it. When it is hard puſhed by the dogs, it ſometimes ſtops ſhort and ſquats down, by which means its too eager purſuer overſhoots the ſpot and loſes the trace. It ſeldom ſprings but when driven to extremities, and generally flies with its legs hanging down, but never to a great diſtance. As ſoon as it alights, it runs off, and before the fowler has reached the ſpot, the bird is at a conſiderable diſtance. It emigrates, appearing with us about the latter end of April, and departing in October. On its firſt appearance, and till the female begins to ſit, the male is frequently heard to make a ſingular kind of noiſe, much reſembling that of a comb when the finger is drawn along the teeth of it, and which has been uſed as a decoy. When they firſt arrive, they are very lean, but before their departure, they become exceſſively fat, and are much ſought after for the delicacy of their fleſh. They lay from twelve to ſixteen eggs in the graſs, of a dirty whitiſh colour, with a few yellow ſpots: the fleſh is excellent. There are two varieties, thus deſcribed: 1. Rufous brown, beneath paler; wings and tail deeper; the chin and vent are white; the legs are duſky red. This is found in the iſland of Jamaica. The bill is larger and black. 2. Reddiſh-grey beneath, and wing-coverts ruſty brown. This ſpecies inhabits China; the legs are of a duſky colour.

Aquaticus; Water Rail. Wings grey ſpotted with brown; flanks ſpotted with white; bill orange beneath, but black and reddiſh at the baſe; the irides are red; the feathers of the upper part of the body are of an olive-brown, and black in the middle; the lower ones are cinereous; thoſe of the lower part of the belly and vent are edged with rufous; quill-feathers duſk; the lower tail-coverts are white; the tail-feathers are ſhort and black; the two middle ones at the tip, and the others, are edged with ferruginous; the legs are of a duſky red. It is about twelve inches long, but does not weigh more than four ounces. It is found in the watery places in Europe and Aſia. It is ſometimes, but not in any

any great numbers, met with in various parts of Great Britain, in low ſituations, about water courſes and rivulets, where it ſeeks ſhelter among ſedge, ruſhes, and reeds, and is ſeldom put to flight, depending on its legs. for ſafety. When rouſed it flies only to ſmall diſtances, and in a heavy and very awkward manner, with its legs hanging down. It runs nimbly, and frequently fli ts up its tail. The neſt is made of ſedge and coarſe graſs, among the thickeſt aquatic plants, or in willow beds. The female lays ſix or more eggs, rather larger than thoſe of a blackbird, of a pure white colour. This bird continues with us all the year, and by many it is erroneouſly believed to be the land rail metamorphoſed in the autumn; but the different bills which the two birds have conſtitute an eſſential diſtinction.

* Porzana; ſpotted gallinule, or ſpotted water hen. This ſpecies has the two middle tail-feathers edged with white; the bill and legs are of a pale olive. It inhabits Europe and North America, and is generally found on the ſides of ſmall ſtreams, hiding itſelf among the buſhes; it is nine inches long. This bird is deſcribed as having a greeniſh-yellow bill; its irides are hazel, and head brown, ſpotted with black. The line over the eyes is of a pale grey; the neck above and flanks are of a brown-aſh, with ſmall white ſpots; the back and wing-coverts are olive, with black ſtripes, and near the edges of the feathers with white ſpots, the greater with white ſtripes and lines; the cheeks, chin, and throat, are of a pale grey, with brown ſpots; the breaſt is brown, with white ſpots; the belly is varied with cinereous and white; the vent is of an ochre-yellow. This bird is extremely timid and ſequeſtered, and is but ſeldom ſeen in Great Britain, eluding obſervation by its perpetual vigilance and lurking habits. Its neſt is formed, with ſingular care, of matted ruſhes, and materials which will float on the water, on which it remains tied, by ſome filaments, to the ſtalks of reeds, by which it is prevented from being carried away by the tide or current. The bird is in great eſteem for the table.

Crepitans; Clapper Rallus. Bill and legs brown; body above olive, the feathers aſhy at the edges; chin white, throat and breaſt yellowiſh-brown. This ſpecies inhabits New York, and is from fourteen to ſixteen inches long.

Fuscus; Brown Rallus. This is brown, as its ſpecific name imports; its vent is waved with white; the legs are yellow. It inhabits the Philippine iſles, and is ſeven inches long. The body beneath is light cheſnut, on the belly it is inclining to grey; the tail is barred with white and black.

Striatus; Streaked Rallus. Blackiſh, waved with white; chin reddiſh. The bill of this ſpecies is of a horn colour; the crown is varied with duſky and bay; the nape is bay; neck, back, ſhoulders, and rump, brown, with whitiſh ſpots; the wing-coverts are marked with a few tranſverſe whitiſh ſtreaks; the chin is of a reddiſh-white; the cheeks, throat, breaſt, and upper part of the belly, cinereous, with a tinge of olive; the lower part is barred with duſky and white; quill-feathers brown, the outer bands reddiſh-white, the inner are white; the tail is brown with white lines; the legs are of a greyiſh-brown. It inhabits the Philippine iſlands, is eight inches long, and is probably a variety of the philippenſis.

Torquatus; Banded Rallus. Brown, beneath waved with white; it has a white line below the eyes. This alſo is found in the Philippine iſles, and is twelve inches long. The bill and legs are grey-brown; cheeks and chin black. The body beneath is tranſverſely ſtreaked with black and white; the collar is of a bay colour; the quill-feathers on the outer edge paler; bands within on the firſt three white, the ſix next reddiſh-bay.

Philippensis; Philippine Rallus. The ſpecific character of this bird is brown, but beneath it is barred with grey; the eye-brows are white, and the neck beneath has a reddiſh caſt. There are three other varieties, thus deſcribed: 1. Red-brown, ſpotted and ſtreaked with black and white; head cheſnut; body beneath and eye-brows cinereous; this, notwithſtanding its name, is found at Otaheite. 2. Brown, ſpotted and ſtreaked with white, beneath white; eye-brows grey; the tail is barred with brown and white: this inhabits Tongataboo. 3. Above brown, beneath aſhy; back and wings lined with white ſpots; the belly beneath is white, with blackiſh bars. This is about eleven inches long, and is found in the Philippine iſlands.

Ecaudatus; Tailleſs Rallus. Olive; beneath bluciſh; body tranſverſely waved with black; eye-brows white. It inhabits Otaheite. The bill is blackiſh, and the upper part of the head is of a pale brown; the orbits are black; over the eyes, on each ſide the head, it has a broad white line; the body above is of a deep-gloſſy olive, with a tinge of olive on the ſhoulders; the vent is of a pale yellow; the tail is ſo ſhort as to be ſcarcely perceptible; the coverts are of a pale blue.

Carolinus; Soree. This bird is brown; the frontlet is black; the breaſt is of a lead colour; the bill is yellow; the legs are greeniſh. It inhabits Virginia, and is from ſeven to eight inches long: this is a capital bird for the table. The irides of this bird are red; the crown and body above are brown, marked with black ſpots; the face and chin are black; but the reſt of the neck, temples, and breaſt, are of a blueiſh-aſh; the belly and outer edge of the wings are white; the wings and tail are brown.

Phœniculus; Red-tailed Rallus. This ſpecies is black but beneath it is white; the bill and legs are greeniſh; the front is naked and of a fleſh colour; the vent and tail of a ruſty red. It is found in the iſland of Ceylon, and is about nine inches long. The bill and legs are tinged with red; the crown and cheeks are pure white; the quill-feathers are ſpotted with blue. There are two varieties. 1. Above cinereous, beneath white; the belly and vent are red. This is an inhabitant of China, and is fifteen inches long. 2. The front of this is white; the vent is red, and the legs are yellow. It is found in Madagaſcar, and is longer than the laſt.

Virginianus; Virginian Rallus. Brown, without ſpots; the bill and legs are brown. It inhabits Virginia, and is probably a variety of the R. aquaticus.

Ferrugineus; Red-breaſted Rallus. This bird is duſky above, and cinereous beneath; the neck and breaſt are ferruginous; the bill is pale, and the legs yellow. It is nine inches long; the eye-brows are pale, and the flanks are marked with tranſverſe, narrow, white lines.

Capensis; Cape Rallus. This ſpecies is of a ferruginous colour; but the lower part of the breaſt, belly, vent, wings, and tail, are waved with black and white; the bill is black, and the legs are of a blood-red. It inhabits the Cape of Good Hope and Ceylon, and is of the ſize of the R. crex. The two middle tail-feathers are ferruginous.

Cæruleus; Blue-necked Rallus. This is of a bay colour above, but blueiſh beneath; the bill and legs are red; the vent is white, and the belly is marked with tranſverſe black ſtreaks. It inhabits the Cape of Good Hope; it is ſeven and a half inches long.

Zeylanicus; Ceylon Rallus. The head of this bird is duſky; the body above is ferruginous, beneath it is reddiſh, waved with brown; the firſt quill-feathers are black; the bill

bill and legs are red. It is found, as its name imports, at Ceylon; it is larger than the R. aquaticus, and has a long tail.

Australis; Troglodyte Rallus. Rufty afh; wings and tail deep brown; the feathers are barred with black. It inhabits New Zealand, and is feventeen inches long. The bill and legs are yellowifh; the body above is of a rufty brown, beneath rufty afh; quill and tail-feathers are waved with black.

Pacificus; Pacific Rallus. Black, fpeckled with white; wings barred; body beneath whitifh; the head is brown, the breaft is of a blueifh-afh. It is found in Otaheite, and the neighbouring ifles. Bill red, the legs are of a flefh colour; the chin and eye-brows are white; the nape of the neck is rufty.

Tabuensis; Tabuan Rallus. Brownifh-black; beneath it is of a dufky colour; the bill is black, and the legs are bay. A variety has its vent ftreaked with black and white; the legs are red. It inhabits the South-fea iflands, and is fix inches and a half long. The eye-lids and irides are red.

Niger; Black Rallus. Black; bill red at the bafe, brown at the tip; the legs are brown or red. This is an African bird, and is nine inches long.

Sanduicensis; Sandwich Rallus. This is of a pale ferruginous colour; but the bill is of a dufky afh; the legs are of a dull flefh colour. A variety has a yellowifh bill and legs. It inhabits the Sandwich iflands; and another variety is very fmall, and found in the Tanna ifles.

Taitiensis; Otaheite Rallus. Cinereous; body above red-brown; the bill, rounded tail, and claws, are black. This inhabits Otaheite and the Friendly ifles, and is about fix inches long. The quill-feathers are dufky and edged with white; the legs are yellow.

Obscurus; Dufky Rallus. This is brown ftreaked with black, beneath it is of a rufty brown; the bill is black, and the legs are of a red-brown. It inhabits the Sandwich iflands, and is fix inches long; the edge of the mandibles is yellowifh.

Longirostris; Long-billed Rallus. The upper part of this fpecies is cinereous, fpotted with brown, beneath it is rufty white; the flanks are tranfverfely waved with white, the bill is long and of a ferruginous colour. It inhabits Cayenne, and is from nine to twelve inches long. The bill is tipt with brown; the legs are yellowifh, and the chin whitifh.

Variegatus; Variegated Rallus. This bird is ftreaked and fpotted with white and black; the hind-head is dufky; the bill is yellowifh; the chin is white; and the legs are yellow. It inhabits Cayenne, and is eleven inches long. The wings are brown, the coverts are fpotted with white; fome of the middle tail-feathers are edged with white.

Cayennensis; Cayenne Rallus. The crown of this bird is rufous; the body above is of an olive-brown; beneath it is rufous; the ocular band is blackifh; the quill-feathers are black; the bill is brown, and the legs bay. There is a variety having its crown bay; chin and vent reddifh-white. It inhabits Cayenne and Guiana; it is eight inches long: in the evening it is noify and gregarious, by day it is folitary; it builds in the forked branch of a fhrub, near the ground. The vent is pale.

Jamaicensis; Jamaica Rallus. Above reddifh-brown with black ftreaks; the bill and chin are black; the throat and breaft are of a blueifh-afh; the belly is marked with white and brown lines. It, as its name imports, inhabits Jamaica, and is fix inches long. The bill is reddifh at the bafe; wing-coverts brown, fpotted with white; the quill-feathers are of a reddifh-brown, with black lines, the fecondaries and tail-feathers are fpotted with white, and the legs brown.

Minutus; the Little Rallus. This is brown, but beneath it is yellowifh; eye-brows, ftreaks on the back, and fpots on the wing-coverts, white; tail barred black and white. A variety has the middle of the neck above rufous; the belly and vent are waved with black and white. It inhabits Cayenne and Jamaica, and is five inches long. The bill is brown; the wing-coverts are black; the chin is whitifh, and the legs are yellow.

Pusillus; Dwarf Rallus. Striped with ferruginous and black; the body beneath is blackifh, with narrow white bands; the throat and breaft are blueifh. This is found near falt lakes of Dauria, and is of the fize of a lark. The face, neck beneath, and middle of the breaft longitudinally, are blueifh; the middle of the chin is whitifh; the longitudinal band through the eyes of a pale rufty colour; the back is fcattered with white longitudinal lines; the legs are greenifh.

Barbaricus; Barbary Rallus. This is of a ferruginous colour; the bill is black; the wings are fpotted with white; the rump is ftreaked above with white and black, and beneath with white; the legs are of a dufky brown. This, as its name imports, is an inhabitant of Barbary, and is the fize of a plover.

Dubius; Doubtful Rallus. Striped with brown and ferruginous; the belly is white; the flanks are barred with brown and rufty afh; the firft quill-feathers without are longitudinally white. It is the fize of the common gallinule. The face is of a pale rufty colour; the chin is of a dirty white, furrounded with a broad brown collar; the fides are brown; the bill and legs greenifh-black.

RALLYING, in *War*, the reaffembling, or calling together of troops, broken, routed, and put to flight.

RALPH, James, in *Biography*, a mifcellaneous writer, defcended probably from mean parentage, was the intimate friend of Dr. Franklin, who fpeaks of him as ingenious and fhrewd, genteel in his addrefs, and extremely eloquent. Franklin knew him in America, and though he does not mention what Ralph's fituation then was, yet as he wrote a fine hand, and was well verfed in accounts, it is imagined he was a fchoolmafter. In 1725 Ralph accompanied Franklin to England, with a refolution of not returning to America, where he left his wife, with whom, and with whofe family, he had lived on ill terms. In London he was, for a confiderable time, fupported by his friend Franklin, till their intimacy was diffolved, when Ralph confidered the quarrel as a complete difcharge of the debt which he owed his benefactor. Ralph changed his name to that of Franklin, which he thought neceffary, having formed a new female connection, and fettled as a fchoolmafter in a village in Berkfhire. From this time there is no regular narrative of his life, which was probably paffed as a hired party writer. He is fpoken of with much contempt in the Dunciad, as the author of a poem called Night:—

"Silence, ye wolves! while Ralph to Cynthia howls,
And makes night hideous—Anfwer him, ye owls."

In a note, it is faid he wrote a fwearing piece, entitled "Sawney," very abufive of Swift, Gay, and Pope; that he panegyrifed his own works in the journals, was wholly illiterate, wrote plays, and was employed in a political newfpaper. The fatire of Pope muft be taken with much limitation, it being infpired by party motives: Ralph having recommended himfelf to perfons in power at the beginning of George II.'s reign, would for that reafon be obnoxious to Pope and his friends. He became an able writer

writer in profe, and was author of many political pamphlets, which were much applauded in their time; but his chief work was "The Hiftory of England during the Reigns of William, Anne, and George I., with an introductory Review of the Reigns of the Brothers Charles II. and James II., in which are to be found the Seeds of the Revolution. By a Lover of Truth and Liberty," 2 vols. fol. 1774—6. This work obtained the plaudits of Mr. Fox, who, in his pofthumous hiftorical fragment, fpeaks of the author as an hiftorian of great acutenefs as well as diligence. The laft publication of this author was entitled "The Cafe of Authors by Profeffion or Trade, ftated with regard to Bookfellers, the Stage, and the Public," which is faid to contain much good fenfe and lively fatire. Mr. Ralph died at Chifwick, in the year 1762. Gen. Biog.

RAM, in *Geography*, a town of European Turkey, in Servia, on the S. fide of the Danube; 10 miles E. of Paffarowitz.

RAM, in *Agriculture*, the male of the fheep kind. It may be obferved, that the rams of different breeds of fheep vary greatly in their forms, wools, and fleeces, and other properties; but the following defcription by that excellent ftock-farmer, Mr. Culley, deferves the attention of the breeder and grazier. According to him, his head fhould be fine and fmall, his noftrils wide and expanded, his eyes prominent, and rather bold or daring, ears thin, his collar full from his breaft and fhoulders, but tapering gradually all the way to where the neck and head join, which fhould be very fine and graceful, being perfectly free from any coarfe leather hanging down; the fhoulders broad and full, which muft at the fame time join fo eafy to the collar forward, and chine backward, as to leave not the leaft hollow in either place; the mutton upon his arm or fore-thigh muft come quite to the knee; his legs upright, with a clean fine bone, being equally clear from fuperfluous fkin and coarfe hairy wool from the knee and hough downwards: the breaft broad and well forward, which will keep his fore-legs at a proper widenefs; his girth or cheft full and deep, and inftead of a hollow behind the fhoulders, that part by fome called the fore-flank fhould be quite full; the back and loins broad, flat, and ftraight, from which the ribs muft rife with a fine circular arch; his belly ftraight; the quarters long and full, with the mutton quite down to the hough, which fhould neither ftand in nor out; his twift, or junction of the infide of the thighs, deep, wide, and full, which, with the broad breaft, will keep his fore-legs open and upright; the whole body covered with a thin pelt, and that with fine, bright, foft wool. It is obferved, that the nearer any breed of fheep comes up to the above defcription, the nearer they approach towards excellence of form.

But though this is a very correct, appropriate, and admirable defcription of a finely-formed ram, objections have been made by fome to a few of the properties which are laid down. Width and expanfion of the noftrils in fheep, it is fuppofed, are liable to caufe the lower parts of the nofes to be too thick and large; while in naturally good and improved forms, the lower parts of the nofes and mouths are for the moft part fmall. Nor is the prominent and bold daring eye held in more eftimation, as it is thought not to fhew a good difpofition; but, on the contrary, to difplay too much quicknefs and activity, or wildnefs of nature in the animal. Opinions, however, differ much on this point among fheep-farmers; and a lively quick eye is almoft always confidered as favourable to a good difpofition.

Rams naturally poffefs more boldnefs and courage than either wethers or ewes; and they are very apt, unlefs great care is taken, to acquire mifchievous habits of attacking perfons or animals that may by accident approach them.

In fome fheep-diftricts the breeders are greatly in favour of large rams, but in others thofe of a fmaller fize are preferred; the choice of the fize of the rams fhould, however, in every inftance, be regulated by the nature and abundance of the keep, or the quality of the lands, as it is utterly impoffible that the inferior forts of paftures can keep fheep-ftock of the large fize, as in thofe of the better kinds; and it would be highly difadvantageous in the beft rich forts to have a fmall-fized ftock when they could fupport a large one in an equally perfect manner. Middle-fized rams are, upon the whole, the moft fuitable and proper for lands in general, and for all the purpofes of the breeder.

The growth and conftitutions of young rams fhould never be fuffered to be endangered by their having too great a number of ewes, as is too frequently the practice with fheep-breeders.

It is a very improper cuftom, but one which prevails with the graziers in fome fheep-diftricts, to keep all their rams, perhaps to the amount of from twenty to fifty or more of all kinds, in one field or pafture; as their contentions are often fo violent, efpecially about the riding time, as to caufe the lofs of one or two rams to each in all fuch cafes. This practice is the moft common in the fheep-diftricts towards the fouthern part of the ifland, being feldom met with in thofe of the midland or more northern parts. It ought to be every where done away with.

The old rams are now almoft always got quit of by being fattened as rams, and fold at the neighbouring markets, or to butchers, at a very inferior price, there being often much competition for this fort of low-priced meat in fome fituations. It was formerly, however, the cuftom in fome places to *knit* them before they were fattened and fold to the butchers or otherways, but much injury and lofs being found to be fuftained by that method, it has been left off; it being now concluded, on the whole, that the lofs by knitting the rams is greater than that which is fuffered in the reduction of the price of ram mutton.

The practice of letting out rams in the midland diftricts for the purpofe of improving the breeds of fheep, having produced fuch beneficial effects, the rife, nature, and progrefs of it may deferve the attention of the ftock-farmer. It has been ably and accurately delineated, in the following manner, by Mr. Marfhall, in his Rural Economy of that part of the kingdom.

It is ftated, that in this diftrict, in general, the management refpecting rams is fimilar to that of other parts of the ifland; the breeders *rearing* or *purchafing* them. But that it is obfervable, however, that the advocates of the old breeds, though they will not adopt the modern ftock, have fallen, in fome degree, into the modern practice of *letting* by the *feafon*. But that the rams of the *modern* breed are never *fold*; but are paffed from breeder to breeder, by the *feafon* only. And that for the purpofe of promoting this intercourfe, each principal breeder has his *fhow* of rams; commencing, by common confent, the 8th of June, and lafting until Michaelmas, or until the feafon of letting be paft. That during a few weeks after the fhows commence, every ram-breeder may be faid to keep open houfe. Breeders and others, from all quarters of the kingdom, as well as the promoters of the breed who refide in the neighbourhood, attend thefe fhows; going, in parties, from one to another: fome to take, others to fee and pafs their judgment. And that thefe private exhibitions clofe with a *public fhow*, at Leicefter, the 10th of October; when rams of every defcription, but moftly an inferior fort of the improved

proved breed, are collected; being brought in waggons; many of them from a considerable distance; some to be *sold*, but chiefly to be *let* for the season. That this show has been held, he believes, time immemorial; not, however, for the purpose of *letting*, but for that of *sale*. But the letting of rams by the season, has long, he understands, been a practice in Lincolnshire. However, the origin, in the midland districts, may be traced—to a ram let by Mr. Bakewell, at Leicester fair, about forty years ago, at the low price of sixteen shillings. But humble, however, as was this beginning, it proved, Mr. Marshall says, to be the first stone of the foundation of a department of rural business, that has already risen to an astonishing height, and may, for some length of time, continue to bring in a copious source of wealth to the country. In the management of this business, the principal ram-breeders save annually, twenty, thirty, or perhaps forty ram-lambs; castration being seldom applied, in the first instance, to the produce of a valuable ram. For, in the choice of these lambs, they are led more by blood, or parentage, than by form; on which, at an early age, little dependance can be placed. He adds, that their treatment, from the time they are weaned, in July or August, until the time of shearing, the first week in June, consists in giving them every indulgence of keep; in order to push them forward for the show: it being the common practice to let such as are fit to be let the first season; while they are yet yearlings—provincially *sharhogs*. Their first pasture, after weaning, is pretty generally, he believes, clover that has been mown early, and has got a second time into head: the heads of clover being considered as a most forcing food for sheep. After this goes off, turnips, cabbages, colewort, with hay, and report says, with corn. But the use of this the breeders severally deny, though, collectively, they may be liable to the charge. However this may be, something considerable depends on the *art* of making *up*,—not lambs only, but rams of all ages. Fat, like charity, covers a multitude of faults; and, beside, is the best evidence their owners can produce, of their *fatting quality*, —their natural propensity to a state of fatness; while in the fatness of the sharhogs is seen their degree of inclination to fat at an *early* age. And that the fatting quality being the one thing needful in grazing stock: and being found, in some considerable degree at least, to be hereditary,—the *fattest* rams are of course the *best*; though other attachments, well or ill placed, as to form, or fashionable points, will perhaps have equal or greater weight in the minds of some men, even in this enlightened age and district. And the shearlings, which will not make up sufficiently, as to form and fatness, are either kept on to another year, to give them a fair chance, or are castrated, or butchered, while sharhogs.

With regard to the showing, it is remarked, that the shows of the principal breeders consist, by common consent, of forty rams each, mostly from one to five years old, they being seldom found efficient after that age; some, however, will continue in vigour to the sixth or seventh year. And that, during the show, they are mostly kept in small inclosures, of two, three, or four acres; with three, four, or more rams in each, according to their ages, and the advancement of the season. And in a corner, or other convenient part of each paddock, a small pen, made with hurdles, is placed; for the purpose of handling them. Into these pens they go, through custom, as tractably as worked oxen to their stalls. Indeed, the old rams, from the unwieldiness of their frame, and the load of fat they have to carry at this season, as well as from habit, will suffer themselves to be handled abroad; and even appear to take pleasure in the respect which they have shewn them. But it is observed, that of late a new method of showing has been struck out by the leading breeder, and adopted by *one* at least of his followers. Instead of showing them abroad, and driving three or four of them up together in a pen, they are shut up in hovels, and brought out separately, being *never seen* together. He thinks, that among accurate judges, this mode of showing may be well enough; but to those who have had less experience it gives offence, as it deprives them of their best guide, comparison; and he can see no fair advantage accruing from it to the latter.

It is remarked, that though the desirable *points* of a ram are such as have been noticed, the choice of the hirer is determined, in some measure, by the intention for which he is about to hire: as whether it be that of getting wedders, or mere grazing stock: or rams for the purpose of letting. Hence the grazier and the ram-breeder choose different sheep, so as to suit their different purposes. He adds, that the characteristic difference between what is termed a *ram-getter* and a *wedder-getter*, or a good grazier's sheep, is that of the former being every where cleaner and finer, the head small, the bone and offal light, the flesh good, and the form beautiful. The mere grazier likes a ram no worse for having a strength of frame, and is less scrupulous about his form than the ram-breeder, whose great object is fineness: his ewes, and the natural tendency of the breed, serve to give his offspring size and substance when it is wanted.

In respect to the practice of letting, it is observed, that a novel circumstance has likewise taken place lately in the business of letting. The long established custom of setting a price was exploded, at least by the late Mr. Bakewell, and one of his disciples; whose customers were left to make their own valuations, and bid what they pleased. But this, as well as shewing them separately, it is observed, gives great offence, especially to strangers, who cannot brook the idea of being both buyers and sellers. The latter, however, has more than one advantage in reserving the price, provided he do not thereby drive away his customers: he is, in effect, letting to the best bidder. Beside, he is, through this mean, enabled to *regulate* his *prices* to his customers, without giving any of them pointed offence: for as the principal breeders are, in the nature of their business, competitors, it is no more than common good policy, in the leader at least, to advance himself, and keep back those who press upon him closest. It is, therefore, good management, Mr. Marshall thinks, in him to let a superior ram to an inferior breeder, whose ewes are yet of base blood, at a lower price than to one who is farther advanced, and whose ewes perhaps are nearly equal to his own: for if the hirer may not thereby be able to get the lead from him, he may run away with part of the best prices; and the only line the leader has to tread is, either to refuse him, or to make him pay in the first instance. And again: sometimes two or three capital breeders will join in the hiring of one superior ram; and, in this case, the blood being more widely dispersed, the price ought to be, and always is advanced, in proportion to the number of partners there may be in the business. Hence, in the leader, a reservation of price may be allowable, especially in the letting of first-rate rams.

He observes, in regard to the conditions of letting, that notwithstanding the number of years the letting of rams has now been in use, and the extraordinary height to which the prices have risen, the transaction does not appear to have yet received any settled form; nor to have been rendered *legally* binding, by any written articles, or conditions of letting; much being still left to the *honour* of the parties. It is, however, generally understood, that the price agreed upon

upon ſhall not be paid, unleſs the ram in contract, *or another as good*, impregnate the ſtipulated number of ewes. If, through accident or inability, part only be impregnated, a proportional part of the price is abated. If he die while at ride, the loſs falls on the letter, whether his death happens through accident or neglect; no *caſe*, he underſtands, having yet been otherwiſe determined. It is likewiſe underſtood, that the hirer ſhall not ſuffer him to ſerve any other than his own ewes; and of theſe, no more than a ſtipulated number, which is proportioned to the age or ability of the ram, and the mode of uſing him. And further, that if a grazier hire a valuable ram, at a wedder-getter's price, (which is not unuſual at the wane of a ſeaſon, when valuable rams happen to be unlet,) it is underſtood, or rather agreed, that he ſhall not rear rams from him; a condition which may frequently be advantageous to both parties. The letter pockets five or ten guineas, which otherwiſe he might not have had; and the hirer, by ſuffering himſelf to be "tied down," as it is termed, gets a greater improvement in his ſtock than otherwiſe he could have got for the ſame money. He adds, that the time of paying the money is, he underſtands, unfixed; ſeldom, he believes, until after the ewes have brought proofs of the ram's efficiency, or after the lambing ſeaſon.

It is obſerved, that with regard to the prices for letting rams by the ſeaſon, that from the firſt letting to the year 1780, the prices kept gradually riſing from *ſixteen ſhillings* to a *guinea*, and from one guinea to *ten*. In 1780, Mr. Bakewell let ſeveral at *ten guineas* each; and what is *rather* inexplicable, Mr. Parkinſon of Quarendon let one, the ſame year, for *twenty-five guineas*, a price which then aſtoniſhed the whole country. That from that time to 1786, Mr. Bakewell's ſtock roſe rapidly, from ten to a *hundred guineas;* and that year he let two-thirds of one ram (reſerving one-third of the uſual number of ewes to himſelf) to two principal breeders, for an hundred guineas each; the entire ſervices of the ram being rated at *three hundred guineas*. This excellent breeder making that year, by letting twenty rams only, more than a thouſand pounds! and that, ſince that time, the prices have been ſtill riſing. *Four hundred guineas* have been repeatedly given. The above breeder, this year (1789), makes, he underſtands, twelve hundred guineas by three rams, (brothers he believes,) two thouſand of ſeven, and of his whole letting full three thouſand guineas! And that he now lets nothing under twenty guineas; a well-judged regulation, which Mr. Marſhall thinks will probably be beneficial both to himſelf and his cuſtomers.

It is added, that, beſide this extraordinary ſum made by Mr. Bakewell, there are ſix or ſeven other breeders who make from five hundred to a thouſand guineas each. The whole amount of monies produced this year, in the midland counties, by letting rams of the modern breed for one ſeaſon only, is eſtimated, by thoſe who are adequate to the ſubject, Mr. Marſhall ſays, at the almoſt incredible ſum of *ten thouſand pounds*. He knows that it is a popular idea, eſpecially of thoſe who, living at a diſtance, have only heard of theſe extraordinary things, without having an opportunity of coming at facts, that the extravagant prices which are talked of are merely nominal; the principal part of the money being returned, the actual prices given being ſmall, in proportion to thoſe held out. This, however, is, he believes, and on the beſt authority, an erroneous idea. At the firſt ſetting out of the high prices, there might be ſome tranſactions of that nature; but if ever they exiſted, they have ceaſed long ago. Mr. Bakewell at preſent has the name, at leaſt, of being parſimonious, even to the ſhepherds of the flocks on which his rams are employed. His higheſt preſent, he underſtands, is five ſhillings; if the price be under fifty guineas, only half-a-crown. But the enormouſneſs of theſe prices may be explained, he thinks, on other grounds. The *high* prices are not given, he ſays, by graziers, for the purpoſe of getting wedders, as grazing ſtock; but by ram-breeders, for the purpoſe of getting rams, to be let to graziers: the *higheſt* being given by the principal breeders only, not for the purpoſe of getting rams to let to graziers as wedder-getters, but for that of getting rams, to be let out again to inferior tup-men, as ram-getters.

It is further ſtated, that the graziers' prices run, even now, from one to ten guineas. He has not heard of more than ten guineas being given, by a mere grazier, for a ram, for the ſole purpoſe of getting grazing ſtock: five or ſix guineas is the common price. And ſuppoſing he gives the higheſt price, ten guineas, and that the ram ſerves a hundred ewes, (ſome ſingle, ſome double,) the expence of getting amounts to no more than two ſhillings a head; which is inconſiderable, compared with the difference between a well and an ill grazing ſheep, between a ſheep that will get as fat at two years old as another will at three; or, in other words, which will, at two years and a half old, fetch ten or fifteen ſhillings more than his comrades of another breed, but of the ſame natural ſize, and going in the ſame paſture, or feeding on the ſame ſort of food. In reſpect to the *middle* prices, as thoſe from twenty to fifty guineas, they are, under the preſent circumſtances, equally reconcileable, he thinks, to common ſenſe. If a breeder, who gives fifty guineas, rear ten tolerable rams fit for the grazier's uſe, and let them at five guineas each, he brings himſelf home, even the firſt ſeaſon of letting, beſide having the rams for another and another ſeaſon, and beſide a general improvement in his ſtock for the future. And thoſe who give the higher prices, as one to two hundred guineas, have, or ought to have, proper baſes to build upon, ſufficient ſtocks of well-bred ewes; in which caſe, they have a fair chance of producing ram-getters, worth, while the preſent ſpirit of improvement laſts, twenty to fifty guineas a ſeaſon. And that with reſpect to the *very high* prices, they are given by a few firſt-rate breeders, who are playing a high game, running a hard race, for the pride and profit of being a leader, when Mr. Bakewell is not; a contention which may laſt as long as Mr. Bakewell, and be at once an honour to his genius, and a reward of his ſervices.

In reſpect to the treatment of rams after letting, it is remarked that the breeders of rams, as well as of bulls, find it expedient to reduce them from the cumbrous ſtate in which they are ſhewn, previouſly to the ſeaſon of employment; the old rams, in particular, being frequently returned upon their hand, non-efficient. Hence, as they are let, they are transferred to private paſtures, and moderate keep; it being a pretty general rule not to ſhew a ram after he is let, or contracted for to a perſon.

In the ſending out let rams, the uſual time of beginning is the middle of September: the means of conveyance, carriages of two wheels with ſprings, or hung in ſlings; ſome of them being large enough to hold four rams. In theſe they travel from twenty to thirty miles a day; being ſometimes ſent, in this way, two or three hundred miles, and ſometimes more.

It has been obſerved by the ſame writer, that the manner of uſing theſe rams has lately received a very great improvement. Inſtead of turning them looſe among the ewes at large, as heretofore, and agreeably to the univerſal practice of the iſland, they are kept apart, in a ſeparate paddock or

ſmall

ſmall incloſure, with a couple of ewes only each, to make them reſt quietly; having the ewes of the flock brought to them ſingly, and leaping each only once. He thinks, by this judicious and accurate regulation, a ram is enabled to impregnate near twice the number of ewes he would do, if turned looſe among them, eſpecially a young ram. And he adds, that, in the old practice, ſixty or eighty ewes were eſteemed the full number for a ram: in the new, from a hundred to a hundred and twenty are allowed. Seven ſcore have been ſerved by one ram in a ſeaſon: this is, however, much too great a number.

And while at ride, the treatment of the ram is merely that of keeping him well, and free from diſorders; ſuffering him to ſerve no other than the hirer's own ewes, and of theſe the limited number only, and to return him ſafe when he has done; generally the beginning of December: or, if the hirer nas met him on the road, (which is cuſtomary,) the latter, in return, meets him on his journey home. And the after treatment conſiſts in ſtriving, by every deviſeable means, to reload his carcaſe, and make him fat and handſome for the enſuing ſhow, in order that he may be let again with advantage.

This is the whole of the plan that was purſued in that diſtrict, which has led the way to ſo much improvement in the breeding of ſheep ſtock; and from which the country has derived ſuch vaſt benefits, and ſuch a number of advantages. But though the above practices have not been lately carried on to their former extent, they are ſtill very conſiderable. See Sheep.

It is remarked, that the practice of hiring rams in Romney Marſh is not carried on with the ſame degree of ſpirit as it is in Leiceſterſhire, and that rams were of more value for the hiring ſeaſon ſome time ago than they are at preſent, eſpecially when the croſs of the above county took place, as then from twenty to one hundred guineas were frequently given. One grazier ſome time ſince let rams to the amount of twelve hundred guineas; but the rage is now over, the people not being ſo fooliſh as to be duped out of their money, without the proſpect of being repaid. It is here the practice with ſome to ride their ram lambs; but they are ſaid always to be injured in their growth, if not in their conſtitutions and diſpoſitions, by it. When a ram dies while at ride, the loſs falls on the owner, and, beſide, he is not paid for the riding. The time of paying is when the rams are removed from the ewes. This is done by carrying them away in carts, or leading them by ropes. The ram lambs are here now moſtly ſelected and ſaved, in ſuch numbers as are proper for the hirers.

Some time before the riding ſeaſon, the graziers call and agree for the hiring or purchaſing of rams, the general price uſually from three to five guineas; but a ſuperior one will bring ten in particular caſes, though many good uſeful ones let at three guineas. Some purchaſe them to ride, and immediately afterwards ſell them in the markets. The rams, which are to be hired, are here ſhewn all together in paſture fields, which is a diſadvantageous method.

In Suſſex, until lately, ten guineas were the higheſt price that was heard of for the ſale of any ram. Now ſome let many of their three-years old rams for fifty; and inferior ones at thirty, twenty, and ten guineas. Some have even been let ſo high as one hundred guineas.

Ram is alſo a term uſed to ſignify any thing which has a ſtrong ſmell or taſte.

Ram, in *Aſtronomy*. See Aries.

Ram *of M. Montgolfier, Hydraulic*, in *Mechanics*, a machine for raiſing water to any given height, which has lately attracted much attention in France. The firſt perſon who employed this method was Mr. Whitehurſt, and it was afterwards improved by Mr. Boulton. Its conſtruction and uſe may be ſufficiently underſtood by the following ſtatement. It ſerves to raiſe water by means of the momentum of a ſtream of water flowing through a long pipe. The paſſage of the pipe being ſtopped by a valve, which is raiſed by the ſtream, as ſoon as its motion becomes ſufficiently rapid, the whole column of fluid muſt neceſſarily concentrate its action almoſt inſtantaneouſly on the valve, and in this manner it loſes the characteriſtic property of hydraulic preſſure, and acts as if it were a ſingle ſolid; ſo that, ſuppoſing the pipe to be perfectly elaſtic and inextenſible, the impulſe muſt overcome any preſſure, however great, that might be oppoſed to it; and if the valve open into a pipe leading to an air-veſſel, a certain quantity of the water will be forced in, ſo as to condenſe the air, more or leſs rapidly, to the degree that may be required, for raiſing a portion of the water contained in it to any given height. Young's Courſe of Lectures on Nat. Philoſ. vol. i.

Ram, in *Mythology*, the name of the higheſt god among the Gentoos. When a widow offered herſelf to be burnt on the funeral pile of her huſband, ſhe was encouraged by the preſence of a number of attendants, who formed a circle around her, and offered her freſh betel, intreating that, as ſhe would in a ſhort time appear with her huſband in the preſence of Ram, or their higheſt god, ſhe would ſupplicate for various favours for them; and above all, that ſhe would ſalute their deceaſed friends, whom ſhe might meet in the celeſtial abodes, in their names.

Ram, *Battering*. See Aries.

Ram's-*Horns*, in *Fortification*, a name given by M. Belidor to the tenailles.

Ram-*Head*, on board a *Ship*, the name of a great block belonging to the fore and main halliards. It hath in it three ſhivers, into which the halliards are put, and at its head the tyes are reeved into a hole made there for that purpoſe.

Ram-*Head*, in *Geography*, a cape on the S. coaſt of Ireland, and county of Waterford; four miles E. of Youghal bay. N. lat. 51° 56′. W. long. 7° 44′.—Alſo, a cape on the S.E. coaſt of New Holland. S. lat. 36° 56°. E. long. 149° 35′.—Alſo, a cape of England, on the S. coaſt of Cornwall, in the Engliſh Channel, between Whiteſand bay and Plymouth ſound. N. lat. 50° 19′. W. long. 4° 12′.

Ram-*Hormuz*, a town of Perſia, in Chuſiſtan; 65 miles S.E. of Suſter or Shuſter.—Alſo, one of the moſt romantic vallies in Perſia, which has been lately placed under the beglerbeg of Bebahan. It is fifteen furſungs in length (the furſung being eſtimated at $3\frac{3}{4}$ Engliſh miles), and from ſix to eight miles in breadth. The river Jeraki, entering at the eaſtern extremity, flows through the centre of it, when meeting the Kkoorkhankende, which deſcends from the mountains ſix miles E. of the town of Ram-Hormuz, they together force a paſſage through a low ridge of hills, which ſkirt the valley to the ſouth. This fertile ſpot is, at preſent, in the hands of five hoſtile chiefs; the firſt of whom is an Arab, who reſides in a mean village, ſituated at the W. end of the valley, and built amidſt the ruins of the ancient city of Ram-Hormuz. The remaining four are Perſians, and brothers, who have each a caſtle, or fortified village; from which they make frequent ſallies, and carry off the corn and cattle of their rivals. A great battle was fought in this valley, between Artaxerxes Babegan, and Artabanes, in which the former was victorious, and firſt aſſumed the title of "Shah en Shah," or king of kings. Kinneir's Perſ. Emp. 1813.

Ram's *Iſland*, an iſland in lough Neagh, Ireland, about two miles from the ſhore, and containing about ſix acres.

acres. It is in the weftern part of the lough, in what is called Sandy bay, and is the only ifland. One of the round towers, fo frequent in Ireland, is found here, and renders it an interefting object from the neighbouring grounds. Dubourdieu's Antrim.

RAMA, or RAMLA, a town of Paleftine, which was formerly large, and defended with ftrong walls; celebrated as the place where St. Paul cured Æneas. The Muffulmen reverence here the tomb of Locman the wife, and the fepulchres of feventy prophets, faid to have been buried here. The church of St. George is the only object now worthy of notice. The place has a kind of market for gall-nuts, fena, and gum arabic, which the Arabs bring hither for fale; 20 miles N.W. of Jerufalem.

RAMA, a town of Dalmatia; 20 miles S.W. of Moftar.

RAMA, or *Ramah*, fignifying an eminence, in *Scripture Geography*, a town of Judea, in the tribe of Benjamin, according to the book of Jofhua, ch. xviii. v. 20. It was fituated towards the mountain of Ephraim, between Gaba and Bahel, about feven miles from Jerufalem, according to St. Jerom. This city lay on the road from Samaria to Jerufalem; for which reafon Baafha, king of Ifrael, caufed it to be fortified, to obftruct the paffage from the land of Judah into that of Ifrael. This is the Ramatha, or *Ramathaim-Zophim*, the country of the prophet Samuel. 1 Sam. i. 1—19. and ii. 11. &c. It was on the frontiers of Ephraim and Benjamin; and frontier cities were inhabited by both tribes. Jeremiah probably fpeaks of this Ramah. Jer. xl. 1, 2, 3. See alfo ch. xxxi. 15, 16, 17.

RAMA, a city of Naphtali (Jofh. xix. 36.), on the frontier of Afher (Jofh. xix. 29.)

RAMA, in *Hindoo Mythology*, is the name of a diftinguifhed mortal, in whom their deity Vifhnu was incarnated for the purpofe of relieving mankind from the tyranny and oppreffion of Ravena, the malignant king of Lanka, or Ceylon. This incarnation is one of the ten avataras, or defcents of Vifhnu, and is, in its fuppofed importance, fecond only to that of Krifhna. It is fimilarly a popular hiftory, and allufions to it perpetually occur in the writings and converfation of the Hindoos. The invafion and conqueft of Lanka is the fubject of one of their fineft poems, entitled the Ramayana; it furnifhed fubjects for the drama, for itinerant bards, and for every purpofe of poetry, being replete with magnificent imagery, and abounding in ftriking incidents. (See RAMAYANA.) The mortal parents of this divine hero were Raja Dafaratha, king of Ayodetra (Oude), and his firft wife Kahunfilya. Hence this Rama is fometimes ftiled Dafrat Rama, to diftinguifh him from other heroic Ramas; and fometimes Rama Chandra, meaning of lunar defcent.

There are three perfons of the name of Rama, recorded as incarnations of Vifhnu. One is Bala Rama, the elder brother, by the fame parents, of Krifhna; the fecond, Parafu Rama; and the third, Rama Chandra, the fubject more immediately of this article. But it has been made a queftion, whether they be not three reprefentations of one perfon, or three different ways of relating the fame hiftory; and whether any or all of them mean Rama the fon of Cufh, fir W. Jones (Af. Ref. vol. i.) fays he leaves others to determine. He deems Rama to be the fame as the Grecian Dionyfos, who is faid to have conquered India with an army of fatyrs, commanded by Pan; and Rama was alfo a mighty conqueror, and had an army of large monkeys or fatyrs, commanded by Maruty, fon of Pavan. (See MARUTY.) Rama is alfo found, in other points, to refemble the Indian Bacchus: he is, notwithftanding his lunar appellation above noticed, fabled to be a defcendant of the fun, his wife's name is Sita; and it is very remarkable that the Peruvians, whofe Incas boafted of the fame defcent, ftiled their great feftival Ramafitoa.

In a charge delivered by Dr. Watfon, afterwards bifhop of Landaff, to the clergy of the archdeaconry of Ely in May 1780, are many curious and fhrewd obfervations on oriental ufages. He notices a "ftring of cuftoms wholly the fame amongft people fo far removed from each other as the Egyptians and Peruvians. The Egyptian women, he fays, made facred cakes of flour, which they offered to the queen of heaven, at their principal folar feftivals called Raymi and Citua: the Peruvian women did the fame." Almoft all the cuftoms defcribed as common to thefe diftant people, the Egyptians and Peruvians, as well as th... ...cted, are Hindoo cuftoms, ancient and exifting.

All the Ramas are famed as great warriors and as youths of perfect beauty. In the Gita, an epifode of the Mahabarat, Krifhna, defcribing himfelf to Arjun as pre-eminent among all things and perfons, fays, "Among thofe who carry arms, I am Rama." It is Rama Chandra, however, and his lovely Sita, who are the favourite fubjects of heroic and amatory poetics: he is defcribed in the Ramayana "of ample fhoulders; brawny arms, extending to the knee; neck fhell-formed; cheft circular and full, with aufpicious marks; body hyacinthine; with eyes and lips of fanguine hue; the lord of the world; a moiety of Vifhnu himfelf; the fource of joy to Ikfhwaku's race." He is fuitably mated in his faithful Sita, one of the moft interefting females in Hindoo poetry. (See under her name for fome account of her, and a defcription of her perfon.) Rama is alfo called *Raghuva*, or fon of *Raghu*, (fee thefe articles,) like Ikfhwaku, one of his mortal anceftry. Kaka-pakfna-dara, or crow-winged, is an epithet given to the Ramas, and to other warriors, from a certain mode of fhaving the head, leaving the hair over the ears only, refembling crow's wings, as is fancied. Shyamula, or blue-bodied, is an appellation of Rama, as well as of Krifhna, and of their common prototype, Vifhnu; all being reprefented of hyacinthine hue. It may be here remarked, that feveral incidents in the Sri-Bhagavat, (a hiftory of Krifhna,) and in the Ramayana, told fimilarly of their feveral heroes, feem to mix or approximate, though perhaps fcarcely to identify, the characters of Krifhna and Rama. Each won a wife by bending an unyielding bow, not very unlike the ftory of Ulyffes. Each is defcribed as overcoming the demon Kumbakarna, and others. Krifhna defcended into hell; fo did Sita, the fakti, or energy of Rama. Both have adventures with the bear Jamba. See JAMBA, &c.

All fects and tribes, who, under the denomination of *Vaifhnavas* (which fee), worfhip Vifhnu, (bating fuch deiftical philofophers as fceptically deny the perfonal exiftence of inferior deities, attributes, or avataras, of whom fee under JAIMINI,) agree in ftating, that, with the exception of Krifhna, the potentiality of the preferving power was never exhibited in fuch plenitude as in the avatara of Rama. In popularity, and in dramatic, hiftoric, and poetic fhapes, it rivals that of Krifhna. And as one or more fects adore Krifhna as the deity himfelf, and draw rules for their religious and moral conduct from the Sri-Bhagavat; fo the fect called Ramanuj fimilarly clothe Rama in almighty attributes, and deem the Ramayana a complete body of ethics and morality. See RAMANUJ.

In the feries of incarnations of Vifhnu, called *das-avatara*, or the *ten defcents*, to diftinguifh them from others of lefs importance, the avataras of Parafu Rama and Rama Chandra are ufually placed fixth and feventh, as given under VISHNU. Sometimes Krifhna is altogether omitted; in which cafe, Bala

Bala Rama ranks as the eighth. *Mufali* is a name of the third Rama, under which word fome notice is taken of him. And of *Parufa* or *Parufha Rama*, fee under that article. The name of Rama, or perhaps more correctly of Rami, is one of the many names of Parvati, confort of Siva. The name is alfo ufed, beyond the pale of his own fectaries, in fupplication and praife. Ram-Ram is a ufual falutation, like our good morrow, between friends at meeting or parting, and is ufed by both Vaifhnavas and Saivas; and it is reverently reiterated in times, and in aid, of abftraction (fee JAP); and under the operation of feelings of enthufiafm or diftrefs.

The hiftory of the Ramas mixes itfelf with that of fo many others of Hindoo mythological perfons, that in many of our accounts of fuch perfons, &c. particulars occur refpecting them. Thofe defirous of farther notice of the Ramas are, therefore, referred, in addition, to the following articles: CEYLON, JAYA, KAHUNSILYA, LAKSHMAN, LANKA, MARUTY, RAVENA, RAMAYANA, RUNEKA, SITA, &c. from which other references point to articles on fubjects connected herewith.

RAMADA, or *New Salamanca*, in *Geography*, a town of South America, in the province of St. Martha; 90 miles E. of St. Martha. N. lat. 11° 10'. W. long. 72° 20'.

RAMADAN, a fort of lent obferved by the Mahometans, in obedience to the exprefs command of the Koran, during which they faft the whole day, from the time the new moon firft appears, till the appearance of the next new moon, with fuch extreme fuperftition, that they not only abftain from eating, drinking, and women, but dare not wafh their mouth, nor even fwallow their fpittle, from day-break till night, or fun-fet.

The men, indeed, are allowed to bathe themfelves; but it is on condition they do not plunge the head under water, left fome drops enter by the mouth or ears, &c. But as for the women they are ftrictly forbidden bathing. Some are fo cautious, that they will not open their mouth, to fpeak, left they fhould breathe the air too freely. The faft is alfo deemed void if they kifs or touch a woman. To make amends, they feaft all night till day-break; though the more rigid begin the faft again at midnight; and ufually fpend more in this month than in fix others.

The Ramadan happens at different feafons of the year; and when it is in the fummer it is very hard on the labourers. This month once in thirty-three years is in every feafon of the year, the Turkifh month being lunar, and they beginning at the day they can fee the moon; whereas the Jews begin their account from the day the moon makes, which is a day before the Turks.

The reafon given why the month of Ramadan was fixed upon for this purpofe is, that on this month the Koran was fent down from heaven. From this faft of Ramadan none are excufed, except travellers and fick perfons, under which latter denomination are included all thofe whofe health would be manifeftly injured by keeping the faft; but then they are obliged, fo foon as the impediment is removed, to faft an equal number of other days; and breaking of the faft is ordered to be expiated by giving alms to the poor.

RAMAG, a word ufed by fome of the chemical writers to exprefs afhes.

RAMAGE, a term ufed for the boughs or branches of trees. Hence,

RAMAGE-*Hawk*, or *Falcon*, one that is wild and coy, as having been long among the boughs, preying for itfelf. All falcons retain this name till they have left the aery; being fo called in May, June, July, and Auguft. Thefe are very rarely reclaimed. See BRANCHER, FALCON, and HAWKING.

RAMAGE *Velvet*. See VELVET.

RAMAGURRY, in *Geography*, a town of Hindooftan, in the Carnatic; 30 miles W. of Tritchinopoly.

RAMAH, a town of Arabia, in the province of Nedsjed; 120 miles N.W. of Jamama.

RAMAH, or *Ramalla*, *Ramola*, *Ramula*, *Ramba*, *Ruma*, or *Remphtis*, a city W. of Jerufalem, between Lydda and Joppa, according to St. Jerom; or between Joppa and Jerufalem, as modern travellers defcribe it. This is the place which Eufebius and St. Jerom took for Arimathea, the country of Jofeph. Matt. xxvii. 57.

RAMAI, in *Natural Hiftory*, a name given by many old writers to bole armenic.

RAMAK, in *Ichthyology*, a fpecies of *Sciæna*; which fee.

RAMALINGA, in *Geography*, a town of Hindooftan, in Coimbetore; 16 miles S.S.W. of Erroad.

RAMALIS VENA, a name given by fome anatomical authors to the vena portæ.

RAMANUJ, the name of a religious fect of Hindoos, of the great fubdivifion of Vaifhnava, who worfhip Vifhnu, the perfonification of the preferving power of the deity, in his incarnation of Rama. Of this fect fome worfhip Rama only, fome his fpoufe Sita, and fome both Rama and Sita conjointly. (See RAMA.) Among the Ramanuj none are addicted to the indecent, or left-handed, mode of worfhip noticed under the article RADHA as difgracing her votaries. (See farther under SAKTA, and SECTS *of Hindoos*.) The different fects of Hindoos are diftinguifhable by a variety of marks on their foreheads; of which a great many are reprefented in the fecond plate, with copious explanations in page 404, of the Hindu Pantheon. The fect of Ramanuj are known by a double upright white line on the forehead, with a red line between, or fometimes a circlet or dot. Sometimes the lines are red and the circlet black.

RAMAS, CAPE, in *Geography*, a cape on the W. coaft of Hindooftan; 21 miles S. of Goa.

RAMASSERAM, a town of Hindooftan, in the circar of Rajamundry; 35 miles S.S.E. of Rajamundry.

RAMAYANA, the title of a poem in the Sanfcrit language, of great celebrity in India, and regarded as facred by fome fects of Hindoos, and greatly venerated by all. Its fubject is the exploits of three perfons named Rama; but more efpecially the wars conducted by one of them, named Rama Chandra, for the conqueft of Lanka or Ceylon, from its powerful fovereign Ravena, or rather, indeed, for the refcue of his wife from the hands of that tyrant. It is comprifed in feven kandas, or books, containing 24,000 fhlokas, or metrical ftanzas; named thus: 1. Adi-kanda, containing 64 fections, and 2850 ftanzas; 2. Ayodhya-kanda, 80 fections, and 4170 ftanzas; 3. Aranyaka-kanda, 114 fections, and 4150 ftanzas; 4. Kefhkinda-kanda, 64 fections, 2925 ftanzas; 5. Sundara-kanda, 43 fections, 2045 ftanzas; 6. Yudha-kanda, 105 fections, 4500 ftanzas; 7. Uttara-kanda, 90 fections, 3360 ftanzas. The Ramayana may be called an epic poem, as it is on one continued, interefting, and heroic action. It is fecond in celebrity only to the Mahabarat, and perhaps fuperior to it in reputation for holinefs. (See MAHABARAT.) We have the authority of fir William Jones for faying, that this great epic poem, in unity of action, magnificence of imagery, and elegance of diction, far furpaffes the elaborate work of Nonnus, in forty-eight books, entitled Dionyfiaca; and for believing that the heroes of the poems Rama (patronimically diftinguifhed by the name of Dafrat Rama) and Dionyfos are the fame.

A curious parallel might be drawn between the manners and customs described in these two works, the Dionysiaca and Ramayana. The processions and rites detailed in the former seem descriptive, with a little licence for poetical embellishment, of those in usage to this day in India. Some of these Bacchic orgia are noticed under our articles DIONYSIA and NONNUS; which see. A keen etymologist would find innumerable lingual coincidencies; and, in truth, many of the names of persons, Bacchus and Dionysos, and of places, as well as original persons, seem soberly traceable to the sacred language and rites of the Brahmans.

So highly is the Ramayana venerated, that the fourth class of Hindoos, the Sudra, is not permitted to read it. At the end of the first book, a promise is made of great benefit to any individual of the three first classes or tribes who shall duly read it. "A Brahman, reading it, acquires learning and eloquence; a Kshetriya will become a monarch; a Vaisya will obtain vast commercial profits; and a Sudra, *hearing* it, will become great." Of these distinctions of tribes or classes, the reader will find due notice under SECTS *of Hindoos*. Under RAMA we have stated that his name reiterated is used by several sects as a sort of salutation, or benediction. The author of the Ramayana, in the vanity of playful egotism, which, from its frequency with oriental poets, has ceased to seem assuming, calls on his readers to "salute Valmiky, the kukila (cuckoo), who, mounted on the branch of poesy, sounds the delightful note of Rām-Rām."

It has been surmised that the Ramayana, like the Mahabarat, is allegorical, so far as relates to personal adventures; which, in both cases, are mere machinery for the introduction of a concealed system of philosophy and ethics: in the first instance the allegory is *physical*, in the latter *moral*. Under the article MAHABARAT the allegorical nature of that extraordinary poem is sufficiently shewn. The Kurus and Pandus, the heroes of that poem (see KURU and PANDU), are personifications of virtues and vices. The Ramayana and the Dionysiaca relate how their respective Indian conquerors led armies of satyrs. (See hereon under MARUTY and RAMA.) These satyrs, or monkies, we apprehend to be personifications of winds, or gazeous metaphors. In the Ramayana we find the machinery to consist of the sun and planets, fire, the firmament, wind, water, &c. personified in the gods or regents of those bodies, elements, &c. It has been farther surmised, that whenever these two extraordinary poems, the Mahabarat and Ramayana, shall appear in English, and their allegories be more fully examined, it may possibly be found, that not only the three Ramas will melt into one, but that all will amalgamate with Krishna. Some objections to the identity of the Ramas have been offered of a chronological nature. Parasu Rama, it is contended, reigned or flourished eight generations before Rama Chandra. Their poetical identity, however, is sufficiently established; and one can scarcely bring such a tissue of allegory, incarnations, and whimsical adventures, to the test of sober historical and chronological accuracy. Persons of these names may have reigned or flourished at any given period, for they have always been very common, and are so still.

The Ramayana is so replete with incident, that it is scarcely possible to give any analysis of its subject with sufficient brevity for this work. Unity of action is, however, its characteristic, namely, the recovery of Sita from the hands of her ravisher Ravena, the gigantic tyrant of Ceylon. It may be noticed in passing, that the Ramayana, like the Iliad, is founded on a rape, and that Sita is the Helen of the Hindoo epic. (See SITA.) So inseparably intermixed are the varied subjects of the Hindoo mythological history, that the discussion of one necessarily brings another under notice. This is the cause of such frequent references to and from the articles under which we have endeavoured to give a succinct account of such a number of subjects of that description, distinct apparently, but in reality connected, and often confounded with each other. On the subject of this article, the Ramayana, or for quotations from it, we may therefore refer to the following, among others: CEYLON, LAKSHMI, LANKA, MANTRA, PARASU RAMA, MENAKA, RAVENA, RHEMBA, in addition to those pointed to in earlier passages of this article, and in those articles just named.

What precedes, referring to the poem bearing the title of this article, is offered respecting the Ramayana of Valmiki. There are many other poems of the same name in Sanscrit, Prakrit, Hindvi, and many other Hindoo dialects; as well as in Arabic, Persian, Malayan, and others derived from the like source. These are of course of unequal celebrity and merit; and acknowledged to be greatly distant from Valmiki's divine poem. Even of this it may be said, that the style is frequently flat and diffuse, deficient in ornament, and abundant in repetitions. As well as Valmiki's work, several others, under the same title, are usually considered with more respect than mere profane poems. One is ascribed to Vyasa, the reputed author or compiler of the *Vedas* and *Puranas*. (See those articles.) A considerable portion of several of the latter mythological romances is occupied by the same subject, to wit, the adventures of Rama; but in the Vedas no mention is made of this person, except, indeed, in some detached parts, reasonably suspected to have been interpolated by zealous sectaries. The titles even of the philosophical and profane poems, commentaries, &c. that in divers languages owe their origin to the Ramayana, would require a catalogue of no inconsiderable extent to contain them. Among these are included many dramatic works. The quotations from, and allusions to its mythological personages and fables, in the works of the minor poets, are incessant; and upon the whole, there is no subject, perhaps, in the whole range of Hindoo mythology, or history, so often in the minds and mouths of that race of all ranks and sects, as the story of the Ramayana in some of its bearings. That of Krishna rivals it in popularity. Both are chanted by itinerant bards, who illustrate their subjects by exhibiting a series of pictures from the Ramayana and Mahabarat. Women singers frequently accompany these eastern troubadours, who are commonly met with in every city, camp, and town of India.

RAMAZZINI, BERNARDIN, in *Biography*, an Italian physician of distinction, was born at Carpi, near Modena, in 1633, where his father was a respectable citizen. Having received a classical education from the Jesuits at his native town, he went to Parma for the study of philosophy at the age of 19, undecided what profession to adopt: at the end of three years he selected that of physic, and received the degree of doctor at Parma in the beginning of 1659. He then repaired to Rome for the completion of his studies, and settled in practice in the duchy of Castro. He was soon obliged by ill health, however, to return to his native air; and, on his recovery, he married, and pursued his profession at Carpi. Finding his reputation increasing, he removed to Modena, at the solicitation of some friends, in 1671, where he met with merited success, and excited the jealousies of his brethren. In 1682 he was appointed professor of the theory of medicine in the university, which had been recently established at Modena, by duke Francis II.; and he continued to fill this office for eighteen years, attending at the same time to practice, and not neglecting the cultivation of polite literature, to which he was particularly partial. The elegance

elegance of his Latin ſtyle in his writings, evinces the ſucceſs with which he purſued the ſtudy of the claſſics. In 1700 he was invited to a profeſſorſhip at the more diſtinguiſhed univerſity of Padua, and removed thither. Though ſomewhat advanced in age, he fulfilled the duties of his chair with an ardour, not to be ſurpaſſed by his junior colleagues, for the ſpace of three years, when he was attacked with a diſeaſe of the eyes, which threatened to deſtroy his viſion, and which, in fact, did ultimately deprive him of that faculty. Having loſt the pleaſure of reading, which was the only ſource of his regret, he ſupplied that amuſement by the aſſiſtance of his grand-children, who read to him, and acted as his amanuenſes. In 1708, however, the ſenate of Venice appointed him preſident of the college of phyſicians of that capital, and in the following year raiſed him to the firſt profeſſorſhip of the practice of medicine. He continued to perform the duties of theſe honourable poſts, at the earneſt ſolicitations of his conſtituents and pupils, with great diligence, to the end of his life, and died on his birth-day, November 5th, 1714, in conſequence of an attack of apoplexy, which ſeized him while he was preparing for his lectures, at the age of 81.

Ramazzini was a member of ſeveral of the academies of ſcience eſtabliſhed in Germany, Berlin, &c., and left ſeveral works; the principal of which, and one which will ever be held in eſtimation, is his treatiſe on the diſeaſes of artiſts and manufacturers, entitled "De Morbis Artificum Diatriba," firſt publiſhed in 1700, and frequently reprinted. He alſo publiſhed ſome tracts relative to certain epidemics, both among men and cattle; ſome "Ephemerides Barometricæ;" a work on the abuſe of Peruvian bark; and ſeveral orations delivered in his profeſſorial capacity. All his works have been collected and publiſhed together at Padua, Geneva, London, and Naples; the edition of London is the moſt correct. Eloy Dict. Hiſt. de la Med. Hutchinſon's Biog. Med.

RAMBANG, in *Geography*. See REMBANG.

RAMBERVILLER, or REMBERVILLEE, a town of France, in the department of the Voſges, and chief place of a canton, in the diſtrict of Epinal; 19 miles E. of Merecourt. The place contains 4926, and the canton 14,014 inhabitants, on a territory of 317½ kiliometres, in 28 communes. N. lat. 43° 21′. E. long. 6° 43′.

RAMBIN, a town of Anterior Pomerania; 10 miles W.S.W. of Bergen.

RAMBLE, a town of Spain, in the province of Cordova; ſeven miles N.W. of Montella.—Alſo, a town on the W. coaſt of the iſland of Teneriffe; three miles W. of Laguna.

RAMBOUILLET, a town of France, in the department of the Seine and Oiſe, and chief place of a canton, in the diſtrict of Verſailles, the ſeat of a tribunal, and of a national farm, where the ſheep are much celebrated for the fineneſs of their wool; 27 miles S.W. of Paris. The place contains 2586, and the canton 9652 inhabitants, on a territory of 305 kiliometres, in 17 communes. N. lat. 48° 39′. E. long. 1° 54′.

RAMBURE, a town of France, in the department of the Somme; 3 miles W. of Oiſemont.

RAMBURELLES, a town of France, in the department of the Somme; 9 miles S. of Abbeville.

RAMCHUND-POUR, a town of Bengal; 30 miles N.E. of Calcutta.

RAMCHUNDRA, a town of Hindooſtan, in the circar of Mohurbunge; 23 miles S.S.E. of Harriopour.

RAMCHUNPOUR, a town of Bengal; 60 miles N. of Dacca.

RAMCOTTA, a town of Thibet; 18 miles S.W. of Sirinagur.

RAMCOUTY, a town of Hindooſtan, in Bahar; 28 miles N.E. of Goorackpour. N. lat. 26° 51′. E. long. 84° 8′.

RAMDILLY, a town of Hindooſtan, in the Nayrs; 25 miles N.N.W. of Tellicherry.

RAMEAU, JOHN PHILIP, in *Biography*, chevalier de St. Michel, compoſer to the king of France, and to l'Academie Royale de la Muſique, or ſerious opera at Paris, was born at Dijon in 1683. He went early in his life to Italy, and at his return was appointed organiſt at Clermont en Auvergne, where his "Traité de la Muſique" was written, in 1722. He was afterwards elected organiſt of St. Croix de la Bretonnerie at Paris. Here his time was chiefly employed in teaching; however, he publiſhed harpſichord leſſons, and ſeveral other theoretical works, without diſtinguiſhing himſelf much as a vocal compoſer, till the year 1733, when, at fifty years of age, he produced his firſt opera of "Hippolite et Aricie." The muſic of this drama excited profeſſional envy and national diſcord. Party rage was now as violent between the admirers of Lulli and Rameau, as in England between the friends of Bononcini and Handel, or, in modern times, at Paris, between the Gluckiſts and the Piccíniſts.

When the French, during the laſt century, were ſo contented with the muſic of Lulli, it was nearly as good as that of other countries, and better patronized and ſupported by the moſt ſplendid prince in Europe. But this nation, ſo frequently accuſed of more volatility and caprice than their neighbours, have manifeſted a ſteady perſevering conſtancy in their muſic, which the ſtrongeſt ridicule and contempt of other nations could never vanquiſh.

Rameau only anſwered his antagoniſts by new productions, which were ſtill more ſucceſsful; and, at length, he was acknowledged by his countrymen to be not only ſuperior to all competition at Paris, but ſole monarch of the muſical world. From 1733 to 1760 he compoſed twenty-one operas, of which the names and dates are annually publiſhed in the "Spectacles de Paris," and in many other periodical works.

Rameau's ſtyle of compoſition, which continued in favour almoſt unmoleſted for upwards of forty years, though formed upon that of Lulli, is more rich in harmony, and varied in melody. The *genre*, however diſpleaſing to all ears but thoſe of France, which had been nurſed in it, was carried by the learning and genius of Rameau to its acme of perfection; and when that is achieved in any ſtyle, it becomes the buſineſs of ſubſequent compoſers to invent or adopt another, in which ſomething is ſtill left to be done, beſides ſervile imitation.

The opera of "Caſtor and Pollux" having been long regarded in France as the maſter-piece of this compoſer, we ſhall here inſert a few remarks upon it, that have been made on a recent examination.

The overture is the beſt of this author, upon Lulli's plan. The opening ſymphony is beautiful; but why the ſame melody was not applied, in the ſame meaſure, to the poetry, we know not, unleſs the verſification required a change of time; but, in that caſe, why write the ſymphony on a ſubject that would not ſuit the words? But thoſe eternal changes in the meaſure, which teaze and diſappoint the ear of all that are uſed to other muſic, is general in ſerious French operas, and ſeems as much the fault of the poet as muſician. It is, however, wonderful, that this defect was not ſooner diſcovered. The over-charged tenderneſs of Rameau's muſic appears in all his ſlow movements, which are in one ſtyle, and generally in triple time. This maſter perpetually

tually discovers himself to be a great harmonist; but inured to a bad taste and style of composition, as well as to bad singing, he has only augmented the defects of his predecessors, and rendered what was rude and clumsy in Lulli still more offensive, by endeavours at sweetness or high seasoning. The appoggiaturas, or leaning notes, being so frequently incorporated in the harmony, renders it crude, and the hanging on every note, as if unwilling to relinquish it, checks and impedes the motion of the air, and gives it a slow and languid effect, however lively the theme on which it is composed. Every passage in such melody resembles a French heroic verse:

> "Each is an *Alexandrine*, through the song,
> That, like a wounded snake, drags its slow length along."

The opening of the second act, "Que tout gemisse," is very fine, and the pathos well applied; but the subsequent air, which is cast in an admirable mould, is spoiled by frequent and unnecessary changes of measure; and yet in spite of these defects, and the vocal outrages of mademoiselle Arnould, we were more pleased and affected by this scene, than any other we ever heard at the French serious opera. The march, which has few appoggiaturas in it, is like other Christian music.

The *prelude tendre*, at the opening of the third act, abounds with too many of these drags, which being equally harsh to the ear and injurious to pulsation, seem to prevent the performer from ever falling on his feet; and bar eleventh, the chord of the superfluous fifth, which makes all nature shudder, except our Gallic neighbours, is here continued so long, that it distorts the countenance of every other hearer, like *hiera picra*. The major minuet, page 121, after so long and tiresome a minority, is rich in harmony and graceful in melody. The voice is worse used by the composer than the most insignificant instrument. For after several symphonies that are extremely promising, and the ear has been made to expect a continuation of the prefatory strain, nothing is given to the vocal part but broken accents and dislocated measures. In the *chaconne*, which is admirable, the measure is well marked and well accented. This must long have preceded Jomelli's favourite chaconne, and have served as a model to him, Theller, and others, in composing this species of dance. More genius and invention appear in the dances of Rameau than elsewhere, because in them, there is a necessity for motion, measure, and symmetry of phrase. And it may with truth be said, that nothing in Lulli's operas was imitated or adopted by the rest of Europe, but the style of his overtures, or in Rameau's, but the dances.

But though the several merits of this musician have been too much magnified by partizans and patriots in France, and too much depreciated by the abettors of other systems and other styles, as well as patriots of other countries, yet Rameau was a great man; nor can the professor of any art or science mount to the summit of fame, and be elected by his countrymen supreme dictator in his particular faculty, without a large portion of genius and abilities.

The successful revival of his opera of "Castor and Pollux" in 1754, after the victory obtained by his friends over the Italian burletta singers who had raised such disturbance by their performance of Pergolesi's intermezzo, the "Serva Padrona," was regarded as the most glorious event of his life. The partizans for the national honour could never hear it often enough. "This beautiful opera," says M. de la Borde, "without any diminution in the applause or pleasure of the audience, supported a hundred representations, charming at once the soul, heart, mind, eyes, ears, and imagination of all Paris."

From this era to the time of his death, in 1767, at eighty-four years of age, Rameau's glory was complete. The Royal Academy of Music, who all regarded themselves as his children, performed a solemn service in the church of the Oratory, at his funeral. And M. Philidor had a mass performed at the church of the Carmelites, in honour of a man whose talents he so much revered. See Base, Basse *Fondamentale*, and Counterpoint.

RAMED, a name given by some chemical writers to rhubarb.

RAMEDEGA, in *Geography*, a town of Hindoostan, in the circar of Gangpour; 15 miles S.W. of Pada.

RAMEE, a town of Bengal; 50 miles S. of Islamabad.

RAMEEAPATAM, a town of Hindoostan, in the Carnatic; 30 miles S. of Ongole.

RAMEEPOUR, a town of Hindoostan, in Allahabad; 35 miles E.N.E. of Gazypour.

RAMELLI, Agostino, in *Biography*, a celebrated Italian mechanist and engineer, was born, in 1530, at Masanzana, in the diocese of Milan. Having entered the army, he served a considerable time under the marquis de Marignano, a general of Charles V. After this, he served under the duke of Anjou as captain, or engineer, at the siege of Rochelle, in 1573, where he was dangerously wounded, and taken prisoner. When that prince, afterwards Henry III., was called to the crown of Poland, he was the friend of Ramelli, and he nominated him his engineer when on the throne of France. In 1588 he published a work in Italian and French, entitled "Le Diverse et Artificiose Machine del Capitono Agostino Ramelli," &c. with nearly 200 figures, describing a great number of machines for various purposes, most of his own invention, and which exhibit much ingenious contrivance. The work is very scarce, and is much prized by the curious.

RAMELSPACH, in *Geography*, a town of Austria; 5 miles S.E. of Meissai.

RAMELTON, or Rathmelton, a small post-town of the county of Donegal, Ireland, situated on a bay at the bottom of lough Swilly. It is 117 miles N.W. by N. from Dublin.

RAMENAPILLY, a town of Hindoostan, in the circar of Rajamundry; 42 miles E. of Rajamundry.

RAMENTUM, in *Botany*, a form of pubescence in plants, which, as the name signifies, has the appearance of a shaving, being flat, membranous, mostly irregular in size and shape, quite unlike the uniform hairs or bristles of which the clothing of most plants consists. (See Pubescence.) The above term was first used, if we recollect rightly, by l'Heritier, and occurs in some species of *Begonia*. The scaliness of Ferns is of a similar nature.

RAMERUP, in *Geography*, a town of France, in the department of the Aube, and chief place of a canton, in the district of Arcis-sur-Aube; 6 miles E. of Arcis-sur-Aube. The place contains 493, and the canton 8870 inhabitants, on a territory of 440 kiliometres, in 29 communes.

RAMESAN, an oriental term for a month of fasting, very religiously observed among the Turks, and otherwise called *Ramadan*; which see.

RAMESERAM, in *Geography*, a town of Hindoostan, in the circar of Cuddapa; 6 miles E. of Gandicotta.

RAMETTA, a town of Sicily, in the valley of Demona; 6 miles W. of Messina.

RAMEX, (*ramus*, a branch,) in *Surgery*, a rupture, or hernia. See HERNIA.

RAMEX *Varicosus*. See CIRSOCELE.

RAMGAD, in *Geography*, a town of Hindooftan, in Bahar; 10 miles W. of Bahar.

RAMGARY, a town of Hindooftan, in the country of the Nayrs; 19 miles W.N.W. of Palicaudchery.

RAMGAUT, a town of Hindooftan, in the fubah of Delhi; 37 miles S.E. of Secundara.

RAM-GETTER, in *Rural Economy*, a term applied by the midland breeders to fuch rams as are proper for getting ram-ftock, in contradiftinction to fuch as are fit only for getting wedder-ftock. See RAM.

RAMGONGA, in *Geography*, a river of Afia, which rifes in Thibet, and runs into the Ganges, 10 miles N. of Canoge.

RAMGOT, a town of Hindooftan, in Conean; 25 miles N. of Goa.

RAMGUR, a circar of Bengal, bounded on the N. by Bahar, on the N.E. by Curruckdeagh, on the S.E. by Pachete, on the S. by Nagpour, and on the W. by Koonda and Toree; about 90 miles long, and 60 broad.—Alfo, the capital of this circar; 175 miles W.N.W. of Calcutta. N. lat. 23° 40′. E. long. 83° 42′.—Alfo, a town of Hindooftan, in Dowlatabad; 35 miles S. of Neermul. N. lat. 18° 30′. E. long. 79° 11′.—Alfo, a town of Hindooftan, in Malwa; 8 miles S. of Ragoopour.—Alfo, a town of Hindooftan, in the fubah of Delhi; 5 miles N. of Coel.—Alfo, a town of Hindooftan, in Guzerat; 50 miles E.S.E. of Surat.—Alfo, a town of Bengal; 13 miles N.W. of Midnapour.

RAMGUR. See SESVAH.

RAMGURRA, a town of Hindooftan, in the Myfore, captured by the Englifh in 1791; 42 miles N.E. of Seringapatam.

RAMHYTTE, a town of Sweden, in Weftmanland; 36 miles from Stromfholm.

RAMI, in *Hindoo Mythology*, one of the many names of the goddefs *Parvati*; which fee. Under this name fhe is faid to be worfhipped at the fplendid temple on the ifland called Ramiferam, between Ceylon and the cape named by us Comorin, but which fhould be called cape Kaumari, or Kumari, another of the names of this goddefs, and meaning the virgin. (On this point fee LANKA and PARVATI.) Sami is the name of a tree or wood facred to Parvati, and fhe is fometimes called Sami Rami, and it has been upheld that this is the origin of the Semiramis of the Greeks, (See hereon Af. Ref. vol. iv. p. 382. vol. viii. p. 256. 8vo. ed.) A defcription of the celebrated temple of Ramiferam will be found under that article. See alfo SAMI.

RAMJAVENPOUR, in *Geography*, a fort of Bengal; 27 miles S.S.W. of Burdwan.

RAMIFICATION, the production of boughs or branches, or of figures refembling branches.

RAMIFICATIONS, in *Anatomy*, are the divifions of the arteries, veins, and nerves, arifing from fome common trunk.

RAMIGRI, a word ufed by fome writers as a name for colophony.

RAMILLIES, in *Geography*, a village of France, in the department of the Sambre and Meufe, at the fource of the river Geete; worthy of being recorded on account of a battle fought here in the year 1706, between the allies commanded by the duke of Marlborough, and the French under marfhal Villeroy. The confederates took the whole of the enemy's baggage and artillery, and about 120 ftandards, 600 officers, and 6000 private foldiers: about 8000 were killed or wounded. The lofs of the allies did not exceed 3000 men; 13 miles N. of Namur.

RAMING, a town of Auftria; 11 miles S. of Steyr.—Alfo, a town of Perfia, in the province of Irak; 40 miles E. of Confar.

RAMINGAM, a town of Hindooftan, in Dowlatabad; 10 miles N. of Oudigher.

RAMINGSDORF, a town of Auftria; two miles E. of Steyr.

RAMINGUE, in the *Manege*. A horfe gets this name that is reftive, and refifts or cleaves to the fpurs; that is, defends himfelf with malice againft the fpurs; fometimes doubles the reins, and frequently yerks to favour his difobedience. See TICKLISH and DOUBLE.

RAMIS, BARTOLOMEO, in *Biography*, a Spaniard, the firft modern who fuftained the neceffity of a temperament in mufical inftruments, of which the tones are fixed. He was contemporary with Franchinus, and in 1482 publifhed a work, entitled "De Mufica, Tractatus, five Mufica practica."

He feems to have converted Pietro Aaron to his opinion: as that theorift manifeftly exalts the character of Ramis on all occafions at the expence of Franchinus.

The Spaniard was attacked in a rough manner by Nicholas Burtius, for differing from Guido in his divifion of the monochord, in a tract entitled "Mufices Opufculum cum Defenf. Guidonis Aretini adverfus quendam Hifpanum veritatis prævaricator." Bonon. 1487. This tract, printed in black letter, is in the Afhmol. Collect. among the books of Ant. Wood.

Burtius imagined the honour of Guido to be injured by the Spaniard, as Guido ufed the Pythagorean proportions, and had never thought of a temperament. Burtius, in his turn, was handled very roughly by Spataro, the difciple of Ramis (Joannes Spadarius Bononienfis, Mufices ac Bartolomii Rami Paulo ejus Præceptoris honefta Defenfio in Nicol. Burtij Parmenf. Opufc. Bologna, 1491.); and the venerable Franchinus, finding himfelf very rudely handled in the difpute by the favourers of temperament, in 1522, when he was upwards of feventy years of age, took up the defence of Pythagoras, as Fontenelle, at near a hundred, did of Des Cartes. After this, the war became general, and continued to rage with great violence for more than a century, between the friends of tempered fcales, and the adherents to ancient proportions and equal harmony.

RAMISERAM, in *Geography*, an ifland in the Indian fea, between the ifland of Ceylon and the coaft of Coromandel; to which there is a paffage of about 12 or 14 leagues from the ifland of Manaar, on the coaft of Ceylon. But the advantages that might be derived from this fpeedy communication are in a great meafure prevented by the numberlefs fhallows and fand-banks, which every where interrupt the paffage, and which are fo high, that many of them are dry except during the monfoons. There is in particular a line of fand-banks, which runs quite acrofs from Manaar to Ramiferam, denominated Adam's bridge, and alfo Rama's bridge, becaufe God is faid to have come by this way into Ceylon. (See ADAM's *Bridge* and MANAAR.) From Rama, Ramiferam takes its name, and it has a large temple dedicated to him. The fhortnefs of the paffage from Ramiferam to Manaar is particularly ufeful on account of the fpeedy conveyance it affords to people on bufinefs, and the communication of intelligence. The meffengers who ufually go from Columbo to Manaar, a diftance of 160 miles, in three days, take boat here, and crofs over by Adam's bridge to Ramiferam, and then proceed along the Coromandel coaft to Madras. An exprefs in favourable weather will run from Columbo to Madras in eight days, and the journey has been accomplifhed once in feven days. (See MANAAR.) The ifle of Ramiferam, which is the limit of the Hindoo religion in more modern times, and of the conquefts of the Muffulman princes, is, as we have faid, feparated from Ceylon by Adam's bridge. The ifland is low, fandy, and uncultivated, except with a few fcattered Palmira and cocoa-trees. The pagodas, for which it is fo famous, lie on the Ceylon fide, near the fea, and are the refort of innumerable multitudes of different fects of religion in India, during the feafon of certain feftivals. The numerous pagodas are conftructed in the fame ftile with thofe on the Coromandel coaft; and they are furrounded with the houfes of the brahmins, priefts, and other religious perfons, whofe zeal leads them to attend on their temples; among whom, in particular, may be feen the defcendants of the Tamuls, Telingas, Canarians, Mahrattas, and Orias, who compofe a great body of the original inhabitants of the fouthern peninfula. Their houfes are built of the cocoa-tree, in fmall fquares and ftreets, where their families are feen reclining on the little mud terraces, and under the payals or virandahs. They do not allow Europeans to enter thefe temples; but they are known to refemble thofe of the coaft in their crowded ornaments, fpires of brickwork, long porches in front, and viftas, at the extreme end of which are placed the deities, in an obfcure fituation, furrounded by lamps burning day and night. The fame referve to ftrangers fubfifts among all the fouthern brahmins. The brahmins allow no labour or cultivation to be carried on in the ifland of Ramiferam, confidering it altogether as facred. The contributions of thofe who vifit it are fufficient for the fupport of the temples. Several of the neighbouring Poligar chiefs contribute largely, and fome of thefe rajahs have ftatues erected to them for their gifts. The chief pagoda has feveral of thefe ftatues in its different fquares. Low as the fand lies in this ifland, good water is eafily procured; for on fcooping it up, the water collects immediately in the holes; but this is not the cafe in Manaar and the weft coaft of Ceylon.

The guardianfhip of this facred ifle belongs to a family of devotees, called "Byragees," the chief of whom is always doomed to celibacy: the fucceffion being carried on by the fifters or the collateral branch, who only are permitted to marry. This inftitution is fimilar to that of the fovereignty of the Travancorians and Nairs of the Malabar coaft. The clothes and turbans of the devotees are of a tawny red colour, decorated with large black beads, of a particular kind of wood. From the pagodas juft mentioned there runs out a long narrow piece of fand, terminating in a point, within a mile of which is a choultry at Tona Goody. This is a fquare of houfes with a court inclofed for the accommodation of pilgrims, who come to the fartheft point of the ifland to perform their ablutions in the fea, the moft facred and the pureft of their ceremonies. A brahmin takes care of this choultry, and a pole with a light is fixed at the end of the point to direct the pilgrim. N. lat. 9° 18′. E. long. 79° 22′. Percival's Ceylon.

Of the temple in this ifland we fhall give fome account, extracted from a publication of Mr. Cordiner, who vifited it. The external appearance is not remarkably grand, and at a diftance, no idea is excited of the minute ornaments and laboured workmanfhip which ftrike the eye on a nearer infpection. All the architecture feen without doors is infignificant, compared with the magnificence of the interior. After an examination of the whole ftructure, which is entirely of hewn ftone, Mr. C. deemed the extent of mafonic labour in its erection, muft have been equal to that of any of the moft fplendid cathedrals of Europe. "On entering it we were," he fays, "completely aftonifhed at the grandeur of the workmanfhip, and extent of the dimenfions, which far furpaffed any idea that we had formed of Indian magnificence." From the weft gate a low gallery, 144 feet in length, with three rows of pillars on each fide, leads down to the centre of the building; where it branches off, in galleries fimilarly conftructed, to the right and left, each extending 150 feet, then running from weft to eaft 500 feet, and enclofing an oblong rectangular fpace. The gallery runs alfo along the centre of the temple 788 feet, and a fimilar gallery runs acrofs from north to fouth, where are like entrances, interfecting the former in the centre of the rectangular fpace. All the galleries have on each fide triple rows of maffy ftone pillars, of highly laboured workmanfhip. Thofe in the front line are the largeft and moft fuperb, having a huge lion, with the mouth wide open, fculptured in bas relief, above three diftinct capitals, over which are a fcroll, and a richly ornamented cornice. Statues of the fize of life are attached to many of the pillars, reprefenting gods and deified perfons. The pillars ftand on a continued bafement, forming the floor of the galleries, raifed three feet, with fteps to afcend by, all of ftone. The roofs of all the galleries are flat, formed of ftones reaching acrofs, from the projection of one cornice to that of the other. The galleries are eighteen feet wide, and in the centre thirty feet high from the floor. The number of pillars within the temple amounts to 2628. The edifice is inclofed by a heavy ftone wall, 20 feet high, 830 feet from eaft to weft, and 625 from north to fouth. Large as thefe dimenfions may appear, they are ftated to be but fmall compared with thofe of temples on the continent of India, one of which covers a fquare mile of ground. The covered gallery, fronting the fouth gate, which feems unfinifhed, ftrikingly refembles the entrance of the Elephanta cavern, near Bombay. Solid pyramidal erections furmount the weftern and eaftern entrances, compofed externally of a great number of fmall pillars, two and two, in the form of window frames or gateways, rifing one above another, in feven different ftories. That over the weftern, which is the principal entrance, appears to be 150 feet high; the eaftern feems lower, and unfinifhed. The north and fouth gates are lefs majeftic than the others; but their completion is faid to be intended, when they will be fimilarly furmounted and ornamented as the weftern portal. Privileged perfons, among whom were women carrying water-pitchers, appeared conftantly paffing and re-paffing about the interior of the temple.

Two hundred Brahmins are attached to this temple, and fupported in eafe and luxury by its endowments. It is dedicated to Siva, the deftroying power, called by the vulgar Rama Lingam. It contains likewife, Mr. Cordiner fays, images of Vifhnu the preferver, and of all the fubordinate divinities. Of Brahma, the creator, he ftates, the Hindoos never dare to form any likenefs. This is a common error, that is explained and corrected in the article IDOLATRY of this work.

A broad ftreet runs parallel to each fide of the temple compofed of comfortable houfes, and large choultries for the accommodation of pilgrims and travellers, of ftone, with flat roofs fupported in front by pillars; the fronts being open. In one of thefe Mr. Cordiner obferved two ivory palankeens inlaid with gold, the property of officers belonging to the fanctuary. In others he noticed five carriages, called by the Englifh Swamy coaches, ufed for the purpofes of carrying the idols in proceffion: the ufe to which the ivory palankeens are, we apprehend, alfo applied.

Thefe

These carriages are described as solid masses of wood, of a pyramidal shape, intended to symbolize the Linga. (See LINGA.) The exterior of these coaches are covered with grossly obscene carving.

At the external corners of the temple, and in the streets of the town, there are smaller temples in honour of different deities, and containing images. In some of the streets spreading trees, among them the ficus religiosa and tamarind, are surrounded with square stone terraces, on which are placed little images of Pollear or Ganesa, (see POLLEAR,) the Linga, two serpents entwined, and other emblems of Hindoo mythology. These terraces are used for contemplation, or more active religious duties, as noticed under the article PRADAKSHNA. Rows of fruit-trees, among them the cocoa-nut, plantain, and pomegranate, stand in gardens beyond the north and south walls of the temple.

On the opposite side of the island, near the sea, distant about eight miles from the temple, is the ancient fort and choultry of Pombom. The road between is very elegantly paved with smooth stones, each six feet by four; and the greater part of the road is nobly shaded by the most beautiful and majestic trees. The larger trees of this superb avenue are surrounded by smooth raised terraces of masonry, on which travellers rest in comfort, completely shaded. About half way between the grand temple and Pombom is a very elegant small temple, built on the same general plan with the larger, having two massy towers raised in the centre of the oblong area, and a covered walk, with three rows of pillars on each side, all round. The outside of the towers is completely covered with statues in miniature, representing all the variety of their mythological divinities. The choultry, for the accommodation of pilgrims and travellers at Pombom, has two fronts, and three inclosed squares; and is surrounded by piazzas raised several feet, with square pillars and terraced roofs. Contiguous is a small temple, the door of which was open, displaying an image of Ganesa or Pollear, in the usual form, elephant-headed and pot-bellied, ornamented with necklaces of flowers.

There are several other elegant temples on this interesting island, which is entirely dedicated to the purposes of religion. No plough is allowed to break the soil, and no animal, wild or tame, is ever killed on it.

Dancing girls, mountebanks, and beggars, abound here, as in other resorts of the idle and wealthy.

The small remains of antiquity still extant on Ceylon, sufficiently prove that similar religious institutions did once exist there, and that choultries and temples were erected at the different stages, all the way from Manaar through the island, 200 miles, to Dondra, its southern extremity, and the ultimate extent of Hindoo pilgrimage. At the latter place, the ruins of a temple dedicated to Siva are still to be recognized; but only some rows of scattered pillars, and a few remnants of broken images, have survived the fanatic fury of the early European invaders. Rama's peaceful island falling under the protection of a more liberal and enlightened government, fortunately escaped those religious tempests, which spread destruction round the coasts of Ceylon.

Lord Valentia has more recently visited this interesting scene, and Mr. Salt, who accompanied his lordship, has published a very elegant view of the temple. The entrance is described to be through a gateway, about 100 feet high, covered with carved work to the summit. The door is 40 feet high, composed of single stones placed perpendicularly, with others crossing. This massive workmanship reminded lord Valentia of the ruins of Egyptian architecture. He describes the quadrangle to be about 600 feet each side, and says that, on the whole, this temple is the finest piece of architecture that he had seen in the east. Words, he says, cannot describe its magnificence. The concourse of pilgrims is very great, and brings in a large sum; each paying according to his rank. The raja of Tanjore had been expected the year before, but could not afford it; as in presents and various expences, it was estimated that his highness could not have performed this act of devotion under 60,000 pagodas, about 25,000*l.* sterling. His whole family would of course have expected to participate in the happiness and benefits of the pilgrimage. The idol uses no water but what is brought from the Ganges by fakirs: with this it is bathed every morning; and this holy water, thus acquiring additional sanctity, is sought and purchased by the devout for sin-expelling purposes.

RAMISTS, in the *History of Learning*, the disciples of Peter Ramus, who was born in a small village in Picardy, in 1515, and from being a servant in the college of Navarre at Paris, became, by his talents, industry, and perseverance, one of the most famous professors of the sixteenth century. By attacking the authority of Aristotle, and attempting to substitute in the place of his logic a method of reasoning better adapted to the use of rhetoric and improvement of eloquence, he excited a terrible uproar in the Gallic schools; so that the two first books he published, *viz.* his "Institutiones Dialecticæ," and "Aristotelicæ Animadversiones," were prohibited through the kingdom of France, and the author prohibited from any more teaching philosophy. His enemies persecuted him with lampoons and satires, and even held him up to public ridicule on the stage. However, Ramus afterwards recovered his credit, so that he obtained the royal professorship of philosophy and eloquence, and afterwards of mathematics, at Paris, in 1547. But his enemies were inveterate in their persecution of him, and as soon as it was known that he favoured the party of the Hugonots, he was obliged once again to withdraw himself from the effects of their resentment. In the intervals of peace, he returned to his station; but in 1568, when the civil war was a third time renewed, he resolved to leave France, and make a tour through Germany. After spending three years in visiting the principal German universities, and receiving many tokens of respect, he resolved, fatally for himself, in 1571, to return to his own country. Accordingly he settled at Paris, where he perished in the massacre on St. Bartholomew's day. On the tumult of this execrable day, Charpentaire, professor of mathematics, who had been eclipsed by the superior talents of Ramus, seized the opportunity of being revenged upon his rival, and, under the pretence of religion, employed assassins to murder him. His body was afterwards thrown into the street to the enraged pupils of Charpentaire, who dragged it ignominiously along the streets, and then cast it into the Seine.

The disciples of Ramus, such was the astonishing influence of their master's learning and character, prevailed so far as to banish the Peripatetic philosophy from several seminaries of learning, and to substitute in its place the system of their master, which was of a more practical kind, and better adapted to the purposes of life.

Although he had considerable merit in exposing the defects and inconsistencies of the Aristotelian philosophy, he does not seem to have been equally successful in his attempt to establish a new logical institute. The general outline of his plan is as follows. Considering dialectics as the art of deducing conclusions from premises, he endeavours to improve this art, by uniting it with that of rhetoric. Of the several branches of rhetoric he considers invention and disposition pofition as belonging equally to logic. Following chiefly the example of Cicero, he divides his treatife on Dialectics into two parts; the firft of which treats of the invention of arguments, the fecond of judgments. Arguments he derives not only from what the Ariftotelians call middle terms, but from any kind of propofitions, which, connected with another, may ferve to prove any affertion. Of thefe he enumerates various kinds. Judgments he divides into axioms, or felf-evident propofitions, and "dianoëa," or deductions by means of a feries of arguments. Both thefe he divides into various claffes; and illuftrates the whole by examples from the ancient orators and poets.

In the logic of Ramus, many things are borrowed from Ariftotle, and only appear under new names; and many others are derived from other Grecian fources, and particularly from the dialogues of Plato, and the logic of the Stoics. Whilft the author has the merit of turning the art of reafoning from the futile fpeculations of the fchools to forenfic and common ufe, his plan is defective in confining the whole dialectic art to the fingle object of difputation, and in omitting many things which refpect the general culture of the underftanding, and the inveftigation of truth. Defective as the fyftem of Ramus is, lord Bacon (Augm. Sc. l. vi. c. 2.) has paffed too fevere a cenfure upon him, and others have concurred in it: for he is unqueftionably entitled to great commendation for having, at the period in which he lived and wrote, with fo much firmnefs and perfeverance, afferted the natural freedom of the human underftanding. The logic of Ramus obtained great authority in the fchools of Germany, Great Britain, Holland, and France; and fcience derived ultimate advantages from the contefts which were maintained between the followers of Ramus and thofe of the Stagyrite. But the fame of Ramus vanifhed before that of Des Cartes. Brucker's Phil. by Enfield, vol. ii.

RAMLA, in *Geography*, the original *Arimathea*, a town of Paleftine, diftant one-third of a league from the village of Loudd, or the ancient Lydda and Diofpolis. This town is almoft in as ruinous a ftate as Loudd itfelf. Within its boundaries nothing is found but rubbifh; neverthelefs, the aga of Gaza refides here in a ferai, the floors and walls of which are tumbling down. He maintains about 100 horfemen, and as many Barbary foldiers, who are lodged in an old Chriftian church, the nave of which is ufed as a ftable, and in an ancient kan, which is difputed with them by the fcorpions. The adjacent country is planted with lofty olive trees, difpofed in quincunces. Amidft thefe plantations, which are decaying, are found dry wells, cifterns fallen in, and vaft vaulted refervoirs, which prove that, in ancient times, this town muft have been upwards of 1½ league in circumference. At prefent it fcarcely contains 200 families. The little land, which is cultivated by a few of them, belongs to the mufti, and two or three of his relations. The reft content themfelves with fpinning cotton, which is chiefly purchafed by two French houfes eftablifhed there. At Ramla there is alfo a foap manufactory, the produce of which is almoft wholly fent to Egypt. In 1784 the aga built here a wind-mill, which, fays Volney, is the only one I have feen in Syria or Egypt, though they are faid to have been invented in thefe countries. The only remarkable antiquity at Ramla is the minaret of a ruined mofque on the road to Yafa. By an Arabic infcription, it appears to have been built by Sai-el-din, fultan of Egypt. From the fummit, for it is very lofty, the eye difcerns the whole chain of mountains, which begins at Nablous, and fkirting the plain, lofes itfelf toward the fouth. Volney's Travels in Egypt and Syria, vol. ii.

RAMLEAH, a mountain of Arabia, in the province of Nedsjed, extending from S.W. to N.E. about 250 miles; the S.W. extremity being 80 miles E. of Kalaat el Moilah.

RAMLER, Charles-William, in *Biography*, a celebrated German poet and profeffor of belles lettres at Berlin, was born at Colberg in the year 1725. He was diftinguifhed at a very early period by his poetical genius; and in 1754 publifhed a poem, entitled "The Game of Chefs," which difplayed a confiderable fhare of genius. In 1758 he tranflated the abbè Batteaux's Treatife on the Belles Lettres, which he adapted to the genius of his native language, and added fome differtations on the German ftyle and verfification. In the following year he publifhed, in conjunction with Leffing, the epigrams of Logan, an author who, notwithftanding his great merit, had been fuffered to remain in obfcurity. In 1760 he publifhed "Sacred Cantatas," which were followed, during the next 20 years, by a great number of other publications, chiefly poetical, of which a lift is given in the General Biography. In the year 1780 Ramler turned his attention to feveral of the old German poets, and publifhed at Leipfic the Epigrams of Wernike, Opitz, Tfcherning, Andrew Gryphius, and Adam Olearius. He was fo fuccefsful in polifhing the works of others, and gave fuch proofs of his tafte and critical talents, that Göze, one of the moft diftinguifhed German amatory poets, allowed him full liberty in his laft will to retain or reject fuch parts of his poems as he might think proper. In 1782-3 he publifhed at Berlin a tranflation of the poetical pieces in the different volumes of the Spectator, which he followed, in the fubfequent ten years, by a variety of other works on different fubjects; among which may be mentioned "A fhort Introduction to Mythology, in two Parts." Ramler has been ftyled the German Horace; and his biographer fays, that though his verfes difplay perhaps lefs boldnefs and fimplicity than thofe of the Roman, they equal them in fublimity, and furpafs them in harmony. It has been remarked to the honour of Ramler, that he attached to him Frederic the Great, and his fucceffor, by his poetical talents: from the latter he had a confiderable penfion paid him during the clofing years of his life. Ramler was one of the directors of the national theatre at Berlin, and profeffor of the belles lettres in the fchool of the corps of cadets; but the latter office he refigned in 1790. Gen. Biog.

RAMME, in *Geography*, a river of the duchy of Bremen, which joins the Ofte, near its fource.

RAMMED *Earth Buildings*, in *Rural Economy*, are fuch as are raifed with fome fort of earthy material. This mode of building with earthy materials is fuppofed by fome to have been known at a very early period, and has been long practifed with fuccefs in the fouthern parts of France, efpecially about Lyons, though but little underftood in any other part of Europe until lately. This method has, however, appeared to have fo many advantages, that it was made trial of in different places in this country; and the refult has been fo favourable, that the practice feems to deferve the attention of the proprietors of land, in all fituations where buildings are to be erected on a cheap and economical plan. In order to facilitate the knowledge of the art, Mr. Holland has prefented the public with the method of performing the bufinefs, in a paper, tranflated from a French work on the fubject, inferted in the firft volume of Communications to the Board of Agriculture, in which he fays that the French writer, M. Francois Cointeraux, remarks, that the poffibility of raifing the walls of houfes two or even three ftories high, with earth only, which will fuftain floors loaded with the heavieft weights, and of building the largeft manufactories in this manner, may aftonifh every one who has not become an eye-witnefs of fuch things. It is a method, which in the above diftrict of France is known by the term *pifé;* but as it is accomplifhed by the ramming or compreffing earth, or earthy fubftances, in moulds or cafes, the above term has alfo been applied to it. See Pisé, *Building in.*

RAMMEKENS, in *Geography*, a fea-port town of Holland, in the ifle of Walcheren, formerly one of the beft harbours in Zealand. This town, which was conftructed as a fortrefs in the year 1547, and called "Zeebourg," was one of the towns pledged to queen Elizabeth by the ftates general for the fuccours fhe lent them againft Spain in the year 1585; three miles E. of Flufhing.

RAMMEL, in *Agriculture*, a term applied to a fubftance which forms a part of the fubfoil or fubftrata of particular diftricts. It is ufually covered with a thin weak earth or mould in fome places. It is penetrable by the roots of fome plants, but notwithftanding that, is very unfriendly to the vegetation of plants in general. It is frequently met with in Chefhire and fome other counties. See Soil.

The term fignifies a compofition of various kinds of clay, white fand, and gravel, which is intimately intermixed with a fmall portion of oxyd of iron. It is for the moft part found under a weak brown or grey earth which is rarely more than four or five inches in depth in the above diftrict, lying in ftrata of from eighteen to thirty inches in thicknefs, upon a white or red fand or clayey marle, the latter often partaking of its nature for the depth of fome feet. Rammel or rammelly foils are therefore conftantly of a barren and unproductive nature.

RAMMELBERG, in *Geography*, a large and lofty mountain in Weftphalia, celebrated for its mines. Thefe mine-works yield lead, copper, filver, fome gold, borax, lapis calaminaris, zinc, fulphur, jet, vitriol, and yellow ochre. It lies near Goflar.—Alfo, a town of Weftphalia, in the county of Mansfeld; three miles S.E. of Wippra.

RAMMELLY, in *Agriculture*, a word ufed to fignify fuch crops as are tall or rank, as beans, &c.

RAMMER, a well-known implement formed of wood in different ways, according to the purpofe for which it is to be ufed. Thefe implements are very neceffary in putting pofts into the ground, in inclofing land, in order to clofe the earth firmly about them, as well as for laying down turf or fward, in order to render it fmooth and even. See Beetle.

Rammer *of a Gun*, the *gun-ftick;* a rod or ftaff ufed in charging a gun, to drive home the powder to the breech, as alfo the fhot, and the wad, which keeps the fhot from rolling out.

The rammer of a great gun is a cylinder of wood, whofe diameter and length are each equal to the diameter of the fhot, with a handle fixed to it. See Spunge.

RAMNA, in *Geography*, a mountain of Bofnia; 16 miles N. of Orach.

RAMNAGUR, a town of Hindooftan, in Bahar; 42 miles N.E. of Durbungah.—Alfo, a town of Bengal; 10 miles N.E. of Kifhenagur.—Alfo, a town of Hindooftan, in Oude; 27 miles N.E. of Lucknow.

RAMONCHAMP, a town of France, in the department of the Vofges, and chief place of a canton, in the diftrict of Remiremont. The place contains 2385, and the canton 11,325 inhabitants, on a territory of 245 kiliometres, in 6 communes.

RAMONDON, Lewis, in *Biography*, an Englifh finger, who firft appeared on the ftage of Drury-lane in 1706. But he fung in Arfinoe, and Pyrrhus and Demetrius, when thefe operas were performed at the Queen's theatre in the Haymarket. He appears no more as a public finger after this period, but his name occurs as a compofer in a collection of fongs called the "Merry Mufician," 1716; and as the editor of "the fong tunes in the opera of Camilla, contrived and fitted to the harpfichord or fpinet;" in the title of which it is faid, "that the leffons being placed on five lines render them proper for a violin and a bafe." Almoft all organ and harpfichord mufic was till this time written and printed on fix lines.

RAMOO, in *Geography*, a town of Aracan; 60 miles N.N.W. of Aracan.

RAMOR, Lough, a lake of Ireland, in the fouthern part of the county of Cavan, which contains feveral iflands, on which are beheld the ruins of fome ancient caftles. Thefe were formerly adorned with wood, but are now bleak and defolate. The river Blackwater, which iffues from it, joins the Boyne at Ravan. Lough Ramor is about 13 miles S. from Cavan.

RAMOS, or Lamos, a river of Africa, which runs into the Atlantic, 60 miles N.N.W. of cape Formofa. N. lat. 5° 45'.

Ramos, *Dos*, an ifland in the river of the Amazons, about 70 miles long, and from 10 to 20 broad; 60 miles above Pauxis.

RAMOSE Leaf, in *Botany*. See Leaf.

RAMOTH, in *Scripture Geography*, a famous city of Paleftine, in the mountains of Gilead, and hence called Ramoth-Gilead. This city belonged to the tribe of Gad. It was affigned to the Levites, and was one of the cities of refuge beyond Jordan. According to Eufebius, it was 15 miles E. from Philadelphia; but St. Jerom places it in the vicinity of Jabok, and confequently N. of Philadelphia.

RAMOUCH, in *Geography*, a river of Thibet, which runs into the Dewa, N. lat. 30° 20'.

RAMOURY, a town of Hindooftan, in the circar of Hindia; 20 miles E. of Hurdah.

RAMPAH, a town of Hindooftan, in the circar of Rajamundry; 40 miles N. of Rajamundry.

RAMPANT, in *Heraldry*, is applied to a lion, bear, leopard, or other beaft, in pofture of climbing, or ftanding upright upon his hind-legs, and rearing up his fore-feet; fhewing only half of his face, as one eye, and one ear.

The term is French; and fignifies, literally, *creeping*.

It is different from *faliant*, which denotes a pofture lefs erect, or fomewhat ftooping forwards, as if making a fally.

This pofture is to be fpecified, in blazoning, in all animals, except in the lion and gryphon; it being their natural fituation.

RAMPARA, in *Geography*, a town of Hindooftan, in Concan; 20 miles N. of Gheriah.

RAMPART, or Rampier, in *Fortification*, a maffy bank, or elevation of earth about the body of a place, to cover it from the direct fire of the enemy, and of fufficient thicknefs to refift the efforts of the cannon for many days; and formed into baftions, curtains, &c.

The word is formed from the Spanifh *amparo, defence*, or *covering*.

Upon the rampart the foldiers continually keep guard, and pieces of artillery are planted there for the defence of the place. Hence, to fhelter the guard from the enemy's fhot, the outfide of the rampart is built higher than the infide, *i. e.* a parapet is raifed upon it with a platform. Hence, alfo, earth not being capable to be raifed perpendicularly, like ftone, the rampart is built with a talus or flope, both on the inner and outer fide.

The rampart is fometimes lined, *i. e.* fortified with a ftone wall withinfide, otherwife it hath a berme.

It is encompaffed alfo with a moat or ditch, out of which the earth that forms the rampart is dug.

The height of the rampart fhould not exceed three fathoms, this being fufficient to cover the houfes from the battery of the cannon: neither ought its thicknefs to be above ten or twelve, unlefs more earth be taken out of the ditch than can be otherwife beftowed. See Construction, *according to M. Vauban's firft Method.*

The ramparts of half-moons are the better for being low, that the fmall fire of the defendants may the better reach the bottom of the ditch; but yet they muft be fo high as not to be commanded by the covert-way.

Rampart is alfo ufed, in *Civil Architecture*, for the fpace left void between the wall of a city and the next houfes. This is what the Romans call *pomærium*, in which it was forbid to build, and where they planted rows of trees, for the people to walk and amufe themfelves under.

RAMPARTS, in *Geography*, a town of Bengal; 8 miles S.E. of Rungpour.

RAMPERING, or Sodding, denotes the procefs of building fod or turf walls, or banks.

RAMPFERSGRUBE, in *Geography*, a town of Germany, in the county of Henneberg; fix miles W. of Meinungen.

RAMPHASTOS, the *Toucan*, in *Ornithology*, a genus of birds of the order Picæ, of which the generic character is as follows: Bill very large, light, hollow, convex, ferrate at the edges; each mandible incurvate at the tip; noftrils behind the bafe of the bill, long, narrow; the tongue is feathered at the edges, the feet moftly climbers.

The birds of this genus firft became known to naturalifts on the difcovery of South America, and to the warmer regions they appear, in general, to be confined. Like the hornbills, they are diftinguifhed by the fize of their beaks, which, in fome fpecies, is nearly equal to that of the whole body. It is, howevor, of a very light fubftance, and, in the living bird, it is compreffible between the fingers. Both mandibles are ferrated in an outward direction; the tongue is of a highly fingular form, reprefenting the appearance of a very narrow lanceolate feather, being of a fomewhat horny or cartilaginous nature, and divided on each fide into innumerable fhort and clofe-fet fibres; in confequence of which ftructure it was defcribed by fome early writers on natural hiftory as a real feather, fupplying the place of a tongue. The orbits of the eyes are generally bare. The toucans are fuppofed to feed on fruits, but in a ftate of captivity they will eat animal food. They depofit their eggs, which are ufually two in number, in the hollows of trees, on the furface of the decayed wood. Thefe birds have been as yet met with only in South America, and there merely between the tropics, being totally incapable of fuftaining the cold. They are eafily tamed and familiarized, and feveral fpecies have been brought to England, where fruits, fifh, and flefh have been promifcuoufly devoured by them with confiderable voracity. Whatever was received by the bill was thrown into the air, and on its return caught, and, without the flighteft maftication, inftantly devoured. There are feventeen fpecies enumerated by Gmelin, though Mr. Latham mentions only fifteen.

Species.

Viridis; Green Toucan. Green, with a yellow belly, and red rump. This fpecies is found in Cayenne, and is about fourteen inches long. The upper mandible is yellow, with red fides, and a black line in the middle; the lower one is black, the bafe and round the noftrils are red; the teeth in both are white; the irides and naked orbits are yellow; the legs are of a lead colour; the claws are black; the tail is wedged, beneath inclining to afh; head, chin, and throat, in the male black, in the female bay, terminated by a black narrow tranfverfe band.

Edentulus; Toothlefs Toucan. In this the bill is not ferrate at the edges. It inhabits Cayenne, and is twelve inches long. The upper part of the body is green, but beneath it is more of a yellowifh colour; the head and neck are chefnut; the rump is red; the upper mandible is brown, the lower black; the thighs green, and it is thought to be a variety of the *viridis*.

Pavonicus; Pavonine Toucan. The general colour of this is green; but the feathers are fprinkled with red fpots. It is alfo known by a mixture of red and changeable or peacock-coloured feathers interfperfed. The bill is variegated yellow and black; the legs and claws are black.

Piperivorus; Piperine Toucan. Green; the fore parts are black; the vent and thighs red. This fpecies has been defcribed by Edwards under the name of the green toucan. Its length is about feventeen inches, and its general colour is of a dull green; the head, neck, and breaft, are of a deep black; behind each ear is a fomewhat lengthened orange-coloured fpot, and immediately behind the lower part of the neck is an orange-coloured bar or collar; the belly is pale and yellowifh-green; the thighs are purple; the vent is red, and the tail, which is cuneated, flightly tipped with dull red; the bill is about three inches long, and of a black colour, but towards the bafe it is varied with red, whitifh, and orange-yellow. In the female the head, neck, and breaft, are brown inftead of black, and the lower part of the belly is grey. It is a native of Cayenne, and faid to feed on the pepper of the country. The female of this fpecies has been known to vary in having the bill of a horn colour, with a black bar near the end, and two others near the edge; the ridge alfo being black, and the yellow crefcent at the neck is wanting.

Aracari. This fpecies is green, but the abdominal band, vent, and rump, are red; the belly and breaft are yellow. It is a native of Brazil, Surinam, and Cayenne, and is full fixteen inches long. The upper mandible is black on the back and tip, but the fides are whitifh. The bafe is three-lobed at the noftrils, with a white arch at the root, lower black; the head, the wings, and tail, are black; the breaft and body are yellow and fcarlet, with a black roundifh fpot in the middle of the breaft, and a fimilar tranfverfe one on the beginning of the belly; the thighs are tawny.

Torquatus; Collared Toucan. This bird is black above, and beneath it is whitifh; the belly is green, the hind part is red, and the collar red. It inhabits the coafts of New Spain, is about eighteen inches long, and feeds on fifh. The upper mandible is blackifh, and the lower black; the irides are of a reddifh-yellow; the head and neck are black; the lower tail-coverts are red; the thighs purple; the legs are of a greenifh-afh colour; the claws are black.

Piscivorus; Brazil Toucan. This is blackifh, but the abdominal band and vent are red; the rump is white. It inhabits South America, and is twenty-one inches long. The bill is yellow, with a fcarlet fpot on the tip; the lower mandible is blue; the cap, back, wings, tail, belly, and thighs, are black; the temples, chin, breaft, and rump, are white.

Erythrorynchos; Red-beaked Toucan. Blackifh; cheeks, chin, and throat, white; upper tail-coverts fulphur, but the lower and crefcent on the breaft are red. This is

 found

found in various parts of South America. The base and back of the bill are yellow; tip of the upper mandible, and hollow of the lower, red; the nostrils are edged with black; the orbits are blueish; the legs are plumbeous, and the claws are black.

Tucanus; Yellow-breasted Toucan. This is also blackish; the abdominal band, vent, and rump, yellow. It measures about nineteen inches in length, and has been described by Mr. Edwards from a living specimen brought into England. According to this gentleman, the bill of this species is large in proportion to the size of the bird; it is compressed sideways, having a sharp ridge along its upper part, and toothed on its edges; the upper mandible is green, with a long triangular spot of orange colour on each side, and the ridge on the upper part yellow; the lower mandible is blue, with a shade of green in the middle; the point is red; it has about five transverse faint dusky bars, which cross the joinings of the two mandibles; the nostrils are invisible in the black line that surrounds the bill; the iris of the eye is of a fair green colour; round the eye is a broad space of naked skin, of a violet colour; the skin beneath the feathers is of a violet colour, below which is a bar of scarlet feathers, which parts the yellow on the breast from the black on the belly; the covert-feathers of the tail are white above, and those beneath are of a fine red; the crown of the head, upper part of the neck, the back, wings, belly, and tail, wholly black, though on the upper side of the wings and tail it has a changeable gloss of blueish-purple; the legs and feet are all of a blue or violet colour. The specimen from which this description was made, was brought from Jamaica, but the bird is a native of the hotter parts of South America.

Picatus; Preacher Toucan. Blackish; breast yellow, vent and tips of the tail-feathers red, rump black. It inhabits Guinea and Brazil, and is more than twenty inches long. The bill is yellowish-green, tipt with reddish; the belly is red; the tail is dotted with red at the tip. This bird is said to have a frequent habit of moving its head from side to side, while uttering its notes; hence it has obtained the name of preacher.

Dicolorus; Yellow-throated Toucan. Blackish; breast, belly, vent, and rump, red; the chin is yellow. It inhabits Cayenne, and is seventeen inches long. The bill is olive, with a black base; the mandibles are edged with red; the cheeks are of a sulphur colour; the throat is orange, but edged with sulphur.

Toco; White-throated Toucan. Blackish; chin, throat, and rump, white; orbits, circle on the breast, and vent, red. It inhabits Cayenne, and is about nine or ten inches long. The bill is of a reddish-yellow, the base is black; the upper mandible is black at the tip.

Indicus; Indian Toucan. The throat, quill-feathers, and tail, black; the cheeks and breast are white; belly and thighs are yellow; the crown is of a reddish-orange; rump crimson. It is found in divers parts of India. The bill is hardly serrate, and not so large as in the others.

Luteus; Yellow Toucan. This is of a yellowish-white; the neck is marked with two black lateral stripes; the tail and wings are variegated with black and white; the lesser wing-coverts are yellow. It inhabits New Spain, and is about the size of a pigeon. The bill is black; the irides are yellow; the legs are brown; the claws are yellowish.

Cæruleus; Blue Toucan. Blue mixed with cinereous. It inhabits the coasts of New Spain. The bill is longer than the body; the eyes are black and the irides are tawny.

Dubius. This is the blue-throated toucan of Mr. Latham, described from a catalogue of the museum of baron Fangeres of Montpellier, where it is announced as an undescribed species.

Albus; White Toucan. This is entirely white.

RAMPICHERLA, in *Geography*, a town of Hindoostan, in the circar of Guntoor; 12 miles N.E. of Innaconda.

RAMPIN, in the *Manege*. See Toe.

RAMPION, in *Botany*. See Rapunculus, of which Dr. Johnson supposes it a corruption. See also Phyteuma.

Rampions, *Crested*, a species of the *lobelia*.

Rampions, *Common esculent*, a species of the *campanula*; which see.

Rampions *with scabious heads*. See Jasione.

RAMPOUR, in *Geography*, a town of Bengal; 13 miles N. of Curruckpour.—Also, a town of Hindoostan, in Bahar; 31 miles N.W. of Bettiah.—Also, a town of Almora; 30 miles N.N.W. of Bereilly. N. lat. 28° 45′. E. long. 79° 22′.—Also, a town of Hindoostan, in Oude, on the Ganges; 34 miles N.W. of Manickpour.—Also, a town of Hindoostan, in Oude, on an island formed by the divided stream of the Dewah; 35 miles N.E. of Lucknow.—Also, a town of Hindoostan, in Oude; 25 miles E.S.E. of Goorackpour.—Also, a town of Hindoostan, in Oude; 30 miles N.E. of Goorackpour.—Also, a town of Hindoostan, in the Carnatic; 30 miles S.W. of Nellore.—Also, a town of Hindoostan, in the circar of Boggilcund; 20 miles W. of Rewah.—Also, a town of Hindoostan, in Benares; 20 miles N.W. of Bidzigur.—Also, a town of Hindoostan, in the circar of Schaurunpour; 23 miles S.S.W. of Schaurunpour.—Also, a town of Hindoostan, in the circar of Oudipour; 40 miles E.N.E. of Oudipour.

RAMPS, in *Fortification*, are gentle slopes made for the cannon to be drawn up and down by, and also for the easy communication of the troops posted in a battery that is raised above the level of the ground on which it is built. The rise of these slopes is about two inches, on twelve of base, or the length of the ramp's base is six times the height, and this is general for the draught of carriages; but footways need not be of so gentle a slope, as a rise in one foot in three may answer the purpose; or, instead of ramps, stairs may be, and commonly are, used for the passage of the foot. The breadth of a carriage ramp is usually about nine or ten feet, that breadth being sufficient both for the carriage and footway; but those for foot-passage only need not be above three or four feet wide. Ramps may either rise on the side of an elevated work, or against a saliant angle of that work, or on each side of an entering angle.

RAMQUILLA, in *Geography*, a town of Sweden, in the province of Smaland; 5 miles N.W. of Calmar.

RAMSAY, Allan, in *Biography*, a poet of considerable celebrity, who wrote in the Scottish dialect, was born in the year 1686, in the parish of Crawford, Lanerkshire. He received no other education than that of the parish school, and was apprenticed to a barber in Edinburgh. It has not been ascertained when he first began to make verses; but about the year 1715, several of his poems had been published. Soon after this he laid aside the trade to which he had been brought up, and adopted the more congenial one of a bookseller. In 1721 his detached poems were published, by subscription, in a quarto volume. In 1724 he began to publish his collection of songs, entitled "The Tea-table Miscellany," which at length extended to four volumes. This work was followed by one, entitled "The Evergreen," being a collection of songs written by the ingenious before the year 1600. These publications were well received; but his fame was greatly extended by his

"Gentle Shepherd," which was afterwards enlarged from two paſtoral poems, in the form of a regular drama. He now held a correſpondence with ſeveral poets and other ingenious perſons of the time, and his ſhop in Edinburgh was the reſort of the men of letters who then flouriſhed in the capital of Scotland. He is ſuppoſed to have opened the firſt circulating library in that city, and in 1736 he built a play-houſe, which was the firſt ever known at Edinburgh; but the act prohibiting the exhibition of plays in unlicenſed buildings, cauſed it to be ſhut up. Ramſay, towards the middle of his life, withdrew from the field of authorſhip, and attended to the much more profitable buſineſs of ſelling, rather than writing of books. He died in 1758, at the age of 71. The poems of Allan Ramſay, ſays an eminent critic, "diſplay none of the fire of the genius ſo conſpicuous in thoſe of Burns, but have occaſionally an agreeable paſtoral ſimplicity, and are often marked with a vein of humour, natural, though coarſe. The Gentle Shepherd is, perhaps, one of the beſt paſtorals with reſpect to the pictures of real life, which are drawn with great propriety, and generally preſent pleaſing images."

Ramsay, Allan, ſon of the preceding, was born at Edinburgh about 1709, and having devoted himſelf to painting, went at an early period of his life to ſtudy in Italy, and there received inſtructions from Solimene and Imperiale.

After his return, he practiſed in Edinburgh for ſome time, but afterwards removed to London, and by the influence of his countryman, the earl of Bute, was introduced into the vortex of the court, painted the prince of Wales, and on the death of Shakleton in 1767, was appointed principal painter to the crown; although Reynolds was then in poſſeſſion of the higheſt reputation.

Ramſay never ventured to attempt the higher walks of the art, but confined himſelf ſolely to portraits, which he painted agreeably. Not poſſeſſed of brilliancy of genius ſufficient to attempt ſtrong character, with ſtriking effects in his pictures, he contented himſelf with that portion of art which meets the expectations of common obſervers; never offending with affectation or neglect, he finiſhed his pictures with care and neatneſs, and retained his friends and reputation till he ceaſed to practiſe. He was ſo far attached to his art, that he viſited Italy four times: to what purpoſe does not appear, unleſs it were to derive benefit from the portraits of Pompeo Battoni; for no traces of higher character are obſervable in his productions. Yet he was a man of ſound ſenſe and ſtrong underſtanding; poſſeſſed of literary acquirements, and devoted to ſtudy. Though he underſtood the Latin, French, and Italian languages, he was not ſatisfied till he added a knowledge of the Greek, acquired when he was advanced in life. Thus endowed, he was emulous of literary fame, and publiſhed, under the title of "The Inveſtigator," Eſſays on Ridicule, as the teſt of truth, on the Naturalization of Foreigners, on Taſte, &c.; and, as occaſion prompted, the town was favoured by him with ſome fugitive pieces on the politics of the day. He was always held to be highly eſtimable as a man, and enjoyed his fame and good fortune to about the advanced age of 75.

Ramsay, Andrew Michael, called the chevalier Ramſay, was born at Ayr, in Scotland. He received a good education at Edinburgh, where he diſtinguiſhed himſelf ſo much, that he was choſen to attend the ſon of the earl of Weemys at St. Andrew's. After this he went to Leyden, with the view to farther improvement, where he became acquainted with Poiret, one of the leaders of the Quietiſts, ſome of whoſe doctrines he imbibed. He next went on a viſit to the celebrated Fenelon, archbiſhop of Cambray, who converted him to the Roman Catholic religion, and Ramſay ever after this conſidered himſelf as the diſciple of that excellent prelate. Upon his works he formed his literary taſte, and he even adopted France for his country, and made uſe of its language in his writings. Here he obtained ſome poſts of honour and emolument, and was made knight of the order of St. Lazarus, whence he had the title of chevalier. His reputation cauſed him to be invited to Rome by the Pretender, in order that he might undertake the care and education of his children. This he accepted; but having found that little court ſo divided by faction, he quickly reſigned his office, and returned to Paris. In the next year, 1725, he re-viſited his native country, and reſided ſome years with the duke of Argyle, employing himſelf in the compoſition of ſeveral works. After his return to France, he entered into the ſervice of the prince of Turenne, duke of Bouillon. He died in 1743, at St. Germain-en-Laye, the retreat of the exiled Stuart family, at the age of 57. His principal writings were, "L'Hiſtoire de la Vie et les Ouvrages de M. de Fenelon;" "Eſſai ſur le Gouvernement Civil;" "Diſcours ſur le Poeme Epique;" "Le Pſychometre," being remarks on lord Shafteſbury's Characteriſtics; "L'Hiſtoire du Marechal de Turenne;" and "Les Voyages de Cyrus." The laſt is that which is by much the beſt known, and it has been frequently printed in the French and Engliſh languages. Voltaire has ſtyled it a feeble imitation of Telemachus; it is, however, written with elegance, but is tedious. Another of the chevalier's works was "A Diſſertation on Free-Maſonry," of which he was grand chancellor in France. In this he traces the origin of the inſtitution to Paleſtine, in the time of the Cruſades; and having found a great declenſion of the myſtical ceremonies formerly practiſed, he ſtrongly urged their renewal, and propoſed a general aſſembly of the brotherhood of all nations to be held at Paris. Biog. Brit.

Ramsay, in *Geography*. See Ramsey.

Ramsay *Point*, a cape on the S.E. coaſt of the iſland of Lewis. N. lat. 57° 44′. W. long. 6° 36′.

RAMSBURY, a village and pariſh in the hundred of Ramſbury, and county of Wilts, England, is ſituated about ſix miles to the eaſtward of the town of Marlborough, and 70 miles weſt by ſouth from London. In the time of the Saxons it was a place of ſo much importance, as to be conſtituted the ſeat of the ſee, when Wiltſhire was made a diſtinct biſhopric by Plegmund, archbiſhop of Canterbury, in the year 909. Ramſbury church was then the cathedral church of the dioceſe, and continued to be ſo till biſhop Herman prevailed upon king William the Conqueror to unite the biſhoprics of Wiltſhire and Sherborne, and fixed his epiſcopal ſeat at Old Sarum. The church, an ancient building, is divided into a nave, two aiſles, and a chancel, with a maſſive ſquare tower at its weſtern extremity. In the chancel is a long ſtone, which tradition affirms to be the grave-ſtone of a giant; alſo an old altar tomb of Purbeck marble, without any inſcription, and ſeveral monuments commemorative of the Joneſes of Ramſbury manor, or park. This ſeat is now the property of ſir Francis Burdett, bart. in right of his mother, ſecond daughter of the late William Jones, eſq. The houſe was deſigned in the Grecian ſtyle, by John Webb, nephew to Inigo Jones. The incloſures are extenſive and well wooded, and are interſected by a branch of the river Kennet, which ſpreads itſelf out in the form of a lake, from the ſides of which the grounds riſe in eaſy, ſloping lawns.

Littlecot park, the ſeat of major-general Edward Leybourne

bourne Popham, is ſituated partly in the pariſh of Ramſbury, and partly in that of Chilton-Foliot. The houſe is a large ancient ſtructure, built by one of the Darells, the former poſſeſſors of this domain, about the time when feudal warfare ceaſed, and defence was no longer an object in a country manſion. Notwithſtanding many late alterations, the interior ſtill preſerves many of its original features. The great hall is very ſpacious, floored with ſtones, and lighted by large and very lofty windows. In it ſtands a large oaken table, at which the vaſſals of the domain were wont to feaſt at the expence of their lord. The remainder of the furniture is in a ſuitable ſtyle, particularly an arm-chair, which is ſaid to have been uſed by ſir John Popham, chief juſtice of the court of king's bench in the reigns of queen Elizabeth and king James I., who purchaſed the houſe and manor from the laſt of the Darells. There is alſo a curious inſtrument for the puniſhment and confinement of ſervants; by faſtening their thumbs between two boards. The walls of the hall are decorated by numerous guns, carbines, piſtols, doublets, &c.: and here are alſo two very fine candelabras, deſigned and executed by Mr. George Bullock of London, in an admirable ſtyle, as adapted to the age and character of the manſion. One of the bed-rooms is ſaid to have been the ſcene of a ſingular and myſterious murder, the incidents attending which are recorded in a note to Scott's poem of Rokeby. In the gallery, which is about 110 feet in length, are portraits of judge Popham and Nell Gwyn; alſo a curious piece of needle-work, repreſenting a large Roman teſſellated pavement, which was diſcovered in the adjoining park in 1728, by Mr. George (ſteward to Edward Popham, eſq.), who made a coloured drawing of it, and communicated the ſame to the Society of Antiquaries. This pavement conſiſted of two diviſions, which appear to have formed the floor of a temple. The interior diviſion was ornamented with the figure of Apollo playing on a harp; and in four ſurrounding compartments were four female figures riding on different animals, and deſigned to repreſent the Horæ, or Seaſons. Exterior to the circle incloſing them were three other compartments, each diſplaying a face of the ſun. From theſe circumſtances the temple is ſuppoſed to have been dedicated to Apollo; but ſome emblems on its exterior diviſion referring to Ceres and Neptune, it may, perhaps, be more properly eſteemed a ſort of pantheon. Another ſmaller Roman pavement, and a curious cup or patera of braſs, were likewiſe diſcovered by Mr. George on Rudge-farm, adjoining the northern boundary of Littlecot park. The cup was adorned with foliage, and was inſcribed with the names of five Roman ſtations. It was conjectured by Gale to have been a libation cup uſed at an annual feaſt inſtituted by the inhabitants of theſe towns.

Pickedfield, in this vicinity, is a government depôt for the interior, eſtabliſhed in 1803. It includes about forty acres of ground, on which are erected three magazines for powder, barracks for a detachment of the military, and various neceſſary houſes and offices. Beauties of England and Wales, vol. xv. by John Britton, F.S.A.

RAMSDAL. See Remsdal.

RAMSDEN, Jesse, in *Biography*, an eminent Engliſh mathematical and aſtronomical inſtrument-maker, the ſon of an inn-keeper at Salterhebble, near Halifax, in Yorkſhire, where he was born in the year 1735. At nine years of age he was admitted into the Halifax free-ſchool, where he acquired, during three years, the elements of claſſical learning; after which he was removed to the care of an uncle at Craven, by whom he was ſent to a clergyman of the name of Hall, who had acquired much reputation by teaching at his ſchool the mathematical ſciences. Under this gentleman's inſtructions, young Ramſden became a proficient in geometry and algebra, and was advancing rapidly in theſe and other collateral branches of ſtudy when his father ſent for him home, to apprentice him out with a clothier at Halifax. At the age of twenty he went to London, where he became clerk in a wholeſale cloth warehouſe. This ſituation he retained about two years and a half, when his inclination for the ſciences revived ſo ſtrongly, that he reſolved to qualify himſelf for ſome buſineſs which ſhould prove ſuitable to the bent of his mind. With this view he bound himſelf apprentice for four years to Mr. Burton in the Strand, who was eſteemed one of the beſt workmen of his time in making thermometers and barometers, and in engraving and dividing mathematical inſtruments. After the expiration of his apprenticeſhip, he worked as journeyman with a perſon of the name of Cole, with whom he afterwards aſſociated himſelf as partner. This connection did not laſt long, when Mr. Ramſden opened a workſhop on his own account, in which he ſoon recommended himſelf to the employment of the principal mathematical inſtrument-makers in London. In the courſe of his buſineſs his repeated examination of the inſtruments which were ſent him to be engraved or divided, led him to diſcover their defects, and his genius ſuggeſted to him the means of removing them, or of conſtructing better inſtruments. In order to put his plan into execution, he made himſelf maſter of the practical operations of the trade, and formed the deſign of examining every aſtronomical inſtrument in uſe, with the view of correcting thoſe which, being founded on good principles, were faulty only in the conſtruction, and of proſcribing thoſe which were defective in both theſe reſpects. About this time, by his marriage with Miſs Dollond, he became poſſeſſed of a part of Mr. Dollond's patent for achromatic teleſcopes. In the year 1766, Mr. Ramſden opened a ſhop in the Haymarket, where he continued till 1774, when he removed to Piccadilly, where he remained till the time of his death. Before his ſettlement in the Haymarket, he had improved the ſextant, and he had invented his celebrated dividing machine. (See the art. Engine.) Having ſpent ten years in bringing this machine to perfection, he obtained from the Board of Longitude a premium of 1000*l*. Mr. Ramſden conſtructed an inſtrument for dividing ſtraight lines, which has been deſcribed in a former volume of the New Cyclopædia, and while he was employed on his dividing-machine he made great improvements in ſeveral other inſtruments. The Theodolite (ſee the article), before his time, conſiſted merely of a teleſcope, turning on a circle, divided at every three minutes, by means of a Vernier, which ſee; but in the hands of Mr. Ramſden it became a new and perfect inſtrument, ſerving for meaſuring heights and diſtances, as well as taking angles. The largeſt and moſt perfect theodolite ever conſtructed was made by him for general Roy, for the purpoſe of meaſuring the ſeries of triangles in England. Though this inſtrument is only of eighteen inches radius, its accuracy is ſo great as not to admit of an error of a ſingle ſecond. With this inſtrument general Roy meaſured the angle between the polar ſtar and the ſides of his triangles, in order to have the exact difference between the obſervations of Paris and Greenwich, which he found to be 9′ 20″. Mr. Ramſden was a great improver of the barometer for meaſuring the height of mountains, which he could obtain to a degree of accuracy that was very ſurpriſing, and he cauſed to be engraved a table to accompany his barometers, which, without the trouble of calculation, gives the heights of places, according to the heights of the mercury, and even at different temperatures. He alſo pointed

pointed out a new method and apparatus adapted to the conveyance and fupport of the portable barometer. Mr. Ramfden made improvements on the electrical machine; and on manometers for meafuring the denfity of the air: he invented an inftrument for meafuring inacceffible diftances: affaying balances which turn with lefs than a ten thoufandth part of the weight ufed: levels and a variety of other inftruments. The pyrometer alfo exercifed his talents, and on this occafion, as on all others, Mr. Ramfden fhewed a fort of natural and almoft intuitive fagacity in difcovering the effential faults of an inftrument, and in inventing the moft fimple and exact methods of correcting them. With refpect to optics, he difcovered a method of correcting, in a new and perfect manner, the aberration of fphericity and refrangibility in compound eye-glaffes applied to all aftronomical inftruments. Opticians had imagined that the purpofe might be accomplifhed by making the image of the object-glafs fall between the two eye-glaffes, which was attended with this great inconvenience, that the eye-glafs could not be touched without deranging the line of collimation, and the value of the parts of the micrometer. To remedy this inconvenience, he fet out from a fimple experiment, *viz.* that the edges of an image obferved through a prifm are lefs coloured, according as the image is nearer the prifm. This led him to attempt placing the two eye-glaffes between the image of the object-glafs and the eye, without failing to correct the two aberrations; which he did by changing the radii of the curves, and placing the glaffes in a manner very different from that commonly employed. In the Philofophical Tranfactions for the year 1779, Mr. Ramfden has defcribed a new reflecting object-glafs micrometer; to the paper on this fubject we refer our readers, and alfo to the article MICROMETER in this Dictionary. With this micrometer the diameters of the planets may be meafured; it may be adapted to all kinds of achromatic telefcopes; it may be brought near to, or removed from, the object-glafs at pleafure, to render vifion diftinct; and it may be removed from the telefcope, if the obferver wifh to ufe the latter without a micrometer. The high degree of merit to which Mr. Ramfden's many and important inventions were intitled, led his friends to propofe him as a member of the Royal Society, and he was elected in the year 1786.

The *Equatorial* or *Tranfit* inftrument (fee the articles) received great improvements in the hands of Mr. Ramfden, who rejected the endlefs fcrew, which by preffing on the centre deftroyed its precifion; he placed the centre of gravity on the centre of the bafe, and caufed all the movements to take place in every direction; he pointed out the means of rectifying the inftrument in all its parts, and he applied to it a very ingenious fmall machine, for meafuring or correcting the effect of refraction. The greateft equatorial inftrument ever attempted, is that which he conftructed for fir George Shuckburg, on which he employed feveral years, and of which we have given a defcription and figure. Mr. Ramfden's meridian telefcopes which he made for Blenheim, Manheim, Dublin, Paris, and Gotha, are alfo remarkable for the excellence of their object-glaffes. With that of Dublin, Mr. Ufher obferved ftars of the fourth magnitude in the open day, and thofe of the third very near their conjunction with the fun. Thefe telefcopes are eight feet in length. There is a five-feet one at the obfervatory at Palermo. Mr. Ramfden made great improvements in the mural quadrant, of which a full account will be found in the article CIRCLE, to which we refer our readers for much valuable information on the fubject of aftronomical inftruments. Having in various parts of our work entered into the nature of Mr. Ramfden's improvements and inventions, it is unneceffary to repeat here what has already been fully explained.

The field in which the inventive genius and fuperior talents of Mr. Ramfden were exercifed, was, as we have feen, very extenfive. In order that every part of his inftruments might be fabricated under his own infpection, he collected in his workfhops men of every branch of trade neceffary for their conftruction. So important did he confider the principle of divifion of labour, that he always confined the fame workmen to the fame branch, and by that means arrived at the greateft correctnefs and nicety in executing it. Notwithftanding the great perfection of his inftruments, which ought to have fecured to Mr. Ramfden a large fortune, he fold them cheaper than any other artift in London, fometimes even one-third below the ufual price. Such was the demand for them, from almoft all parts of the world, that though he employed fixty men, he was unable to execute all the orders which he received. His great attention to bufinefs injured his health, and haftened his death. He died at Brighton, where he had been for the benefit of the fea-air, November 5, 1800, in the fixty-fixth year of his age. He had been elected a member of the Imperial Academy of Sciences at Peterfburg in 1794, and in the following year he was prefented with the gold medal, adjudged by the Royal Society to perfons diftinguifhed for their fcientific talents.

Mr. Ramfden was by nature endowed with uncommonly ftrong reafoning powers, and a moft accurate and retentive memory, but, at the fame time, with fuch a quicknefs of penetration, that he could, as it were, with a fingle glance, view in every light the fubject on which he thought, and adopt the moft advantageous mode of confidering it. He poffeffed, in an exquifite degree, that quality of mind which is emphatically ftyled elegance, which in the abftract fciences leads to clearnefs, fimplicity, and precifion, as in the fine arts and literature, it gives the laft polifh to genius, and is more generally known by the appellation of tafte. In his habits he was temperate to abftemioufnefs, fatisfied with fmall quantities of food, and a fmall portion of fleep. Unacquainted with diffipation or amufement, and giving but little time even to the fociety of his friends, the whole of thofe hours which he could fpare from the duties of his profeffion, he devoted either to further improvements in his inftruments, or to the perufal of books of fcience, particularly thofe mathematical works of the fublime writers which had any connection with the fubject of his own purfuits. Mr. Ramfden's only relaxation from almoft conftant and fevere ftudies, was the occafional perufal of the beft authors, both in profe and verfe; and when it is recollected that at an advanced age he made himfelf fo completely mafter of the French language, as to read with peculiar pleafure the works of Boileau and Moliere, no one can believe that he mis-fpent even his hours of amufement. Short and temperate as were his repafts, a book or a pen was the conftant companion of his meals; and when illnefs broke his fleep, a lamp and a book were ever in readinefs to beguile the fenfe of pain, and make bodily ficknefs minifter to the progrefs of his mind. He was well fkilled in the abftrufer parts of mathematics, and converfant with the beft writers on the fciences; and fuch was his manual dexterity, that there was not one tool in any of the numerous branches of his profeffion which he could not ufe with a degree of perfection equal to that of the very beft workman in that particular branch, and he could have begun and finifhed every fingle part of his moft complicated inftruments. For this article we are chiefly indebted to a very elaborate and excellent original memoir in the 8th vol. of the Gen. Biog.

RAMSDORF, in *Geography*, a town of Saxony, in the bishopric of Naumburg; three miles N.E. of Zeitz.

RAMSEA, or Ramsey, a market and sea-port town in the parish of Kirk-Maughold, Isle of Man, Great Britain, is situated at the distance of fourteen miles north-east from Douglas, the chief town in the island. Anciently this place was of considerable note, but it is now comparatively decayed. The bay upon which it is built might be rendered capable of affording anchorage and security to very large vessels, but it is much choaked up with sand at the entrance to the harbour, and is therefore little frequented, though protected by a fort, mounted with several pieces of cannon. At the extremity of the pier is a light-house, the lower division of which is used as an occasional prison. The chief article of export from Ramsea is grain, the produce of the vicinity which is among the best cultivated districts in the British islands. Several boats, with good accommodation for passengers, sail weekly from hence to Liverpool, and to Whitehaven; but what gives most importance to the town at present is, the circumstance of its being the seat of the courts of justice for the northern district. According to the population returns of 1792, (the last returns made for the island,) Ramsea contained 1100 inhabitants, but their number is now probably increased to 1400.

In the parish of Kirk-Andreas, to the north of Ramsea, are several curiosities, particularly an ancient intrenchment at Ballachurry, which occupies a small isolated eminence, in a very level tract of country. This earthen work is of a square form, and is surrounded by a wide and deep fosse and rampart, flanked at each angle by a very noble bastion. The area within is much sunk below the level of the works, which are in a state of excellent preservation, and might easily be rendered effectual for the purposes of modern warfare. This district abounds with sepulchral tumuli; some of them environed by large upright stones. Several of these barrows were opened, about twenty years ago, by Mr. Chaloner, and found to contain simple urn interments. In the church-yard here stands a square pillar of stone, bearing a Runic inscription, which is thus translated by Mr. Beauford of Athy, in Ireland. "The son of Ulf of the Swedri (Swedes) erected this cross to the warrior Afterarin, the son of Cunnu." Another inscription on a similar monument is to be seen in the neighbouring church-yard of Kirk-Michael, which is an extensive village, pleasantly situated near the sea. In this parish is a monument of the cairn description, composed of small stones heaped together. It is called Cairn-Viael, but nothing is known respecting its origin, and peculiar appropriation. About a mile from hence is Bishop's-Court, the usual residence of the bishops of Man. The palace was nearly rebuilt about twenty years ago. It is an elegant and convenient mansion, surrounded by agreeable gardens and pleasure grounds. Beauties of England and Wales, vol. iii. By John Britton and E. W. Brayley, 1802. Carlisle's Topographical Dictionary of Scotland, 2 vols. 4to. 1813.

RAMSEIL, a town of Hindoostan, in Baglana; ten miles N. of Nasseck.

RAMSELE, a town of Sweden, in Angermanland; 70 miles N.W. of Hernosand.

RAMSENTHAL, a town of Germany, in the principality of Culmbach; four miles N. of Bayreuth.

RAMSEY, a market-town in the hundred of Hunstingstone, and county of Huntingdon, England, is situated on the banks of a small river, to which it gives name, at the distance of ten miles N.N.E. from the town of Huntingdon, and sixty-eight miles N.W. from London. It is particularly celebrated in history for its abbey, which was founded by the renowned duke Ailwin, at the persuasion of Oswald, bishop of Worcester, in the year 969. The buildings were completed in the course of five years, at the expiration of which, the monastery was dedicated to the Holy Virgin and St. Benedict, and filled with monks of the Benedictine order. Ailwin gave considerable possessions to his new establishment, and procured for it many valuable privileges from king Edgar. This monarch confirmed to the monks all their lands, and gave them the right of impressing the image of his royal person upon their seals. Several succeeding princes, and many private persons of rank and opulence, contributed to enrich the abbey, which afterwards became one of those distinguished by the title "mitred." Its abbots were consequently privileged to sit in parliament among the peers, and enjoyed all the other accustomed rights of mitred abbots. Many of the monks were men of pre-eminent genius and learning, and were especially noted for their proficiency in the Hebrew language. The library belonging to the monastery was extensive, and contained many books written in that tongue by its inmates. At the era of the dissolution, its annual revenues were estimated, according to Dugdale, at 1716*l.* 12*s.* 4*d.*; but Speed, on the authority of sir Robert Cotton, states their amount at 1987*l.* 15*s.* 3*d.* Some years after that event, the demesnes and lands of the abbey, with several lakes belonging to it within this parish, were granted to sir Richard Cromwell, ancestor to the Protector.

Ramsey consists chiefly of one long street, with another branching off from it, in a northern direction. The abbey stood at the upper end of the town, towards the south, near the manor-house, a large and elegant mansion, built out of its ruins. The only portion of the old buildings standing is a gateway, which appears, from the style of its architecture, to have been erected about the reign of Henry VI. Since the destruction of the abbey, it was for some time used as a prison. At a short distance from this relic stands the present church of Ramsey, a spacious and handsome edifice, consisting of a nave, chancel, and aisles, with an embattled tower at the west end. The nave is separated from the aisles by seven large and well-proportioned arches on each side, springing from clustered columns; and from the chancel by a still larger arch, with a screen richly carved in wood crossing the lower part. The windows are large, and, as is apparent from many fragments remaining, have once been filled with stained glass, exhibiting figures of angels, crowned heads, &c. Several branches of the Cromwell family were buried in this church, but there are no monuments to their memory. In this town is a free-school, founded and endowed in 1663, under a decree of chancery, but the establishment has been much neglected; also a charity-school for girls, instituted about a century ago by John Dryden, esq. who bequeathed 16,000*l.* for various charitable purposes. The market day here is Wednesday, weekly, and there is an annual fair on the 22d of July. Ramsey suffered greatly from the plague in the year 1665—6, that dreadful distemper having been introduced by the accident of major William Cromwell wearing a coat, the cloth of which had been brought from the metropolis. The number of deaths amounted to 400 within one month. This town likewise sustained much injury from fire in 1731; but the damage was soon repaired. According to the population returns of 1811, the parish contains 484 houses, and 2390 inhabitants.

The country around Ramsey is extremely marshy, and hence is intersected by numerous ditches, or drains to carry off the water. To the north-west about two miles, is a lake

lake called Ugg-Mere, and at the diſtance of a mile further northwards, is a ſtill larger collection of water, named Whittleſea-Mere; and there is a third to the north-eaſt of the town, ſtyled Ramſey-Mere. All theſe lakes abound with fiſh of various kinds. Running northwards from that laſt mentioned, is a high cauſeway, called King's-delf, or dyke, which is mentioned in record as early as the reign of king Edgar. It is commonly confounded with Cnuts-delf, or Swerdes-delf, called alſo Steeds-dyke, which forms the boundary of this county with Cambridgeſhire. Beauties of England and Wales, vol. vii. by E. W. Brayley, 1808.

Ramsey, *Iſle of*, an iſland in the cwmwd of Mynyw, cantref of Pybidiog, (now called the hundred of Dewiſland,) and county of Pembroke, South Wales, is ſituated in the Iriſh ſea, oppoſite to the promontory called St. David's Head, from which it is about three miles diſtant. This iſland is nearly four miles in length, and exceeds one mile in breadth. Throughout its whole extent the ſurface is lofty, and at each extremity a mountain ſhoots to a great height above the general level, giving the iſland a very romantic appearance. From the ſhore the aſcent is bold and precipitous on all ſides, and at one ſpot, called the Choir, the rocks aſſume an amphitheatrical form, and riſe perpendicularly to a ſtupendous elevation. Ramſey was formerly cultivated, but is now chiefly appropriated as paſturage for ſheep and horſes. It is abundantly ſupplied with freſh water, for which benefit tradition records that the iſland is indebted to Juſtinian, a devotee from Brittany, who ſettled here in the fifty century. Here were anciently two chapels, one ſacred to Devanus, or Devynoy, and the other to Juſtinian above-mentioned, who was murdered by his ſervants, and buried on the ſpot where the chapel was raiſed to his memory. Ramſey belongs to the biſhop of St. David's, as do likewiſe ſeveral ſmaller iſlands in its vicinity, of which ſeven are diſtinguiſhed by the appellation of the Biſhop and his Clerks. Innumerable flocks of birds frequent and breed on theſe iſlands, and, among other kinds, the celebrated hunting falcon is frequently ſeen. An Hiſtorical Tour through Pembrokeſhire, by Richard Fenton, F. S. A. Carliſle's Topographical Dictionary of Wales, 4to. 1813.

RAMSGATE, a member of the town and port of Sandwich, in the upper half hundred of Ringlow, Iſle of Thanet, lathe of St. Auguſtine, and county of Kent, England, is ſituated on the ſhore of the German ocean, at the diſtance of 72 miles S.E. from London. Like Margate, it was formerly only a ſmall fiſhing hamlet, conſiſting of a few mean, and indifferently built, houſes. In the reign of queen Elizabeth, indeed, it was returned in the maritime ſurvey as having no more than ſeventy ſailors belonging to it, and theſe chiefly fiſhermen. What firſt gave it importance was the extenſion of the Ruſſian trade after the revolution in 1688; but it is chiefly indebted for its preſent conſequence to the improvements made in the harbour ſince the middle of the laſt century; for although a pier for ſhipping exiſted here, at leaſt from the time of Henry VIII., yet it was altogether inadequate to afford ſecurity to the numerous ſhips driven on the coaſt in tempeſtuous weather. Parliament was therefore induced, at the petition of the merchants and ſhip-owners who were intereſted, to paſs an act, ordering a proper harbour to be formed for the reception "of ſhips of, and under, 300 tons burthen." Under this act truſtees were, as uſual, appointed; and in the year 1749-50, the work was begun, according to deſigns by William Ockenden, eſq., and captain Robert Brooke. So many difficulties, however, occurred in carrying it into execution, that the harbour was not completed till the year 1791. The ſum which the whole coſt exceeded 600,000*l.*; but that amount is trivial compared to the great benefit derived from it to our ſhipping intereſt. The area of the harbour is nearly circular, and comprehends about forty-ſix acres. The piers, baſin, &c. are conſtructed of Purbeck and Portland ſtone, principally the latter. The entire length of the eaſt pier, including its flexures, or angles, amounts to nearly 2000 feet; that of the weſt pier is about 1500 feet; the width of the entrance is 240 feet. The general breadth of the piers is twenty-ſix feet, including a ſtrong parapet, which defends the outer ſides next the ſea. What is called the Eaſt Channel, is formed by the paſſage between the eaſt pier and a large bank of ſand which nearly croſſes the harbour as far as the baſin, and is of conſiderable uſe for ſhips to bring up upon, in heavy gales, when driven into the harbour without anchors or cables. Near the north end of the weſt pier is a maſſive frame work of timber, and a ſtaircaſe, called Jacob's ladder, forming a communication from the top to the bottom of the cliff. The eaſt pier is a favourite promenade in ſummer, and is much admired for the peculiarly fine ſea-views which it commands.

In judicial proceedings, Ramſgate is technically denoted the *ville* of Ramſgate. It is in the pariſh of St. Lawrence, and is aſſeſſed to that church, but it maintains its own poor ſeparately, and the inhabitants have the right of chooſing one churchwarden from among themſelves. As an ancient member of the town of Sandwich, it is in ſubjection to the juſtices of that place. The mayor of Sandwich appoints a deputy, or conſtable, here, and the inhabitants are allotted by the commiſſioners of that borough, what proportion of land tax they ſhall pay. A ſmall annual ſum is alſo paid out of the duties collected at Ramſgate harbour towards the ſupport of Sandwich haven. The influx of viſitors to this town of late years has greatly increaſed, and has conſequently occaſioned a conſiderable extenſion of its buildings. A market has been eſtabliſhed for ſeveral years; and the ſtreets are paved, lighted, and watched, under the authority of an act of parliament paſſed in 1785. Here is a ſpacious chapel of eaſe, and ſeveral meeting-houſes for diſſenters of different denominations. The accommodation for the ſummer reſidents are ſimilar to thoſe at Margate, though perhaps leſs numerous, and ſcarcely ſo ſplendid. The aſſembly room and tavern is a ſpacious building adjoining the harbour. It is elegantly fitted up, and contains convenient tea and card-rooms, a billiard-room, and a coffee-room. Here are likewiſe ſeveral good inns, with bathing-rooms, libraries, boarding-houſes, &c. The bathing-place is a fine ſandy ſhore, beneath the cliffs to the ſouth of the pier: the machines are ſimilar to thoſe at Margate, *viz.* a ſort of cloſe caravan, having a door and ſmall flight of ſteps behind, by which the bathers deſcend to the water, and are concealed from view by a pendant covering of canvas. Within the laſt forty years the population of Ramſgate has increaſed almoſt in the ratio of three to one. In 1801, according to the parliamentary returns, it contained 726 houſes, and 3110 inhabitants; but, in 1811, the former were returned as amounting to 919, and the latter to 4221.

Half a mile weſtward from Ramſgate is Ellington, anciently a ſeat of a family of the ſame name, who, towards the end of the reign of Edward IV., were ſucceeded by the Thatchers, another ancient Kentiſh family, from whom it paſſed to the Sparklings. St. Lawrence is a large village, ſituated on the brow of the hill overlooking Ramſgate; the houſes forming a long winding ſtreet along the high road to London. The church here is a ſpacious edifice, conſiſting of a nave, aiſles, and three chancels, with a ſquare tower, ſupported upon four maſſive columns, between the nave and principal chancel. The tower, and part of the body, are of Norman architecture, and on the outſide of the former, by way of decoration,

decoration, appear ranges of fmall femicircular arches fpringing from plain octagon pillars; the capitals of the piers which fupport it alfo difplaying fome curious fculpture. Among the fepulchral memorials here, are feveral in memory of the Sparklings of Ellington, and the Manftons of Manfton-court, an ancient manfion, fituated about two miles to the north-weft of St. Lawrence, now converted into a farm-houfe. Minfter, another village in this vicinity, derives its name from a church or nunnery founded here in 670, by Domneva, wife to Merwald, fon of Penda, king of Mercia. In the early part of life fhe had been left, with her fifter Ermengitha, and her brothers Ethelred and Ethelbright, under the guardianfhip of her uncle Egbert, king of Kent, who murdered the princes, and in expiation of the crime offered to give to Domneva whatever fhe fhould afk. The lady demanded as much land as a tame deer would run over at one courfe, to endow a monaftery, which was accordingly granted to her. When her buildings were raifed, fhe placed therein 70 nuns, and, taking the veil herfelf, became their firft abbefs. She was fucceeded by her daughter St. Mildred, from whom the abbey afterwards was denominated St. Mildred's abbey. This eftablifhment was frequently plundered by the Danes during the eighth and ninth centuries, and at length was fet fire to, and totally deftroyed, together with the nuns, the clergy, and many of the people who had fled hither for fanctuary. The poffeffions of this abbey were fubfequently granted to the monks of the monaftery of St. Auguftine, in Canterbury, by king Canute, and by them the body of St. Mildred was removed to their own abbey. The parifh church of Minfter, which occupies the fcite of the ancient nunnery, appears to have been originally founded about the time of the conqueft, but it has undergone many alterations, and confequently exhibits various ftyles of architecture. The nave, which is the oldeft portion of it, is divided from the aifles by femi-circular arches fpringing from fhort maffive columns. The chancel is vaulted with ftone, as is likewife part of the tranfept. Beauties of England and Wales, vol. viii. by E. W. Brayley. Hiftory of Kent, by Edward Hafted, efq., 8vo. edit. vol. x. Lewis's Hiftory of the Ifle of Thanet, 4to.

RAMSHAGUR, a town of Bengal; 5 miles S. of Dinagepour.

RAMSHYDA, a town of Sweden, in the province of Nericia; 28 miles N. of Orehro.

RAMSIN, a town of Saxony; 3 miles W. of Bitterfeld.

RAMSONS, in *Botany*, a name given to the broad-leaved wild allium. See ALLIUM.

RAMSTADT, in *Geography*, a town of Heffe-Darmftadt; 3 miles S.E. of Darmftadt.

RAMTCHIEU, a lake of Thibet, formed by three feparate rivulets, and furrounded with an incruftation, of a white colour and faltifh tafte. This fubftance is collected and employed for cleanfing and wafhing woollen and cotton cloths, as a fubftitute for foap, to which the inhabitants of the adjacent country are utter ftrangers. Near this lake is a large monaftery, called Lubchea Goomba, feated amidft rocks, which protrude their bafes into the lake, and are bordered with a white foam, produced by its agitated waves. The banks of this lake are perforated with innumerable burrows of a fmall animal, to which they give the name of rat, larger than a mufk rat, of a cinereous grey, without a tail, conceived by Mr. Turner to have been the daman of Ifrael and Egypt, or the Schaphan of the Hebrews. The lake is alfo frequented by great abundance of water-fowl, wild geefe, ducks, teal, and ftorks, which, on the approach of winter, take their flight to milder regions. Prodigious numbers of fauraffes, the largeft fpecies of the crane kind, are here feen at certain feafons of the year, fo that any quantity of eggs may be collected. The lake gradually narrows, and from its northern edge fends off a fmall brook; and at the other extremity it difcharges itfelf into a much larger lake. This lake, it is faid, is held in high refpect by the inhabitants of Bootan, whofe fuperftition leads them to confider the increafe or decreafe of its waters as portentous of good or evil to their nation. They fancy it to be a favourite haunt of their chief deities. Turner's Thibet, p. 212, &c.

RAMTEAK, or RAMTEGH, a town of Hindooftan, in the circar of Goondwana, held facred by the Hindoos, who pretend that Ram collected his army here, prior to his expedition againft Rawun at Lanka, or Ceylon. The Hindoos believe all the Europeans to have defcended from Rawun, and Ceylon to be an immenfe mountain of gold invifible to them. Near the town is a temple, in which they offer up their facrifices and devotions; 15 miles N.E. of Nagpour. N. lat. 21° 23'. E. long. 79° 57'.

RAMTRUT, in *Mythology*, the name of a deity worfhipped by the Kanazins, a people of Hindooftan, where he has a celebrated temple, at Onor. The characters under which he is reprefented more refemble thofe of a monkey than of a man.

RAMULOSE LEAF, in *Botany*. See LEAF.

RAMUNDA, or ROMLA BODA, in *Geography*, a town of Sweden, in Nericia.

RAMURAH. See RAMGUR.

RAMUS, PETER, in *Biography*. See RAMISTS.

RAMUS, in *Anatomy*. This word, fignifying *branch*, and the term *ramification*, are ufed in defcribing the arteries, veins, and nerves, the divifions and fubdivifions of which bear fome analogy to the branching of a tree. In the fame way we fpeak of *trunks* of arteries, &c. and defcribe them as *branching* out.

RAMUS, in the *Anatomy of Plants*, a name given to the firft or lateral branches, which go off from the petiolum, or middle rib of a leaf. The fubdivifions of thefe are called *furculi*; and the final divifions of thefe into the moft minute of all, are by fome called *capillamenta*: but in general, both thefe kinds are comprehended under the name of *furculus*.

RAMUSIO, or RANNUSIO, GIAMBATISTA, in *Biography*, an early collector of voyages and travels, the fon of Paolo, an eminent lawyer, defcended from a learned and diftinguifhed family of Venetian citizens, was born at Venice in 1485. He was in early life deputed by the ftate upon public bufinefs to Switzerland, Rome, and France; and in the latter country he fo much ingratiated himfelf with Lewis XII., that he was by him caufed to travel through almoft the whole of his kingdom. As a reward for his fervices, he was made fecretary of the council of ten at Venice, which poft he at length refigned; and returning to Padua, employed himfelf in compiling his great work, "Raccolta delle Navigazioni e de Viaggi," which was publifhed at different periods between the years 1554 and 1559, in three volumes folio. He had prepared a fourth volume, which was burnt at the printer's. Ramufio died at Padua in 1557; of courfe, a part of his work was given to the world after his deceafe. Ramufio was author of a treatife "De Nili Incremento." He was a man of great learning, and was extremely converfant in hiftory, geography, and the ancient languages: he had fome knowledge in aftronomy, and held a correfpondence with many learned men and well informed perfons, both in Italy and Spain. It was by their affiftance, and at the defire of Fracaftoro, that he compofed the

the work already mentioned. This work was a collection of all the voyages and travels that had hitherto been publiſhed; in which he gave tranſlations of thoſe in foreign languages; and he prefixed diſſertations, in which he diligently examined the pretenſions of different authors, comparing them with one another.

RAN, in our *Old Writers*, is uſed for open and public robbery, ſo manifeſt that it cannot be denied. "Ran dicitur aperta rapina quæ negari non poteſt." Lamb. 125. Leg. Canut. cap. 58. Hence it is to this day vulgarly ſaid of one who takes the goods of another injuriouſly and violently, that he has taken or ſnatched all he could *rap* and *ran*.

RAN, twenty cords of twine, wound on a reel; and every cord ſo parted by a knot, as to be eaſily ſeparated.

RANA, in *Geography*, a town of Auſtria; 12 miles S. of Aigen.—Alſo, a town of Auſtria; 13 miles S.S.W. of Zwetl.

RANA, or *Oranoi*, one of the Sandwich iſlands, in the North Pacific ocean, ſituated about three leagues from Mowee and Morotoi, and lying to the S.W. of the paſſage between theſe iſlands. The country to the ſouth is high and craggy; but the other parts of the iſland had a better aſpect, and appeared to be well inhabited. It produces very few plantains, and bread-fruit trees; but abounds in roots, ſuch as yams, ſweet potatoes, and tarrow. The number of inhabitants is eſtimated at 20,400. Its S. point is in lat. 20° 46′. E. long. 203° 8′. Cook's Third Voyage, vol. iii.

RANA, in *Surgery*. See RANULA.

RANA, in *Zoology*, the frog, a genus of the claſs Amphibia, of the diviſion Reptiles, of which the generic character is: Body four-footed, naked; it generally has no tail, the hind legs are longer than the fore. This genus differs from the *Lacerta* (ſee the art. LIZARD), in having a ſhorter body, broader, thicker head, and in general no tail. The animals of it feed on inſects; they are full grown about the fourth year, and ſeldom live beyond the twelfth. Their fore-feet are moſtly cleft, having four toes: their hind-feet are palmate and five-toed; they are extremely ſalacious, ſticking to the female for days and weeks: the tadpole is excluded from the egg without feet, but with a tail reſembling a fiſh's, which drops off as the legs are protruded; in this ſtate they have likewiſe a ſort of gills and lungs, and many have a ſmall tube on the lower lip, by which they can affix themſelves to other bodies; near the left eye is a veſicle, from which they diſcharge water: in breeding time, the fore-thumb of the male is warty: toads, as we all know, are filthy in their aſpect, and live in damp, obſcure, dark places, and crawl out only by night: their eggs are in a long chain: frogs are more active, and more about by day; theſe lay their eggs in a confuſed maſs.

Dr. Shaw, in his entertaining and inſtructive Zoology, ſays this genus may be divided into three ſections; *viz.* 1. Frogs, commonly called *Ranæ*, with light active bodies, and which leap when diſturbed. 2. Slender-limbed frogs, *Hylæ*, *Calamitæ*, or *Ranæ arboreæ*, *viz.* ſuch as have light bodies, very ſlender limbs, and toes terminating in flat, circularly expanded tips, enabling the animal to adhere at pleaſure to the ſurface even of the ſmootheſt bodies. Several of this diviſion actually reſide on trees, adhering by their toes to the lower ſurfaces of the leaves and branches. 3. Toads, *Bufones*, or ſuch as have heavy bodies, ſhort thick limbs, and which rather crawl than leap when diſturbed.

Gmelin has given a different arrangement, which, according to our uſual cuſtom, we ſhall follow in this article. He divides the genus into three ſections, *viz.* A, thoſe with warty and puffed up bodies; and ſhort legs: theſe are *toads*. B, thoſe with bodies rather oblong, ſmooth and with longer legs: theſe are *frogs*, properly ſo called. And C, whoſe hind feet are very long; and whoſe claws are lenticulate. Dr. Shaw enumerates more than fifty ſpecies, but Gmelin deſcribes only thirty-ſix.

Section A.—*Body warty, puffed up: ſhorter Legs.*

Species.

PIPA; Surinam Toad. The toes of the fore-feet of this ſpecies are unarmed, four-cleft; thoſe of the hind-feet are clawed and palmate.

This hideous and deformed animal inhabits the waters of Guiana, and is actually eaten by the natives. The male, after the excluſion of the eggs, collects the maſs together, and ſmears it over the back of the females with its paws, where they are received into ſmall cells, impregnated by the males and cloſed up; after ſome time the perfect young are excluded from thoſe hollow tubercles on the back of the female.

The ſize of the *Pipa* conſiderably exceeds that of the common toad; the head is flat, broad, and very ſhort; the beak is ſpatula-ſhaped; the eyes very ſmall and remote; neck very ſhort, wrinkled; the body is orbicular, flat, with a hard cartilaginous ſkin; the fore toes are round, and the hind ones very long, connected by an undivided membrane. This ſpecies was firſt made known to the Europeans about the latter end of the 17th century.

MUSICA; Muſical Toad. The ſpecific character of this is, that it has gibbous ſhoulders that are dotted; the body is varied with lurid and brown; the fore-feet are cleft, and the hind-feet are ſubpalmate and five-toed, with ſcarcely any claws. It inhabits the freſh waters of Surinam: it is larger than the common toad: in the evening, and during the whole night, it keeps up a continual muſical kind of croaking; hence it takes its name.

*BUFO; Common Toad. Body lurid and brown: of this animal there are three varieties, as follows: the firſt has its back of an olive colour; and an unequal yellowiſh-red band down the ſide: the body of the ſecond is marked with confluent green ſpots and warts on the ſpots of the ſame colour, thoſe of the intervals red, the ſpaces between bicoloured. The third is particularly diſtinguiſhed for its ſize, being much leſs than the others. This of all the European toads ſeems to be the moſt univerſally known. It is found in ſhady places, in gardens, woods, and fields, and frequently makes its way into cellars, or any obſcure receſſes in which it may occaſionally conceal itſelf, and where it may find a ſupply of food, or a ſecurity from too great a degree of cold. In the early part of ſpring, like others of this genus, it retires to the waters, where it continues during the breeding ſeaſon, and depoſits its ova or ſpawn in the form of double necklace-like chains or ſtrings of beautifully tranſparent gluten, and of the length of three or four feet, in each of which are diſpoſed the ova in a continued double ſeries throughout the whole length, having the appearance of ſo many ſmall jet-black globules or beads; being in reality no other than the tadpoles or larvæ convoluted into a globular form, and waiting for the period of their evolution, or hatching, which takes place in the ſpace of about fourteen or fifteen days, when they break from the ſurrounding gluten, and like the tadpoles of frogs, ſwim about in the water, and are nouriſhed by various animalcules, gluten, leaves of water-plants, &c. &c. till, having arrived at their full growth, the legs are formed, the tail gradually

gradually becomes obliterated, and the animals leave the water, and betake themſelves to the ſurface of the ground. This generally happens early in the autumn, at which period it is not uncommon to find ſuch numbers of the young animals in ſome particular places, that their appearance has frequently given riſe to the vulgar idea of their having been ſhowered from the clouds.

The toad is an animal too well known to require any very particular deſcription of its form. It may be neceſſary to obſerve, that it is always covered by tubercles, or elevations on the ſkin, of larger or ſmaller ſize in different individuals, and that the general colour of the animal is an obſcure brown above, much paler and irregularly ſpotted beneath. The toad, however, is occaſionally found of an olive caſt, with darker variegations; and in ſome ſpecimens, more eſpecially in the earlieſt part of ſummer, the ſhoulders and limbs are marked with reddiſh ſpots, while a tinge of yellow often pervades the under parts both of the limbs and body.

The toad arrives at a conſiderable age; its general term of life being ſuppoſed to extend to fifteen, or even twenty years; and Mr. Pennant, in his Britiſh Zoology, gives us a curious account, communicated by Mr. Arſcott, of Teholt, in Devonſhire, of a toad's having lived, in a kind of domeſtic ſtate, for the ſpace of more than forty years, and of having been, in a great degree, tamed, or reclaimed from its natural ſhyneſs or deſire of concealment; ſince it would always regularly come out of its hole at the approach of its maſter, &c. in order to be fed. It grew to a very large ſize, and was conſidered as ſo ſingular a curioſity, that even ladies, laying aſide their uſual averſion and prejudices, requeſted to ſee the favourite toad. It was, therefore, often brought to table, and fed with various inſects, which it ſeized with great avidity, and without ſeeming to be embarraſſed by the preſence of company. This extraordinary animal generally reſided in a hole beneath the ſteps of the houſe door, fronting the garden; and might probably have ſurvived many years longer, had it not been ſeverely wounded by a raven, which ſeized it before it could take refuge in its hole, and notwithſtanding it was liberated from its captor, it never again enjoyed its uſual health, though it continued to live above a year after the accident happened.

The toad is looked upon with great averſion by the major part of mankind, and it muſt be confeſſed, that its appearance is diſguſting, yet the eyes are remarkably beautiful, being ſurrounded by a reddiſh gold-coloured iris, the pupil, when in a ſtate of contraction, appearing tranſverſe.

We ſhall conclude the hiſtory of this animal, with mentioning the very extraordinary circumſtance of its having been occaſionally diſcovered incloſed, or imbedded, without any viſible outlet, or even any paſſage for air, in the ſubſtance of wood, and even in that of ſtone or blocks of marble. "For my own part," ſays Dr. Shaw, "I have no heſitation in avowing a very high degree of ſcepticiſm as to theſe ſuppoſed facts, and in expreſſing my ſuſpicions that proper attention, in ſuch caſes, was not paid to the real ſituation of the animal. That a toad may have occaſionally latibulized in ſome part of a tree, and have been in ſome degree overtaken or incloſed by the growth of the wood, ſo as to be obliged to continue in that ſituation, without being able to effect its eſcape, may perhaps be granted: but it would probably continue to live ſo long only as there remained a paſſage for air, and for the ingreſs of inſects, &c. on which it might occaſionally feed: but that it ſhould be completely blocked up in any kind of ſtone or marble, without either food or air, appears entirely incredible, and the general run of ſuch accounts muſt be received with a great many grains of allowance for the natural love of the marvellous, the ſurprize excited by the ſudden appearance of the animal in an unſuſpected place, and the conſequent neglect of minute attention at the moment, to the ſurrounding parts of the ſpot where it was diſcovered."

* Rubeta; the Natter Jack. Of this the vent is obtuſe; and it has a yellow line on the back; the body beneath is ſpotted with black, but above it is of a dirty yellow, clouded with brown, and covered with porous pimples of unequal ſizes. This ſpecies frequents dry and ſandy places, and is found on Putney Common, and near Reeveſby-Abbey in Lincolnſhire, where it derives its trivial name. It never leaps, neither does it crawl, with the ſlow pace of a toad, but its motion is more like running. Several are frequently found together, and like others of the genus they appear in the evening.

Gibbosa; Gibbous Toad. Body oval, convex, with a longitudinal cinereous dentate band. A variety has its back marbled with red and yellowiſh-aſh; the belly is yellow, ſpotted with black. The firſt is found in divers parts of India, the ſecond at Surinam.

Bombina; Laughing Toad. Belly orange, ſpotted with ſky-blue; the pupil is triangular. Gmelin gives three varieties of this ſpecies; *viz.* 1. That which is diſtinguiſhed with a black belly, marked with clear white ſpots and points. 2. One which is brown with white ſpots; the ſides and round the joints are red. 3. One which is diſtinguiſhed for its loud ſonorous voice. It is found in the fenny parts of Germany and Helvetia; leaps like a frog; emits a clear ſound like a man laughing: it a good deal reſembles the common toad, but is ſmall, black, and every where rough, with dots on the upper part, and variegated beneath, with tranſverſe wrinkles under the neck.

Salsa; Salt Toad. Above of a dirty olive colour, but beneath it is white, ſpotted with black. This ſpecies is found in the ſtagnant waters of Berchteſgad, and is leſs than the R. arborea, hereafter to be noticed; it avoids the light, is inodorous, and emits no liquid from its minute perforated warts: the legs are marked with brown bands, beneath it is yellow.

Ventricosa; Tumid Toad. The mouth of this is ſemi-ovate, and the throat ovate. A variety is marked with pale white puſtules. It is found in South America, and in ſome parts of India. The body is brown and orbicular; the tubercles on the top of the neck longitudinally diſpoſed; the back has three longitudinal wrinkles; the flanks are tumid and dilated.

Marina; Marine Toad. Shoulders tumid; eye-lids warty, conchate; the hind feet are ſubpalmate: there is a variety, which is ſpotted with brown; beneath it is ſhaded with livid, the neck and ſhoulders are ſpotted with grey. This is found in various parts of America, and is more than ſix inches long. Its body is yellowiſh-grey, with a few rather tawny ſpots: the warts are diſtinguiſhed with an elevated bay ſpot in the middle: the protuberances of the ſhoulders are oval, ſmooth, and porous; the vent is ſurrounded with wrinkled radii; the hind toes are connected only as far as the firſt joint, the laſt joint is fringed with a bay membrane.

Brasiliensis; Braſil Toad. Yellowiſh-aſh, with red waved ſpots, beneath ſmooth.

Arunco; Chili Toad. All the feet of this ſpecies are palmate. It inhabits, as its name imports, the waters of Chili: in its ſize it reſembles the R. temporaria deſcribed below: on the hind toes there is a ſlight appearance of claws.

Lutea;

Lutea; Yellow Toad. The body of this is yellow; all the feet are fubpalmate. This is alfo found in Chili, and much refembles, in its habits, the R. efculenta, but is much lefs; the laft joints of the toes are not connected.

Margaritifera; Pearled Toad. Body brown-red, fprinkled with pale red fpots.

Cornuta; the Horned Toad. This takes its fpecific name from the circumftance of having its eye-lids horned. It inhabits Virginia and Surinam, and of the whole tribe it is the moft deformed. It is faid, indeed, to furpafs all animals in uglinefs. It is thus defcribed: the head is large, and rounded before; the mouth is exceffively large; the eye-lids are foft, mucronate, trifid at the point; the eyes are feated in the middle; the body is of a greenifh-brown, with broad longitudinal whitifh ftripes on the back; the legs are tranfverfely fafciate with brown: when full grown, the back, the thighs, and vent, are fpiny.

Sitibunda; Defart Toad. The fpecific character is, that above it is afhy-glaucous, varied with blackifh-green fpots, beneath of a dirty white; the hind feet are femi-palmate, with the appearance of feven toes. It inhabits the dry defarts near the Ural, fometimes hides itfelf in holes, and crawls out in the evening; it refembles the common toad, but is fomewhat larger.

Vespertina; Siberian Toad. This has a tranfverfe fpot between the eyes, forked behind, and other fpots running obliquely from the eyes to the nofe; the body above is cinereous, with longitudinal fubconfluent brown fpots, varied with different fhades of green; beneath it is dafhed with a whitifh-afh. As its trivial name imports, it inhabits Siberia, and is about the fize of a common toad; it leaps flowly: the head is fhort; the body above is fprinkled with fubwarty papillæ.

Ridibunda; Jocular Toad. Body brown, fpotted above with cinereous; the dorfal line is yellow, or greenifh; beneath it is fmooth, whitifh; haunches brown, fpotted with milk-white. The head of this fpecies is broad; the upper eye-lid is convex, fprinkled with pores; the apertures of the ears are flat; the back is porous; the fides are marked with obfolete warts; the fore thumb is divaricate, thick at the bafe; the next toe fhorter than the reft; the hind limb fubfafciate; the hind feet have a callus within, refembling a fixth toe; the toes have a wart beneath, near the joints.

This fpecies is found in great numbers near the rivers which empty themfelves into the Cafpian fea; it never ventures on the dry land; it is very large, and frequently weighs more than half a pound: it refembles the R. temporaria, but is broader and fhorter; its voice in the evening is like that of a man laughing.

Variabilis; Changeable Toad. Colour variable; back and fides gibbous; warts yellowifh in the centre; it is very fmall on the middle of the back, and larger on the moft prominent part of the flanks. It inhabits the fhady places in Germany, and is only about two inches long: in its habits, it holds an intermediate place between the toad and frog; when full awake its body is white, with green fpots; in the heat of the fun it is entirely cinereous; when afleep, the fpots are only cinereous, and when torpid the body has a flefh-coloured caft.

The head is rounded, and the mouth without teeth; the margin of the upper jaw is doubled; the tongue is flefhy, thick, placed far back, the bafe obfcurely bifid, very entire at the tip; it has hardly any upper eye-lid, the lower one is folding; cavities of the ears white; the warts refemble teats, very numerous on the groin; the chin is marked with prominent dots; the colour, when preferved in fpirits, is yellowifh, and above it is of a pale olive; the fore feet are three-toed, beneath they are emarginate, the thumb is larger; the fecond toe of the hind feet is very long.

Section B.—*Body more oblong, fmooth; Legs longer.* Frogs.

Species.

Typhonia; Hurricane Frog. Of this fpecies, the diftinguifhing characteriftic is, that the lobes of the ears are oval. It inhabits America, and is faid to make a noify croaking before hurricanes and whirlwinds. The back is marked with four longitudinal wrinkles, elevated points, and black fpots; the hind toes are narrow, without claws, the fecond is very long.

Pentadactyla; Mackarel Frog. All the legs are fafciate, five-toed; body veined, the dorfal ftreaks tranfverfe, the lateral ones are ocellate. There is a variety which is brown; the fore feet have four toes, with the rudiment of a fifth; the hind feet have five toes, with the rudiment of a fixth.

Ocellata; Ocellate Frog. The ears are marked with an ocellate fpot; feet with claws, the hind ones fub-palmate. It inhabits America.

Pipiens; Clamorous Frog. This is green, with numerous ocellate fpots, furrounded with a yellowifh ring. This fpecies is fmaller than the *green* frog, but, in its general habits, it bears a confiderable refemblance to that animal. It is a native of North America, and frequents rivulets and ditches of water, and is fo ftrong and vigorous, that it is faid it can leap to the diftance of five or fix yards. In the fpring and beginning of fummer, it is faid to indicate the approach of rain by the peculiar found which it emits. In the living animal the ears are of a fhining gold colour; the region of the anus is very much wrinkled; the third fore toe from the thumb longer than the reft; the body refembles that of the efculent, or green frog, but the hind thighs are longer; the fhanks are longer ftill, and hind feet are longer than thefe, marginate on each fide; the toes are connected nearly to the tip, the fourth is longer than the reft.

Bicolor; Blue and Yellow Frog. Colour blue, ochreous beneath, feet unwebbed; toes flattened and orbicular. This elegant fpecies is of a moderate fize; it meafures more than four inches in length. The whole of the upper furface is of a beautiful blue, while the under parts are of a pale orange, or ochre colour. The head is large, the mouth wide, and the tip of the nofe truncated. All the toes are furnifhed with a large orbicular tip, and beneath each of the joints there is a procefs or tubercle. The upper parts of the female have a deeper fhade of violet than thofe of the male. It is fuppofed to be a native of Surinam.

Maxima; the Great Frog. All the feet are palmate, as well as the toes, fafciate; body veined and variegated; the top of the back obliquely fpotted. Bands of the legs in pairs, approximate, above confluent.

Alpina; Alpine Frog. This is entirely black, and inhabits the declivities of the mountains in Auftria.

Venulosa; Veined Frog. Feet cleft; the body veined with confluent fpots. It inhabits India and South America.

Virginica; Virginian Frog. Cinereous, fpotted with red, beneath it is yellowifh; the back is five-angled, with as many ftripes. It is found in Virginia.

* Temporaria; or Common Frog. The back of this is flattifh and fub-angular. There is a variety, which is of a dirty olive colour, with large warty fpots, the head above plain, beneath whitifh; twice the fize of the common frog. Both are found in this country, and the latter alfo in Perfia; it lives, during the fpring, in water, among toads, and in the fummer

fummer on land, at which time it is filent; it feeds on various infects, and is the prey of ducks and cranes, croaks very much when in muddy ditches; the variety makes, by night, a noife like that of an angry man.

Of all the European fpecies this is the moft common. The general colour is of an olive-brown, variegated on the upper parts of the body with irregular blackifh fpots. The patch beneath each eye, which reaches to the fetting on of the fore-legs, feems to conftitute one of the principal fpecific diftinctions. The under part of the body is of a pale greenifh colour, and obfcurely fpotted. But it ought to be obferved, that the colour of the frog varies at different feafons of the year, and perhaps in different places. Towards the end of fummer, for inftance, the colours are much brighter; and as this fpecies frequently cafts its fkin, the cuticle falling off irregularly from different parts of the body, produces confiderable variations in the intenfity of the colours.

The frog has a light elegant form and a lively appearance; the limbs are well calculated for its peculiar motions, and the hind feet being ftrongly webbed, enable it to fwim well. The frog, it is faid, does not reach its full fize till it is five years old, and it lives from twelve to fifteen years. It retires during the heat of fummer to the water, and in winter it becomes torpid, and is generally found in the foft mud at the bottom of ftagnant waters, or in the cavities beneath their banks, where it remains till the return of fpring.

The frog, as well as many other of the reptile tribe, is extremely tenacious of life. It furvives, for a confiderable time, the lofs even of fome of its effential organs, and it has been found to exift for feveral days when entirely confined under water.

The frog depofits its fpawn in the month of March. This is compofed of a gelatinous tranfparent mafs, including the ova or eggs, in each of which is imbedded the embryo or tadpole, which has then the appearance of a round black globule. The period of hatching varies according to the temperature of the feafon, but it is commonly in about a month or five weeks. In its progrefs the egg becomes gradually larger, and before the tadpole is excluded, it is feen in motion within the furrounding gluten. When they are firft hatched, their only food is the remains of the gluten in which they were included. A few days afterwards, if they are minutely examined, a pair of ramified branchiæ, or temporary organs, may be obferved on each fide of the head, which after a fhort time difappear. The tadpole, which is fo extremely unlike the animal in its perfect ftate, feems to confift only of a head and tail. The head is large, black, and roundifh; the tail is flender, and margined with a broad tranfparent fin. The motions of the tadpole are very lively. Its food confifts of duck-weed and other fmall water plants, with different kinds of animalcula. The mouth is furnifhed with very minute teeth, and when the tadpole has reached a certain fize, it may fometimes be heard gnawing the edges of the leaves on which it feeds. By means of a fucker placed between the lower jaw, with which the animal in this ftate is furnifhed, it can attach itfelf at pleafure to the under furface of aquatic plants. When it is very young, it fometimes hangs from this part by means of a glutinous thread, fimilar to fome fmall flugs.

The internal ftructure of the organs of the tadpole is very different from that of the future animal. In no refpect is this difference greater than in the difpofition of the inteftines, which are coiled in the form of a flat fpiral, like a cable. The firft change which appears on the tadpole is at the end of five or fix weeks after it is hatched. It is about this time that the hind legs firft appear; and gradually increafing in length and fize, they are fucceeded about two weeks afterwards by the fore legs. Thefe latter, indeed, are formed at an earlier period beneath the fkin, and are fometimes protruded, and again drawn back by the animal, through a fmall hole on each fide of the breaft, before their complete evolution. The tail now gradually decreafes, and afterwards more rapidly, fo that in the fpace of a day or two, it is quite obliterated. After this change, the animal leaves the water, and covers the banks in myriads. The fudden appearance of fuch multitudes of young frogs, has probably induced the groundlefs but popular belief, of their having fallen from the clouds in fhowers. The frog having now arrived at its perfect form, it changes entirely the nature of its food. It lived formerly on vegetables, now it depends folely for its exiftence on animal food. It lives chiefly on fmall fnails, worms, and infects. To feize its prey, the ftructure and pofition of the tongue are remarkably well fitted. It is of confiderable length, and is attached to the fore part of the mouth; and when at reft it lies backwards. The extremity is bifid, and fecretes a glutinous matter, fo that in this way it can fecure its prey, by darting out its tongue with great celerity, and to fome diftance from the mouth. This it does with fo inftantaneous a motion, that it is fcarcely perceptible to the eye.

MARGINATA; Bordered Frog. The fides of this are marginate, and the feet cleft. It inhabits India and South America.

* ESCULENTA; Efculent, or Edible, or Green Frog. Of this fpecies the diftinguifhing characteriftics are, that it is of an olive colour, fpotted with black, with three yellowifh lines on the back; the abdomen is whitifh.

Of all the European frogs this is the largeft fpecies. The general appearance is very like that of the R. temporaria, but it is larger in fize, and of an olive-green colour, ftrongly marked on the upper part of the body with roundifh black fpots. The limbs are elegantly marked with tranfverfe bands of the fame colour. Three diftinct pale yellow ftripes run from the tip of the nofe down the whole length of the back; the middle one being flightly depreffed, but the two lateral ones are confiderably elevated. The head is proportionably larger than that of the common frog.

The green frog is rare in England, but is very common in France, Italy, and Germany, where it is employed as an article of food.

This fpecies, it is obferved by naturalifts, does not leave its winter retirement till a much later period than the common frog; and in thofe countries where it is ufed as food, it is worth while to attend to this fact: for if they are pretended to be brought to market at an earlier period, the common frog, and fometimes even toads, muft be fubftituted. During the breeding feafon, the croaking of the male is fo loud, that it may be heard at a great diftance; and in thofe places where they are numerous, it becomes fo intolerable to thofe who are unaccuftomed to hear them, that they are often deprived of fleep. At this time, too, a large inflected globular veficle is protruded from each fide of the head of the male. The globules of fpawn in the green frog are proportionally fmaller than in the former fpecies: they have fomewhat of a yellowifh caft. The progrefs of the tadpole, towards the evolution of the perfect animal, is confiderably flower in this fpecies. The fore legs do not appear before October, and the animal does not affume its perfect fhape till the beginning of November. The tail at this time begins to decreafe, and in the fpace of four days entirely difappears.

This fpecies is extremely voracious, feizing, it is faid, on young

young birds of different kinds, mice, and even ducklings, and, as it does with the reft of its prey, fwallowing them whole. At the end of four years it has reached its full growth. It begins to breed the year following, and the period of its life is fometimes extended to fixteen years.

Australisia; Auftralian Frog. The body of this is brown above, beneath blueifh; the fides are fpeckled with ochre colour; the toes of the fore feet are fpiny. It inhabits New Holland. The fecond toe of the hind foot is very long; the claws are red.

Paradoxa; Paradoxical Frog. This is of a yellowifh and olive colour, variegated with rufous bands; the hind legs or thighs are obliquely ftreaked.

In its general form this fpecies refembles the R. temporaria. The oblique longitudinal ftripes on the hind legs conftitute the principal mark of diftinction. There are four toes on the fore feet, and they are unwebbed; the hind feet have five toes, and are deeply palmated to the very ends of the toes. Near the fhorteft toe there is an oblong callus, forming a fpurious one. The upper jaw is befet with a row of fmall denticulations. This fpecies is a native of South America, and is more common in Surinam than in other places.

Naturalifts, fays Dr. Shaw, have been extremely puzzled with regard to the real nature of what has been taken for the tadpole of this frog. At one time it was confidered by Linnæus as a fpecies of lizard, and therefore arranged by him under the genus lacerta. At another time he has placed it under the prefent genus, with the fpecific name pifcis. It was defcribed by Edwards under the denomination of the frog-fifh of Surinam. The ftructure of the animal, which has been the fubject of fo much difcuffion, fhews clearly that it is the larva or tadpole of a frog; and it is fuppofed, with no fmall degree of probability, that the differences in the accounts given of this animal by naturalifts have arifen from the different ftages of its progrefs, in which it has been found. But as this tadpole is fo much larger in fize, in proportion to the perfect animal, than any other fpecies yet known, it may be the larva or tadpole of fome of the larger fpecies, and not that of the R. paradoxa, which is but a fmall frog.

C. *Hind Feet very long; the Claws lenticulate.*

Arborea; Tree-Frog. The body of this fpecies is green, beneath granulate; feet cleft. Gmelin enumerates five varieties of this fpecies. 1. Thofe which have four toes to their fore feet, and five to thofe that are behind; the knees are warty beneath. 2. Thofe that are of a green colour, with a ftraight yellow line on each fide. 3. The body of this variety is reddifh. 4. Of this it is brownifh-green. 5. The flendernefs of the body marks this variety.

"In the beauty of its colours," fays Dr. Shaw, "as well as in the elegance of its form, and agility of its movements, the tree-frog exceeds every other European fpecies. It is a native of France, Germany, Italy, and many other European regions, but is not found in the Britifh iflands. Its principal refidence, during the fummer months, is on the upper parts of trees, where it wanders among the foliage in queft of infects, which it catches with extreme celerity; ftealing foftly towards its prey, in the manner of a cat towards a moufe, and, when at the proper diftance, feizing it with a fudden fpring, frequently of more than a foot in height. It often fufpends itfelf by its feet, or abdomen, to the under parts of the leaves; thus continuing concealed beneath their fhade. Its fize is fmaller than any European frog, except the R. bombina. Its colour, on the upper parts, is more or lefs bright in different individuals; the abdomen is whitifh, and marked by numerous granules; the under furface of the limbs is reddifh; and the body is marked on each fide by a longitudinal blackifh or violet coloured ftreak, feparating the green of the upper parts from the white colour of the lower: the inferior edge of this dark lateral ftripe is tinged with yellow. The body is fmooth above, and moderately fhort or plump; the hind legs are very long and flender; the fore feet have four, and the hind feet five toes, all of which terminate in rounded, flat, and dilated tips, the under furface of which, being foft and glutinous, enables the animal to hang with perfect fecurity from the leaves of trees, &c. The fkin of the abdomen is alfo admirably calculated by nature for this peculiar power of adhefion, being covered with fmall glandular granules, in fuch a manner as to faften clofely even to the moft polifhed furface; and the animal can adhere at pleafure to that of glafs, in whatever pofition or inclination it be placed, by merely preffing itfelf againft it.

Though the tree-frog inhabits the woods during the fummer months, yet, on the approach of winter, it retires to the waters, and there fubmerging itfelf in the foft mud, or concealing itfelf beneath the banks, remains in a ftate of torpidity; and again emerges in the fpring, at which period it depofits its fpawn in the waters, like the reft of this genus. The male at this period inflates its throat in a furprifing manner, and exerts a very loud and fharp croak, which may be heard to a vaft diftance. The fpawn is depofited about the end of April, in fmall cluftered maffes; the inclofed globules or embryos being of a pale yellowifh-brown colour. The tadpoles become perfect frogs, by the total decay of the tail, about the beginning of Auguft; and foon begin to afcend the neighbouring trees, where they continue to refide during the remainder of the warm feafon; as do likewife the parent animals, after the breeding feafon is paft. During their refidence among the trees, they are obferved to be particularly noify on the approach of rain; fo that they may be confidered, in fome meafure, as a kind of living barometers; more efpecially the males, which, if kept in glaffes, and fupplied with proper food, will afford an infallible prefage of the changes of weather.

Leucophyla; White-fpotted Frog. Body fmooth, hoary, with oblong milk-white fpots; the fore feet are lobate, the hind feet palmate. It inhabits America, and weighs only about forty-fix grains. Eyes of a fine golden colour, and between thefe, on the fides and middle of the back, there are oblong white fpots; the haunches are flender.

Squantigera; Scaly Frog. In this a fcaly band reaches half-way round the back; the fides and throat have folds; the fore feet are femi-palmate, the hind feet are palmate. This is about two inches long, and is fuppofed to be an inhabitant of America. The body is varied with grey and brown in thick aggregate fpecks, and a few fpots down the hind part of the back, in a ferpentine direction; the band confifts of minute, fub-pellucid, rhomboid, imbricate fcales; the hind limbs are twice as long as the fore.

Boans; Croaking Frog. Body fmooth, with continuous dots beneath; feet palmate. There are two varieties. 1. The body above is of a blueifh lead-colour. 2. The body of this is inclining to orange. It is found in America, and differs only from the tree-frog in having the feet webbed, and the body marked with white fpots.

Rana *Arborea*, the *Tree-Frog*. See Ranunculus *Viridis*, and the preceding article.

Rana *Pifcatrix*. See Lophius *Pifcatrix*, and Sea-*Devil*.

RANARIDL, in *Geography*, a town of Auſtria; 11 miles S. of Aigen.

RANASAGUR, a town of Hindooſtan, in Bahar; 18 miles W. of Arrah. N. lat. 25° 37′. E. long. 84° 31′.

RANCAGUA, a juriſdiction of South America, in Chili. It derives its name from the inhabitants living in ſingle houſes, without the appearance of a village; every family lodging in their lonely cottage, four, ſix, or more leagues from each other. It is not, however, without a capital, conſiſting of about 50 houſes, and between 50 and 60 families, moſt of them being Meſtizos, though their caſt is not perceivable by their complexion. The whole juriſdiction may contain about 1000 families, Spaniards, Meſtizos, and Indians. Ulloa's Voyage, vol. ii.

RANCE, Armand-John le Bouthillier de, in *Biography*, the inſtitutor of the order of La Trappe, was of noble deſcent, and born at Paris in the year 1626. At a very early period he exhibited an extraordinary genius for claſſical and polite learning; and at the age of 10 he had read many claſſical works, in the Greek as well as the Latin languages, and is ſaid at that early period to have underſtood Homer. When he was only 13 years of age, he prepared for the preſs a new edition of Anacreon, with notes, that diſplayed conſiderable talent and reſearch. This was publiſhed in 1639. Four years previouſly to this, he had received the clerical tonſure, and had been nominated a canon of Notre Dame at Paris. He was promoted by the king to the ſinecure priory of Boulogne, near Chambor; and he was ſubſequently promoted to three different abbies, among which was that of La Trappe, and to other places of honour and truſt in the church. He ſtudied divinity at the Sorbonne, and in 1651 he was ordained prieſt; and in leſs than three years, the degree of doctor of divinity was conferred upon him by the faculty of the Sorbonne. Having thus completed his ſtudies, he entered into the world, and, like one broken from his ſhackles, he devoted himſelf eagerly to its honours, pleaſures, and gaieties. He ſoon became a favourite at court, and was appointed almoner to the duke of Orleans, and one of the deputies of the ſecond order in the aſſembly of the clergy in 1655. On a ſudden, and for a cauſe that never was well underſtood, he became diſguſted with the world, and reſolved to renounce for ever its pleaſures, enjoyments, and vanities. No ſooner had the abbè de Rancè formed the reſolution than he withdrew to his eſtate in the country, to deliberate concerning the mode of life which he ſhould purſue. Having made up his mind to embrace the monaſtic life, he ſold his eſtate, and beſtowed the money which it produced on the Hôtel-de-Dieu at Paris. He alſo reſigned all his benefices and dignities, excepting his priory of Boulogne, and the abbey of La Trappe; the latter of which he retained by a ſpecial permiſſion of the king, in order to introduce into it a reformation of the ſtatutes and diſcipline. He took the habit, and made his profeſſion in the year 1664, and ſet about eſtabliſhing the gloomy and auſtere diſcipline of monkery in its full perfection. The place itſelf ſeemed peculiarly adapted to the horrid ſyſtem which he eſtabliſhed, being the moſt gloomy, barren, and deſolate ſpot in the whole kingdom of France. Here the days of the monks were conſtantly ſpent in prayers, tears, contemplation, ſilence, the peruſal of holy books, the hardſhips of bodily labour, and the practice of the moſt rigid auſterities. All other deſigns and occupations, however laudable and excellent in themſelves, they were to regard as vain and ſinful to perſons of their order. The leaſt relaxation, or amuſement of the moſt innocent nature, they were not allowed; and they were prohibited from engaging at all in literary ſtudies. Strange! that a mind ſtored with liberal knowledge, and diſtinguiſhed by good taſte, ſhould have been ſo far perverted by ſuperſtition and fanaticiſm, as to deviſe or ſanction ſuch regulations.

That the world might be acquainted with the diſcipline of his community, he publiſhed "A Treatiſe on the Sanctity and Duties of the Monaſtic State." As de Rance advanced in years, the ſevere diſcipline to which he ſtrictly conformed, rendered him ſo infirm, that, finding himſelf unequal to the duties of his poſt, he reſigned it into the king's hands, but was permitted to appoint his ſucceſſor. At length, worn out with infirmities and mortifications, and lying on a bed of aſhes and ſtraw, he died in 1700, in the 74th year of his age. He was author of a great number of theological and other pieces, among which may be mentioned "Moral Reflections on the Four Evangeliſts;" "The Conſtitution and Rules of the Abbey of La Trappe," in 2 vols.; and "A Diſcourſe on Purity of Intention." Moreri.

Rançe, in *Geography*, a river of France, which runs into the ſea near St. Malo.

RANCHANO, a ſmall iſland near the coaſt of Darien, in the Pacific ocean.

RANCHERIA, a town of South America, in the viceroyalty of Granada, and province of St. Martha; 20 miles N.E. of Hacha. N. lat. 11′. W. long. 72° 36′.—Alſo, a ſmall iſland in the Pacific ocean, near the coaſt of Veragua. N. lat. 7° 50′. W. long. 82° 16′.

RANCHERIAS, a name given, in the province of Panama, to aſſemblages of Indian huts under the juriſdiction of a village. Theſe rancherias are ſituated to the ſouthward, in the ſmall chaſms or breaches of the mountains.

RANCID, in *Rural Economy*, from the Latin *rancidus*, of *rancio*, *to be rank*, a term applied to ſubſtances, which have contracted a ſtrong offenſive ſmell and taſte by keeping, as bacon, butter, and all fat ſubſtances are apt to do. It would be a very uſeful diſcovery, to find out any eaſy ſimple method of preventing this effect from taking place.

RANÇON, in *Geography*, a river of France, in the department of the Lower Seine, which runs into the Seine, at Caudebec.—Alſo, a town of France, in the department of the Upper Vienne; 8 miles E. of Bellac.

RANCONET, Aimar de, in *Biography*, a learned and worthy magiſtrate, who flouriſhed in the 16th century, was born at Bordeaux, in which city his father was an advocate of parliament. Having received the advantages of a good education, he became deeply ſkilled in the Roman law, to the ſtudy of which he joined that of philoſophy, mathematics, and antiquities. Having been ſome time a counſellor in the parliament of Bourdeaux, he was raiſed to the poſt of preſident of the fourth chamber of inqueſts in that of Paris. The religious contentions of the time were fatal to him. When the cardinal of Louvain aſſembled the parliament of Paris, to procure its opinion concerning the puniſhment of heretics, Ranconet brought the works of Sulpicius Severus, and read aloud the paſſage in which that writer cenſures the execution of Priſcilian; upon this the prelate cauſed him to be impriſoned in the Baſtille, where he died of grief in 1559, at the age of 60. His latter days had been ſingularly unfortunate. He was reduced by want to be a corrector of the preſs to the Stephenſes; he ſaw his daughter die on a dunghill, and his ſon executed, and his wife was killed by lightning. This learned man publiſhed ſcarcely any thing in his own name, but contributed much to the labours of others. He is ſaid to have had the chief part in the valuable treatiſe, "De Verborum Significatione," and in the "Formulæ" of Briſſon; and Pithou aſſerts,

asserts, that he compiled the Dictionary that bears the name of Charles Stephens. He wrote "Le Tresor de la Langue Françoise, tant ancienne que moderne." Moreri.

RANÇONNIERES, in *Geography*, a town of France, in the department of the Upper Marne; 9 miles W. of Bourbonne.

RANDAL, *Dr.* John, in *Biography*, organist, doctor in music, and music professor in the university of Cambridge. He was brought up in the king's chapel, was one of the children of that choir who first performed in Handel's oratorio of Esther, at the house of Bernard Gates, master of the boys in James-street, Westminster, on Wednesday, February 23, 1731, when it was performed in action, previous to its having been heard in public, or any where but at Cannons, the magnificent seat of the duke of Chandos, for whose chapel it was composed in 1720.

Randal was never rated very high in his profession: he was regarded as a slight organ-player, and had never distinguished himself as a composer. He obtained his degree at the installation of the duke of Grafton in the university of Cambridge, for which he composed the ode written by Mr. Gray, to the astonishment of all the musical profession, by undertaking to have it performed by the musicians resident in the university, without putting his grace to the expence of additional hands and voices from London, as Drs. Greens and Boyce had thought necessary on former occasions at Cambridge, and Dr. William Hayes at Oxford.

As Dr. Randal's professional life was unmarked by talents, his death, which happened in 1799, was hardly noticed, except by the candidates for the professorship, and his organist's places.

RANDALSTOWN, in *Geography*, a post-town of Ireland, in the county of Antrim, in the neighbourhood of which is Shanes castle, the seat of lord O'Neill. It is situated on the river Maine, to the northward of lough Neagh. Randalstown is 4 miles N.W. from Antrim, and 88 N. by W. from Dublin. Before the union, it was represented in parliament. Carlisle, &c.

RANDANS, a town of France, in the department of the Puy-de-Dôme, and chief place of a canton, in the district of Riom; 12 miles N.E. of Riom. The place contains 1047, and the canton 7996 inhabitants, on a territory of 130 kiliometres, in 11 communes.

RANDASALMI, a town of Sweden, in the government of Kuopio; 52 miles S. of Kuopio.

RANDAZZO, a town of Sicily, in the valley of Demona; 25 miles W. of Taormina. N. lat. 37° 57′. E. long. 15° 4′.

RANDEER, a town of Hindoostan, in Guzerat, on the Taptee, opposite to Surat.

RANDEGG, a town of Austria; 8 miles N.N.E. of Bavarian Waidhoven.

RANDERADT, a town of France, in the department of the Roer; 10 miles N.W. of Juliers. N. lat. 50° 59′. E. long. 6° 8′.

RANDERS, a town of Denmark, in North Jutland, on the Gulden. This town is reduced, and has now only one parish church, a grammar-school, an hospital, and a chapel near the town. The chief articles of trade consist of leather gloves, salmon, earthen-ware, and strong beer. It was formerly well fortified; 20 miles E. of Viborg. N. lat. 56° 28′. E. long. 10° 3′.

RANDERSACKER, a town of the duchy of Wurzburg, on the Maine; 2 miles S. of Wurzburg.

RANDIA, in *Botany*, was so named by Houstoun and Linnæus, in honour of Mr. Isaac Rand, F.R.S., an apothecary in London, who filled the place of lecturer and demonstrator of botany in the Chelsea garden, from the year 1722 to 1739. He published in 1730 an octavo index of the officinal plants of that collection, 518 in number, specifying the part of each used in physic. He also printed, in 1739, a general catalogue of the Garden. His name often occurs among the botanists of that period. The *Randia*, however, of which two supposed species are defined in Linn. Sp. Pl. 213, 214, by the names of *mitis* and *aculeata*, both West Indian shrubs, is now sunk in Gardenia; see that article, where we have suggested a doubt, possibly not well founded, of the propriety of this measure. Both species of *Randia* are united by Willdenow, Sp. Pl. v. 1. 1230, on the authority of Swartz, as well as in Ait. Hort. Kew. v. 1. 370, under the name of *Gardenia Randia.* This plant, sent by Houstoun to Miller, before the year 1733, does not appear to exist in our stoves at present. Its form may be seen in Browne's Jamaica, 143, t. 8. f. 1. That author says the pulp of the berries stains paper or linen of a fine permanent blue, which resists the action of soap and of acids. The shrub is frequent in the low lands of Jamaica, on the most barren clay soil.

RANDNITZ, in *Geography*, a town of Bohemia, in the circle of Schlan; 12 miles N.N.E. of Schlan. N. lat. 50° 23′. E. long. 14° 24′.

RANDOLPH, Thomas, in *Biography*, an English poet of great celebrity, was born at Newnham, in Northamptonshire, in 1605. He was educated at Westminster school, and having completed his course, he was elected to Trinity college, Cambridge. He shewed an early turn for poetry, and at ten years old wrote "The History of the Incarnation of our Saviour," in verse. He acquired an unfortunate, and, to him, a fatal habit of conviviality, which diverted him from the pursuit of any profession, and which led him to waste his scanty patrimony, and his health, in the company of wits and men of pleasure in the metropolis. He died in his 30th year, to the great regret of those who admired his poetry and loved his company. He possessed an excellent genius, and had his life been extended, it has been thought he might have attained to a very high rank among the poets of his age. His miscellaneous poems were collected after his death by his brother, who published them at Oxford, in 1640. They have been, but not of late years, several times reprinted. He likewise composed six dramatic pieces of the comic class, one of which, "Hey for Honesty, down with Knavery," was taken from the Plutus of Aristophanes. His pieces are said to be some of the best in the manner then prevalent, which consisted in playing with words and thoughts, and connecting remote ideas by fanciful resemblances. His expressions are often elegant, and his verses harmonious. His friend, sir Christopher Hatton, caused, at his own expence, a monument of white marble to be erected over his grave, the inscription on which, in Latin and English verse, was made by Peter Hausted. Biog. Brit.

Randolph, John, a learned prelate of the church of England, descended from a respectable family in Kent, was born July 6th, 1749. He was the younger son of Dr. Randolph, formerly president of Corpus Christi college, Oxford, who died in March 1783, after having presided over the college for the long space of 35 years. The president's father was recorder of Canterbury, and had several sons, among whom was Dr. Francis Randolph, principal of Alban Hall, Oxford. The whole family have been remarkable for their orthodox zeal and attachment to the established religion of the country. The subject of this article became a student of Corpus Christi college, Oxford, where he took his several degrees, that of D.D. he had by diploma in 1783. Previously

viously to this he had been appointed prelector of poetry, proctor, and in 1782 Regius professor of Greek. In this same year he was made prebendary of Salisbury, canon of Christ-church, and Regius professor of divinity; and in 1783 rector of Ewelme. In 1799 he was elevated to the bishopric of Oxford, from which he was translated to that of Bangor in 1807, and then to the metropolitan see of London in the year 1809. Notwithstanding these high preferments he passed a great part of his life in the university of Oxford, and it was generally believed that when he was elevated to the see of Oxford, the university was complimented with the nomination by the crown. His lordship was author of many single sermons, and charges delivered on different occasions: also of "De Græcæ Linguæ Studio Prælectio habita in Scholâ Linguarum," 1783, and "Concio ad Clerum in Synodo Provinciali Cantuariensis Provinciæ ad D. Pauli," 1790. His lordship was a zealous promoter of the *National schools* in opposition to those founded by Lancaster, and he was understood to be a violent opponent to the bible society, and to the spread of what has been termed Sectarism. One of his last works was a Report of the Progress made by the National Society, to which the general committee referred in terms of gratitude, at their first meeting after his lordship's decease, in the following terms; "whose latest employment had been to state, for the information of the public, the progress of a work to which he had contributed his time, his labour, and his counsels, the committee could not fail to entertain a common sentiment of profound regret for the loss which they have sustained, and to cherish in their minds the liveliest recollection of the service which has been so succesfsully fulfilled by him in this second report. They wish, therefore, to add to this document, designed for general circulation, their sense of what is due from the public, and themselves, to the memory of one who was a constant and assiduous promoter of this salutary institution, from its first establishment to the last hour of his life.—The committee trust, that this testimony, though limited to a single object in the large field of pastoral duty in which he was incessantly engaged, may serve to denote the benefits which have resulted from his prompt, unwearied, and effectual exertions." The following is the character drawn of him by Mr. archdeacon Jefferson, and which alludes to his zeal for the church of which he was an active member. "Fearless now of being censured for mercenary adulation, or reproved by unconscious merit, a just tribute may be paid to the character of that departed and exalted prelate, who is, and will be, most lamented where he was best and most entirely known. This opportunity, therefore, is willingly embraced of offering a heart-felt condolence to the ministry of the diocese on the affecting and important loss, which, in these perilous times of contending sects and unsettled opinion, has arisen to them, and to the church:—To them, in the premature privation of a diocesan, firm in his support of ecclesiastical authority, but considerate in its application; eminently versed in the letter of ecclesiastical law, but liberal in its practical construction, reluctant in interference, but determined in duty, slow in the profession of service, but prompt in its execution; disinterested in patronage, unwavering in measures, correct in judgment, attentive in counsel, and kind and compassionate to distress:—To the church, in the premature privation of a father, diligent in her rites and services, but unostentatious in piety and devotion; sound and unrelaxing in her doctrines and faith, but discreet in zeal, and comprehensive in charity; ever vigilant in defending her interests, ever forward in asserting her privileges, and ever able in the assertion and the defence." The bishop died suddenly on the 28th of July 1813. He was one of the governors of the Charter-house; trustee of the British Museum; dean of the Chapel royal; visitor of Sion college; and provincial dean of Canterbury. Gent. Mag.

Randolph, in *Geography*, a post-town of America, in Massachusetts, formed of the S. precinct of Braintree, in Norfolk county, in the year 1783; 15 miles S.E. of Boston. The inhabitants are mostly farmers, but manufacture large quantities of shoes for market.

Randolph, a county of Hillsborough district, in North Carolina, bounded N.E. by Orange, and N.W. by Guildford. The number of inhabitants is 10,112, and they are mostly Quakers; the other denominations are Presbyterians, Baptists, Methodists, and Universalists. Their good land produces 40 or 50 bushels of Indian corn, or 20 of wheat, *per* acre. The chief town is Ashborough.

Randolph, a county of Virginia, bounded N. by Monongalia, and S. by Pendleton. The number of inhabitants is 2854.

Randolph, a post-town in Orange county, Vermont, being the 4th town W. of Thetford, on Connecticut river. The number of inhabitants is 2255. White river, by its two branches, waters the E. and W. side of the town. It has a large bed of iron ore, two forges, and a slitting mill. The congregational meeting-house has a steeple, and is large; 47 miles from Rutland.

Randolph, a county of the Indiana territory.

Randolph, a town of Morris county, in New Jersey, containing 1271 inhabitants.

RANDOM, a township of Essex county, in Vermont, W. of Brunswick.

Random *Island*, a small island in Trinity bay, near the E. coast of Newfoundland. N. lat. 48° 15′. W. long. 53° 40′.

Random-*Shot*, a shot made when the muzzle of a gun is raised above the horizontal line, and is not designed to shoot directly, or point-blank.

The utmost random of any piece is about ten times as far as the bullet will go point-blank; and the bullet will go farthest when the piece is mounted to about forty-five degrees above the level range.

The space or distance of the random is reckoned from the platform to the place where the ball first grazes.

RANDOW, in *Geography*, a river of Brandenburg, which runs into the Ucker; three miles S. of Uckermunde.

RANDS, a lake of Norway, in the province of Aggerhuus, 35 miles long, and two broad; 20 miles N. of Christiania.

RANDSBERG, a town of Sweden, in West Gothland; 76 miles E. of Uddevalla.

RANDYCHOAR, a town of Bootan; 18 miles N. of Beyhar.

RANEA, a town of West Bothnia; 60 miles W. of Tornea.

RANELAGH, *Rotunda* and *Gardens*, built and opened for musical performances and public amusements in 1742. The building was erected in the spacious garden belonging to the residence, at Chelsea, of lord Ranelagh, one of the ministers of Charles II., when paymaster of the army.

It was planned by the late Mr. Lacey, afterwards joint-patentee of Drury-lane theatre with the great actor Garrick.

At the first opening of this stupendous building, several experiments were made in placing the orchestra, in filling it, and in the time of performance, before it was settled as an evening promenade. The orchestra was at first placed in the middle of the rotunda. The performance was in a morning; and oratorio chorusses chiefly furnished the bill of fare. Sir John Barnard complaining to the magistrates, that

that the young merchants and city apprentices were frequently feduced from their counting-houfes and fhops by thefe morning amufements, they were prohibited, and the doors opened at fix o'clock in the evening. The performance, however, did not begin till eight o'clock, but was ended at ten.

It was intended to rival Vauxhall, and was little injured by bad weather; as the company, at fuch times, had a fafe and pleafant retreat into the rotunda, and as few went thither but in carriages.

Its fuccefs as an evening's amufement remained undiminifhed more than 40 years. It was ruined by the late hours to which it was gradually brought by fine folks, who, at length, never came thither till paft ten o'clock, when the mufical performances were over, and fober people ufed to return home before eleven o'clock to their fupper, which enabled them and their fervants to go to bed, and rife, at their accuftomed time.

But, at length, perfons of rank and fafhion made a debauch of this innocent amufement, and went to it and departed from it as late as at a mafquerade. This precluded all that had any thing to do themfelves, or any employment for their fervants in the morning, and fo much refined the company, that at midnight there had been feldom fufficient money received at the entrance, to cover the expences of the lamps, the terms of admiffion being only 3*s*., for which, befides a good concert by the beft performers in London, the company was furnifhed with excellent rolls, butter, and tea. In the year 1803 it was fhut up, and only ufed occafionally for a mafquerade, a feftival, or an exhibition of fire-works. But fince the period juft-mentioned, the building has been pulled down, and the materials fold piecemeal, as was the cafe at Cannons, the fplendid manfion of the duke of Chandois, (or *Palazzo*, as it would have been called in Italy,) and the ground is now (1809) of no other utility than occafionally to drill and exercife the Chelfea volunteers.

RANES, in *Geography*, a town of France, in the department of the Orne; 10 miles S.W. of Argentan.

RANESTAD, a town of Sweden, in Angermannland; 50 miles N.N.E. of Hernofand.

RANFORCE Ring. See Reinforced *Ring*.

RANG, in *Geography*, a town of Sweden, in the province of Skonen; 11 miles S.S.W. of Lund.

RANGA, in *Hindoo Mythology*, one of the many names of Siva, the perfonification, according to the Hindoo mythologifts, of the deftructive or changing form of the deity. (See Siva.) The epithet Sri, meaning holy, or divine, or bleffed, prefixed, has given this name to the capital of Myfore; Sri Ranga-pattan being the city of the bleffed Ranga, altered by Europeans to Seringapatam. See Sri.

RANGALORE, in *Geography*, a town and fortrefs of Hindooftan, in the circar of Cicacole; 38 miles W. of Cicacole.

RANGAMATTY, a circar of Bengal, bounded on the N. by Bootan and Affam, on the E. and S. by Affam, and on the W. by Baharbund, Bettrebund, and Goollah; about 40 miles long, and from 10 to 40 broad. Rangamatty, the capital, is 128 miles N.N.E. of Moorfhedabad, and has a celebrated pagoda. N. lat. 26° 8′. E. long. 90° 6′.

RANGANJA, a town of Bengal; 15 miles N.E. of Chittigong.

RANGAPALEAM, a town of Hindooftan, in Coimbetore; eight miles N.N.E. of Daraporum.

RANGAPILLA, a town of Hindooftan, in the Carnatic; fix miles N.E. of Pondicherry.

RANGASUNDRUM, a town of Hindooftan; 15 miles W. of Tinevelly.

RANGE, in *Gunnery*, the path of the ball, or the line it defcribes from the mouth of the piece to the point where it lodges. The flight of a fhot is diftinguifhed, by artillerymen, into three different ranges, of which the firft is called the *point-blank*, the fecond the *random-fhot*, and the third the *ricochet*, or rolling and bounding fhot. The firft, or point-blank, is to fuppofe a piece ftood upon a level plain, and laid level, then the diftance between the piece and the point where the fhot touches the ground firft, is called the *point-blank range* of that piece; but as the fame piece ranges more or lefs, according to a greater or lefs charge, the point-blank range is to be underftood to be that, when the piece is loaded with that charge which is commonly ufed in action.

This range is much lefs than the greateft range, or random-fhot; but the piece cannot be levelled, or, as it is generally expreffed, *pointed* at an object intended to be battered, if that object is not within the diftance of the point-blank range; for beyond that the fhot is very uncertain, therefore rarely ufed in the fea-fervice, and on land only when the fhot cannot fail of doing great execution in the place on which it falls.

In ricochet firing, the piece is only elevated from three to fix degrees, and loaded with a fmall charge, in order that the ball may be bounded, and roll along the infide of the parapet. The fhot, thus difcharged, goes rolling and bounding, killing and maiming, or deftroying all it meets in its courfe, and creates much more diforder by going thus flowly, than if thrown from the piece with greater violence. See Cannon, Gun, and Projectile.

Range *of a Projectile, Amplitude of the*. See Amplitude.

Range, *Point-blank*. See Point-*blank*.

Range, in a *Ship*, denotes a fufficient length of the cable, drawn up on the deck, before the anchor is caft loofe from the bow, to let it fink to the bottom, without being interrupted, that the flukes may be forced the deeper into the ground, by the additional weight which the anchor acquires in finking. For this reafon, the range, which is drawn up out of the tire, ought to be equal in length to the depth of the water, where the fhip anchors.

RANGER, a fworn officer of the foreft, whofe bufinefs it is to walk daily through his charge, to drive back the deer out of the purlieus or difafforefted places into the foreft lands; and to prefent all trefpaffes done in his bailiwick at the next court held for the foreft.

The ranger is made by the king's letters, and has a fee paid yearly out of the exchequer, and certain fee-deer. In the Charta de Forefta mention is made of twelve kinds of rangers. It is now principally a honorary and finecure employment; but the holders fometimes likewife receive pay.

RANGES, in *Ship Building*, horned pieces of oak, like belaying cleats, but much larger, bolted to the infide of a fhip, in the waift, for belaying the tacks and fheets. Alfo thofe pieces of plank fixed between the ports, with femicircular holes in them for keeping fhot in.

RANGIFER, in *Zoology*, a variety of the Cervus *Tarandus*; which fee.

RANGING, in *War*, the difpofing of troops in a condition proper for engagement, or for marching.

In *Building*, the fide of a work that runs ftraight, without breaking into angles, is faid to *range*, or *run range*.

Ranging *out a canal*, denotes determining or fetting out on the ground the lines which are to be occupied by its middle and fides.

RANGLE, in *Falconry*, is when gravel is given a hawk to bring her to her ftomach.

RANGOON, in *Geography*, a fea-port town of the Birman

Birman empire, fituated on a branch of the Irrawaddy, called the Rangoon river, which forms the only communication that the Pegue river has with the fea. The town, in its prefent ftate, has been extended by increafing trade and confequent population far beyond the limits which formerly comprehended Rangoon, as it was originally founded, in 1755, by Alompra, the fovereign of the Birman empire. Rangoon, or Dzangoon, which fignifies victory achieved, was denominated Dagon, before Alompra took it, and laid the foundation of the prefent town. Here ftood, in former days, a large and populous city, called in the Pali, or facred language, Singounterra; the fcite of which Alompra diligently explored, and raifed on its ruins the prefent flourifhing fea-port of the Pegue dominions. Dagon, often called Shoe-Dagon, or the golden Dagon, is a name peculiar to the temple; a noble edifice, three miles diftant from the banks of the river. (See DAGOUNG.) Rangoon ftretches along the bank of the river about a mile, and is not more than a third of a mile in breadth. The city, or miou, (mious being a term applied either to a city or a diftrict,) is a fquare furrounded by a high ftockade, in the manner of the country, and on the N. fide it is further ftrengthened by an indifferent foffe, acrofs which a wooden bridge is thrown; in this face there are two gates, in each of the others only one. Wooden ftages are erected in feveral places within the ftockade, for mufqueteers to ftand upon in cafe of an attack. On the S. fide, towards the river, which is about 20 or 30 yards from the palifade, there are feveral huts, and three wharfs, with cranes for landing goods. A battery, of twelve cannon, fix and nine-pounders, raifed on the bank, commands the river; but the guns and carriages are in fuch a wretched condition, that they could do little execution. Clofe to the principal wharf are two commodious wooden houfes, ufed by the merchants as an exchange, where they ufually meet in the cool of the morning and evening, to converfe, and tranfact bufinefs. The ftreets of the town are narrow, and much inferior to thofe of Pegue, but clean and well paved; there are numerous channels to carry off the rain, over which ftrong planks are laid, to prevent an interruption of intercourfe. The improvement of the town has been very much owing to the activity of the defcendant of a Portuguefe family, named Jaunfee, of low origin, but advanced at length to the important office of Shawbunder, or intendant of the port, and receiver of the port-cuftoms. Under his direction and influence, the ftreets were paved, feveral well built wooden bridges were conftructed, and alfo a wharf, which, extending into the river, and raifed on pofts, enables the fhips to deliver and receive cargoes without the affiftance of river-craft; under his direction alfo a fpacious cuftom-houfe has been erected. This is the only lay building in Rangoon that is not conftructed of wood, it is compofed of brick and mortar, and the roof covered with tiles; within, there is a number of wooden ftages for the reception of bale goods. The houfes, in general, are raifed on pofts from the ground; the fmaller fupported by bamboos, the larger by ftrong timbers. All the officers of government, the moft opulent merchants, and perfons of confideration, live within the fort; fhipwrights, and people of inferior rank, inhabit the fuburbs; and one entire ftreet, called Tackally, is exclufively affigned to common proftitutes, who are not permitted to dwell within the precincts of the fortification. Swine are fuffered to roam about the town at large; they do not belong to any particular owners, but are regarded as fervants of the public, or common fcavengers; as they go under the houfes and deftroy the filth. The Birmans are alfo fond of dogs, numbers of which infeft the ftreets; the breed is fmall, and very noify. The borders of the terrace on which the temple of Dagoung is raifed, are planted with fhady trees in regular rows; and from this eminence there is a beautiful and extenfive profpect; the Pegue and Rangoon rivers are feen winding through a level woody country, and the temple of Syriam, little inferior to others at Pegue and Rangoon, ftands near the junction of the ftreams. The road leading from the city to the temple is formed with care, a wide caufeway in the centre throwing off the rain to the fides; and numberlefs little fpaces are ranged along the edge of the road, in which are niches to receive fmall images of their divinity Guadma. Several kioums or monafteries lie in this direction, generally removed at a fhort diftance from the public way, under the fhade of pipal or tamarind trees. The Birmans being, like other inhabitants of the eaft, fond of proceffions, fcarcely a week paffes in which there is not a religious difplay at Rangoon; either a funeral of fome perfon who leaves fufficient to defray the expence of a pompous public burning, or the ceremony of admitting youths into the convents of the Rhahaans, on which occafion parents and friends fpare no expence in entertainments and prefents to the Rhahaans. See RHAHAANS.

The population of Rangoon is confiderable; there are 5000 regiftered taxable houfes in the city and fuburbs; fo that if each houfe be fuppofed to contain fix people, the eftimate will amount to 30,000. Having long been the afylum of infolvent debtors from the different fettlements of India, it is crowded with foreigners of defperate fortunes, who find from the Birmans a friendly reception, and generally fupport themfelves by carrying on a fmall trade. The exchange, if it may be fo called, exhibits a motley affemblage of merchants, fuch as few towns of much greater magnitude can produce; Malabars, Moguls, Perfians, Parfees, Armenians, Portuguefe, French, and Englifh. The members of this difcordant multitude, engaged in various branches of commerce, are not only permitted to refide under the protection of government, but likewife enjoy the moft liberal toleration in matters of religion. They celebrate their feveral rites and feftivals, totally difregarded by the Birmans, who have no inclination to make profelytes. In the fame ftreet may be heard the folemn voice of the Muezim, calling pious Iflamites to early prayers, and the bell of the Portuguefe chapel tinkling a fummons to Romifh Chriftians. Proceffions meet and pafs each other without giving or receiving caufe of offence. The Birmans never trouble themfelves about the religious opinions of any fect, nor difturb their ritual ceremonies, provided they do not break the peace, or meddle with their own divinity Gaudma; but if any perfon commit an outrage, which the Muffulmen, in their zeal for the true faith will fometimes do, the offender is fure to be put into the ftocks; and if that does not calm his turbulent enthufiafm, he is baftinadoed into tranquillity.

The Parfees, the Armenians, and a fmall proportion of Muffulmen, engrofs the largeft fhare of the trade of Rangoon; and individuals from their number were frequently felected by government to occupy employments of truft, that related to trade and tranfactions with foreigners, the duties of which the Birmans conceive that fuch perfons could perform better than themfelves. Thefe people, particularly the Armenians, naturally behold with a jealous eye any ordinance of a commercial nature, that may tend to diminifh their influence, and deprive them of that dictatorial power, which they affume and exercife over all merchants and mariners that refort to Rangoon; but of none are they fo apprehenfive as of the Englifh: a connection with whom might teach the Birmans to tranfact foreign bufinefs without their affiftance, and give them a more adequate fenfe of their own intereft.

The

The French have long maintained an agent at Rangoon, and are thoroughly acquainted with the advantages which the country of Pegue affords. The imports into Rangoon from the Britifh fettlementss in the years 1794—5, amounted, according to Mr. Symes, to more than twelve lacks of rupees, about 135,000*l.* fterling: thefe confifted chiefly of coarfe piece goods, glafs, hardware, and broad cloth, the demand for the laft article being confiderable; and returns were almoft wholly made in timber. Teak, the moft durable wood that is known, and beft adapted for the conftruction of fhips, is produced in the Birman and Pegue empire in inexhauftible abundance. The river of Rangoon is equally commodious for the conftruction of fhips; the fpring tides rife 20 feet in perpendicular height; the banks are foft, and fo flat, that little labour is neceffary for the formation of docks: veffels of any burden may be built. Nature, fays Symes, has liberally done her part to render Rangoon the moft flourifhing fea-port of the eaftern world. The entrance of the river, about twelve miles below Rangoon, and the banks on each fide, bear a near refemblance to thofe of the Ganges; but the navigation is much more commodious. The channel is bold and deep, from fix and a half to eight fathoms, uninterrupted by fhoals or inequality of foundings. At this place the breadth of the river is eftimated to be from three quarters to one mile. On the bank of the river, oppofite to Rangoon, is a confiderable town, called Maindu, the refidence of the governor of the province of Dalla. This government is entirely diftinct from Rangoon, on the eaft fide. The city of Dalla, from which the province takes its name, is faid to be on the weft fide of the China Buckier river, and was formerly a place of confiderable importance. The town of Maindu is compofed of one long ftreet; at the eaft end is a creek, which goes all the way to Baffein, and has twelve feet depth of water, at high tide; on the weft fide is a fmaller creek, on the bank of which ftands a village called Mima-Shunrua, or the village of proftitutes, being wholly inhabited by women of that defcription. Rangoon lies in N. lat. 16° 47′. E. long. 96° 9′. Symes's Embaffy to Ava, in 3 vols. 8vo. See BIRMAN *Empire*.

RANGSIO, a town of Sweden, in Helfingland; 15 miles W.N.W. of Soderhamn.

RANGUANA, a fmall ifland in the bay of Honduras, near the coaft of Mexico. N. lat. 16° 25′. W. long. 88° 52′.

RANHADOS, a town of Portugal, in the province of Beira; 18 miles N.W. of Caftel Rodrigo.

RANINA, *Arteria et Vena*, in *Anatomy*. the artery and vein fituated on the inferior furface of the tongue. See ARTERY and VEIN.

RANINAL VESSELS, *Bleeding from*. See FRÆNUM LINGUÆ, *Divifion of*.

RANISH, in *Geography*, a fmall ifland near the W. coaft of Scotland. N. lat. 57° 55′. W. long. 5° 5′.

RANK, a due order, or a place allotted a thing fuitably to its nature, quality, or merit.

Kings are perfons of the firft rank on earth. In cavalcades, proceffions, &c. every perfon is to obferve his rank.

RANK, in *Military Difcipline*, denotes a feries, or row of foldiers, placed fide by fide; a number of which ranks form the depth of the fquadron or battalion, as a number of files does the width.

When infantry is drawn up three deep, the firft rank is called the *front* rank; the fecond, the *centre* rank; and the third, the *rear* rank.

To *clofe the rank*, is to bring the men nearer; to *open* it, is to fet them farther apart. To *double the ranks*, is to throw two into the fpace of one, by which the files are thinned. See DOUBLING.

RANK, in the *Army* and *Navy*, is ufed for the order of *precedence;* which fee.

In the army the officers in the life-guards are entitled to the rank of lieutenant-colonel, when they obtain or purchafe a majority, provided they are of feven years ftanding. Their commiffions in this cafe run major and lieutenant-colonel. But if an officer fhould not have completed either of thofe periods, he obtains the rank of major only until its completion. A lieutenant-colonel attains to the rank of full colonel if he has been feven years major, or twenty-one years in the Britifh fervice. Cornets in the life-guards rank as fub-lieutenants in their own corps, and as firft lieutenants in the army. The Englifh fuzileers enjoy the fame privilege. Sub-lieutenants in the Welfh fuzileers, rank only as fecond lieutenants in the army. Marines do the fame.

Officers of the regular forces command the officers of equal degree belonging to the other fervices. Officers of the militia, fencibles, yeomanry cavalry, and volunteer corps, rank together, according to the dates of their refpective commiffions. Thefe regulations are fubject to fome exceptions, fpecified in the articles of war. Officers of the militia rank generally with the regular forces as junior of their refpective commiffions. An enfign in the guards ranks no higher than an enfign in the regulars. The chief of the engineers ranks as colonel; director, as lieutenant-colonel; fub-director, as major; engineer in ordinary, as captain; engineer extraordinary, as captain-lieutenant; fub-engineer, as lieutenant; practitioner-engineer, as enfign.

In the navy the admiral or commander-in-chief of his majefty's fleet has the rank of a field-marfhal; admirals, with the flags on the top-maft-head, rank with generals of horfe and foot; vice-admirals, with lieutenant-generals; rear-admirals, as major-generals; commodores with broad pendants, as brigadier-generals; captains of poft-fhips, after three years from the date of their firft commiffion, as colonels; other captains, commanding poft-fhips, as lieutenant-colonels; captains, not taking poft, as majors; and lieutenants, as captains.

RANK, *Brevet*, rank without pay, nominal diftinction, which fometimes entitles the holder of it to command in mixed fervice. The brevet rank in the militia is confined to the colonels and adjutants of the feveral corps in that eftablifhment. The former receive the brevet rank of colonels in the army whilft actually embodied for fervice, and command all lieutenant-colonels in the line when they do duty together. Adjutants in the militia may have the brevet rank of captain, provided they have ferved five years as lieutenants in the militia, or in other forces on the Britifh eftablifhment. In the line, an adjutant who has the rank of captain, may command as fuch when there is no fuperior officer on the parade, or for duty. This is not the cafe in the militia. No adjutant, let his brevet rank of captain be ever fo ancient, can command the youngeft captain of a company. The fame difference prevails with refpect to the captain-lieutenancy; which is literally brevet rank. In the regulars, a captain-lieutenant, the inftant he is promoted to a company, takes rank according to the date of his firft commiffion, and, as we have obferved, may be major by brevet; but no captain-lieutenant can ever avail himfelf of that feniority to the prejudice of a captain of a company in the militia; nor can an officer in the latter eftablifhment take advantage of his ftanding, when he quits one regiment to ferve in another, even in time of war, although he may have the requifite qualifications in both counties.

Brigade majors rank with captains, provided they have that

that rank in the army, independent of their staff appointment. But aids-de-camp do not possess any rank in that capacity with regard to the army. The latter constitute a part of the general's family, and are paid out of his allowance; they are in fact the mere carriers of his orders in the field, and his domestic inmates at home, &c. The former belong to the brigade, and are a necessary part of its effective force. It has been judiciously ordained, that both the one and the other should be regular officers.

There is likewise a sort of brevet rank which exists in the several regiments belonging to the British service, and is confined to the rank and file, or corporals and private soldiers. Thus a lance-serjeant is a corporal who does the duty of serjeant without the pay or emoluments of the latter; and a lance-corporal is a private soldier who does the duty of corporal. So that *lance*, which comes from *lansquenet*, and ought therefore to be written lans-serjeant, &c. is the abbreviation of that word, which signifies a private soldier, and is derived from the German, and when put before serjeant or corporal, points out, that a private soldier has the brevet rank of one of those situations. Captains of companies appoint or reduce lance-serjeants or corporals, according to their judgment.

RANK, in respect of ships. See RATE.

RANK *and File*, denote men carrying the fire-lock and standing in the ranks. Thus corporals are included in the return which is made under that head.

RANKS *and Files*, are the horizontal and vertical lines of soldiers, when drawn up for service.

RANK *Keel*, in *Ships*. See KEEL.

RANK *Modus*, in *Law*. See MODUS.

RANK is also a term provincially applied to signify any sort of crop of large growth, standing thick or close on the ground, as corn, pease, beans, &c. and even trees in woods. The term is often used to denote corn or grass crops, which are of such strong growths as to be laid down or lodged.

RANKAH, in *Geography*, a town of Bengal; 25 miles W.N.W. of Palamow.

RANKERAH, a town of Hindoostan, in Candeish; 25 miles S. of Burhanpour.

RANKNESS *in Cheese*, in *Rural Economy*, a term signifying its strong pungent quality arising from the impurity of the rennet or steep, either in consequence of neglect of the vessels holding it, the want of salt, or the imperfect separation of the curdy matter from the whey, by which fermentation and partial putrefaction occur and produce this taste. See CHEESE and DAIRYING.

RANKPORE, in *Geography*, a town of Hindoostan, in Guzerat; 45 miles E. of Radunpour.

RANNEE, a town of Hindoostan, in Orissa; 30 miles S.S.W. of Balasore.

RANNEL-BAUK, in *Rural Economy*, a word provincially used to signify the wooden bar or bauk laid across the cottage chimney, for hanging the pot-hooks on, &c.

RANNIGUNGE, in *Geography*, a town of Bengal; 76 miles N.N.E. of Dacca.

RANNING, a town of the duchy of Wurzburg; five miles N. of Schweinfurt.

RANNISERAI, a town of Hindoostan, in Allahabad; 35 miles N.W. of Gazypour.

RANNUTSCH, a town of Thibet; 36 miles E. of Jemlah. N. lat. 30° 42′. E. long. 82° 15′.

RANNY, in *Rural Economy*, a provincial word, applied to the small field-mouse.

RANNY *Bednore*, in *Geography*, a town of Hindoostan, in the circar of Sanore; 20 miles W. of Bisnagur. N. lat. 15° 18′. E. long. 75° 37′.

RANNYCOTTA, a town of Thibet; 35 miles S. of Gangotri.

RANNYDEE, a town of Bengal; 11 miles S. of Curruckdeagh.

RANNYGONG, a town of Hindoostan, in Dowlatabad; 15 miles S.S.W. of Amednagur.

RANNYGUNGE, a town of Bengal; 35 miles N. of Dinagepour.

RANNYPOOKRA, a town of Bengal; 30 miles W.N.W. of Rogonatpour.

RANO, a small island in the N. part of the gulf of Bothnia. N. lat. 65° 43′. E. long. 22° 52′.

RANRAN, a town of Cochinchina, and the capital of a province. N. lat. 12° 30′. E. long. 108° 56′.

RANSACKEN, a town of the duchy of Wurzburg; 3 miles S. of Wurzburg.

RANSOM, a sum of money paid for the redemption of a person out of slavery, or for the liberty of a prisoner of war.

With regard to prisoners of war, it is allowed that there is no obligation of releasing those who are detained as such, till after satisfaction has been obtained. Whoever makes a just war has a right, if he thinks proper, to detain his prisoners till the end of the war; and then, in releasing them, he may justly require a ransom, either as a compensation at a peace, or, if the war continue, for diminishing his enemy's prisoners, at the same time that he strengthens him with the return of soldiers. Prisoners of war, among European nations, are exchanged or ransomed during the war; and this is generally stipulated in a previous cartel. If sovereigns at war have agreed on a cartel for the exchange or ransom of prisoners, they are faithfully to observe it no less than every other convention; but if, as was formerly the general practice, the state leaves to every prisoner, at least during the war, the care of redeeming himself, such particular conventions offer many questions, of which some of the principal are the following. He who has acquired a lawful right of demanding a ransom from his prisoner, may transfer his right to a third person. This was practised in the last ages. But as the person taking a prisoner is obliged, for the sake of his reputation, to treat him with justice and humanity, he is not to transfer his right, in an unlimited manner, to one who might probably abuse it. When he has agreed with his prisoner, concerning the price of the ransom, he may transfer the right to whom he pleases. On the conclusion of an agreement made with a prisoner for the price of his ransom, it becomes a perfect contract, and cannot be receded from, under a pretence that the prisoner is discovered to be richer than was imagined; for there is no manner of necessity that he should be rated according to the wealth of a prisoner, because that is not the scale for measuring the right of detaining a prisoner of war. But it is natural to proportion the price of the ransom to the prisoner's rank and character; the liberty of an officer of distinction being of greater consequence than that of a private man, or inferior officer. If the prisoner has not only concealed, but disguised his rank, it is a sordid fraud, and gives a right for annulling the agreement. If a prisoner, having agreed on the price of his ransom, dies before payment, it has been queried whether this price be due, and whether the heirs are obliged to discharge it? Unquestionably, says Vattel, they are obliged to it, if the prisoner died in the possession of his liberty; for, from the moment of his release, in consideration of which he had promised a sum, this sum becomes due, and does not at all belong to his heirs; but if he had not

not obtained his liberty at the time of his death, it can be no debt to him, or to his heirs, unless the agreement was otherwise: and he is not reputed to have received his liberty, till he is absolutely permitted to depart free; when neither he whose prisoner he was, nor the sovereign, opposed his release and departure. If indeed he has only been permitted to take a journey for applying to his friends, or his sovereign, in order to obtain the means of ransoming himself, and he dies before he is possessed of his full liberty, before his final discharge from his parole, nothing is due for his ransom. If, after agreeing on the price, he is detained in prison till the time of payment, and he dies before, the debt is paid by his death, and does not affect his heirs; such an agreement on the part of him, who detains his prisoner, being no more than a promise of giving him his liberty for a certain sum paid down. A promise of buying and selling does not suppose the purchaser to pay the price of a thing, if it happen to perish before the bargain is concluded. But if the contract of sale be perfect, the purchaser shall pay the price of the thing sold, though it should happen to perish before the delivery of it, provided there was no fault or delay in the seller. F r this reason, if the seller has absolutely concluded the agreement of the ransom, and from that time owns himself a debtor for the stipulated sum, remaining no longer as a prisoner, but for the security of the payment, his intervening death does not extinguish the debt: the ransom agreed on remains still due. If the agreement says, that the ransom shall be paid on a certain day, and the prisoner happens to die before that day, then the heirs are bound to discharge it; for the ransom was due, and the day was assigned, only, as the term for payment. Upon the same principles, strictly speaking, it follows, that a prisoner, released on condition of procuring the release or discharge of another, should return to prison, in case the latter happens to die before he could procure him his liberty. Such an unfortunate case, however, is entitled to regard, and equity seems to require that this prisoner should continue in the enjoyment of liberty, provided he pays a just equivalent; it being now out of his power to purchase it precisely at the price agreed on. If a prisoner fully set at liberty, after having promised, but not paid, his ransom, happen to be taken a second time, it is evident that, without being exempted from paying his first ransom, if he is willing to be set at liberty, he must pay a second ransom. On the contrary, though the prisoner has agreed for the price of his ransom, if before the execution of the compact, before he is set at liberty in virtue of it, he be retaken by his party, he owes nothing. It is here evidently supposed, that the finishing hand was not put to the compact, and that the prisoner had not acknowledged himself debtor for the rate of his ransom. He whose prisoner he was, had, as it were, only made him a promise of selling, and he had promised to purchase; but the purchase and sale had not actually passed into effect; the property was not actually transferred. The property belonging to a person does not pass to him who takes him prisoner, unless at the same time he seizes on such things. Of this there is no doubt, especially in our times of moderation, when prisoners of war do not fall into slavery. And even by the law of nature, the property of a slave's goods does not, without some other reason, pass to the master of a slave. There is nothing in slavery of which this can itself be the natural effect. If a man obtain a power over the liberty of another, does it follow that he has likewise a right over his property? Therefore, if an enemy has not stripped his prisoner, or the latter has found means to conceal something from his search, what he has preserved should belong to him, or he may employ it towards the payment of his ransom. At present even prisoners are not always stripped. The death of a prisoner puts a period to the right of him who had taken him; therefore an hostage, given for the procuring of a person's liberty, is to be released the moment the prisoner expires; and if the hostage dies, the prisoner is not released by such death. The reverse of this is true, if one, instead of being an hostage for the other, had been substituted in his stead. Vattel's Law of Nations, b. iii. ch. 17.

Formerly it was a common practice to ransom British ships, when captured by an enemy, by delivering to the enemy what was called a ransom-bill, which secured to the captor the price agreed upon, and operated as a bill of sale of the ship and cargo to the original owners, and as a protection to the ship against other cruisers of the enemy during the remainder of the voyage. A hostage was delivered to the captor, for securing to him the punctual payment of the stipulated sum. This ransom-bill, independent of the hostage, was considered as a contract of the law of nations, and obligatory upon the owners, as well as upon the captain and hostage who signed it; and actions have been often brought upon them in our courts of common law. And where the ship or goods were insured, the amount of the ransom was usually taken to be the measure of the demand of the insured upon the underwriters, in respect of the capture. But this practice of ransoming ships captured by the enemy being found to operate more to the disadvantage than for the benefit of this country, it was thought proper at length to prohibit it altogether. And therefore by stat. 22 Geo. III. c. 25. § 1. it is enacted, that it shall not be lawful for any of his majesty's subjects to ransom, or to enter into any contract or agreement for ransoming, any ship or vessel belonging to any of his majesty's subjects, or any merchandizes or goods on board the same, which shall be captured by the subjects of any state at war with his majesty, or by any person committing hostilities against his majesty's subjects. By § 2. all contracts and agreements which shall be entered into, and all bills, notes, and other securities, which shall be given by any person or persons for ransom of any such ship or vessel, or of any merchandize or goods on board the same, shall be absolutely void in law, and of no effect whatever. And by § 3. a penalty of 500*l.* is given to the informer, for every offence against the act. This statute has put an end to all questions on the law of ransoms. Marshall's Treatise on the Law of Insurance, vol. ii.

In our *Law Books*, ransom is also used for a sum paid for the pardoning of some notorious crime.

Horn makes this difference between *ransom* and *amerciament*, that ransom is the redemption of a corporeal punishment due to any crime.

It is never usual to assess a larger fine than a man is able to pay, without touching the implements of his livelihood, but to inflict corporal punishment, or a limited imprisonment, instead of such fine as might amount to imprisonment for life. And this is the reason why fines in the king's court are frequently denominated *ransoms*, because the penalty must otherwise fall upon a man's person, unless it be redeemed or ransomed by a pecuniary fine (Mirr. c. 5. § 3. Lamb. Eirenarch. 57.); according to an ancient maxim, "qui non habet in crumena luat in corpore." Yet, when any statute speaks both of fine and ransom, it is holden, that the ransom shall be treble to the fine at least. Dyer. 232.

RANSTADT, in *Geography*, a town of Germany, in the principality of Stolberg; 17 miles N.E. of Frankfort on the Maine.

RANSTADT, or *Mark Ranstadt*, a town of Saxony, in the

the territory of Merfeburg; 10 miles S.S.E. of Merfeburg. N. lat. 51° 18′. E. long. 12° 14′.

RANT, in the *Drama*, an extravagant flight of paffion, overfhooting nature and probability.

Lee's tragedies abound with rants; yet the wildeft of them, it is obferved, have frequently met with applaufe on the ftage.

We find inftances of rants, even in our fevereft poets. Such, *e. gr.* is that in the beginning of Ben Johnfon's Cataline, where the parricide, in fpeaking to Rome, fays, "I'd plow up rocks, fteep as the Alps in duft; and lave the Tyrrhene waters into clouds, but I would reach thy head!"

RANTAMPOUR, in *Geography*, a circar of Hindooftan, in the country of Agimere, bounded on the N. by Jyenagur, on the E. by Agra, on the S. by Kottah, and on the W. by Oudipour and Sirowy.—Alfo, a town and fortrefs, being the capital of the above named circar; 86 miles E. of Agimere. N. lat. 28° 35′. E. long. 76° 58′.

RANTZAU, John, in *Biography*, a general in the Danifh fervice, was born in 1492, and at the age of 13 he entered into the army. In 1515 he began to travel into foreign countries, vifiting in fucceffion England, Spain, Germany, Italy, Greece, Syria, Paleftine, and other parts of the Eaft. In 1517 he was knighted at Jerufalem; and upon his return to Denmark, was appointed to accompany duke Chriftian, afterwards Chriftian III., on his tour to Brandenburg, and other towns of Germany. When Frederic I. accepted the crown of Denmark, he was promoted to be a general in 1553, and entrufted with the command of the troops in Holftein. He became greatly diftinguifhed in his military character, and on various diplomatic concerns, and died in 1565. As an author he is known by the following works: "A true and brief Account of the Wars carried on in 1559, by Frederic king of Denmark, and Adolphus duke of Holftein," &c.; "Defcriptio Cimbriæ," printed in Weftphalen's Monumenta inedita, tom. i. Gen. Biog.

Rantzau, in *Geography*, a county of Germany, in the duchy of Holftein, about ten miles long and fix broad. It takes its name from a feat feven miles N. of Eutyn.

RANTZEN, a town of the duchy of Stiria; 6 miles N.W. of Muckrau.

RANTZENBACH, a town of Auftria; 6 miles S.S.W. of St. Polten.

RANVILLE, a town of France, in the department of the Calvados; 5 miles N.E. of Caen.

RANULA, dim. of *rana*, *a frog*. This term is, in *Surgery*, applied to a fwelling of the falivary ducts under the tongue. Whether the tumour is fo named from a whimfical fuppofition that it bears a refemblance to a frog, or from its being fancied to oblige the patient to make a croaking noife, in attempting to articulate, is a point which furgical writers leave undetermined. The fwelling is round, of a greyifh colour like an hydatid, foft, compreffible, indolent, and, in the early ftage, almoft tranfparent. At firft, it is of about the fame fize as a nut, or cherry; but, by degrees, its volume becomes much more confiderable. It is very frequently met with in young children: its occurrence in adults is more uncommon. It confifts of a fucceffive dilatation of the excretory tube of the fubmaxillary, or elfe of the fublingual gland, the orifice of which duct is by fome caufe or another ftopped up, or obliterated; fo that the confined faliva accumulates, becomes vifcid, and ceafes to flow in the ufual manner. In proportion as the ranula increafes, the incipient ftate of it having been neglected, its enlarged fize raifes up the tongue, and forces it backward; the confequence of which is, that maftication, deglutition, and refpiration, are obftructed. The voice becomes indiftinct, and hoarfe; the motion of the tongue is reftrained: this organ cannot be put out of the mouth. By degrees, the incifor and canine teeth of the lower jaw are loofened; the layer of mufcles, compofing the lower parietes of the mouth, is depreffed; and the fwelling, having attained a confiderable fize, makes a very manifeft prominence beneath the chin. In this advanced ftage, that is to fay, when the ranula has exifted ten or twelve years, as practitioners occafionally fee inftances of, the appearance of the fwelling is quite altered from what it originally was. The tumour is now hard, elaftic, painful, ulcerated, and, as it were, farcomatous: it is as large as a turkey's egg, and not fituated at the fide of the frænum, but anteriorly under the tongue, to which it is clofely adherent. The mouth emits a very fetid fmell; and the breathing is fo much obftructed, that the patient, through fear of fuffocating, is obliged to lie with his mouth wide open, when he goes to fleep.

While a ranula is recent, the fluid which it contains is a vifcid faliva, refembling the white of egg, and fometimes of rather a yellow colour. In time it is gradually changed, becoming turbid and puriform; and, in certain inftances, foft, friable, greyifh concretions, from the fize of a pea to that of an almond, commonly called falivary calculi, are found in the kind of cyft, which is produced by the dilatation of the falivary duct. Thefe calculi effentially confift of a large proportion of the phofphate of lime, united with a mucilaginous fubftance; and concretions of the fame kind frequently occur in the tonfils, and in the falivary glands themfelves, as well as their excretory ducts. Foreftus, lib. xiv. obf. 26. p. 112. Blegney, Nouvelles Décovertes, &c. tom. i. ann. 1679, p. 230. Mém. de l'Acad. de Chirurgie, tom. v. p. 464. Petit, Œuvres Pofthumes, &c. tom. i. p. 188. Blafius, Obf. 14. p. 81.

A ranula, whether recent or inveterate, cannot be cured except by a furgical operation. The curative indication, in the firft of thefe ftates, is to make an outlet for the fluid accumulated in the tumour, and to make an opening fufficiently capacious to let the faliva readily pafs into the mouth. Merely making an incifion into the fwelling, or opening it with a trocar, or a feton drawn through it, are ftated to be ineffectual methods. The tumour does indeed fubfide as foon as the aperture is made; but the edges of the wound grow together again, and the difeafe recurs. There is an abfolute neceffity for firft making an incifion the whole length of the fwelling, and then removing, with the aid of fciffors and a pair of diffecting forceps, a portion of the edges of the recent wound. This flight lofs of fubftance prevents the return of the complaint, and always infures a free paffage for the faliva; an advantage of which there is no certainty in any other mode of proceeding. By this flight operation, ranulæ in children may be cured in the courfe of a few days, without the leaft occafion for the application of any dreffings whatfoever. It has been propofed to dilate the contracted orifice of the falivary duct with a probe. (Mém. de l'Acad. de Chirurgie, tom. iii. p. 460.) But this orifice is difficult of detection, and the fwelling cannot be in this manner eafily emptied. M. Laffus feems to entertain doubts whether Warton's canal can ever be made to refume its original ftate, after once being clofed. Pathologie Chirurg. tom. i. p. 405.

When a ranula has exifted a long while, is attended with confiderable hardnefs, and is of large fize, it is a tumour which requires to be completely extirpated. A tranfverfe incifion, parallel to the opening of the mouth, is to be made in it through its whole extent. The furgeon is then to cut out

out the upper portion of the ſwelling, ſituated in front of the frænum of the tongue, to which it is alſo adherent, and next the inferior portion, which ſometimes extends into the interſpace betwixt the genio-hyoidei and genio-gloſſi muſcles, with which it becomes confounded. A pair of forceps, a hook, ſciſſors, and a ſtraight biſtoury, are the inſtruments neceſſary for this operation. A degree of hemorrhage always enſues. The uſe of a detergent gargle, made of barley-water and honey of roſes, will ſerve to finiſh the cure in a very moderate ſpace of time.

In confirmation of the latter obſervation, Laſſus adduces the following caſe. A young man, aged 22, had a ranula, which had continued ever ſince he was born, and was equal in ſize to a turkey's egg. The inciſor teeth of the lower jaw were looſened, and forced forward by the ſucceſſive increaſe of the ſwelling. A ſeton had been paſſed quite through it, without any uſeful effect. The breath of the patient and his ſaliva were intolerably fetid. The tumour was cloſely adherent to the lower and anterior part of the tongue; and extending laterally, confounded itſelf with this organ, of which it impeded the motion. A ſtraight, narrow biſtoury was introduced into one of the openings at the ſide of the tumour, and carried completely acroſs to the oppoſite aperture. Thus a tranſverſe inciſion was made into the cavity of the diſeaſe. By means of the ſame inſtrument and a hook, the lateral portions of the ſwelling were removed. A profuſe hemorrhage enſued, cauſed by the total diviſion of the frænum, the raninal veins, and one of the raninal arteries. It was ſtopped by putting under the tongue a large quantity of dry lint, and by compreſſing the dorſum of the tongue ſeveral hours with the fingers, while the thumb was employed in compreſſing the parts behind the chin from below upwards. This double ſort of preſſure anſwered the purpoſe. No cautery was found neceſſary, and, by the uſe of detergent gargles, the patient was cured in about a fortnight.

When a ranula of long duration, ſituated at the ſide of the tongue, and of conſiderable ſize, forms a tumour, that makes its appearance outwardly towards the baſe of the jaw, Laſſus ſeems to diſapprove of making a free inciſion through the ſkin, for the purpoſe of extirpating that part of the ſwelling which cannot be removed through the mouth; a plan which was, in one inſtance, practiſed by Marchettis. Obſ. Med. Chirurg. obſ. 31. p. 48. See Laſſus' Pathologie Chirurgicale, tom. i. chap. 61.

RANULARES, in *Anatomy*. See RANINA.

RANUNCULACEÆ, in *Botany*, the 61ſt natural order in Juſſieu's ſyſtem, or the firſt of his 13th claſs, for whoſe character ſee GERANIA. The *Ranunculaceæ* are defined as follows.

Calyx of many leaves, ſometimes wanting. *Petals* definite, moſtly five. *Stamens* indefinite, except in *Myoſurus*; their anthers incorporated with the filaments. *Germens* ſeveral, indefinite or definite, rarely ſolitary, placed on a common receptacle; each of them furniſhed with a ſtyle, which is rarely wanting, and a ſimple ſtigma. *Capſules*, or rarely *berries*, as many as the germens; in ſome inſtances ſingle-ſeeded, and not burſting; in others many-ſeeded, ſplitting half way down, at their inner margin, into two valves, bearing the ſeeds at the edges. *Corculum* minute, lodged in a cavity at the upper part of the large horny *albumen*. *Stem* generally herbaceous. *Leaves* alternate; rarely (in *Clematis* and *Atragene*) oppoſite; ſome of them half ſheathing the ſtem; ſome compound, pinnate or fingered; ſome, as is more frequently the caſe, ſimple, and theſe are moſtly palmate or lobed, their ſinuſes often pale at the baſe. See RANUNCULUS.

Juſſieu divides the order in queſtion into four ſections.

Sect. 1. *Capſules ſingle-ſeeded, not burſting; berries in Hydraſtis.*

This ſection conſiſts of *Clematis*, *Atragene*, *Thalictrum*, *Hydraſtis*, *Anemone*, *Hamadryas* of Commerſon, *Adonis*, *Ranunculus*, *Ficaria*, and *Myoſurus*.

Sect. 2. *Capſules many-ſeeded, ſplitting at the inner edge. Petals irregular.*

The calyx in this ſection is often coloured, being what Linnæus terms corolla; that author conſidering the petals of Juſſieu as nectaries. The genera are *Trollius*, *Helleborus*, *Iſopyrum*, *Nigella*, *Garidella*, *Aquilegia*, *Delphinium*, and *Aconitum*. Some ſpecies of *Delphinium* have but a ſingle capſule.

Sect. 3. *Capſules many-ſeeded, ſplitting at the inner edge. Petals regular.*

Caltha, *Pæonia*, *Zanthorrhiza*, *Cimicifuga*.

Sect. 4. *Germen ſolitary. Berry of one cell, with many ſeeds, affixed to a ſingle lateral receptacle.*

The only genera are *Actæa* and *Podophyllum*, and theſe we feel diſpoſed to remove to Juſſieu's next order, PAPAVERACEÆ. See that article.

We cannot but remark that the *petals*, as Juſſieu terms them, in *Trollius* and *Helleborus* are by no means definite, and that they greatly exceed the number five. Neither are they irregular in *Trollius*. As to the other genera of his 2d ſection, the parts in queſtion are ſuch obvious nectaries, that they can have no other function to perform, except poſſibly in *Aquilegia*, where their limb partakes of the nature of petals.

RANUNCULOIDES, a genus of Vaillant's, founded on the *Ranunculus hederaceus* and *aquatilis* of Linnæus, and named from its reſemblance or affinity to RANUNCULUS; ſee that article. No one has followed Vaillant in this inſtance, nor is there any real mark of diſtinction for his ſuppoſed genus. *Ranunculoides* is, beſides, the ſpecific name of a rare Britiſh *Anemone*, but *ranunculina* would have been better Latin; as in *Helleborus ranunculinus*, Sm. Pl. Ic. faſc. 2. t. 37. Willd. Sp. Pl. v. 2. 1336. See HELLEBORUS.

RANUNCULUS, an ancient name, whoſe origin is as obvious as its ſenſe is obſcure. The word is, no doubt, derived from *rana*, and means a little frog. The Greeks call the ſame plant βατράχιον, which is nearly ſynonimous. Moſt etymologiſts ſuppoſe this name to allude to the native ſtation of the plant, in bogs and watery places, ſuch as frogs frequent. But the original βατράχιον of Dioſcorides is the beautiful *Ranunculus aſiaticus* of Linnæus, or Garden Ranunculus, which inhabits corn-fields, and does not grow in wet places; though indeed the other three ſpecies, deſcribed by that ancient writer, do; theſe are our *lanuginoſus*, *muricatus*, and *aquatilis*. It ſeems poſſible that the diviſions of the leaves in all theſe plants may have ſuggeſted the idea of a frog's foot, which ſuppoſition is confirmed by the Engliſh name, Crowfoot. Ambroſinus hints at a reſemblance between the root and the foot of a frog, which is not, to us, by any means apparent.—Linn. Gen. 281. Schreb. 377. Willd. Sp. Pl. v. 2. 1307. Mart. Mill. Dict. v. 4. Sm. Fl. Brit. 587. Prodr. Fl. Græc. Sibth. v. 1. 380. Ait. Hort. Kew. v. 3. 351. Purſh v. 2. 391. Juſſ. 233. Poiret in Lamarck Dict. v. 6. 97. Lamarck Illuſtr. t. 498. Gærtn. t. 74. (Ficaria; Dill. Gen. 108. t. 5. Hudſ. Angl. 244. Juſſ. 233. Ranunculoides; Vaill. Mem. de l'Acad. des Sciences for 1719, German edition, 321.)—Claſs and order, *Polyandria Polygynia*. Nat. Ord. *Multiſiliquæ*, Linn. *Ranunculaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth of five ovate, concave, ſomewhat

what coloured, deciduous leaves. *Cor.* Petals five, obtufe, polifhed; with fmall claws. Nectary a cavity in each petal, juft above the claw. *Stam.* Filaments very numerous, half the length of the corolla; anthers firmly united therewith, erect, oblong, obtufe, of two feparate lobes. *Pift.* Germens numerous, collected into a head; ftyles none; ftigmas reflexed, very fmall. *Peric.* none. *Receptacle* befet with extremely minute ftalks, to which the feeds are attached. *Seeds* numerous, naked, irregular, uncertain in figure, with a reflexed point.

Obf. The effential mark of this genus confifts, as Linnæus remarks, in the nectary, the reft of the parts being uncertain; hence he takes occafion to point out the ufe of adverting to that organ, which before his time had been neglected, and which his opponents accufe him of fometimes making of too much importance. The great Juffieu will not, in this obvious cafe, ufe the language, though he adopts, unacknowledged, the idea of Linnæus; nor will he allow the manifeft nectaries of fome of his RANUNCULACEÆ (fee that article) to be other than petals. "Such," to ufe his own words, in his preface, p. 26, "is the love of undivided praife!"

The nectary in *Ranunculus*, fays Linnæus, is, in fome fpecies, a naked pore; in fome it is bordered with a cylindrical margin; in others clofed with a notched fcale. *Ficaria* of authors has only a three-leaved calyx, with a fuperabundance of petals. The feeds in fome fpecies are roundifh; in others depreffed, prickly, and fewer in number. *R. hederaceus* has but five ftamens; *falcatus* has a fword-fhaped point to each feed, and appendages to the bafe of the calyx; *fceleratus*, and a few befides, have an awl-fhaped receptacle, and confequently a fpiked fruit.

Eff. Ch. Calyx of five leaves. Petals from five to eight, with a honey-bearing pore in the claw of each. Seeds naked.

This extenfive genus is divided into two fections, by the form of the leaves. The fpecies are all herbaceous, generally of an acrid quality. The prevailing colour of the flowers is yellow; we know of none that are blue, except by accidental variation in *R. afiaticus*. They are plants of temperate or cold climates; fome of them alpine. Linnæus, in Sp. Pl. ed. 2, enumerates twenty-eight fpecies; the 14th edition of Syft. Veg. has forty-four, and Willdenow reckons up fixty-one. Fifteen are natives of Britain, as mentioned in Fl. Brit.; but the 11th fpecies in that work, *parvulus* of Linnæus, muft be expunged, as a mere variety of *hirfutus*, n. 8. The original number is, however, made up, by a new-difcovered Scottifh fpecies, the *alpeftris*, figured in Engl. Bot. v. 34. t. 2390.

So many additions have been made to this genus by the labours of Poiret in Lamarck's Dict. v. 6, and the difcoveries of Michaux and Purfh, that, with fome neceffary corrections, and a few communications of our own, the whole fubject requires to be detailed.

Sect. 1. *Leaves fimple and undivided.*

1. R. *Flammula*. Leffer Spear-wort. Linn. Sp. Pl. 772. Willd. n. 1. Ait. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 387. Curt. Lond. fafc. 6. t. 37. (R. flammeus minor; Ger. Em. 961, and R. flammeus ferratus; ibid. 962.)—Leaves ovato-lanceolate, bluntifh, ftalked. Stem declining.—Native of watery places throughout Europe, flowering moft part of the fummer. *Root* perennial, of long fimple fibres. *Herb* fhining, not quite fmooth, very various in fize and luxuriance. *Stems* fpreading in every direction, round, leafy, hollow. *Leaves* many-ribbed, either entire or varioufly ferrated. *Flowers* numerous, folitary, on long ftalks, of a bright golden yellow, half an inch or more in diameter. The whole plant is of an exceffively acrid burning quality, faid to produce inflammation in the vifcera of fheep, whence the name *flammula*, a little flame. Dr. Withering recommends the diftilled water, as preferable to all other medicines, for procuring inftantaneous vomiting in cafes of poifon.

2. R. *reptans*. Creeping Spear-wort. Linn. Sp. Pl. 773. Fl. Lapp. ed. 2. 198. t. 3. f. 5. Lightf. 289; fig. in frontifpiece to v. 1. Fl. Dan. t. 108.—Leaves linear-lanceolate. Stem creeping.—About the margins of alpine lakes, on a fandy foil; common in Scotland, flowering in June and July. We have always thought this a variety of the former, as mentioned in Fl. Brit.; but Willdenow contends for the contrary. He truly afferts that it differs in having a thread-fhaped creeping *ftem*; linear entire *leaves*, tapering down into their *footftalks*; *flower-ftalks* folitary, erect, fingle-flowered; and much fmaller *flowers*. Neverthelefs, we have feen fo many intermediate varieties, and fuch a difpofition in weak plants of the *Flammula* to take root at their joints, that we moft incline to our original opinion, fuggefted firft by Linnæus himfelf in his Sp. Pl.

3. R. *Lingua*. Great Spear-wort. Linn. Sp. Pl. 773. Willd. n. 3. Ait. n. 3. Fl. Brit. n. 2. Engl. Bot. t. 100. Fl. Dan. t. 755. (R. flammeus major; Ger. Em. 961. R. longifolius, lingua Plinii dictus, foliis ferratis; Ambrof. Phyt. 459.)—Leaves lanceolate, pointed. Stem erect, many-flowered. In marfhes and muddy ditches, chiefly in the northern parts of Europe; rare in England; flowering in July. Thrice the fize of *R. Flammula*, and quite erect. *Leaves* more nearly feffile, and taper-pointed; occafionally ferrated, as in the rude cut of Ambrofinus, but not commonly fo. *Calyx* hairy. The whole *herb* is more or lefs covered with clofe-preffed hairs, vifible alfo in *Flammula*. *Flowers* large and brilliant, very confpicuous.

4. R. *nodiflorus*. Knot-flowered Crowfoot. Linn. Sp. Pl. 773. Willd. n. 4. Ait. n. 4. Waldft. et Kitaib. Hung. v. 2. 192. t. 176. *Ait.* (R. parifienfis pumilus, plantaginellæ folio; Petiv. Gazoph. v. 1. 6. t. 25. f. 4. Vaill. Mem. de l'Acad. for 1719, Germ. ed. 324. t. 17. f. 4. R. ficulus, &c.; Petiv. Gaz. t. 24. f. 9, is a variety.) —Leaves ovate, ftalked. Flowers feffile.—In marfhy places about Paris; alfo in Sicily; flowering in fummer. A fmall, fmooth, annual plant, varying in luxuriance, and having much the appearance of *Limofella aquatica*. *Leaves* about an inch long, various in breadth, on very long ftalks. *Flowers* fmall, folitary, feffile, axillary. *Seeds* taper-pointed.

5. R. *filiformis*. Slender Creeping Crowfoot. Michaux Boreal-Amer. v. 1. 320. Purfh n. 4. Lamarck Dict. n. 4.—"Stem thread-fhaped, creeping, jointed, almoft naked. Leaves linear-awlfhaped, obtufe. Flowers axillary, folitary, ftalked."—In inundated places, on the banks of the river St. Lawrence; at Hudfon's bay and Labradore; flowering in June and July. This is defcribed as a very fmall, flender, fmooth fpecies, very much refembling *R. reptans*, n. 2. We have feen no fpecimen.

6. R. *pufillus*. Diminutive Crowfoot. Purfh n. 3. (R. Flammula; Walt. Carol. 159. Michaux Boreal-Amer. v. 1. 321; according to Purfh.)—"Smooth. Leaves ftalked; lower ones ovate, toothed; upper linear-lanceolate, toothed at the end; uppermoft linear, like bracteas. Stalks alternate, folitary, fingle-flowered."—Native of North America. Perennial, flowering from June to Auguft. A fmall fpecies, with exceeding fmall *flowers*. *Petals* pale yellow. *Purfh.* A fpecimen from Kalm, unnamed, in the Linnæan herbarium, anfwers nearly to the above characters, and yet feems a variety of *R. abortivus*, hereafter mentioned.

7. R.

7. R. *gramineus*. Graſſy Crowfoot. Linn. Sp. Pl. 773. Willd. n. 5. Ait. n. 5. Fl. Brit. n. 3. Engl. Bot. t. 2306. Curt. Mag. t. 164. Bulliard. t. 123.—Leaves linear-lanceolate, glaucous, many-ribbed, ſeſſile. Stem erect, very ſmooth throughout, with few flowers. Fruit globoſe.—Native of mountainous ſituations in the ſouth of France. *Gerard.* In Italy, Columm. Ecphr. 314. Withering ſays it was brought from North Wales by Mr. Pritchard. Willdenow mentions moiſt meadows in France as its native ſtation, for which we can find no authority. The plant thrives in England in rather dry gardens, flowering in May or June, and is perennial. The graſſy, broadiſh, glaucous *leaves*, and large golden *flowers*, readily diſtinguiſh this ſpecies. The *root* is tuberous and round. *Stem* twelve or eighteen inches high. *Calyx* very ſmooth, ſpreading, not deflexed. The *fruit* is deſcribed as globoſe. We have not ſeen it ripe.

8. R. *pyrenæus*. Pyrenean Crowfoot. Linn. Mant. 248. Willd. n. 6. Jacq. Miſc. v. 1. 154. t. 18. f. 1. (R. pumilus, gramineis foliis; Bauh. Hiſt. v. 3. append. 850. R. n. 1180; Hall. Hiſt. v. 2. 77.) β. R. plantagineus; Allion. Pedem. n. 1445. v. 2. 48. t. 76. f. 1.—Leaves linear-lanceolate, many-ribbed, ſtalked. Stem erect, with one or two flowers; woolly at the top. Fruit ſomewhat cylindrical. Seeds with recurved beaks.—Native of the Pyrenees, as well as of the Alps of Switzerland, Dauphiny, and Carinthia. Linnæus, for a long while, confounded this with the laſt, and many botaniſts have conſidered them as hardly to be diſtinguiſhed, but by the colour of the *flowers*. The *leaves* of the preſent vary greatly in breadth, being ſometimes quite narrow and linear; but in variety β they are elliptical, and an inch wide. They appear to be green, not glaucous. The upper part of the *ſtem*, quite ſmooth in *R. gramineus*, is always hairy, and under the flower is denſely woolly, in the preſent ſpecies. The *petals* are pure white. *Fruit* nearly cylindrical. *Seeds* with elongated, remarkably recurved, points. Few plants vary more in luxuriance.

A moſt remarkable variety, as Haller and Villars eſteem it, is the *R. lacerus*, Bellardi Append. ad Flo. Pedem. 27. t. 6, of which we have a ſpecimen from the author himſelf. In this the *ſtem* is branched, bearing thirteen or fourteen *flowers*, but its chief ſingularity conſiſts in the jagged, and partly almoſt palmate, *leaves*, which nevertheleſs bear all the marks of caſual luxuriance. We have a ſpecimen of Allioni's *plantagineus*, our variety β, which, by a tooth or two in ſome of the leaves, evinces an approach towards this *lacerus*; and we have another of the ſame with four flowers on one ſtem.

9. R. *parnaſſifolius*. Parnaſſia-leaved Crowfoot. Linn. Sp. Pl. 774. Willd. n. 7. Ait. n. 6. Curt. Mag. t. 386. Wulf. in Jacq. Coll. v. 1. 191. t. 9. f. 3, without leaves. (R. n. 1179; Hall. Hiſt. v. 2. 77. Herb. Davall.)—Leaves many-ribbed; radical ones roundiſh-ovate, ſomewhat heart-ſhaped, on long ſtalks; ſtem-leaves ovato-lanceolate, pointed, ſeſſile.—Native of the Alps of Switzerland, Dauphiny and Carinthia, as well as of the Pyrenees, from all which countries we have received ſpecimens. The plant is eſteemed very rare, and Wulfen regrets that he loſt the root and leaves of his only ſpecimen; ſo that Mr. Curtis has rendered a valuable ſervice to botaniſts by his excellent figure. This is a ſingularly elegant ſpecies, on account of its *leaves*, which reſemble our *Parnaſſia*, as well as for its large and brilliant white *flowers*, with their roſe-coloured *calyx*. Their *ſtalks* are woolly. *Fruit* ovate. *Seeds* obovate, obtuſe, with ſhort incurved beaks. The *root* is perennial, formed of copious, very long, pale fibres, as if it grew in watery places, but Haller ſays it inhabits ſtony alpine ſituations, being quite common in his own territory of Aigle.

10. R. *ophioglоſſoides*. Serpent's-tongue Crowfoot. Willd. n. 8. (R. ophioglоſſifolius; Villars Dauph. v. 3. 731. t. 49.)—Stem ſimple, erect, leafy. Lower leaves ovate, or heart-ſhaped, many-ribbed, on long ſtalks; upper linear-lanceolate, ſeſſile.—Found between Toulon and Hyeres in Provence, by M. Villars, who mentions having ſeen a drawing of the ſame plant, in the royal collection at Paris, marked R. leſbius paluſtris, ophiogloſſi folio; Tourn. Cor. 20. The *root* is deſcribed by Villars as ſomewhat bulbous, or tuberous, with many whorls of fibres. *Stem* erect, a foot high. *Leaves* ſmooth, rather fleſhy. *Flowers* ſmall, yellow, with ſhining *petals*. *Seeds* in a ſmall round head. He conceives it ſomewhat allied to *R. Flammula*. The reſemblance of the *leaves*, in his plate, to *parnaſſifolius*, ſeems to have induced Willdenow to range it here. We have ſeen no ſpecimen.

11. R. *amplexicaulis*. Plaintain-leaved Crowfoot. Linn. Sp. Pl. 774. Willd. n. 9. Ait. n. 7. Curt. Mag. t. 266. (R. folio plantaginis; Ger. Em. 963.)—Leaves ovate, pointed, glaucous, claſping the many-flowered ſtem. Root faſciculated.—Native of the Apennine and Pyrenæan mountains, but not, as far as we know, of the Swiſs Alps, Haller having miſtaken his n. 1179, which is *parnaſſifolius*, for this ſpecies. It is a hardy perennial in our gardens, not difficult of culture, yet not common, flowering in May. The *herbage* is glaucous. *Stem* erect, leafy, twelve or fifteen inches high, branched above. *Leaves* generally more or leſs fringed with ſoft hairs. *Calyx* green, ſmooth, concave, partly membranous and white at the edge. *Petals* of a pure and brilliant white. *Anthers* yellow, as in other ſpecies. We have never ſeen the ripe *ſeeds*.

12. R. *heterophyllus*. Various-leaved Slender Crowfoot. (R. bonarienſis; Lamarck Dict. n. 9.)—Leaves ſtalked, toothed, heart-ſhaped or ovato-lanceolate, with three central ribs. Stem erect. Flowers ſtalked, ſolitary, oppoſite to the leaves. Seeds obtuſe, granulated.—Gathered by Commerſon at Buenos Ayres, in marſhy places. *Root* fibrous. *Stem* erect, a foot or more in height, ſlender, ſmooth, ſtriated, branched, leafy. *Leaves* alternate, on long ſtalks; the lower ones ovate, or heart-ſhaped; the upper lanceolate, or ovate; all obtuſe, more or leſs crenate or toothed, about an inch long, ſmooth, furniſhed with three central ribs, and ſeveral lateral branching veins. *Footſtalks* bordered at their baſe; the lowermoſt much the longeſt. *Flowers* very ſmall, whitiſh, on ſolitary, ſtraight, ſimple, lateral ſtalks, an inch or an inch and half long, oppoſite to the leaves. *Fruit* ovate. *Seeds* obtuſe, or obovate, rough with minute points. The *calyx* is ſmooth and reflexed, often remaining till the ſeeds are ripe.

13. R. *flagelliformis*. Long-ſtalked Crowfoot.—Leaves on long ſtalks, heart or kidney-ſhaped, wavy or crenate. Stem creeping, thread-ſhaped. Flowers ſtalked, ſolitary, oppoſite to the leaves. Petals ovate. Seeds obtuſe, dotted.—Native of Chili and New Granada. We have ſpecimens from Mutis and Cavanilles, but this ſpecies does not ſeem to be any where deſcribed. The *ſtems* are long, thread-ſhaped, much branched, proſtrate, creeping or perhaps floating, ſending out from each joint long fibrous radicles, and one or more ſmooth, roundiſh, heart-ſhaped or kidney-ſhaped *leaves*, hardly an inch wide; their *footſtalks* meaſuring from two to three inches. *Flowers* very ſmall, white, ſolitary, oppoſite to the leaves, on ſlender *ſtalks*, rather ſhorter than thoſe of the foliage. *Stamens* few. *Fruit* rather oblong. *Seeds* obovate, obtuſe, compreſſed, minutely dotted. This *Ranunculus* is perhaps moſt nearly akin to our Britiſh *hederaceus*, hereafter deſcribed, though very certainly diſtinct, and as the ſpecies are at preſent arranged, they muſt remain

 at

at a diſtance. In habit and general reſemblance they cloſely accord.

14. R. *Cymbalaria.* Small Trailing Crowfoot. Purſh n. 5.—"Leaves heart or kidney-ſhaped, with five blunt teeth. Stem creeping, thread-ſhaped. Flower-ſtalks ſolitary, moſtly two-flowered. Petals linear. Fruit oblong."—In ſaline marſhes, near the ſalt works of Onondago, New York, flowering in June and July. Perennial, ſomewhat reſembling the following. *Flowers* ſmall, pale yellow, ſometimes white. *Purſh.*

15. R. *ſalſuginoſus.* Salt-marſh Crowfoot. "Pallas's Travels, ſmall edition, v. 3. 173." Willd. n. 11. (R. ruthenicus; Jacq. Hort. Vind. v. 3. 19. t. 31. R. repens, flore in caule ſingulari, foliis variè ſectis; Amm. Ruth. 81. t. 13. f. 2.)—Leaves ovate, ſomewhat heart-ſhaped; toothed at the extremity. Stem creeping, thread-ſhaped. Flower-ſtalks ſolitary, moſtly ſingle-flowered. Petals obovate. Fruit nearly globoſe.—Found by Gmelin, on the banks of the Neva; *Ammann;* by Pallas in the ſalt plains of Siberia, beyong the lake Baical. The *flowers* are yellow, as big as our common Crowfoots, being more than ten times the ſize of the laſt. Their *petals* are about ten, obovate. The *root* ſends out long runners, like a garden ſtrawberry. Gmelin's ſpecimen is much ſmaller than Jacquin's figure.

16. R. *bullatus.* Portugal Crowfoot. Linn. Sp. Pl. 774. Willd. n. 10. Ait. n. 8. (R. luſitanicus; Dod. Pempt. 429. R. autumnalis Cluſii; Ger. Em. 954. R. luſitanicus Cluſii; ib. 955.)—Leaves ovate, ſerrated. Flower-ſtalks radical, ſingle-flowered, hairy.—Native of Portugal and the north of Africa, cultivated in England before 1640, but now ſcarcely ſeen. It flowers in May and June, and has a perennial fibrous *root*, more like Gerarde's fig. 10 than 11. *Leaves* all radical, ſtalked, ovate, ribbed and veiny, ſomewhat hairy, ſtrongly and unequally ſerrated, an inch or an inch and half long; ſometimes, according to Cluſius, bliſtered. *Flowers* yellow, on ſimple, hairy, upright, radical *ſtalks*, three or four inches long. *Petals* more than five, narrow-obovate. The old authors delineate two kinds, generally ſuppoſed to be varieties, but which may poſſibly be ſpecies. We have not ſeen either, except in a dried ſtate.

17. R. *Ficaria.* Pilewort, or Leſſer Celandine. Linn. Sp. Pl. 774. Willd. n. 12. Ait. n. 9. Fl. Brit. n. 4. Engl. Bot. t. 584. Curt. Lond. faſc. 2. t. 39. Mart. Ruſt. t. 21. Bulliard t. 43. (Chelidonium minus; Matth. Valgr. v. 1. 578. Fuchſ. Hiſt. 867. Ger. Em. 816.)—Leaves heart-ſhaped, angular, ſmooth, ſtalked. Petals numerous.—Native of waſte ground throughout Europe, in moiſt, ſhady, or buſhy places, flowering in the early ſpring. Dr. Sibthorp found it common in Greece; and there can be no doubt of its being, as all botaniſts have judged, χελιδόνιον το μικρον, the Leſſer Celadine, of Dioſcorides. *Root* perennial, fibrous, with many fleſhy, pear-ſhaped, annual knobs, whoſe appearance gave riſe to the Latin, as well as Engliſh, name of this ſpecies, and to an idea that the plant might be ſerviceable in the piles, which thoſe who believe, may conſult Gerarde for the mode of application. The *ſtems* are leafy, and moſtly ſingle-flowered. *Leaves* ſmooth and ſhining. *Flowers* ſtalked; with three, ſometimes five, leaves to the *calyx;* and eight, occaſionally ten, elliptic-oblong, highly poliſhed *petals*, which fade to white in bright ſunſhine.

18. R. *frigidus.* Alpine Siberian Crowfoot. Willd. n. 13.—Radical leaves wedgeſhape-ovate, five-toothed at the extremity; thoſe of the ſtem ſeſſile, palmate.—Native of the alps of Siberia. Willdenow ſays he received this by the name of *gracilis*, meaning *glacialis*, "with which it agrees in the ſize, and perhaps colour, of the *flower*, but is abundantly diſtinct in the *leaves*." Several Siberian unnamed ſpecimens, in the Linnæan herbarium, anſwer exactly to Willdenow's deſcription. The radical leaves are ſeveral, ſtalked, between half an inch and an inch in length, ſmooth; rounded and entire at the baſe; abrupt and variouſly cut into broad blunt teeth, we might almoſt ſay lobes, at the ſummit. *Stem* erect, uſually ſingle-flowered, with two or three, alternate, ſeſſile, more deeply lobed, or palmate, *leaves*. *Calyx* brown, hairy. *Petals* five, inverſely heart-ſhaped, apparently white. The *flower* is ſo like *glacialis*, that we cannot but ſuſpect the difference of the *leaves*, however great, to be but caſual. At any rate, they are ſometimes ſo deeply cut, that this ſpecies might perhaps, without violence, have been placed in the following ſection, next to *glacialis*.

19. R. *Thora.* Kidney-leaved Crowfoot. Poiſon-root of the Swiſs. Linn. Sp. Pl. 775. Willd. n. 14. Ait. n. 10. Jacq. Auſtr. t. 442. Obſ. faſc. 1. 25. t. 13. (Thora major et minor; Camer. Epit. 825, 826. Th. valdenſis, et montis Baldi; Ger. Em. 966. Pſeudo aconitum pardalianches; Matth. Valgr. v. 2. 430.)—Leaves kidney-ſhaped, abrupt, crenate, reticulated; the radical ones on long ſtalks. Stems with one or two flowers. Bracteas lanceolate.—Native of the alps of Switzerland, Auſtria, and Greece, as well as of mount Baldus, near Verona, flowering rather early in ſummer. It is ſaid to have been formerly in the Engliſh gardens, but has never fallen under our obſervation. *Root* perennial, of thick, tapering, fleſhy fibres or rather knobs. *Stem* ſolitary, ſmooth, ſimple, near a ſpan high; terminating in one, rarely more, long-ſtalked golden *flowers*, about half an inch wide; its *calyx-leaves* lanceolate, coloured, ſmooth, like every other part of the plant. *Leaves* about two inches wide, and one long, rather coriaceous, ſtrongly reticulated with veins, neatly crenate, terminating either abruptly, with a notch, or elongated into three acute, entire, triangular, central lobes; the uppermoſt, or floral, ones, lanceolate and entire; the radical ones only on long ſlender ſtalks. *Fruit* globular, of a few, large, tumid, ovate *ſeeds*, with hooked points. The *root* of this plant is reported to be extremely acrid and poiſonous, its juice having been uſed formerly, by the Swiſs hunters of wild beaſts, to envenom their darts, whoſe wound by that means becomes ſpeedily fatal and incurable. Hence the name, from φθορα, *corruption*, or *venom*. We can ſee no poſſible reaſon for diſtinguiſhing the greater and ſmaller kinds, even as permanent, or well-marked, varieties.

Section 2. *Leaves diſſected and divided.*

20. R. *creticus.* Cretan Crowfoot. Linn. Sp. Pl. 775. Willd. n. 15. Ait. n. 11. (R. creticus latifolius; Cluſ. Hiſt. v. 1. 239. Ger. Em. 963.)—β. R. macrophyllus; Desfont. Atlant. v. 1. 437. Lamarck Dict. n. 19.—Radical leaves kidney-ſhaped, crenate, ſomewhat lobed; ſtem-leaves in three deep, lanceolate, entire ſegments. Stem many-flowered.—Native of Crete; cultivated in the Oxford garden in 1658, but perhaps now loſt. The *root* is perennial, of many thick, tapering, fleſhy fibres. *Stem* thick, moderately branched, eighteen inches, or more, in height, hairy as well as the reſt of the herbage. *Radical leaves* from two to four inches long, and more in breadth, kidney-ſhaped, reticulated with ſtrong veins, light green, downy, unequally divided into about ſeven three-cleft, or coarſely notched, ſhallow lobes: *ſtem-leaves* alternate, in three deep, oblong, obtuſe, entire lobes; the baſe tapering or wedge-ſhaped. *Flowers* ſeveral, yellow, nearly as large as *R. Lingua*, n. 3. *Calyx* reflexed, ovate, looſely hairy. β appears, by the account of M. Desfontaines, to differ merely in having the lower

lower *leaves* more deeply lobed than uſual, and ſomewhat leſs hairy.

21. R. *caſſubicus*. Caſſubian Crowfoot. Linn. Sp. Pl. 775. Willd. n. 16. Ait. n. 12. (R. aconitifolius, folio rotundo, ad radicem præſtolante; Loeſ. Pruſſ. 225. t. 72.)—Radical leaves roundiſh-heartſhaped, crenate, undivided; ſtem-leaves in ſeveral deep, lanceolate, toothed and jagged ſegments. Stem many-flowered.—Native of Pruſſia and Siberia, flowering in May. Meſſrs. Loddiges are ſaid to have introduced it into England, in 1794. Though the character of this approaches the laſt, the two plants are very different. The radical *leaves* of the preſent, though heart-ſhaped, are almoſt orbicular, their two lobes meeting each other; their margin ſharply crenate, but not at all divided; their ſurface minutely downy. *Stem* much branched; ſmooth below; downy above; bearing ſeveral fingered, veiny, ſmooth, ſeſſile *leaves*; the lower ones largeſt, many-lobed, and jagged; the upper with only three lanceolate, entire lobes. *Flowers* rather ſmall, deep yellow. *Calyx* hairy towards the baſe. *Fruit* ovate. *Seeds* hairy, roundiſh, ſlightly compreſſed, each with a ſtrongly revolute beak.

22. R. *auricomus*. Wood Crowfoot, or Goldilocks. Linn. Sp. Pl. 775. Willd. n. 17. Ait. n. 13. Purſh n. 9. Fl. Brit. n. 5. Engl. Bot. t. 624. Curt. Lond. faſc. 2. t. 41. Fl. Dan. t. 665. Ger. Em. 954. (R. prima ſpecies ſylveſtris; Fuchſ. Hiſt. 156. Dalech. Hiſt. v. 1. 1029.)—Radical leaves kidney-ſhaped, deeply three-cleft, crenate; ſtem-leaves divided to the baſe into linear ſegments. Stem many-flowered. Calyx coloured.—Native of woods and ſhady places, throughout Europe; alſo in Pennſylvania; flowering in April and May. *Root* fibrous, perennial. *Herb* of a pale pleaſant green, and deſtitute of the acrimony uſual in this genus. *Stems* a foot high, erect, branched, ſcarcely downy, except near the top. *Leaves* generally a little downy; the radical ones on long ſtalks, deeply divided into three or five, wedge-ſhaped, crenate, or cut lobes; the reſt in many linear, entire, or partially cut, ſpreading diviſions. *Flowers* terminal, erect, ſolitary at the top of each branch, of a bright golden hue. *Calyx* pale yellow, hairy, ſcarcely at all reflexed. *Nectary* a naked pore in each petal, not cloſed by any ſcale. In cold backward ſeaſons the *petals* are ſometimes wanting, or rather identified with the *calyx*, which is then dilated, and more coloured than uſual.

23. R. *abortivus*. Small-flowered Virginian Crowfoot. Linn. Sp. Pl. 776. Willd. n. 18. Ait. n. 14. Purſh n. 6.—Radical leaves heart-ſhaped, undivided, crenate; lower ſtem-leaves pedate; upper in three deep linear ſegments. Calyx reflexed, coloured. Petals obſolete.—In wet places, by the ſides of ponds and ditches, from New York to Carolina, flowering in July and Auguſt. *Purſh*. In ponds at Buenos Ayres. *Commerſon*. This ſpecies appears to have been cultivated in Chelſea garden 100 years ago, but it has, long ſince, diſappeared, nor has any author given a figure of the plant. Its habit is moſt like *ſceleratus*, n. 26. *Root* perennial, of many long fibres. *Herb* ſmooth. *Stem* from ſix to eighteen inches high, branched, leafy. *Radical leaves* like thoſe of a violet, not an inch long, crenate, ſmooth; their *ſtalks* two inches, or more, in length: lower *ſtem-leaves* ternate, their lateral leaflets deeply divided, all cut or crenate: uppermoſt *leaves* nearly ſeſſile, in three deep, lanceolate, entire diviſions. *Flowers* ſmall; yellow according to Purſh, but Commerſon, in his MSS. calls them fleſh-coloured; each ſtands on a ſimple ſolitary ſtalk, half an inch or an inch long, either from the forks of the branches, or at their ſummits. The *calyx* is reflexed, large, membranous and coloured. We find ſcarcely any certain traces of *petals*, but the plant may be variable in theſe parts, like *auricomus*. *Stamens* few. *Germen* large, globoſe.—Linnæus took his ſpecific character, *caule ſubtrifloro*, from ſpecimens not fully grown; yet he had an authentic one by him, with above thirty flowers. In Commerſon's the upper *leaves* are more ſtalked than uſual.

24. R. *nitidus*. Varniſhed American Crowfoot. Walt. Carol. 159. Lamarck n. 68. Purſh n. 7.—"Very ſmooth. Stems hollow. Radical leaves roundiſh-kidney-ſhaped, bluntly crenate; ſtem-leaves ſeſſile, digitate; their leaflets cut, with blunt ſegments. Seeds nearly globoſe, very ſmooth."—In inundated grounds, from New York to Carolina, flowering in July and Auguſt. *Root* perennial. *Flowers* ſmall. *Petals* white. This and the foregoing one are probably only varieties. *Purſh*.

25. R. *trilobus*. Three-lobed Barbary Crowfoot. Deſfont. Atlant. v. 1. 437. t. 113. Willd. n. 19.—Stem erect, much branched. Leaves ſmooth, deeply three-lobed, cut; uppermoſt linear, obtuſe, undivided. Flower-ſtalks ſtriated. Seeds compreſſed, tuberculated.—Gathered by Deſfontaines, in moiſt fields, near Mayane, in Barbary. He deſcribes it as akin to *R. parviflorus*, except in its upright growth, and ſmooth, deeply three-lobed *leaves*. The loweſt *leaf* of all is undivided and crenate. *Flowers* very ſmall, yellow, ſituated as in the two laſt. *Seeds* in a round head, ſmall, compreſſed, orbicular with a point, covered with tubercles on both ſides. To us this ſpecies ſeems, by its *ſeeds*, allied to *parvulus* of Linnæus, which is a variety of *hirſutus*, hereafter deſcribed.

26. R. *ſceleratus*. Celery-leaved Water Crowfoot. Linn. Sp. Pl. 776. Willd. n. 20. Ait. n. 15. Purſh n. 8. Fl. Brit. n. 6. Engl. Bot. t. 681. Curt. Lond. faſc. 2. t. 42. Fl. Dan. t. 571. (R. paluſtris rotundifolius; Ger. Em. 962.)—Stem erect, much branched. Lower leaves palmate, ſmooth; upper ones fingered. Fruit oblong. Seeds very numerous, minute.—Found about ditches and in watery places by road ſides, in moſt parts of Europe and North America, flowering in ſummer. *Root* annual. *Herb* various in ſize and luxuriance, of a pale ſhining green, juicy, very ſmooth, except occaſional hairineſs on the flower-ſtalks. *Stem* round, thick and hollow. Lower *leaves* larger, broader, leſs divided, and more ſtalked, than the upper; the floral ones moſtly lanceolate, ſimple, and entire. *Flowers* numerous, ſmall, yellow. *Calyx* deflexed, ſhaggy. *Nectary* ſomewhat tubular. *Stamens* few. *Seeds* very ſmall, but exceſſively numerous, making a denſe, oblong, obtuſely rounded head. This is one of the moſt acrid of its tribe, raiſing bliſters and dangerous ſores in the ſkin.

27. R. *aconitifolius*. Aconite-leaved White Crowfoot. Linn. Sp. Pl. 776. Willd. n. 21. Ait. n. 16. Curt. Mag. t. 204. (R. montanus quartus; alſo R. pleno flore albo; Cluſ. Hiſt. v. 1. 236. R. aconiti folio; Ger. Em. 954. R. albus multiflorus; ib. 957. R. albus, flore denſo; Bauh. Hiſt. v. 3. 844, not 860.)—Leaves veiny, ſmooth, in five deep, pointed, toothed lobes; the middle one three-cleft: floral leaves ſeſſile, fingered, lanceolate, cut. Stem branched, many-flowered.—Native of the alps of Switzerland, France, Auſtria, &c.; a hardy and long-eſtabliſhed perennial in our gardens, flowering in May and June; generally in a double ſtate, as figured by Curtis. He remarks that it requires moiſture, ſhade, and a pure air. The *ſtem* is one and a half or two feet high, partly purpliſh, ſmooth, with ſpreading branches. *Leaves* dark green, with a glaucous hue beneath; the radical ones on long ſtalks; the reſt nearly ſeſſile; all compoſed of more or leſs diſtinctly ſeparate, often ſtalked, leaflets, ſtrongly veined and coarſely toothed; the uppermoſt ſmaller, more ſimple, quite ſeſſile.

Flowers

Flowers white, three-quarters of an inch in diameter, not very ornamental in their single wild ftate, but much admired when double, and formerly called Fair Maids of France. Their pearly whitenefs is enhanced by the violet *calyx*.

28. R. *platanifolius*. Plane-tree-leaved White Crowfoot. Linn. Mant. 79. Willd. n. 22. Ait. n. 17. Fl. Dan. t. 111. (R. albus, flore fimplici; Lob. Ic. 668. R. alpinus albus; Ger. Em. 951.)—Leaves veiny, fmooth, deeply palmate, five-lobed, cut and toothed; the middle ones three-cleft: floral leaves feffile, fingered, linear-awlfhaped, entire. Stem branched, many-flowered.—Native of the Alps of Germany, Norway, Switzerland, Italy, and of the Pyrenees, in fhady places. Said to have been introduced into the Englifh gardens in 1769, by Meffrs. Kennedy and Lee. This is very diftinct from the laft, with which Linnæus originally confounded it. The *leaves* are larger, not divided quite to the bafe, though their lobes are more cut and jagged: the floral ones are remarkably long, flender, and entire. *Flowers* twice as large, and rather more abundant. The radical *leaves* of both have occafionally feven or nine lobes, inftead of five.

29. R. *fpicatus*. Spike-fruited Crowfoot. Desfont. Atlant. v. 1. 438. t. 115. Willd. n. 23.—Leaves radical, five-lobed, toothed. Stem nearly fimple, hairy. Fruit cylindrical, thrice as long as the calyx.—Gathered by Desfontaines in marfhes at Algiers. *Root* perennial, of numerous, oblong, flefhy, tapering knobs. *Stem* folitary, erect, a fpan high, hairy, fimple, except at the top, where it divides into two or three fimple fingle-flowered ftalks; fometimes accompanied by a few *bracteas*, in three or four deep linear fegments; fometimes naked. *Leaves* all radical, on hairy ftalks, heart-fhaped, rounded, five-lobed, ftrongly toothed, villous, about an inch and a half broad. *Calyx* of five ovate-oblong, coloured, hairy, fpreading leaves. *Petals* five, obovate, yellow, the fize of *R. acris*. *Fruit* cylindrical, flender, an inch and a half or two inches long. *Seeds* very numerous, ovate, compreffed, bordered each with a hooked, prominent beak.

30. R. *paludofus*. Marfh Crowfoot. Poiret Voy. en Barb. v. 2. 184. Lamarck n. 22. Desfont. Atlant. v. 1. 439.—"Downy. Lower leaves in three deep, many-cleft, fan-fhaped fegments; upper fimple, linear, entire. Stem branched, many-flowered. Calyx erect."—Gathered by Poiret, in the borders of extenfive marfhes, near la Calle, and in fome other parts of Barbary. *Root* fibrous, denfely fafciculated. *Herb* downy, with fhort, clofe-preffed hairs. *Stems* feveral, eight or ten inches high, with fpreading leafy branches, bearing abundance of widely-fpreading, deep-yellow *flowers*, the fize of the foregoing, on flender ftalks of various lengths. Radical *leaves* ftalked; the earlieft ones ovate, undivided, deeply toothed; the reft almoft pinnate, with three long, narrow, deeply cut, fan-fhaped fegments; thofe on the lower part of the ftem lefs compound: the uppermoft linear, undivided, acute, entire. *Fruit* oval, or almoft elliptical, obtufe. *Seeds* oblong, fmooth, compreffed, fcarcely pointed.

31. R. *illyricus*. Illyrian Silky Crowfoot. Linn. Sp. Pl. 776. Willd. n. 24. Ait. n. 18. Jacq. Auftr. t. 222. Ger. Dod. Pempt. 428. Em. 953. (R. grumofâ radice quartus; Cluf. Hift. v. 1. 240.)—Leaves fhaggy with filky hairs, linear-lanceolate, ternate, entire. Calyx filky, reflexed. Stem branched. Flower-ftalks woolly.—Native of Hungary, France, Italy, Auftria, Thrace, and of the Swedifh ifle of Oeland; cultivated here in Gerarde's time. Clufius received his fpecimens, from a phyfician of Ferrara, with the name of *R. illyricus*, which has been retained, abfurdly enough, for a plant found in fo many different countries, and for which fo many expreffive appellations might eafily have been contrived. The *root* is perennial, compofed of numerous, fmall, round granulations. Whole herb more or lefs clothed with fnow-white, filky, or partly cottony, down. *Stem* a foot high, or more, fomewhat branched, bearing feveral bright lemon-coloured *flowers*, nearly the fize of *R. Lingua*, their *calyx-leaves* ovate, reflexed, externally filky. *Leaves* all linear-lanceolate, entire, feldom divided; the radical ones on long ftalks, ternate or pinnate; thofe about the middle of the ftem ternate, almoft feffile; upper ones fimple: the ufual length of each leaf or leaflet is two or three inches.—Dodonæus takes this for the fecond Βατράχιον, or *Ranunculus*, of Diofcorides, with whofe defcription it in fome meafure accords. That fpecies is faid to be extremely acrid. Hence Dodonæus, who is copied by Gerarde, fuppofes our plant may be the *Gelotophyllis* of Pliny, which caufed thofe who took it to dye laughing. But this opinion depends on too many conjectures to deferve attention; even if any benefit could accrue from afcertaining the point. We muft obferve however that Dr. Sibthorp thought the above *Ranunculus* of Diofcorides to be our *lanuginofus*, which is a common Greek plant, and anfwers better to his defcription.

32. R. *flabellatus*. Fan-leaved Crowfoot. Desfont. Atlant. v. 1. 438. t. 114. Willd. n. 25. Sm. Fl. Græc. Sibth. t. 520, unpublifhed. (R. alter faxatilis, afphodeli radice; Columm. Ecphr. 312. t. 313.)—Radical leaves undivided or twice ternate, toothed or deeply cut, ftalked; upper ones ternate or fimple. Stem hairy, fimple below, few-flowered. Fruit elliptical.—Found by Desfontaines, near Algiers, on moift uncultivated hills, flowering in winter: by Sibthorp on the northern mountains of Greece. *Root* perennial, of many oblong, tapering, cluftered fibres, rather than knobs. *Stem* a fpan high, hairy, fomewhat divided above, and bearing two or three yellow *flowers*, the fize of our common *R. bulbofus*, accompanied by deeply two or three-cleft *bracteas*. *Leaves* chiefly radical, on longifh ftalks; feveral of the earlieft undivided, fan-fhaped, ftrongly toothed; the reft deeply three-cleft, and fubdivided.

33. R. *afiaticus*. Perfian Crowfoot, or common Garden Ranunculus. Linn. Sp. Pl. 777. Willd. n. 26. Ait. n. 19. Mill. Ic. t. 216. Sm. Fl. Græc. Sibth. t. 518, unpublifhed. (R. afiaticus, grumofâ radice; Cluf. Hift. v. 1. 240—243. Ranunculi varii; Ger. Em. 958—960. Βατράχιον; Diofc. book 2. chap. 206.)—Leaves once or twice ternate; leaflets three-cleft, cut. Stem hairy, branched. Petals thrice as long as the calyx. Fruit cylindrical.—Found by Dr. Sibthorp wild in various parts of Afia Minor, but moft plentifully in the ifle of Cyprus, where it ftill retains one of its ancient names, mentioned by Diofcorides, αγριο-σέλινον, or Wild Parfley. In the gardens of Europe it has been cultivated, ever fince the latter part of the fixteenth century, under the form of innumerable varieties, chiefly double, of every variegated hue. In a wild and fingle ftate the large and fplendid *petals* are of a moft vivid crimfon, occafionally varying to yellow. The *root* is perennial, of numerous, brown, flefhy, tapering knobs. *Stem* twelve or fifteen inches high, erect, round, downy, hoary, leafy, branched from the middle or lower part, and bearing from three to five large long-ftalked *flowers*, whofe *calyx* is brown, hairy, and reflexed, but one-third the length of the broad, obovate, concave *petals*. *Leaves* rather hairy, moftly ftalked, varioufly three-cleft and notched, more or lefs compound; the floral ones, as ufual, narrower and moft fimple. *Fruit* cylindrical. *Seeds* oblong, with recurved points.

34. R. *japonicus*. Japan Crowfoot or Ranunculus. Thunb. Tr. of Linn. Soc. v. 2. 337. Willd. n. 27. (R. afiaticus;

asiaticus; Thunb. Jap. 241.)—"Leaves deeply three-cleft, cut and toothed, hairy as well as the stem."—Common in ditches about Nagasaki, Jedo, and elsewhere in Japan, flowering from February to May. It is hairy in every part, except the *corolla*. The radical *leaves* are rounded; the uppermost divided into lanceolate segments; all three-cleft, their segments cut, toothed, acute, hairy on both sides. *Footstalks* from an inch to a foot in length. *Stems* striated, scarcely leafy, zigzag, branching into flower-stalks at the top. *Thunberg*. The above character and description are not sufficient to distinguish this species from the last, with which Thunberg originally confounded it. Something is necessary to be known respecting the *calyx*, and its relative proportion to the *petals*, as well as the form of the *fruit* and *seeds*.

35. R. *rutæfolius*. Rue-leaved Crowfoot. Linn. Sp. Pl. 777. Willd. n. 28. Ait. n. 20. Jacq. Coll. v. 1. 186. t. 6, 7. Allion. Pedem. v. 2. 49. t. 67. f. 1. (R. præcox rutaceo folio; Clus. Hist. v. 1. 232. Ger. Em. 965. Ranoncolo alpino, con foglia di Coriandro; Pon. Bald. 197.)—Leaves pinnate, ternate, many-cleft, glaucous, smooth; their segments elliptic-oblong. Stem nearly simple. Petals numerous. Calyx smooth. Seeds ovate, with straight points.—Native of the loftiest alps of Switzerland, Dauphiny, Austria, and the north of Italy, flowering early in July. The *root* is tuberous, with long, simple, stout fibres, perennial. *Herb* glaucous and smooth. *Stem* from two to five inches high, mostly simple and single-flowered, sometimes bearing two, rarely three, flowers. *Leaves* stalked, elegantly decompounded; their leaflets wedge-shaped, many-cleft; the ultimate segments oblong, slightly elliptical, bluntish. *Flowers* of a brilliant white, at first tinged with red, on long stalks. *Calyx* purplish, five-leaved, smooth. *Petals* eight or ten, very erroneously represented in the figure of Clusius and Gerarde, so as to look like a syngenesious flower. *Seeds* few, large, ovate, pitted, pointed, straight, spreading every way, stalked, in a round head.

36. R. *glacialis*. Alpine Hairy-cupped Crowfoot. Linn. Sp. Pl. 777. Fl. Lapp. ed. 196. t. 3. f. 1. Willd. n. 29. Ait. n. 21. Fl. Dan. t. 19. (R. montanus purpureus, calyce villoso, Felicis Platerii; Bauh. Hist. v. 3. b. 846. Scheuchz. Alp. v. 1. 399, and 139. t. 20. f. 1.)—Leaves ternate, three-cleft, cut; their segments elliptical. Stem nearly simple. Calyx very hairy.—Native of the highest alps of Lapland, Switzerland, Dauphiny, Germany, &c. in the neighbourhood or ice and snow, flowering in June and July. *Root* perennial, with very long strong fibres. *Stem* from three to six inches high; simple and naked in its lower part; leafy near the top, bearing one or two, very rarely three, *flowers*, on long, smooth stalks. *Leaves* green, scarcely hairy, rather fleshy; the radical ones more or less compound, on long stalks; their segments broader, more elliptical, and blunter than in the former. *Flowers* large and handsome, of five broad, roundish, white *petals*, rose-coloured or purple underneath; the *calyx* purplish-brown, singularly rough, with shining tawny hairs. When we contemplate the great diversity of subdivision in the foliage of this species, we are disposed to believe our *frigidus*, n. 18, may possibly be a mere variety. Their *flowers* precisely agree, as well as their general habit.

37. R. *Seguieri*. Sharp-leaved Alpine Crowfoot. Villars Dauph. v. 3. 737. t. 49. Willd. n. 30. (R. Columnæ; Allion. Pedem. v. 2. 50. t. 67. f. 3, 4. Wulf. in Jacq. Coll. v. 4. 345. R. alpinus apii folio, flore albo magno; Pont. Comp. 117. Seguier Veron. v. 1. 490. t. 12. f. 2, 3.)—Leaves ternate; segments wedge-shaped, subdivided, decurrent, acute. Stem branched, about three-flowered. Calyx smooth.—Native of mount Baldus, where it was first found by Pontedera; as well as of the mountains of Dauphiny, Piedmont, and Carniola; in stony situations. This resembles some of the most luxuriant varieties of *glacialis*, but differs in the acute and decurrent segments of its *leaves*, as well as its smooth pale *calyx*; for Villars is incorrect in describing that part "externally downy." It is quite smooth, in his own and Allioni's specimens; the hairiness being confined to the top of the *flower-stalk*, where it is very dense and conspicuous; while the same part in *glacialis* is smooth, up to the base of the hairy *calyx*. The *petals*, and even the *nectary*, are white. Villars is surely right in removing the synonym of Columna, cited by Allioni, which we refer, with hardly any scruple, to *flabellatus*, n. 32, a very different plant.

38. R. *nivalis*. Palmate Alpine Crowfoot. Linn. Sp. Pl. 778. Fl. Lapp. ed. 2. 195. t. 3. f. 2. Willd. n. 31. (Excluding the variety.)—Leaves palmate, five-lobed, spreading, entire; those of the stem sessile. Stem single-flowered, smooth. Calyx hairy, half the length of the petals.—Found by Linnæus in Lapland, by the alpine rivulets on the snowy mountains of that country. Martens had previously gathered it at Spitzbergen. The *root* is fibrous, and slender. *Stem* simple, erect or ascending, smooth, leafy, about six inches high. *Radical leaves* two or three, on long slender stalks, heart-shaped at the base, rather deeply palmate, in five broad, divaricated, obovate, entire lobes, veiny and quite smooth: *stem-leaves* one or two, sessile, with five deeper, longer, more lanceolate lobes; the uppermost only three-lobed, or occasionally quite undivided. *Flower* solitary, on a long, terminal, hairy stalk. *Calyx* of five ovate yellowish leaves, rough with blackish hairs. *Petals* yellow, obovate, twice the length of the calyx.

39. R. *pygmæus*. Dwarf Small-flowered Alpine Crowfoot. Pursh n. 10. (R. nivalis pygmæus; Linn. Fl. Lapp. ed. 2. 196. t. 3. f. 3. R. lapponicus; Fl. Dan. t. 144.)—Leaves palmate, somewhat pedate, five-lobed, spreading entire; the upper ones almost sessile. Stem single-flowered. Calyx nearly smooth, rather longer than the petals.—Native of Lapland and Labrador. Perennial, flowering in May and June. Much smaller than the foregoing. Middle lobe of the *radical leaves* very deeply separated. *Stem-leaves* less perfectly sessile, and with narrower segments, than in *nivalis*. *Flower* not a quarter the size of that species; its *petals* yellow, roundish, scarcely so long as the *calyx*, which is likewise small, and very slightly hairy.

40. R. *montanus*. Yellow Mountain Crowfoot. Willd. n. 32. Ait. n. 22. (R. nivalis; Jacq. Austr. t. 325, 326. Sibth. in Prodr. Fl. Græc. n. 1272? Villars Dauph. v. 3. 742. Crantz Austr. fasc. 2. 92. t. 4. f. 3, 4. R. n. 1168; Hall. Hist. v. 2. 71, excluding the references to Linnæus. R. minimus alpinus luteus; Bauh. Hist. v. 3. 845, two upper figures.)—Leaves five-lobed, rounded, cut; those of the stem sessile, with deep, lanceolate, entire segments. Stem single-flowered, rough with erect hairs. Calyx hairy.—Very abundant on the alps of Switzerland, Dauphiny, and Germany; not of Lapland. It was one of those many alpine plants, introduced into the English gardens in 1775, by a person sent on purpose to collect them, at the expence of Dr. Fothergill and Dr. Pitcairn. This species has been confounded with the Linnæan *nivalis*, by all writers previous to Willdenow; yet they are truly distinct. The *montanus* has remarkably long, subdivided, tuberous *roots*, with very long strong fibres. *Stem* hairy throughout, the hairs erect; sometimes quite leafless. Lobes of the radical *leaves* un-

equally

equally cut and toothed, not entire. *Calyx-leaves* narrower, and lefs hairy. *Petals* larger, and of a deeper yellow. This is the *nivalis* of moft botanifts, few having feen the true Linnæan Lapland plant. The variety of *montanus* with a leaflefs *ftem*, figured in Jacquin's t. 326, at the right hand, was taken for a new fpecies, and called *acaulis*, by Favrod and Reynier, as appears by their dried fpecimens.

41. R. *Gouani*. Gouan's Pyrenean Crowfoot. Willd. n. 33. (R. pyrenæus; Gouan Illuftr. 33. t. 17. f. 1, 2.)—Leaves five-lobed, rounded, cut; thofe of the ftem feffile, deeply palmate; the uppermoft with acute, entire lobes. Stem fingle-flowered, rough with deflexed hairs. Calyx hairy.—Gathered by Gouan on the Pyrenees, where it flowers foon after the melting of the fnow. We have a fpecimen from the late M. Brouffonet. This is a larger plant than the preceding, efpecially in its *flower*, and differs, as Willdenow remarks, in having the *ftem-leaf* toothed or cut; but that character applies only to the lower one. The upper *ftem-leaves*, if there be more than one, confift of entire, acute lobes. The moft decifive mark of diftinction appears to us in the hairs of the *ftem*, below the leaves, which in Gouan's plant are either widely extended or bent downwards; in the *montanus* the hairs of every part of the *ftem* are erect, or clofe-preffed. To this no perfon has hitherto adverted.

42. R. *alpeftris*. Alpine White Crowfoot. Linn. Sp. Pl. 778. Willd. n. 34. Ait. n. 23. Sm. Tr. of Linn. Soc. v. 10. 343. Engl. Bot. t. 2390. Jacq. Auftr. t. 110. (R. n. 1167; Hall. Hift. v. 2. 71. R. montani fpecies prima et fecunda; Cluf. Hift. v. 1. 234. R. montanus, flore minore, & majore; Ger. Em. 964. R. minimus alpinus albus; Bauh. Hift. v. 3. 845, two lower figures.)—Leaves very fmooth; radical ones fomewhat heart-fhaped, obtufe, in three deep, lobed fegments; ftem-leaf lanceolate, entire. Stem moftly fingle-flowered.—Native of the higheft alps of Auftria and Switzerland, and of the mountain of Clova, in Angusfhire, Scotland, in which laft place it was difcovered by the late Mr. George Don, by the fides of little rills, flowering, though fparingly, in the fpring of 1809. The *roots* are perennial, with long fibres. Whole *herb* very fmooth, and rather glaucous. *Stem* erect, from one to four inches high, almoft always fimple and fingle-flowered, naked, except one or two fimple, linear-lanceolate, obtufe, entire *leaves*, apparently of the nature of *bracteas*. Radical *leaves* feveral, ftalked, in three deep, fubdivided, acute lobes. *Calyx-leaves* oval, fmooth, edged with white. *Petals* of a pure and brilliant white. Haller fays this is one of the moft acrid of its tribe, bliftering the fkin; and yet the alpine hunters chew it, by way of refrefhment.

43. R. *lapponicus*. Long-ftalked Lapland Crowfoot. Linn. Sp. Pl. 778. Fl. Lapp. ed. 2. 194. t. 3. f. 4. Lapland Tour, v. 1. 156, 252.)—Leaves fmooth, in three very deep, dilated, blunty notched lobes. Flower-ftalks elongated, naked, fingle-flowered. Petals the length of the fmooth calyx.—This rare fpecies, not known out of the limits of Lapland, was difcovered by Linnæus in two or three different places, near the river Juchtan, flowering in June. Profeffor Swartz alfo gathered it, many years after, near Luloa. It grows in watery fituations, and is very different from all others of this genus. The afpect of the plant, at firft fight, recalls the idea of *Adoxa Mofchatellina*. The *root* is long, thread-fhaped, and creeping, throwing up here and there, from its joints, a little, fhort, fimple, folitary, fmooth *ftem*, fometimes an inch or two high, fometimes fcarcely diftinguifhable. *Leaves* one from the bafe, and another from the top, of the ftem, on flender, weak *foot-ftalks*, two or three inches in length; each *leaf* an inch or an inch and half wide, fmooth, veiny, rather flefhy, fomewhat kidney-fhaped, in three very deep, almoft diftinct, broad wedge-fhaped lobes, having a few broad and rounded, blunt notches, each tipped with a minute glandular point. *Flower-ftalks* from three to five or fix inches high, terminating the ftem, folitary, fimple, naked, fmooth, each bearing a fmall yellow *flower*, fcarcely half an inch in diameter. *Calyx* of three elliptical, concave, fmooth, pale, reflexed leaves. *Petals* five or fix, obovate, ribbed, about the length of the calyx; their nectary clofed by a fcale. *Stamens* from nine to twelve. *Piftils* from fix to twelve. *Seeds* in a round head, ovate, fmooth, with ftrongly recurved points.

44. R. *hyperboreus*. Arctic Crowfoot. Retz. Scand. ed. 2. 131. Willd. n. 36. "Rottb. in Copenh. Tranf. v. 10. 458. t. 4. f. 16." (R. Fl. Dan. t. 331, excluding the fynonym of Ammann, which belongs to *falfuginofus*, n. 15. R. n. 50; Gmel. Sib. v. 4. 204. t. 83, b, excluding the Linnæan fynonyms.)—Leaves fmooth, in three deep divaricated lobes; the lateral ones cloven. Stem creeping. Flower-ftalks the length of the leaves. Petals fcarcely longer than the fmooth calyx.—Native of Iceland, Greenland, Norway, and Siberia, in watery places. Gmelin and Linnæus confounded this with *hederaceus* hereafter mentioned; Gunner miftook it for *falfuginofus*, which he called *R. Ammanni*, Fl. Norv. n. 826. From both, as well as from *lapponicus*, it is very diftinct. The *ftems* are long and creeping, or floating, throwing out from each joint, feveral fimple, very long, fibrous *radicles*, with a ftalked *leaf*, not a quarter the fize of *lapponicus*, whofe lobes are by no means toothed or crenate, the lateral ones only being fimply cloven. The *flowers* are fmall, pale yellow, folitary, each on a lateral, but not axillary, *ftalk*, whofe length is about equal to the adjoining leaf with its footftalk. *Calyx-leaves* only three or four, fmooth, coloured. *Petals* about the fame number, and fcarcely longer, obovate. *Seeds* ovate, gibbous, with a hooked, but very fhort, beak.

45. R. *monfpeliacus*. Montpellier Crowfoot. Linn. Sp. Pl. 778. Willd. n. 37. (R. faxatilis, magno flore; Bauh. Prodr. 96. Sauv. Monfp. 181.)—"Leaves in three deep crenate fegments. Stem fimple, villous, nearly naked, fingle-flowered."—Native of rocky places about Montpellier, according to Bauhin, who thus defcribes his plant. "*Root* compofed of long capillary fibres. *Leaves* from the root feveral; on long, fomewhat woolly, ftalks, each leaf hardly fo broad as the nail, in three fmall fegments, which are again divided into two or three acute ones. The *ftem* is about three inches high, flender, woolly, bearing one large *flower*, of a brilliant golden yellow, compofed of five petals, with many reddifh *ftamens*." We know no authentic fpecimen nor figure of this plant. Linnæus has marked it as never feen by him; but a fpecimen fent him by Gouan, from the Pyrenees, marked *R. alpinus humilis, magno flore*, which we have been difpofed therefore to confider as *R. Gouani*, n. 41, anfwers very well to Bauhin's defcription, and it is not impoffible that thefe fuppofed two fpecies are one and the fame. Yet Poiret, who profeffes to have gathered *R. monfpeliacus* at Montpellier, and in Barbary, fpeaks of them as diftinct, though, it muft be confeffed, his defcription is hardly fufficient to eftablifh the point in difpute.

46. R. *penfylvanicus*. Penfylvanian Crowfoot. Linn. Suppl. 272. Willd. n. 38. Ait. n. 24. Purfh n. 11. (R. canadenfis; Jacq. Ic. Rar. t. 105. Mifc. v. 2. 343.)—Stem erect, hairy, branched. Leaves ternate; leaflets ftalked, deeply three-cleft, jagged, toothed; hairy beneath. Calyx reflexed, rather longer than the round petals. Fruit cylindrical.

cylindrical. Seeds compreffed, with ftraight beaks.—Native of low meadows, from Canada to Penfylvania, but rare, flowering in July and Auguft. This fpecies was fent by profeffor Thunberg, in 1785, to Kew garden, from whence we procured a fpecimen the fame year. Mr. Aiton makes it biennial; Jacquin and Purfh perennial. The *ftem*, like the *footftalks*, is very hairy. Whole *herb* of a light green, two feet or more in height, branched, many-flowered. *Leaflets* one and a half or two inches long, ftrongly veined, with fpreading fegments. *Flower-ftalks* terminal, longifh, furrowed, rough with clofe-preffed hairs. *Flowers* fmall, their little, round, yellow *petals* not fo long as the *calyx*, which is fmooth and bent downward. *Seeds* in a cylindrical head, numerous, ovate, gibbous, compreffed, fmooth, very minutely dotted, each tipped with a fhort, fharp, erect, or flightly inflexed, beak. *Receptacle* hairy. Mr. Purfh's defcription does not, in every circumftance, anfwer to the Linnæan plant; for the *flowers* are not near fo big as *R. acris*, nor are their *ftalks* round.

47. R. *ternatus*. Ternate-leaved Japanefe Crowfoot. Thunb. Jap. 241. Willd. n. 39.—"Calyx reflexed. Leaves all ternate; leaflets three-cleft. Stem many-flowered."—Native of the Japanefe ifland of Nipon, flowering in May. Nothing more is known of this fpecies, concerning whofe peculiar characters, or affinities, we can form no precife opinion.

48. R. *biternatus*. Twice-ternate Magellanic Crowfoot.—Leaves fmooth, twice ternate, cut; fegments ovate, acute. Stem creeping. Stalks fingle-flowered, the length of the leaves. Petals obovate, the length of the fmooth calyx.—Gathered by Commerfon, in the ftraits of Magellan. No author appears to have taken up this fpecies, of which a fpecimen, from Commerfon's herbarium, was given by Thouin to the younger Linnæus. The whole *plant* is fmooth. The *leaves* bear a confiderable refemblance to thofe of *R. Seguieri*, but are rather fmaller, and diftinctly twice ternate. The habit of the plant more accords with *lapponicus* and *hyperboreus*, however unlike at firft fight. The *ftem* is thread-fhaped and creeping, fending forth, from every joint, a few fibrous *radicles*, a pair of upright, ftalked *leaves*, two or three inches in height, and one *flower*, whofe fimple, naked *ftalk* is about as tall as the *leaves*. This *flower* appears to be extremely like that of *lapponicus*, though fcarcely more than half fo large. The dried *petals* have the fame opaque whitenefs as is obfervable in that fpecies, and others, on their upper furface, and are probably yellow when frefh.

49. R. *peduncularis*. Long-ftalked Magellanic Crowfoot.—Leaves ternate, deeply cut, fomewhat hairy. Stems hairy, taller than the leaves, two-flowered. Calyx reflexed, nearly fmooth. Seeds globofe, fmooth, with recurved, hooked beaks.—Gathered by Commerfon in the ftraits of Magellan, with the preceding. This has a general likenefs to feveral common European kinds, which we fhall next defcribe, but is effentially diftinct. The radical *leaves* are feveral, on hairy ftalks, four inches long, their circumfcription roundifh, meafuring an inch, or inch and half, acrofs; the leaflets almoft always quite diftinct, with fhort partial ftalks, their form wedge-like, or fan-fhaped, more or lefs deeply cut, feldom regularly three-cleft. *Stems* feveral, erect, ftriated, rough, with fpreading hairs; fimple and naked to the height of four or fix inches, then dividing into two upright, hairy, fimple *flower-ftalks*, greatly elongated, (from one to feven or eight inches), after flowering, and accompanied at their bafe by a folitary, ftalked, deeply divided, palmate or fingered, *leaf*, an inch long. The *flowers* are much like thofe of *bulbofus*, or *acris*. *Calyx-leaves* ovate, concave, reflexed, bearing a few external hairs. *Petals* yellow, wedge-fhaped, ftriated, nearly twice as long as the calyx. *Fruit* globofe. *Seeds* globofe, tumid, keeled, even and fmooth; their beaks rather fpreading, hooked at the tip.

50. R. *bulbofus*. Bulbous Crowfoot, or Butter-cups. Linn. Sp. Pl. 778. Willd. n. 40. Ait. n. 25. Fl. Brit. n. 7. Engl. Bot. t. 515. Purfh n. 12. Curt. Lond. fafc. 1. t. 38. Mart. Ruft. t. 28. Ger. Em. 953. Lob. Ic. 666.—Leaves hairy, ternate, three-cleft, cut. Stem many-flowered. Calyx reflexed. Seeds compreffed, fmooth. Root bulbous.—Very common in Europe, as well as North America, in meadows and paftures, flowering throughout the fummer. The *root* is a round, folid, perennial bulb, about an inch in diameter, increafing by offsets from the top, and fending out from its bafe many long ftout fibres. *Stems* feveral, erect, a foot high, branched, leafy, round, hairy, many-flowered, deftitute of trailing fhoots or runners. *Leaves* ftalked, varioufly cut, more or lefs hairy. *Flowers* terminal, folitary, on angular furrowed ftalks, rough with erect, briftly hairs. *Calyx* hairy, bent back to the ftalk. *Petals* nearly equal in fize to *R. Lingua*, of a deep fhining yellow. *Nectary* covered by a notched fcale. *Fruit* globofe. *Seeds* orbicular, greatly compreffed, bordered, fmooth, and even, tipped with a fhort blunt beak.—This is one of the moft acrid, and even cauftic, fpecies. Villars fays the root may be ufed as a blifter, inftead of cantharides, but not fo fafely. It is moft active in the fpring, and muft not then be left on the fkin more than four or fix hours, for fear of leaving a dangerous fpreading fore.

51. R. *hirfutus*. Pale Hairy Crowfoot. Curt. Lond. fafc. 2. t. 40. Fl. Brit. n. 8. Engl. Bot. t. 1504. Ait. n. 26. (R. Philonotis; Ehrh. Beitr. fafc. 2. 145. Herb. 116. Willd. n. 41. Lamarck Dict. n. 48. Purfh n. 13. R. fardous; Crantz Auftr. fafc. 2. 84. Lamarck Dict. n. 47. R. pallidior; Villars Dauph. v. 2. 751. R. bulbofus β; Hudf. Angl. 241. R. rectus foliis pallidioribus, hirfutis; Bauh. Hift. v. 3. p. 2. 417. R. fecundus; Matth. Valgr. v. 1. 559. R. paluftris, apii folio lanuginofus; Bauh. Pin. 180. Morif. fect. 4. t. 29. f. 27 and 28.)—β. R. parvulus; Linn. Mant. 79. Fl. Brit. n. 11. Willd. n. 50. Ait. n. 31. Lamarck Dict. n. 73. R. agrarius; ib. n. 46? R. minimus faxatilis hirfutus; Bauh. Prodr. 96. R. minimus apulus; Column. Ecphr. 314. t. 316. f. 1.—Leaves ternate, notched. Stem erect, branched. Calyx reflexed. Seeds orbicular, compreffed with a fhort afcending beak, bordered; tuberculated at the fides.—Native of moift ground, in various parts of Europe, from Britain to Greece, flowering from June to October. The *root* is fibrous and annual. *Stem* erect, generally much branched, leafy, fpreading, many-flowered, ftriated, clothed with foft, widely fpreading hairs; in variety β fmaller, fmoother and weaker, fometimes, in a very ftarved ftate, bearing but one or two flowers. *Leaves* on longifh, more or lefs hairy, *footftalks*, pale green, hairy, ternate, varying much in fize; their leaflets wedge-fhaped, fometimes deeply three-lobed, fometimes only bluntly notched; upper ones narrower and more fimple, nearly feffile. *Stipulas* membranous, hairy, fomewhat dilated, attached to the bafe of the footftalks. *Flowers* on long, terminal, furrowed, hairy ftalks, folitary, fmaller than in *bulbofus*. *Calyx* hairy, reflexed. *Petals* roundifh; of a bright fhining yellow above; paler and opaque beneath. *Nectary* clofed by an abrupt fcale. *Fruit* globofe. *Seeds* lenticular, compreffed, brown, with a triple-ribbed greenifh border; their beaks fhort, afcending, very obfcurely hooked; their fides ftudded with minute fharp tubercles, efpecially towards the margin, where they are often circularly arranged, as Poiret (or Lamarck)

Lamarck) defcribes them in his *R. agrarius*, cited above.—This fpecies has been very little underftood. It is remarkable that any botanift fhould confound it with *bulbofus*, or with *fceleratus*, and that Mr. Curtis, in labouring to diftinguifh it, did not advert to the decifive character of the tuberculated feeds, by which it approaches a very different tribe, hereafter defcribed, confifting of *parviflorus*, *muricatus*, &c. Even Ehrhart has not noticed this circumftance. We are obliged to Mr. Edward Forfter, F.L.S. for tracing out the identity of *R. parvulus* and *hirfutus*, and we cannot but prefer Curtis's original name for the fpecies, rather than Ehrhart's pedantic one of later date. On the account of priority *fardous* perhaps ought to have been retained; but this name is founded on a very dubious opinion, that the plant of which we are fpeaking caufed the Sardonic laugh. Valerius Cordus, indeed, fays it grows copioufly in Sardinia, and it has certainly the appearance of Smallage, *Apium;* fo far anfwering to the ancient hiftory. But the account of Cordus feems taken from Diofcorides, whofe "fecond *Ranunculus*" is more probably the Linnæan *lanuginofus*, a ftill more general plant of the fouth of Europe than that of which we are fpeaking. After all, the famous Sardinian herb, compared to Smallage, may be actually wild Smallage or Celery, *Apium graveolens*, which is fufficiently acrid and poifonous to warrant our fuppofition, though it becomes fweet and wholefome by culture. In this uncertainty it is furely beft to call our plant *R. hirfutus*.

52. R. *paluftris*. Oriental Marfh Crowfoot. Linn. MSS. (R. orientalis paluftris, apii folio, caule fubhirfuto; Tourn. Cor. 20.) Leaves hairy, in three or five deep fegments, bluntly notched, with rounded dilated finufes. Stem erect, branched, almoft leaflefs. Calyx fpreading. Seeds ovate, compreffed, very fmooth, with a fhort recurved beak.—Native of the Levant. An oriental fpecimen, with Tournefort's fynonym, is preferved in the Linnæan herbarium, and named *paluftris*, but we can find no mention of it elfewhere. This is certainly a moft diftinct fpecies, though not taken up by any recent author. The *root* confifts of many flefhy knobs, tapering into fibres, and refembling thofe of *R. afiaticus*, though not fo thick. *Stem* two feet or more in height; hairy below; much branched, and almoft leaflefs above; the branches ternate. *Leaves* chiefly radical, on long hairy ftalks; their outline fomewhat pentagonal; heart-fhaped at the bafe; hairy on both fides, about two inches wide; their three principal lobes fpreading, deeply feparated by wide rounded finufes, and notched unequally at the extremity with broad, rounded, abrupt teeth; the upper or floral leaves are fmall, fhort, linear, undivided. *Flowers*, as far as we can judge, yellow, not large. *Calyx* hairy, fpreading widely, but fcarcely reflexed. *Seeds* in a round head, brown, fhining, quite fmooth, compreffed, moft like thofe of *bulbofus*, but more ovate, and with a longer, more recurved, and fomewhat hooked, beak. Their edge is green, fimple, not triple-ribbed as in the laft.

53. R. *polyrhizos*. Many-rooted Siberian Crowfoot. Willd. n. 42. Lamarck Dict. n. 38.—Radical leaves palmate, with wedge-fhaped, three-toothed fegments; ftem-leaves feffile, fingered. Stems many-flowered. Root fafciculated. Calyx fpreading. Seeds ovate, compreffed, fmooth, with a blunt beak.—Native of Siberia. *Root* fafciculated, perennial. *Radical leaves* like *R. fceleratus*, three-lobed; their lateral lobes two-lobed, wedge-fhaped like the leaf itfelf, their fegments bluntly three-toothed. *Stems* a finger's length, fimple, erect or afcending, two or three from one root. *Stem-leaves* feffile, fingered, wedge-fhaped at the bafe; their fegments linear, bluntifh, entire. *Flower-ftalks* two, three, or four, long, fingle-flowered, round, not furrowed, very finely downy like the ftem. *Calyx-leaves* coloured, fmooth, obtufe, fpreading. *Petals* yellow, the fize of *R. Flammula*. *Fruit* roundifh. *Seeds* ovate, compreffed, fmooth, crowned with the permanent blunt *ftigma*. *Willdenow*. By the above defcription this fpecies appears related, in many points, to the laft, though they can hardly be the fame.

54. R. *repens*. Common Creeping Crowfoot. Linn. Sp. Pl. 779. Willd. n. 43. Ait. n. 27. Purfh n. 14. Fl. Brit. n. 9. Engl. Bot. t. 516. Curt. Lond. fafc. 4. t. 38. Mart. Ruft. t. 29. (R. pratenfis, etiamque hortenfis; Ger. Em. 951.)—Leaves ternate, three-cleft, cut, hairy. Stems afcending. Runners creeping. Flower-ftalks furrowed. Calyx hairy, fpreading. Seeds ovate, compreffed, even.—Very common in meadows, wafte ground, church-yards, neglected gardens and fields, throughout Europe. Mr. Purfh obferved it in fhady wet woods, particularly on the mountains, from Penfylvania to Virginia. It flowers from June to Auguft, and is perennial, being often a troublefome weed. *Root* fibrous. Befides the upright *ftems*, which are of humble growth, leafy, branched, bearing feveral flowers, the root fends forth long trailing creeping fhoots, whofe joints produce leaves, and fome fhorter fimpler ftems. The whole *herb* is rough and hairy, of a dark green. *Leaves* ftalked, ternate, more or lefs three-cleft, fharply cut or toothed; often marked with dark purple, or black, fometimes pale, fpots; the uppermoft linear-lanceolate and entire. *Calyx* hairy, fpreading, not reflexed. *Petals* deep yellow, generally emarginate. *Nectary* covered by a heart-fhaped fcale. *Fruit* globofe. *Seeds* ovate, compreffed, fmooth at the fides, often hairy at the edge, their beak fhort and blunt.

55. R. *proftratus*. Proftrate Crowfoot. Lamarck Dict. n. 35. Fl. Francoife, n. 3. 197.—Leaves ternate, three-cleft, very hairy. Stems entirely proftrate, creeping, zigzag. Calyx fmooth.—Native of dry hilly places about Paris. Lamarck and Poiret efteem this a diftinct fpecies from the laft, not only becaufe its herbage is much fmaller and more hairy, but becaufe the *ftems* are, even when in flower, entirely proftrate. We have never met with any thing anfwering to this defcription in England. The *flowers* are faid to refemble *repens*, having likewife a fmooth *calyx*. Our *repens* has hairs on that part.

56. Q. *intermedius*. Intermediate Crowfoot. Lamarck Dict. n. 44.—Lower leaves three-lobed, cut; upper fomewhat fingered. Flower-ftalks moftly folitary. Calyx reflexed. Seeds compreffed, fmooth. Root fibrous.—Found at the borders of ponds in France, about Paris and at Fontainebleau. This plant, according to Poiret, is, as it were, intermediate between *bulbofus* and *repens*, having, befides, many characters in common with *proftratus*. The *root* is fibrous, fafciculated. *Stems* feveral, low, fcarcely branched, almoft leaflefs except at the bottom, weak, ftriated, flightly downy, often forked above. *Radical leaves* on long ftalks, almoft fmooth, in three rounded, often cut, lobes; the *ftem-leaves* have three linear or lanceolate irregular lobes; the uppermoft are very narrow, almoft fingered. *Flowers* axillary, or terminal, two or three on each branch, on very long and flender, nearly fmooth, ftalks. *Calyx-leaves* reflexed at the time of flowering, as in *bulbofus*, coloured, concave, bearing fome very fine long hairs. *Petals* of a fine yellow, ftriated, middle-fized. *Fruit* oval or globofe. *Seeds* fmooth, compreffed, roundifh, with a green border. We know nothing of this fpecies but from the above defcription.

57. R. *lucidus*. Shining-leaved Crowfoot. Lamarck Dict. n. 36.—Leaves with three or five lobes, fomewhat pinnatifid, fhining, fmooth. Stem erect, many-flowered. Calyx reflexed.—Suppofed to be a native of the Levant; cultivated in

in the botanic garden at Paris. *Root* perennial. *Stems* one or two feet high, branched, leafy, very fmooth, tender, ftriated. *Leaves* alternate, ftalked, widely fpreading, fmooth, fhining as if varnifhed on their upper furface, divided into three or five diftant dilated lobes, the two lowermoft contracted at their bafe, unequally cut, obtufe. *Footftalks* long, fomewhat downy, dilated at their bafe into a broad membranous expanfion. *Flowers* numerous, fituated at the ends, as well as in the forks, of the *branches*, on long, fimple, cylindrical, rather downy *ftalks*. *Calyx-leaves* coloured, fmooth, concave, reflexed after the flower expands. *Petals* rather large, roundifh, of a fine fhining yellow. This plant has fome agreement with *R. repens*, from which it differs in having entirely upright *ftems* and a reflexed *calyx*, as well as fhorter more dilated lobes to the *leaves*. Such is Poiret's account. This furely cannot be our *paluftris*, n. 52, which has hairy *leaves*, and no refemblance or affinity to *repens*; neither could the intelligent author have overlooked Tournefort's fynonym for that plant.

58. R. *polyanthemos*. Many-flowered Crowfoot. Linn. Sp. Pl. 779. Fl. Suec. ed. 2. 196. Willd. n. 44. Ait. n. 28. Lamarck n. 41. Lob. Ic. 666. (R. fylveftris fecundus; Dod. Pempt. 427. R. furrectis cauliculis; Ger. Em. 951, as to the figure. R. fylveftris; Tabern. Kreuterb. 107. Ic. 42. R. napellifolius; Crantz fafc. 3. 90. t. 4. f. 1, 1?)—Leaves in five deep, repeatedly fubdivided lobes; fegments all linear. Stem erect, many-flowered. Flower-ftalks furrowed. Calyx fpreading. Seeds ovate, bordered, compreffed, fmooth.—Native of moift, elevated, rich meadows, in Upland, and elfewhere in Sweden, but rarely. *Linnæus*. In Germany, and perhaps in Switzerland, on the authority of various writers. *Root* perennial. *Stem* erect, two or three feet high, branched, many-flowered; leafy, clothed with upright, or fomewhat fpreading, hairs. *Radical* and lower *ftem-leaves* three inches wide, on long very hairy ftalks, divided to the very bafe into three lobes, the lateral lobes again divided almoft to the bafe, fo that the leaf may truly be called, in the firft inftance, five-lobed; each lobe is deeply, more or lefs repeatedly, cut, into three-cleft or alternate, linear, bluntifh, entire, fingle-ribbed, fpreading fegments, loofely hairy on both fides, paler beneath: the uppermoft leaves are nearly feffile, in about three deep, linear, entire divifions. *Flower-ftalks* long, terminal, angular or furrowed, rough with upright hairs. *Flowers* large, yellow, drooping, not clofing, in wet weather, according to Linnæus. *Calyx* fpreading, pale, externally hairy. *Fruit* globofe. *Seeds* ovate, fhort, compreffed, fmooth at the fides, bordered and roughifh at the edges, tipped with a broad, fhort, recurved beak. We have defcribed this from the authentic Linnæan fpecimen, which feems diftinct from the following, and anfwers extremely well to the figure of Tabernæmontanus more efpecially, nor does it ill accord with that of Dodonæus, reprinted in Gerarde's herbal. The laft-named author however certainly applies that figure to the common Englifh *R. acris*, which he fays he found double. Hence fome doubt may arife whether the true *polyanthemos* was ever cultivated in England, as it feems to depend on Gerarde's authority only for a place in Hort. Kew. We have never feen it alive. Poffibly it may be found in a double ftate in fome old garden. The above defcription of the *leaves*, and the greater fize of the whole plant, will diftinguifh it from *acris*. The *calyx* is hairy in both, notwithftanding Willdenow's remark to the contrary.

59. R. *acris*. Upright Meadow Crowfoot. Linn. Sp. Pl. 779. Willd. n. 45. Ait. n. 29. Purfh n. 15. Fl. Brit. n. 10. Engl. Bot. t. 652. Curt. Lond. fafc. 1. t. 39. Mart. Ruft. t. 30. Woodv. Suppl. t. 246. Bulliard. t. 109. Curt. Mag. t. 215. (R. hortenfis fecundus; Dod. Pempt. 426. R. pratenfis, furrectis cauliculis; Lob. Ic. 665. R. luteus; Trag. Hift. 94.)—Leaves in three deep, wedge-fhaped, many-cleft, jagged lobes; the lateral ones deeply divided. Stem erect, many-flowered. Flower-ftalks round. Calyx fpreading. Seeds ovate, bordered, compreffed, fmooth.—Native of meadows and paftures in all the more northern countries of Europe, very common in England, flowering in June and July. The double-flowered variety is frequent in gardens. The *root* is perennial, tuberous, with long fimple fibres. *Stem* erect, two feet high, round, ftriated, rough with fpreading hairs below, and with clofe-preffed ones above, branched, flightly leafy. *Leaves* hairy, far lefs divided than in the laft, and with broader, wedge-fhaped, by no means linear, fegments: the upper ones linear, either deeply three-cleft, or fimple. *Flower-ftalks* round, not furrowed. *Calyx* green, fpreading, hairy. *Petals* bright fhining yellow. *Fruit* globofe. *Seeds* much like the laft.

A dwarf alpine variety was brought by Mr. Dawfon Turner from wet rocks, near the fummit of Snowdon, whofe *ftem* is but three or four inches high, and bears but one or two *flowers*. This when cultivated in a garden gradually affumes the fize and habit of the common kind.

60. R. *Breyninus*. Woolly-fruited Alpine Crowfoot. Crantz Auftr. fafc. 2. 91. t. 4. f. 2. (R. Breynifius, by miftake; Lamarck Dict. n. 59. R. n. 1170; Hall. Hift. v. 2. 72.)—Leaves deeply three-lobed, cut and toothed, very hairy beneath. Stems fpreading, few-flowered. Calyx fpreading. Seeds fmooth. Receptacle woolly.—Native of the Auftrian and Swifs Alps. Haller fays it is the fmalleft of all the fpecies. The *ftems* are feveral, two or three inches high, oblique, fimple or fomewhat branched, hairy, bearing one or two *flowers*, which are of a varnifhed yellow. *Radical leaves* numerous, lefs deeply divided than in *acris*, very hairy beneath. *Fruit* globular. *Seeds* fmooth, hooked. *Receptacle* woolly, which Crantz fays he had not obferved in other fpecies, and by which we prefume this is moft effentially diftinguifhed, particularly from the above alpine variety of *acris*. We have not met with a fpecimen, nor was Mr. Davall acquainted with the plant of Haller.

61. R. *lappaceus*. Bur Crowfoot.—Leaves ternate; leaflets ftalked, three-lobed, fharply cut, hairy. Stem erect, many-flowered. Calyx fpreading. Seeds ovate, keeled, reticulated, with elongated, revolute-pointed beaks.—Native of Port Jackfon, New South Wales; communicated by Dr. White. This has much of the habit of *R. acris*, but is very diftinct. The *ftems* are a foot, or more, in height, branched, roundifh, rough with clofe-preffed hairs. *Radical leaves* numerous, on long hairy ftalks, very hairy, about the fize of *acris* or *repens*, but remarkable for the partial ftalks, fometimes an inch or two long, that fupport the leaflets, efpecially the terminal one; the *leaflets* are broad, wedge-fhaped, more or lefs deeply three-lobed, coarfely and fharply cut. The lower *ftem-leaves* are narrower and lefs cut; the upper entire and lanceolate; the uppermoft of all fimple and linear. *Flowers* larger than in *acris*, white in the dried fpecimen, but perhaps yellow when frefh, finely veined, on long, hairy, angular, terminal ftalks. *Calyx* fpreading, clothed with long hairs. *Nectary* covered with a wedge-fhaped fcale. *Fruit* globofe. *Seeds* ovate, turgid, keeled, reticulated with veins, fmooth, each tipped with a prominent angular beak, nearly its own length, whofe point is ftrongly recurved, and even revolute.

62. R. *cappadocicus*. Cappadocian Crowfoot. Willd. n. 46. Lamarck Dict. n. 39. (R. orientalis dulcis, doronici radice; Tourn. Cor. 20.)—"Calyx fpreading. Flower-

ftalk round. Stem fimple or divided. Leaves heart-fhaped, three-lobed, toothed."—Native of Cappadocia. *Root* perennial, hard, the thicknefs of a goofe-quill, and refembling the root of *Doronicum*. *Radical leaves* roundifh-heart-fhaped, with three very fhort lobes, all pointed, furnifhed with a few coarfe teeth, and clothed on both fides with fcattered clofe-preffed hairs. *Stem-leaf* folitary, ftalked as well as the radical ones; and in the middle of the flower-ftalk is a fmall, feffile, lanceolate, entire leaf. *Stem* a fpan high, clothed with clofe-preffed hairs, either fimple, or divided above the leaf, each ftalk fingle-flowered. *Corolla* yellow, the fize of *R. polyanthemos*. *Fruit* roundifh. *Seeds* compreffed, hooked. *Willdenow*, from a dried fpecimen.

63. R. *lanuginofus*. Broad-downy-leaved Crowfoot. Linn. Sp. Pl. 779. Willd. n. 47. Ait. n. 30. Purfh n. 16. Fl. Dan. t. 397. Sm. Fl. Græc. Sibth. t. 519, unpublifhed. (R. montanus fubhirfutus latifolius; Bauh. Prodr. 96. R. nemorofus hirfutus, foliis caryophyllatæ; Loef. Pruff. 220. t. 71. R. magnus valde hirfutus, flore luteo; Bauh. Hift. v. 3. 417. R. n. 1172; Hall. Hift. v. 2. 73. Βατράχιον ἕτερον; Diofc. book 2. chap. 206.) Leaves heart-fhaped, five-cleft, lobed, notched, filky. Stem erect, many-flowered, hairy. Flower-ftalks round. Calyx fpreading. Seeds ovate, compreffed, with elongated, revolute-pointed beaks.—Native of Germany, France, Switzerland, Carniola, Greece, and North America. Mr. Purfh obferved it in old fields and meadows, from Penfylvania to Carolina, flowering from June to October. Dr. Sibthorp found it in fhady watery fituations in the Peloponnefus, but moft plentifully in the north of Greece, and with great reafon concluded it to be the fecond *Ranunculus* of Diofcorides, with whofe defcription it fufficiently well agrees, except being mild, rather than very acrid, in fenfible qualities, if we may truft modern authors. Linnæus diftinguifhes two varieties, between which we can difcover no difference, and Haller unites them. The opinion of this great Swifs botanift however lofes fome of its weight, by the doubt he expreffes whether this plant be diftinct from *R. repens*, n. 54, to which it has indeed a flight general refemblance, though differing totally in its upright *ftem*, deftitute of runners; its very foft filky *leaves*, by which this plant is known at once from every other European *Ranunculus*; and the revolute taper points of its *feeds*, which nearly agree with *lappaceus* in that refpect; but the *feeds* themfelves are compreffed, and, as far as we can fee, deftitute of reticulated veins. The *root* is perennial, with many long, ftout, cylindrical, flefhy fibres, or perhaps flender knobs, intermixed with capillary branched radicles. *Stem* 12 or 18 inches high, branched, leafy, round, clothed with long, fpreading or deflexed, hairs; its bafe purplifh, as are alfo the long hairy *footftalks* of the radical *leaves*. Thefe and the lower *ftem-leaves* are three inches wide, divided about half way down into five or feven broad, fharply notched lobes, whofe clofe finufes have a pale fpot, with a purple ftain, adjoining to their termination. The upper *leaves* are deeply three-cleft, with ovate and toothed, or lanceolate and entire, lobes. *Flowers* yellow, much like thofe of *acris*. *Calyx* hairy, fpreading. *Fruit* globofe. *Seeds* with awl-fhaped, ftrongly revolute beaks, by which this fpecies is clearly diftinguifhable from *repens*, *polyanthemos*, *acris*, if fuch a mark were neceffary, and by which it forms a chain of affinity between thofe fpecies and our *lappaceus*. It is fomewhat remarkable that *R. lanuginofus* has not been found in Britain, and ftill more fo, that any obfcurity fhould envelope the botanical hiftory of fo diftinct a fpecies.

64. R. *fericeus*. Silky Crowfoot. Lamarck Dict. n. 26. —Leaves ternate, very filky; leaflets wedge-fhaped, deeply three-cleft, jagged and toothed. Stem erect, many-flowered, filky. Calyx fpreading. Seeds ovate, compreffed, with fhort erect beaks.—Gathered in the ifle of Bourbon by Commerfon, from whom we have fpecimens. *Root*, as well as the general habit and fize of the *plant*, like the laft, but the whole herb is much more denfely clothed with fhining filky hairs. The *leaves* are ternate, fome of them almoft twice ternate; their lobes deeply and repeatedly cut, in a radiant manner, with fharp teeth. *Flowers* like the laft. *Fruit* ovate. *Seeds* with broad ftraight beaks, longer, and not fo much curved or hooked, as even thofe of *acris*.

65. R. *tomentofus*. Shaggy Crowfoot. Lamarck Dict. n. 70. Purfh n. 17.—Leaves downy, three-lobed or notched; the uppermoft oval, entire. Stem reclining, fomewhat creeping, fhaggy, one or two-flowered. Calyx hifpid, flightly reflexed.—Gathered in North Carolina, by M. Bofc. A fmall, almoft creeping, very hairy plant, with fibrous *roots*. The *ftems* are very low, and nearly proftrate, afcending at their extremities, two or three inches long, tender, covered with whitifh tufted hairs, difpofed in two rows. *Leaves* ftalked, thick, downy, generally with three lobes, which are either diftinct or confluent; fome leaves are merely crenate and rounded. *Footftalks* long and hairy. The uppermoft *ftem-leaf* is feffile, oval, acute, entire. *Flowers* one or two, on terminal, unequal, fimple *ftalks*, clothed with two rows of hairs. *Calyx* hifpid, a little reflexed. *Petals* white or yellowifh, rounded at the end. *Poiret*. We have feen no fpecimen, nor did Mr. Purfh meet with the plant himfelf.

66. R. *marylandicus*. Maryland Crowfoot. Lamarck Dict. n. 69. Purfh n. 18.—Leaves ternate, three-lobed, acute, cut, pale and nearly fmooth beneath. Stem fimple, almoft naked, downy. Calyx fmooth, reflexed. Found in fhady woods, from Penfylvania to Virginia, flowering from May to July. *Purfh*. *Root* fibrous, perennial. *Stems* fimple, erect, downy, flender, about ten inches high; Poiret by miftake, as we prefume, fays ten feet. *Leaves* radical, on long downy ftalks, ternate; the two lateral ones oppofite, ftalked; all with three confluent, lanceolate, acute, cut lobes; their upper furface green; the under paler and whitifh, almoft fmooth. There are no other *ftem-leaves* than what ftand almoft feffile, at the bafe of the flower-ftalks, and either have three or five fhallow irregular lobes, or are fimply cut. *Flowers* two or three, terminal, on fhort, fcarcely downy, ftalks. *Calyx* fmooth, reflexed. *Petals* rather large, oval, rounded at the end, pale yellow. *Poiret*.

67. R. *recurvatus*. Recurved Crowfoot. Lamarck Dict. n. 65. Purfh n. 19.—Leaves in three deep, acute, cut, wedge-fhaped lobes. Stem many-flowered. Calyx and corolla reflexed. Petals nearly linear. Seeds compreffed, dotted, with revolute, awl-fhaped beaks.—Native of fhady woods, from New York to Carolina, flowering from June to Auguft. *Purfh*. We received fpecimens from the Rev. Dr. Muhlenberg, of Lancafter, Penfylvania. The *root* is perennial. *Stems* a fpan high, very hairy; branched and leafy at the upper part. *Leaves* two or three inches wide, rather hairy, on very hairy ftalks; their fide-lobes for the moft part deeply cloven. *Flowers* ftalked, fmall. *Calyx* pale-purplifh, ribbed, clothed with fine long hairs. *Petals* fmall, narrow, almoft white. *Fruit* globofe. *Seeds* ovate, lenticular, minutely dotted, fmooth, with flender, revolute-pointed beaks.

68. R. *feptentrionalis*. Smooth North-American Crowfoot. Lamarck Dict. n. 64. Purfh n. 20.—Leaves ternate, membranous, fmooth, deeply lobed, acute, cut. Stem two-flowered, hairy, like the bafe of the footftalks. Calyx reflexed.

reflexed.—Native of North America. Described by Poiret from Lamarck's herbarium, and adopted by Pursh. *Root* perennial, fibrous, fasciculated. *Stems* nearly simple, hollow, eight or ten inches high, almost leafless; downy in their lower part. *Leaves* stalked, thin, smooth, composed of three stalked leaflets, the central one having three deep spreading lobes, the others often but two; all sharp, cut and toothed. There is usually but one *stem-leaf*, which is nearly sessile, ternate, with narrower segments. *Footstalks* long, slender, most hairy towards their base. *Flower-stalks* two, terminal, unequal, very slender, smooth, each bearing, about half way up, one small linear leaf. *Calyx* reflexed, coloured, smooth, except a few terminal hairs, deciduous. *Petals* pale yellow, rounded. *Fruit* small, globular. *Seeds* nearly orbicular, lenticular, with sharp straight beaks. *Poiret.*

69. R. *hispidus.* Hispid American Crowfoot. Michaux Boreal-Amer. v. 1. 321. Lamarck Dict. n. 27. Pursh n. 21.—Very hairy, erect. Leaves ternate, sharply lobed. Stems few-flowered; leafless below. Calyx close-pressed. Seeds obovate, with awl-shaped, inflexed beaks.—Found in wet fields, and on the banks of ditches, from Virginia to Carolina, flowering from June to August. *Root* perennial. *Flowers* small, pale yellow. *Pursh.* A specimen sent by Gronovius to Linnæus, as akin to his *lanuginosus*, but distinct, answers very well to the characters of Michaux, and we have taken from that specimen the above account of the *seeds.* The *flower* is nearly as big as *acris.* Whole herbage, especially the *footstalks*, very hairy.

70. R. *pinnatus.* Pinnated Indian Crowfoot. Poiret in Lam. Dict. n. 66.—"Downy. Leaves pinnated; leaflets lobed and cut. Branches spreading. Seeds tuberculated."—Gathered in India by Sonnerat. *Stems* with lax, spreading, downy, striated, leafy *branches.* *Leaves* alternate, stalked, downy, of five or seven opposite *leaflets*, divided into irregular, sharp, cut, almost lanceolate, lobes. *Flowers* numerous, on long, downy, single-flowered stalks. *Calyx* coloured, not reflexed. *Petals* yellowish, of a middling size. *Seeds* orbicular, convex, moderately tuberculated on each side, and tipped with a small, thick, straightish beak. *Poiret.*

71. R. *multifidus.* Many-cleft Arabian Crowfoot.—Forsk. Ægypt-Arab. 102. Lamarck Dict. n. 67.—"Leaves many-cleft; the lower ones pinnated. Stem many-flowered. Calyx the length of the corolla. Seeds ovate, acute.—Gathered by Forskall, in ditches near the town of Taes. He describes the *stem* two feet high, erect; round in the lower part; striated above; hairy. *Fruit* oval. We have no other authority, than the authors quoted, for this species or the last.

72. R. *pedatifidus.* Radiating-leaved Crowfoot.—Leaves deeply pedatifid, with linear, obtuse, divided or three-cleft, radiating, entire segments. Stem one or two-flowered. Seeds ovate, hairy, with small recurved beaks.—Native of Siberia. Four specimens from that country are in the Linnæan herbarium, but the species, though very distinct, appears never to have been described. *Root* perennial, of many long, cylindrical, fleshy fibres, and crowned with numerous capillary remains of old footstalks. *Stem* a span high, erect, round, striated, leafy, simple or divided, clothed with long, soft, lax hairs. *Radical leaves* on long hairy stalks, deeply cut, in a pedate manner, into five, seven, or more, narrow, linear, obtuse, elegantly radiating segments, some of which are deeply three-cleft, and their lobes again cloven, others merely divided, and others undivided; all entire at the edges, and somewhat hairy on both sides, with long, lax, white hairs. The *stem-leaves* are mostly sessile, less divided; the uppermost in three, rarely more, deep, linear, simple segments. *Flowers* apparently yellow, the size of *R. acris.* *Calyx* woolly at the base; its segments partly dilated and coloured, all shorter than the *petals*, and closely pressed to their under side. *Fruit* ovate. *Seeds* not very numerous, ovate, tumid, hairy, with short, awl-shaped, reflexed beaks.

73. R. *chærophyllos.* Chervil Crowfoot. Linn. Sp. Pl. 780. Willd. n. 48. Lamarck Dict. n. 32. (R. tenuifolius luteus, grumosâ radice, foractensis seu italicus; Barrel. Ic. t. 581? bad.)—Leaves thrice compound, with linear segments. Stem silky, with few flowers. Calyx reflexed, hairy. Root with tapering fleshy fibres.—Native of the south of Europe. The only certain specimen of this plant, that has ever come under our observation, exists in the Linnæan herbarium. The *root* consists of numerous, long, fleshy, gradually tapering, downy fibres. *Stem* erect, about a span high, slender, silky, slightly leafy, branched, bearing three or four flowers. *Radical leaves* several, stalked, repeatedly ternate, with numerous linear, or somewhat lanceolate, entire segments, hairy beneath. *Footstalks* an inch and half long, hairy; dilated, membranous, and ribbed at the base. *Stem-leaves* few, much less compound, and often nearly sessile. *Flowers* solitary, on long, terminal, simple, hairy, quadrangular stalks. *Calyx* strongly reflexed, coloured; externally hairy. *Petals* yellow. *Fruit* not sufficiently advanced to be described. At the back of this specimen Linnæus has written *Ranunculus lybicus, pulsatillæ folio, T. Cor.;* but there is no such passage in Tournefort's *Corolla*, nor any thing to which it can refer, except *R. lesbius, pulsatillæ folio, flore parvo*, a species unknown to us. A very different plant from the true *R. chærophyllos*, was given by the abbè Pourret to the younger Linnæus, under that name. It seems rather to be *flabellatus*, n. 32, a species allied, in many points, to what we are describing.

74. R. *millefoliatus.* Milfoil Crowfoot. Vahl. Symb. v. 2. 63. t. 37. Desfont. Atlant. v. 1. 441. t. 116. Willd. n. 49. Lamarck Dict. n. 33. Sm. Fl. Græc. Sibth. t. 521, unpublished. (R. montanus leptophyllon, asphodeli radice; Column. Ecphr. 312. t. 311.)—Leaves thrice compound, with elliptic-linear segments. Stem silky, with few flowers. Calyx erect, somewhat hairy. Root with ovate knobs.—Native of Italy, Greece, Syria, and Barbary. The *root*, in Dr. Sibthorp's specimens, consists of many oval fleshy knobs, scarcely half an inch long, intermixed with fibres. Columna describes and delineates the fibres as terminating the knobs; a very material difference. The *stems*, in the Greek and Italian specimens, are simple and single-flowered; in the more luxuriant ones from Aleppo and Tunis, somewhat branched, bearing two or three flowers. The *stem-leaves* are more numerous, as well as more compound, than in the last. *Flowers* large. *Calyx* closely pressed to the corolla; sometimes nearly smooth. *Fruit* oblong. *Seeds* with small recurved beaks. We can scarcely doubt, notwithstanding the above-mentioned diversity respecting the *root*, that the synonym of Columna belongs to the present, rather than the foregoing, species.

75. R. *oxyspermus.* Sharp-seeded Crowfoot. Willd. n. 51. Lamarck Dict. n. 37.—"Radical leaves oblong, obtuse, deeply and unequally toothed; stem-leaves sessile, fingered, cut. Seeds awned."—Native of Siberia, near the river Tereck. *Root* apparently annual. *Radical leaves* stalked, ovate, obtuse, with unequal deep teeth; hairy, like their *footstalks*, on both sides. *Stem* erect, branched, hairy, a foot or more in height. *Stem-leaves* digitate; the segments of the lower ones unequally pinnatifid; of the upper linear and entire. *Calyx* reflexed. *Corolla* yellow, the size of *R. bulbosus.* *Fruit* elliptical. *Seeds* rather compressed, acute,

acute, with upright, awl-ſhaped, briſtly points. *Willdenow.*

76. R. *arvenſis.* Corn Crowfoot. Linn. Sp. Pl. 780. Willd. n. 52. Ait. n. 32. Fl. Brit. n. 12. Engl. Bot. t. 135. Curt. Lond. faſc. 6. t. 36. Mart. Ruſt. t. 56. Fl. Dan. t. 219. Bulliard. t. 117. Brugnon Mem. de l'Acad. de Turin, v. 4. 108. t. 3. (R. arvorum; Ger. Em. 951.)—Leaves ternate, three-cleft, with linear ſegments. Seeds prickly at each ſide. Stem erect.—Frequent in corn-fields throughout Europe, flowering in the middle of ſummer. *Root* fibrous, annual. *Stem* one or two feet high, much branched, many-flowered, leafy, nearly ſmooth. *Leaves* of a light green, ſlightly hairy, ſtalked, once or twice ternate, as well as deeply three-cleft; the ultimate ſegments almoſt linear, entire, or rarely notched. *Flowers* ſmall, lemon-coloured, ſtalked, lateral and terminal. *Calyx* ſpreading, hairy. *Petals* obovate, veined. *Fruit* depreſſed. *Seeds* very large, compreſſed, with erect, awl-ſhaped, hooked beaks; their ſides armed with numerous, prominent, awl-ſhaped prickles, largeſt towards the margin. From the obſervations of M. Brugnon, this appears to be one of the moſt virulent of its genus, eſpecially when young, cauſing ſpeedy inflammation and gangrene in the ſtomachs of ſheep and oxen; who nevertheleſs eat it with avidity. Vinegar much diluted with water, poured down their throats, proved a quick and certain remedy. The expreſſed juice of the plant, given to dogs, is no leſs fatal.

77. R. *muricatus.* Spreading Prickly-ſeeded Crowfoot. Linn. Sp. Pl. 780. Willd. n. 53. Lamarck Dict. n. 75. Ait. n. 33. Purſh n. 24. Sm. Fl. Græc. Sibth. t. 522, unpubliſhed. (R. creticus echinatus latifolius; Alpin. Exot. 263. t. 262. R. Apulei quibuſdam; Cluſ. Hiſt. v. 1. 233. R. parvus echinatus; Ger. Em. 965. R. paluſtris echinatus; Bauh. Hiſt. v. 3. 846. Feuill. Peruv. 58. t. 18. f. 1.)—Leaves ſimple, three-lobed, notched, bluntiſh, ſmooth. Stipulas diſtantly fringed. Seeds prickly at each ſide. Stem diffuſe.—Native of watery places in various parts of the ſouth of Europe; frequent in Greece. It occurs alſo in North America, in old fields, from Virginia to Carolina, flowering in June and July, according to Mr. Purſh. The *root* is annual, conſiſting of numerous long fibres. *Herb* ſmooth and ſucculent, bright green. *Stems* ſeveral, various in length, ſpreading, and moſtly procumbent, leafy, round, ſhining; purpliſh in the lower part. *Leaves* an inch and a half to three inches wide, veiny, in three rather deep lobes, broadly and irregularly notched. *Footſtalks* from one to four inches, or more, in length, with a concave ſheathing baſe, bordered with a membranous *ſtipula*, whoſe edges are regularly fringed with diſtant hairs. *Flowers* the ſize of the laſt, yellow, ſolitary, on axillary ſtalks, rather ſhorter than the leaves. *Calyx* reflexed, nearly, or quite, ſmooth. *Petals* obovate, almoſt twice as long as the calyx, at leaſt in the European ſpecimens, though they appear to be but of the ſame length in American ones. *Fruit* capitate. *Seeds* large, ovate, compreſſed, with broad, awl-ſhaped, angular, ſomewhat recurved beaks; their ſides covered with ſmaller, more uniform prickles, than in *R. arvenſis*. Commerſon gathered, by the ſea-ſhore at Monte Video, a variety of this with more luxuriant herbage, and ſmaller flowers, of which Ventenat makes a ſpecies of the name of *ventricoſus*, founding its character on the inflated baſes of the *footſtalks*, of which, however, we can ſee nothing, in our original ſpecimens from Thouin's herbarium. Its *ſtipulas* are fringed preciſely as in our European *muricatus*, to which we agree with Poiret in referring it, though we can ſcarcely do the ſame by the following.

78. R. *echinatus.* Dwarf Prickly-ſeeded Crowfoot. Venten. Jard. de Cels t. 73. Purſh n. 25. (R. muricatus γ; Lamarck Dict. n. 75.)—Leaves ſimple, three-lobed, notched, ſmooth. Stipulas bearded at the ſummit. Seeds prickly at each ſide. Stem erect, branched.—Found by M. Boſc, near Charleſtown, South Carolina. This ſeems to differ from the laſt, in its ſimple, ſhort, upright *ſtem*; but more eſpecially, if Ventenat's plate and deſcription be correct, which we cannot doubt, in having each *ſtipula* crowned with a tuft of hairs, inſtead of being diſtantly fringed throughout. The *petals* are ſaid to be larger than thoſe of the American variety, at leaſt, of *muricatus*; but that circumſtance is of ſmall moment here, as to a ſpecific diſtinction.

79. R. *parviflorus.* Small-flowered Crowfoot. Linn. Sp. Pl. 780. Willd. n. 54. Ait. n. 34. Fl. Brit. n. 13. Engl. Bot. t. 120. (R. hirſutus annuus, flore minimo; Raii Syn. 248. t. 12. f. 1. Pluk. Phyt. t. 55. f. 1.)—Leaves ſimple, three-lobed, notched, hairy. Seeds covered, at each ſide, with hooked prickles; their beaks recurved. Stem diffuſe.—Native of the more temperate parts of Europe. Found on banks, and in waſte as well as cultivated ground, in England, where the ſoil is gravelly; as alſo in Greece, flowering in the early part of ſummer. The *root* is annual. *Stems* proſtrate. Whole herb hairy, ſmaller in every part than *R. muricatus*. *Flower-ſtalks* oppoſite to the leaves. *Petals* pale yellow, ſcarcely longer than the ſpreading *calyx*, fugacious, and often imperfect. *Fruit* capitate. *Seeds* ovate, with a broad, ſhort, hooked beak, their flat brown ſides denſely covered with ſhort, hooked prickles. *R. trilobus*, Desfont. Atlant. v. 1. 437. t. 113. Lamarck Dict. n. 77, ſeems a variety, not of this, but of our *hirſutus*, n. 51.

80. R. *orientalis.* Spinous Oriental Crowfoot. Linn. Sp. Pl. 781. Willd. n. 55. Lamarck Dict. n. 71. (R. leſbius, pulſatillæ folio, flore magno; Tourn. Cor. 20.)—Leaves deeply laciniated, acute; all ſtalked. Stem branched. Calyx reflexed. Fruit cylindrical. Seeds dotted; their beaks recurved and ſpinous.—Native of the Levant. *Root* annual. *Stem* various in luxuriance, ſilky, leafy; in the Linnæan ſpecimen much branched and divaricated, with many flowers. *Leaves* ſtalked, compoſed in general of three deeply laciniated, often pinnatifid, acute, hairy leaflets. *Flowers* large, pale yellow, on long, ſtout, ſimple, lateral or terminal, ſolitary, ſpreading ſtalks. *Calyx* rather ſpreading than decidedly reflexed, nearly ſmooth. *Fruit* three quarters of an inch long, ſlightly elliptical, obtuſe. *Seeds* in many rows, compreſſed, minutely dotted at each ſide, gibbous at the baſe, each terminating in a very broad, rather ſhort, compreſſed, recurved, ſpinous-pointed beak. We know of no figure of this or the following.

81. R. *grandiflorus.* Large-flowered Oriental Crowfoot. Linn. Sp. Pl. 781. Willd. n. 56. Lamarck Dict. n. 63. (R. orientalis, aconiti folio, flore luteo maximo; Tourn. Cor. 20.)—"Stem erect, two-leaved. Leaves many-cleft; thoſe of the ſtem alternate, ſeſſile."—Gathered by Tournefort in the Levant. We have ſeen no ſpecimen. Willdenow marks this as a perennial ſpecies, and indicates his having ſeen it in a dried ſtate. We regret that he did not ſubjoin a deſcription of the plant, the Linnæan ſpecific character being very inſufficient. What Poiret has given is evidently compiled from the ſhort materials furniſhed by Linnæus and Tournefort. The Abbè Seſtini is ſaid to have gathered *R. grandiflorus* near Conſtantinople; on whoſe authority it finds a place in Prodr. Fl. Græc. v. 1. 385.

82. R. *falcatus.* Sickle-ſeeded Crowfoot. Linn. Sp. Pl.

Pl. 781. Willd. n. 57. Ait. n. 35. Jacq. Auftr. t. 48. (Melampyrum luteum; Ger. Em. 90. Lob. Ic. 37.)—Leaves linear-wedge-fhaped, in three deep many-cleft lobes. Seeds with fickle-fhaped beaks. Stalks radical, fingle-flowered.—Native of corn-fields in the fouth of Europe, and the Levant; cultivated by Miller at Chelfea in 1739. A fmall annual, flowering in the early part of fummer. *Root* thread-fhaped, with a few fibres. *Stem* none. *Leaves* feveral, pale green, downy, about two inches long; their fegments narrow and entire. *Stalks* fimple, downy, taller than the leaves, each bearing a fmall yellow *flower*, whofe *calyx* is erect. *Fruit* large, ovate, or nearly cylindrical, befet on all fides with the long, prominent, afcending, incurved, compreffed, downy, fpinous-pointed beaks of the feeds.

83. R. *polyphyllus*. Many-leaved Water Crowfoot. "Waldft. et Kitaibel Hung." Willd. n. 58.—"Leaves under water oblong, ftalked, capillary; floating ones wedge-fhaped, three-lobed; thofe above the water elliptical. Stem erect."—Native of the waters of Hungary. Annual. *Stem* nine inches high, erect; branched in the upper part. *Leaves* that are under water very numerous, entirely covering that part of the ftem, oblong, the length of the nail, each fupported by a capillary *footftalk* an inch long: the floating leaves fmall, wedge-fhaped, three-lobed, entire, as long as the former, their *footftalks* thicker and fhorter. *Branches* an inch long, erect, rifing above the water, and bearing elliptical obtufe leaves, tapering each way, from four to fix lines long, on fhort *footftalks*. *Flowers* extremely fmall, yellow. *Willdenow.*

84. R. *hederaceus*. Ivy Crowfoot. Linn. Sp. Pl. 781. Willd. n. 59. Ait. n. 36. Fl. Brit. n. 14. Engl. Bot. t. 2003. Curt. Lond. fafc. 4. t. 39. Fl. Dan. t. 321. Dalech. Hift. 1031. (R. hederaceus rivulorum fe extendens, atrâ maculâ notatus; Bauh. Hift. v. 3. 774.)—Leaves fmooth, roundifh, kidney-fhaped, with three or five entire lobes. Stem creeping. Stamens from five to ten. Seeds corrugated.—Native of watery places, on a fandy or gravelly foil, in England, Germany, France, &c. flowering from May to Auguft. *Roots* fibrous, perennial. *Stems* either creeping or floating, proftrate, branched, round, fmooth, and fucculent. *Leaves* ftalked, fmooth, and fhining, nearly uniform; often blackifh in the difk. *Flowers* very fmall, on fimple, axillary or lateral, ftalks. *Petals* linear-oblong, rather exceeding the calyx in length, white, with yellow claws. *Stamens* fcarcely ever more than ten. *Fruit* globofe. *Seeds* ovate, incurved, fomewhat compreffed, with a very fmall inflexed beak, and numerous, lateral, corrugated or reticulated veins.

85. R. *aquatilis*. White Floating Crowfoot. Linn. Sp. Pl. 781. Willd. n. 60. Ait. n. 37. Fl. Brit. n. 15. Engl. Bot. t. 101. Ger. Em. 829.—Leaves capillary under water; above fomewhat peltate. Stamens numerous. Seeds corrugated.—Native of pools, ditches, and rivers, throughout Europe, mantling the furface with its copious white bloffoms, in the early part of fummer. The *roots* are long, fibrous, and perennial. *Stems* floating under water, long, round, branched, leafy. *Leaves* ftalked, fmooth; the uppermoft floating, ufually peltate, with various blunt notches; the next deeply three-lobed, or even ternate; the lowermoft immerfed, repeatedly three-cleft, with innumerable capillary fegments. *Flowers* floating on long fimple ftalks, oppofite to the leaves. *Petals* obovate, much longer than the calyx, white, with yellow claws. *Nectary* tubular. *Stamens* thirty or more. *Fruit* like the laft, but the *feeds* more numerous, and generally briftly, fomewhat obovate.

Varieties, as we deem them, of this fpecies are, 1ft, that whofe *leaves* are all immerfed, and entirely capillary, figured in Ger. Em. 827. f. 3: 2dly, the *circinatus* of Sibth. Oxon. 175, figured in Pluk. Phyt. t. 55. f. 2, whofe leaves are all likewife in capillary divifions, but finer and fmaller than the former: 3dly, the *fluviatilis* of Willdenow, n. 61, *peucedanoides* of Desfont. Atlant. v. 1. 444, figured in Fl. Dan. t. 376, whofe leaves are not only in capillary fegments, but confiderably elongated, by the influence, as we conceive, of the running water, in which this fort is always found. The *feeds* indeed are not briftly, in our fpecimens of this laft variety, but naked, as in *hederaceus*, which fpecies agrees with every variety of *aquatilis*, in the corrugations of the feeds, as above defcribed.

We have thus added twenty-four fpecies to Willdenow's number, following his arrangement, for the prefent at leaft; not only for the convenience of our readers, but becaufe it would be very difficult to make a perfect one on any known principles; the feveral fpecies being allied by fo many characters, and fo diffimilar in others, that nothing could be more precarious than to feek the clue of nature through fuch a labyrinth. The *feeds* perhaps ought to form the bafis of a fpecific arrangement, if they might not even lead to generic diftinctions.

No fmall curiofity in the hiftory of this genus is the *R. alatus*, of Poiret in Lamarck's Dict. n. 72, which, by his defcription, proves to be no other than *Gymnoftyles pterofperma* of Juffieu. (See GYMNOSTYLES.) The *pumilus* of Poiret, n. 82, appears to us a variety of *aquatilis*, growing in fhallow, and perhaps fluctuating, waters; whence, though its *leaves* are all deeply cut, their fegments are not quite capilllary, but linear and obtufe. We have Swifs fpecimens anfwering to this author's defcription.

RANUNCULUS, in *Gardening*, contains plants of the hardy, herbaceous, perennial kind, of which the fpecies cultivated are, the Perfian crowfoot, or garden ranunculus, (R. afiaticus); the aconite-leaved crowfoot (R. aconitifolius); the upright meadow crowfoot (R. acris); the creeping crowfoot (R. repens); and the embracing-leaved crowfoot (R. amplexicaulis). But there are other fpecies that may be cultivated for variety.

Of the firft fpecies the varieties are exceedingly numerous, being fometimes divided into two claffes, as the old Turkey kinds, and the Perfian kinds, the varieties of the latter amounting to many hundreds, and being confiderably more various, rich, and beautiful in colour than thofe of the others.

But in the former of thefe forts they rife with a ftrong generally unbranching ftalk a foot high, terminated by one large double flower, fometimes emitting one or two fmaller ones from its fides, and of which there are red-flowered, fcarlet-flowered, yellow-flowered, and fcarlet turban-flowered, &c.; but being feldom tinged with different colours, as in the Perfian kinds.

And in the latter kind the plants rife eight or nine inches high, generally branching from the bottom, producing from five or ten to twenty or more flowers on each root, and of which there are fingle-flowered, femi-double-flowered, full-double-flowered, large and full like a double rofe, being generally filled with petals to the very centre, forming a regular globular body, of admirable elegance, of all forts of the moft beautiful colours in different varieties, and of numerous degrees of deeper and lighter fhades, ftripes, and tinges in the feveral colours. Indeed Martyn obferves, that the varieties produced of late years from the feeds of femi-double flowers are unbounded; and that Mr. Maddock remarks that they are more numerous than of any other

other flower. Accordingly his catalogue, he fays, boafts nearly eight hundred, all with their proper names: ranged under the heads of—dark and dark purple; light purple and grey, &c.; crimfon, &c.; reds, &c.; rofy, &c.; orange, &c.; yellow and yellow fpotted, &c.; white and white fpotted, &c.; olive, &c.; purple and coffee-ftriped, &c.; red and yellow-ftriped; red and white ftriped.

And according to the above flower gardener a fine ranunculus fhould have a ftrong ftraight ftem from eight to twelve inches high. The flower fhould be of an hemifpherical form, at leaft two inches in diameter, confifting of numerous petals gradually diminifhing in fize to the centre, lying over each other, fo as neither to be too clofe nor too much feparated, but having more of a perpendicular than horizontal direction, in order to difplay the colours with better effect. The petals fhould be broad, with entire well-rounded edges; their colours dark, clear, rich or brilliant, either of one colour or varioufly diverfified, on an afh, white, fulphur or fire-coloured ground, or elfe regularly ftriped, fpotted or mottled, in an elegant manner.

In the fecond fpecies there is a variety with double flowers, which has been obtained by feeds, and is preferved in many curious gardens for the beauty of its flowers. It is by fome gardeners called the *Fair Maid of France*. The root is perennial, and compofed of many ftrong fibres: the leaves are divided into fine lanceolate lobes: the four fide-lobes are upon footftalks coming from the fide of the principal ftalk, and the middle one terminates it; they are deeply ferrate, and have feveral longitudinal veins. The ftalks rife a foot and half high, and branch out at the top into three or four divifions, at each of which there is one leaf, of the fame fhape with the lower, but fmaller. The flowers are pure white, and very double, each ftanding upon a fhort footftalk. The flowers come forth in May.

In the third fort there is alfo a variety with double flowers, which is the fort moft generally cultivated in the garden. It is frequently among other herbaceous perennials, under the name of *Yellow Bachelor's Buttons*.

And in the fourth fpecies there is a variety with double flowers, which is the fort cultivated in the gardens for its ornamental effects.

Method of Culture.—The firft fort and different varieties may be readily increafed by the off-fets taken from the root, and new varieties may be raifed from feed. In the firft of thefe methods the off-fets fhould be feparated from the roots in dry weather, in the latter end of fummer, when the flowering is over, and the ftems and leaves are declining, being placed in bags or boxes, in a dry place, till the autumn, when they fhould be planted out in rows fix or eight inches apart, and fix of them to each, in feparate beds, prepared with light fandy earthy compoft, to the depth of two or three feet; taking care to protect them carefully from the froft during the winter. When the buds begin to break through the ground they fhould be kept perfectly clear from weeds, protecting them from frofts; and when they have flowered and the ftems are decayed, the root fhould be taken up; cleared from dirt, and placed in bags or boxes till the autumn, when they muft be planted again.

But in the fecond mode, the feed fhould be collected from the beft plants of the femi-double kinds, and be fown in flat pans or boxes, filled with light rich earth, in Auguft, covering it in about a quarter of an inch thick with the fame fort of earth, placing them in a fhady fituation, fo as to have a little of the morning fun. The pots fhould remain here till the beginning of October, when the plants fometimes appear, though it is often later before this happens, when they fhould have a more open expofure with the full fun; but when froft is apprehended, they fhould be removed under a common hot-bed frame, being only covered in the nights and bad weather with the glaffes, guarding them well againft rains and froft. In the fpring following they fhould be expofed to the open air, being very flightly refrefhed with water, having a fituation to enjoy the morning fun; and when their leaves and ftems begin to decay, the roots may be taken up, dried in a proper place, and then put up in bags to be planted out in the fame manner as the old roots in October.

In the following fummer they will produce flowers; when fuch as are good fhould be marked, and the others removed from them. The plants intended to flower fhould not be fuffered to run to feed, as roots which have produced feeds feldom furnifh fine flowers afterwards. The difappointments experienced in purchafing thefe roots, chiefly depend upon this circumftance.

It may be noticed that the roots intended for the borders fhould be planted towards the fpring in little clumps or patches, three, four, or five roots in each, putting them in either with a dibble or trowel, about two inches deep, and three or four afunder in each patch, and the patches from about three to five or ten feet diftance, placing them in a varied manner in the borders.

And in regard to their general culture after planting, fuch of the forward autumnal-planted roots of the choice forts in beds as have fhot above ground, fhould in winter, where convenient, have occafional fhelter from hard frofts, by mats fupported on low hoop arches; or in very fevere weather be covered clofe with dry long litter, removing all covering in open weather: and in the fpring, when the flower-buds begin firft to advance, fhelter them in frofty nights with fupported mats, fuffering them, however, to be open to the full air every day; but the latter plantings, that do not come up in winter, or very early in fpring, whilft frofty nights prevail, will not require any protection, and all thofe diftributed in patches about the borders muft alfo take their chance in all weathers: thofe of the different feafons of planting will fucceed one another in flowering from the beginning of April until the middle of June, though the May blow generally fhews to the greateft perfection. After the blow is paft, and the leaves and ftalks withered, the roots fhould be taken up and dried in the fhade, then cleared from all off-fets and adhering mould, putting them up in bags or boxes till next planting feafon, when they muft be planted again, as directed above.

But in each feafon of planting, it is highly neceffary, in the principal fine varieties, to put them either in entire new beds, or the old ones refrefhed with fome frefh rich earth or compoft, working the old and new well together, in order to invigorate the growth of the plants.

All the other fpecies are capable of being eafily raifed by the roots, which fhould be flipped or parted in autumn when paft flowering, or in the fpring before they begin to fhoot, and the flips be either planted at once, where they are to remain, or in nurfery-rows for a feafon, then planted out finally. They fucceed in any common foil and fituation, and may be difperfed about the different flower-borders and clumps, where they conftantly remain, only trimming them occafionally; and once in a year or two, or when they have increafed into large bunches, taking them up in autumn or fpring, to divide them for further increafe, replanting them again directly.

In faving feed for raifing new varieties, it muft be fuffered to continue on the plant till it becomes brown and dry,

dry, then be cut off, with the heads, and ſpread upon paper, in a dry room, expoſed to the ſun, and when quite dry, be put into a bag, and hung in a dry place till it is wanted.

All theſe plants are highly ornamental; the firſt ſort in beds and pots, and the other in the borders, clumps, and other parts of pleaſure-grounds.

RANUNCULUS, *Globe*, in *Botany*. See HELLEBORE.

RANUNCULUS *Viridis*, in *Zoology*, the name of an animal common in many parts of the world, and uſually known by the name of the *tree-frog*, or *rana arborea*.

The creature is eaſily diſtinguiſhed from the common frog, by its being much ſmaller, and of a green colour. It uſually ſits upon the leaves of trees and ſhrubs, and makes a great noiſe in an evening; but that is rather like the ſinging of a ſmall bird than the croaking of a frog.

Theſe creatures have been kept alive many years together in glaſs veſſels, giving them flies and other ſmall inſects: and in winter, when theſe are ſcarce, they uſually become very lean and feeble; but in ſummer, when they are plentiful, they will grow fat again, as if at their liberty. This is eſteemed a poiſonous creature. Ray. See RANA.

RANZ *des Vaches*, a celebrated air among the Swiſs, played upon the bagpipe by the young cow-keepers on the mountains. The air will be found on our muſic-plates. In the article MUSIC, the powerful effects of this tune are mentioned, from Rouſſeau's Dict. de Muſique.

RAOLCONDA, in *Geography*, the ſeite of a diamond-mine in Hindooſtan, placed in Mr. Montreſor's map about 15 geographical miles to the weſt of Ralicotte, and 12 from the north bank of the Kiſtnah, but Mr. Rennell does not know what authority he has for this poſition. Tavernier, who viſited Raolconda, gives its diſtance from Golconda at 17 gos, of 4 French leagues each. He croſſed a river that formed the common boundary of Golconda and Viſiapour, about four gos, or more, before he came to Raolconda; and this river can be no other than the Beemah, which to this day forms the eaſtern boundary of Viſiapour, and paſſes about 80 or 82 miles to the weſt of Golconda, croſſing the road from it to Ralicotte. If we reckon the 82 miles at 13 gos, that is, forming a ſcale from the diſtance between Golconda and the river Beemah, each gos will be 6.3 geographical miles in horizontal diſtance (or nearer three than four French leagues); and Raolconda will be placed about 25 geographical miles on the W. of the Beemah, or 11 E. of Ralicotte.

RAON L'ETAPE, a town of France, in the department of the Voſges, and chief place of a canton, in the diſtrict of St. Dié, on the Meurte; 7 miles N. of St. Dié. The place contains 2528, and the canton 5300 inhabitants, on a territory of 70 kiliometres, in 5 communes.

RAOUDA, or ROUDDA, denoting *gardens*, an iſland of Egypt, in the Nile, in front of Old Cairo, about 500 yards in breadth, where is built the *Mekkias*, ſignifying meaſure, or Nilometer, a pillar, by the gradations on which the riſe of the Nile is meaſured.

This iſland is called Roudd, or gardens, becauſe it is laid out in gardens, and inhabited only by gardeners.

RAOUTTY, a town of Hindooſtan, in Malwa; 20 miles N.N.E. of Tandla.

RAPA, in *Botany*, (an ancient name, of whoſe etymology no plauſible account has come to our knowledge,) the Turnip. See BRASSICA, ſpecies 7.

RAPAAPO, in *Geography*, a town of America, in New Jerſey; 30 miles S. of Woodbury.

RAPACIOUS ANIMALS, in the general, are ſuch as live upon prey.

Naturaliſts divide birds into *rapacious*, *carnivorous*, and *frugivorous*.

The characteriſtic notes of rapacious birds, which are the Accipitres of Linnæus, are, that they have a great head, and a ſhort neck; hooked, ſtrong, and ſharp-pointed beak and talons, fitted for tearing of fleſh; ſtrong and brawny thighs, for ſtriking down their prey; a broad thick fleſhy tongue, like that of man; twelve feathers in their train; and twenty-four flag-feathers in each wing, and the two appendices, or blind guts, are always very ſhort.

Rapacious birds have a membranous ſtomach; and not a muſculous one, or a gizzard, ſuch as birds have which live on grain.

They are very ſharp-ſighted, and gather not in flocks; but, generally ſpeaking, are ſolitary; though vultures will fly fifty or ſixty in a company.

RAPAKIVI, in *Mineralogy*, a name given to the aggregate of felſpar and mica: its colour is brown, or browniſh-red; it moulders by expoſure to the air, but that is only when the mica is in exceſs. When the felſpar exceeds, it forms a durable ſtone, called in Italy "Granitone." Kirwan.

RAPALLO, in *Geography*, a town of the Ligurian republic, ſituated on a bay to which it gives name; 12 miles E.S.E. of Genoa.

RAPANEA, in *Botany*, according to De Theis, its vernacular name in Guiana; though Aublet ſays nothing to that effect.—Aubl. Guian. v. 1. 121. Juſſ. 288. Lamarck Illuſtr. t. 122.—Claſs and order, *Pentandria Monogynia*. Nat. Ord. *Berberides*, or rather perhaps *Rhamni*, or *Sapotæ*; Juſſ.

Gen. Ch. *Cal.* Perianth inferior, minute, of one leaf, with five or ſix teeth, permanent. *Cor.* of one petal; tube very ſhort; limb in five or ſix deep roundiſh ſegments. *Stam.* Filaments five or ſix, inſerted into the tube at the baſe of each lobe of the limb; anthers oblong, quadrangular, of two cells. *Piſt.* Germen ſuperior, roundiſh, of five or ſix cells; ſtyle very ſhort; ſtigma obtuſe. *Peric.* Drupa globular, of one cell. *Seed* ſolitary, globoſe.

Eſſ. Ch. Corolla in five or ſix deep ſegments, oppoſite to the ſtamens. Anthers quadrangular. Drupa ſuperior. Seed ſolitary, globoſe.

1. R. *guianenſis*. Aubl. Guian. t. 46. (Samara floribunda; Willd. Sp. Pl. v. 1. 665.)—Native of thickets, in the ſkirts of meadows, in Cayenne and Guiana, bearing flowers and fruit in December. A ſmall tree, whoſe *trunk* is five or ſix feet high, and four or five inches thick, crowned with branches; the wood white, not very compact. *Leaves* alternate, on ſhort ſtalks, obovate, bluntiſh, entire, ſmooth, two or three inches long, with one rib, and many tranſverſe veins ſcarcely viſible when freſh. *Flowers* copious, ſmall, white, in denſe lateral tufts. *Fruit* violet-coloured.—Mr. Brown, in his Prodromus Nov. Holl. v. 1. 533, ſpeaks of this ſhrub as belonging to the genus MYRSINE, ſee that article; conſequently Juſſieu was moſt correct in hinting its affinity to his *Sapotæ*, an order from which Ventenat and Brown have ſeparated their more recent one of MYRSINEÆ, to which we refer the reader.

RAPATEA, apparently a vernacular name of the plant in Guiana, Aubl. Guian. v. 1. 305. t. 118. Juſſ. 44. Lamarck Illuſtr. t. 226. See MNASIUM.

RAPAX, in *Ichthyology*, a name given by Schoneveldt to the *corvus piſcis* of ſome writers, a ſpecies of chub or cyprinus, called *rappe* by the Germans, and by Geſner and others *capito fluviatilis rapax*.

RAPE, RAPTUS, in *Law*, a *raviſhing*; or the having carnal knowledge of a woman by force, and againſt her will.

will. If the woman conceived, the law formerly efteemed it no rape; from an opinion, that fhe cannot conceive, unlefs fhe confented. But this opinion has been fince queftioned. Coke on Litt. lib. ii. cap. 11.

This crime, by the Jewifh law, Deut. xxii. 25. was punifhed with death, in cafe the damfel was betrothed to another man; and in cafe fhe was not betrothed, then a heavy fine of fifty fhekels was to be paid to the damfel's father, and fhe was to be the wife of the ravifher all the days of his life; without that power of divorce, which was in general permitted by the Mofaic law.

The civil law (cod. 9. tit. 13.) punifhes the crime of ravifhment with death and confifcation of goods; including under this crime both the offence of forcible abduction, and alfo that of forcibly difhonouring; either of which, without the other, is in that law fufficient to conftitute a capital crime. And the ftealing away a woman from her parents or guardians, and debauching her, is equally penal by the emperor's edict, whether fhe confent, or is forced.

Rape was punifhed by the Saxon laws, particularly thofe of king Athelftan, with death; which was alfo agreeable to the old Gothic or Scandinavian conftitution. Inftead of this, another punifhment was inftituted by William the Conqueror, *viz.* caftration and lofs of eyes, which continued till after Bracton wrote in the reign of Henry III. But it was then the law, and ftill continues in appeals of rape, that the woman fhould immediately after go to the next town, and there make difcovery to fome credible perfons of the injury fhe has fuffered; and afterwards fhould acquaint the high conftable of the hundred, the coroners and the fheriff, with the outrage; the time of limitation for this purpofe was by ftat. Weftm. 1. cap. 13. extended to forty days. But there is now no time fixed; for as it is now ufually punifhed by indictment at the fuit of the king, the maxim of law takes place, *nullum tempus occurrit regi:* however, the jury will rarely give credit to a ftale complaint. During the former period it was alfo held for law, that the woman (by confent of the judge and her parents) might redeem the offender from the execution of his fentence, by accepting him for her hufband, if he alfo was willing to agree to the exchange, but not otherwife.

In the 3 Edw. I. by the ftat. Weftm. 1. cap. 13. the punifhment of rape was much mitigated: the offence being reduced to a trefpafs; if not profecuted by the woman within forty days; and fubjecting the offender only to two years imprifonment, and a fine at the king's will. But in the 13 Edw. I. it was found neceffary to make the offence of rape felony, by ftat. Weftm. 2. cap. 34. And by 18 Eliz. cap. 7. it was made felony without benefit of clergy; as is alfo the abominable wickednefs of carnally knowing or abufing any woman-child, under the age of ten years; in which cafe the confent or non-confent is immaterial, as, by reafon of her tender years, fhe is incapable of judgment and difcretion. Sir Matthew Hale is indeed of opinion, that fuch profligate actions committed on an infant under the age of twelve years, the age of female difcretion by the common law, either with or without confent, amount to rape and felony, as well fince, as before the ftatute of queen Elizabeth; but the law has in general been held only to extend to infants under ten. A male infant, under the age of fourteen years, is prefumed by law incapable of committing a rape; and, therefore, cannot be found guilty of it.

The civil law feems to fuppofe a proftitute incapable of any injuries of this kind; not allowing any punifhment for violating the chaftity of her who hath indeed no chaftity at all, or at leaft hath no regard to it. But the law of England holds it to be felony to force even a concubine or harlot; becaufe the woman may have forfaken that unlawful courfe of life.

As to the material facts requifite to be given in evidence and proved upon an indictment of rape, we fhall here only obferve, that the party ravifhed may give evidence upon oath, and is in law a competent witnefs; but the credibility of her teftimony muft be left to the jury, upon the circumftances of fact that concur in that teftimony: *e. gr.* if the witnefs be of good fame; if fhe prefently difcovered the offence and made fearch for the offender; if the party accufed fled for it: thefe and the like are concurring circumftances, which give greater probability to her evidence. But, on the other fide, if fhe be of evil fame, and ftands unfupported by others; if fhe concealed the injury for any confiderable time after fhe had opportunity to complain; if the place, where the fact was alleged to be committed, was where it was poffible fhe might have been heard, and fhe made no outcry; thefe and the like circumftances carry a ftrong, but not conclufive, prefumption, that her teftimony is falfe or feigned. Moreover, if the rape be charged to be committed on an infant under twelve years of age, fhe may ftill be a competent witnefs, if fhe hath fenfe and underftanding to know the nature and obligation of an oath; and, even if fhe hath not, it is thought by fir Matthew Hale that fhe ought to be heard, without oath, to give the court information; though that alone will not be fufficient to convict the offender. And, indeed, it is now fettled, that infants of any age are to be heard; and if they have any idea of an oath, to be alfo fworn: it being found by experience, that infants of very tender years often give the cleareft and trueft teftimony. Blackft. Com. book iv.

The civilians make another kind of rape, called *fubornatio*, *rape of fubornation*, or *feduction;* which is, when a perfon feduces or entices a maid to uncleannefs, or even marriage, and that by gentle means; provided there be a confiderable difparity in age or condition between the parties. In this cafe, the father and mother intend their action reciprocally for the *crimen raptus*, or *fubornationis*.

The French laws make no difference between the rape of violence and that of folicitation, or fubornation; they make both capital. This kind of rape our laws call *Ravifhment;* which fee.

Rape *of the Foreft*, is a trefpafs committed in the foreft by violence.

This is mentioned in the laws of Henry I. as one of the crimes cognizable alone by the king.

Rape is alfo a name given to the wood or ftalks of the clufters of grapes, when dried, and freed from the fruit.

The rape is ufed in making vinegar, ferving to heat and four the wine: but it is firft put into a place to four itfelf, before it be caft into the vinegar veffel; to which end, prefently after the vintage, it is carefully put up in barrels, left it take air, otherwife it would heat itfelf and be fpoiled. There is no other way of keeping rape hitherto difcovered, but to fill the veffel, in which it is contained, with wine or vinegar.

Rape, *Rapa*, is alfo ufed for a part or divifion of a county; fignifying as much as a *hundred*.

Though fometimes rape is taken for a divifion containing feveral hundreds. Thus Suffex is divided into fix rapes, *viz.* thofe of Chichefter, Arundel, Bramber, Lewes, Pevenfey, and Haftings: every one of which, befides its hundreds, has a caftle, a river, and foreft belonging to it.

The like parts in other counties are called *tithings*, *lathes*, or *wapentakes*.

Rape, in *Botany*. See Napus.

Rape, *Broom*. (See Orobanche.) It frequently grows to to the roots of genifta or broom, whence it is called *rapum geniftæ*, or broom rape: it is alfo found among corn. The herb preferved, or its fyrup, is faid to be of excellent ufe in fplenetic or hypochondriac diforders, and an ointment prepared of it with fwine's fat, is good for hard and fcirrhous tumours.

Rape, *Wild*. See Mustard.

Rape, in *Gardening*, the common name of a plant of the cabbage kind. The variety called the French turnip, or *Braffica napus*, has been long cultivated upon the continent, and preferred to the common turnip as a culinary vegetable. And it has been lately noticed in the "Tranfactions of the Horticultural Society," that it has been brought to the principal London markets for more than twelve years paft by one perfon only, and fold chiefly to foreigners, though, when once fully known, it will be found a very ufeful and acceptable root in moft families, as being more delicate in its flavour than the common turnip. It is ufed in much the fame manner. It enriches foups, and there is not any neceffity for cutting away the outer fkin or rind, but only to fcrape it, as it is a great deal thinner than that of the turnip. When ftewed with gravy it forms an excellent difh, and being white and fhaped like the carrot, when laid alternately with thofe on a difh, they become very ornamental. The French drefs them fomewhat in this manner.

The roots are to be wafhed quite clean by means of a brufh; then fcraped, cutting a thin flice away from the top and bottom parts, fo as to make them all of equal lengths: after which boil them in water, with a little falt, until they are tender; then put them into a ftew-pan, with a gill of veal gravy, two fpoonsful of lemon pickle, one of mufhroom ketchup, a little mace, and falt, letting them juft fimmer, but by no means boil, for a quarter of an hour; afterwards thicken the gravy with flour and butter, ferving the whole up quite hot. Some add a few fpoonfuls of cream mixed with yolk of egg to this, juft before difhing up; and others drefs them in a fimilar manner to the above, fliced rather thinly, with Madeira, or other wines, after they have been fried to a brownifh colour. See Brassica.

Rape, in *Agriculture*, the name of a plant much cultivated for its feed, and alfo as a green food for cattle and fheep. The methods of culture and management that are neceffary in raifing crops of this fort, have been already defcribed and explained. (See Cole.) It may, however, be here neceffary to detail a few of the experiments that were made under the direction of the Dublin Society, by Mr. Whyn Baker, about the years 1769 and 1770, as they tend to throw additional light on the nature of the plant, as well as its cultivation, though the foil was not the moft fuitable for it. It was a fhallow foil, of a ftrong adhefive nature when wet, and when perfectly dry, in lumps, almoft impregnable; but between wet and dry, reducible. It lies upon a bed of lime-ftone quarry, and has a natural declivity to the north-weft; naturally very poor, and, he believes, never received any manure until he dreffed it. Three acres of this land were, in 1768, under potatoes, in the ordinary method of the country, in feven-feet beds, and four-feet trenches. In 1769 they were under drilled turnips.

The froft, fnow, hail, and rain which they had this year in the months of March and April, rendered it impoffible to get the grouud in any tolerable condition for the rape-feed before the 28th day of April. On that day twenty broad fets were fown, with twelve ounces of rape-feed to each fet or ridge. He intended to have fown it earlier, but the event will fhew, that, as it was, he fowed it too early, at leaft upon this ground.

It was flow in coming up, and made but a poor figure until July. After which it fhot forward; but inftead of affording a plentiful mowing crop for the purpofe of foddering cattle, it foon began to run up very faft, broke out into branches, with few and fmall leaves, like rape in bloffom from the autumn fowing, but with ftrong branches and few leaves; and, in a fhort time after, began to grow hard, pipey, and the feed to form.

It September he began to mow it for cattle, and they ate it with great eagernefs, but every day it became worfe, by growing harder; infomuch, that before it was exhaufted there was very great wafte, as to the object of fodder, but it wonderfully raifed the dung-hill, which, in his mind, is of the firft moment to the farmer: for if he has manure in plenty, and difpofes of it judicioufly, there is hardly any thing he need to fear, except climate.

It was pretty far in October before all his rape was cut, (and the feed coming forward very faft,) although it was brought home in great profufion. It was fo ftrong, that the mowing of it could not be accomplifhed with a common fcythe; it would have broken an hundred; but he had by him a fhort ftrong fcythe, with a thick back, intended to mow bufhes and other rubbifh; with this inftrument he got it mowed, but not fo clofe to the ground as he wifhed, it being next to impoffible to mow fuch ftrong plants as thefe were clofe to the ground; and he became the lefs folicitous about it, as from the ftrength of the rape ftumps and roots, and the weeds which were upon the ground, owing to the rape fhooting up in tall ftems, he gave up his intention of fowing the ground with wheat, as was originally intended. Hence he concludes, that the rape was fown much too early.

On the 16th of July he tranfplanted fome of this rape in rows upon ridges four feet wide; thefe plants flourifhed much better than the former, and were at leaft four times the fize of any of thofe left in the ground where they were fown. Neverthelefs, thefe alfo ran to feed; but the cold nights coming on prevented their forming their feed like the former. They were vaftly more fappy, and much better food for cattle.

On the 24th of July, he drilled rape-feed upon the fame ground.

N° 1. Six ridges four feet wide, and thirty-two perches long in fingle rows.

N° 2. Six ridges the fame length and breadth, in double rows, ten inches afunder.

It is obferved, that the double and fingle rows were drilled alternately on the fame ground, on the 18th day of July.

N° 3. Six ridges four feet wide, and thirty-two perches long, drilled in fingle rows.

N° 4. Six ridges the fame length and breadth, in double rows, ten inches afunder.

He remarks, that thefe were fown in alternate rows, on the fame ground, on the 24th of July. And that the feveral rows were thinned the latter end of Auguft, and twice horfe-hoed during the fummer. On the third of April 1771, he had a row of each of thefe cut and weighed, and the produce was as follows:

Rows.	Weight. ton.	cwt.	qr.	lb.		Prod. p. Plant. acre. t n.	cwt.	qr.	lb.
N° 1. Single row produced	1	2	1	11	Sown July 18th	29	6	1	16
2. Double row ditto	1	4	3	13		32	12	2	23
3. Single row ditto	1	5	2	22	Sown July 24th	33	14	1	26
4. Double row ditto	1	6	3	25		34	18	0	6

On the whole, it is ftated, that the laft fowing in July afforded confiderably greater produce than the firft, for the plaineft reafon, that the earlier we fow this feed, the fooner it runs; and confequently affords the lefs produce for the purpofe of foddering cattle in the yards for making dung, and feems to account very ftrongly for the ftate of the firft experiment.

And the double rows produced uniformly more than the fingle rows; and indicate that the double are to be preferred in drilling rape for foddering cattle.

The following trials are on fowing rape-feed broad-caft. On the 24th of July two acres were fown broad-caft, with ten pounds of feed to each acre, in the fame field where the other experiments were carried on; but the foil not fo ftiff by a good deal, has abundantly fewer loofe ftones in it, is very fhallow, and poor, to an incapability of producing any thing to profit, without great affiftance of manure.

In July he manured it with the dung of his yard, confifting of that of horned cattle, horfes, and fwine. The dreffing was indeed very high; about two fmart one-horfe cart-loads to a perch. He having ever found that one acre, highly improved, is much more valuable than five imperfectly handled, was the reafon why he gave this poor piece fo liberal a dreffing.

The rape came up but flowly for a time, as he finds to be the nature of the plant, but at length it fhot forward, and flourifhed away: but in winter it met with a fate which he was not aware of, nor did he expect. The wood-pigeons lay upon it prodigioufly, and did it great damage. Some plants he obferved in the froft to appear as if they had been finged: whether that was owing to the wounds given by the birds, and thereby giving the froft the greater force, or whether it was owing entirely to the feverity of the froft, is not in his power to determine. However, very early in the fpring this rape fhot forward, and as the days lengthened the vifits of the pigeons were lefs frequent, until they totally left it.

From this rape breaking out into bloffom fooner than he expected, he is inclined to believe that the 24th of July is too early to fow it for the purpofe of foddering cattle in the yard.

However, early in April he began to mow this rape for the horned cattle, fuch as cows, plough bullocks, young cattle, calves, and fwine. They all ate it with the greateft eagernefs, and were foddered with it every evening, until the 19th of May inclufive, and wheat ftraw in a morning, fave four calves of the preceding year; and they were foddered twice a day with rape, and had ftraw before them alfo, and throve upon it vaftly better than the other cattle; for no other reafon, he believes, than becaufe they were allowed more than the others: in fhort, they were in fuch order, that he dares believe the butchers would have been glad to have had them for killing.

He obferves, that he need not tell the farmer how neceffary it is to be frugal of provender in an harfh dry fpring, as the laft was, when he was like to be hard run with forty head of cattle, many of which he fhould actually have been obliged to fell at fo improper a feafon, had he not been poffeffed of thefe two acres of rape. He adds, that there is yet another circumftance which renders this a truly valuable fodder. The milk of the cows increafed prodigioufly; and the milk and butter were as good, fweet, and well-flavoured, he thinks, in every particular, as ever he tafted in June. Even the cream for the tea appeared to be perfectly free from any foreign flavour. The cows got hay every day, in the fame manner as he has in former years mentioned them to have, when feeding upon cabbages.

The fimplicity of the culture for rape, for the purpofe of feeding cattle, he cannot but think a particular recommendation to the farmer, and the cheapnefs of the feed in purchafe, or the eafe with which he may raife it, are objects which cannot fail, he thinks, of being perfuafive to him. And all perfons, who have annexed to their farms any bog, or other wafte ground, the improvement of which can be executed by burning, might furely raife fuch quantities of rape for the purpofe of mowing pafture, as would enable them to keep almoft any number of cattle; by which they would not only be bringing in the wafte land, but making that the foundation of improvement to their found land, by the immenfe quantities of dung they might raife by this means from the wafte land. Here the advantage to the cultivator would be double.

On the firft day of May he had four perches of this rape meafured out for weighing. It was mowed, immediately drawn home, and weighed. The four perches afforded feven hundred and two quarters: multiplying this by forty, fhews the acreable produce to be fifteen tons. The quantity indeed but fmall. However, the feafon in which it is to be had renders it more than ordinarily valuable, and, he thinks, bids fair to make it an object of hufbandry, as a pafture for cattle.

This year, 1770, Mr. Baker ploughed up fix acres of wheat ftubble, as foon as the wheat came off, harrowed it down the 12th, 13th, 14th, and 15th of September, then fowed rape-feed over the whole field, and gave it a light bufh harrowing. The rape came up very thin, and made fo poor an appearance in the fpring, that he ploughed up the field, and fowed fpring corn. This is a ftrong indication that but little is to be expected from fowing rape upon wheat ftubble; becaufe after the wheat comes off it feems to be too late in the year to fow rape. But fomething may be charged, as he obferves, to the natural moifture of the foil. See Cole.

The following is the recapitulation of his experiments on rape, as pafture for cattle.

				Produce.			
				Ton.	cwt.	qr.	lb.
Exp. I.	April fowing.		Ran, not anfwering the purpofe.				
II.	Ditto tranfplanted.		Ran, but not fo foon as the other.				
III.	July 18, fowing.	Single rows produced *per* acre		29	6	1	16
		Double rows ditto		32	12	2	23
	July 24.	Single rows ditto		34	14	1	26
		Double		35	18	0	9
IV.	Ditto	Broad-caft ditto		15	0	0	0
V.	September fowing on wheat ftubble ditto			0	0	0	0

Rape is a great deal cultivated in fome diftricts in the county of Effex for the feed. The fyftem is very profitable, but this fort of crop is found to draw or exhauft the land a good deal. It is thought by fome to prepare well for wheat, efpecially when fed off upon the land. In fome places they, however, confider it more beneficial to till, after this crop has been feeded for fpring corn, than to put in wheat, which, however, is ftill the moft common practice. Clover would certainly be better than either method.

In other places they conceive that feeding rape is much on the decline, from the general experience, that it leaves the beft prepared land in an unfavourable ftate for oats and clover,

clover, and is consequently prejudicial to the next succeeding winter crop. Other districts think very differently on this point. In feeding the crop, the produce is here considered to be in general from twenty-nine to thirty-four bushels the acre. In the greatest crops and best seasons, in particular parts it is supposed to rise even so high as five and six quarters the acre.

In Berkshire this sort of crop is not so much cultivated as it should be, as it will succeed well on soil where turnips will not, and with equally beneficial effects to the future crops, when fed off on the ground. When employed it is usually sown and managed so as to come into a high state of perfection in the early spring months, when sheep feed is mostly scarce. It is grown by some to supply the deficiency, and found remarkably useful, one acre of it affording more feed than two of turnips.

This sort of crop is still less grown in Oxfordshire, though occasionally had recourse to, especially on the rich red land about Banbury. Some sow it in mixture with the tankard turnip seed, for the purpose of weaning lambs upon: they begin with the rape, and it teaches them to eat the turnips: it is found to be a very good food for this sort of stock.

In the county of Sussex, the South Down sheep farmers hold it in great estimation, sowing it either alone or in mixture with tares as a food for their sheep; very rarely for the purpose of feeding. The ewes and lambs are wattled upon it in the spring, and it is very generally allowed to be most efficacious, and highly nutritious to the young lambs. Some, at the lambing season, hardly allow their ewes any other food but this, as the rape is found to produce a larger supply of milk than turnips; which, it is supposed, has the effect of extending the udder, without affording any considerable flow of milk. This crop is conjectured, however, in some cases, to have the effect of causing the slipping of the lambs, where the ewes are fed upon it. But such an effect is very improbable to arise in this way; other causes may have been overlooked. In some cases on Down land ray-grass is sown with the rape for sheep feed, one gallon of rape-seed and two of ray-grass to the acre. The rape is first fed off; and after that the ray-grass rises and affords a bite for the spring season. The rape crop is usually put in about June, or the following month, one gallon to the acre. When folded off, a rood and a half is a sufficient daily consumption for a flock of six hundred sheep, or rather more.

As it has been found in the improving of peat boggy morassy lands, that what is principally wanted is a crop which can be sown and reaped in the summer months; and which may require neither labour nor attendance during the moist seasons of autumn, winter, and spring; the writer of the "Treatise on Landed Property" has suggested that fortunately, such a crop is natural to, and has long been inured to the climate of this island, as well as one of the most profitable in the agriculture of it; and that this is rape: which is not only sown, but reaped, in the very height of summer; and which is known to delight in a soil of this nature. It has, however, only lately been found capable of being raised with advantage on crude mossy ground, as a first crop after draining, from some recent trials made in the north, after the above operation, levelling, paring and burning, and turning the ashes in. The result of which was, though the crop was too late in being put in, and the land laid in an improper manner, such as to prove clearly that rape-seed may be raised with profit as a first crop on drained moory soils. And it is thought highly probable that many extensive tracts of land, which now lie entirely waste, and as nusances in their neighbourhoods, may through this means be improved with immense profit to their proprietors. The experiment may be tried at a small expence. The cost of the labour and seed required for a sufficient trial are inconsiderable. The proof, it is supposed, is not whether rape will thrive as herbage, but whether it will mature its seed, on the given soil, in the given situation.

After being recompensed for the previous expences, in one or more rape crops, as there is here no danger of the exhaustion of the soil,—of impoverishing, perhaps, ten feet depth of vegetable mould, it remains to lay the foundation of more permanent profits, which is to be done by sowing grass seeds either with or over the rape crop, or by light cautious stocking after removing the stalks, as may be necessary, until there is a firmness of surface and a fitness for mixed cultivation, which may be much hastened by the use of heavy calcareous and earthy substances at any time during the process of improvement.

RAPE *Cake*, the refuse or cake remaining after the oil has been expressed from rape-seed. It is said to be useful as a manure. See MANURE.

This substance is found by chemical trials to contain a large quantity of mucilage, some albuminous matter, and a small quantity of oil. It should be kept as dry as possible before it is applied to the soil, and be employed in that way while it is in a fresh state. It is successfully applied in several ways and intentions, and affords an excellent dressing for turnips. See the next article.

RAPE *Dust*, the small reduced parts of the dried refuse of rape-seed, or the rape cake, after the oil has been obtained from it. This substance has been found useful as a top-dressing for crops of different kinds.

The rape cake, when reduced into powder or dust by means of a machine, has been extensively used in Norfolk; and when for turnip crops, it has been the custom to sow it some weeks before the seed of that root is put into the ground. In the practice of Mr. Coke of that district, it has, however, been found, that by having it brought into a fine powder it may be drilled from the same machine, at the same time with the turnip seed; and that, by thus delivering the manure and the seed from the same pipes and shares of the drill machine, a ton of dust does six acres in the place of three. See TURNIP.

In Lancashire some farmers use it with great advantage as a manure for potatoes, putting it in with the sets in the proportion of about thirty-two bushels to the statute acre; but if the ground were well prepared, and the dust carefully deposited for the reception of the sets, it is supposed, a much smaller quantity would be sufficient. It produces much luxuriance in the crops, and a very fine produce.

RAPE *Oil*, the oil obtained by means of expression from the seeds of this plant, in mills constructed for the purpose. The refuse oily substance of this kind may be employed as manure in mixture with rich earthy matters, with great advantage, wherever it can be procured in any quantity at a reasonable price.

RAPEL, in *Geography*, a river of Chili, which runs into the Pacific ocean, S. lat. 34° 8'.—Also, a town of Chili, on the forementioned river; 70 miles S. of Valparayso.

RAPERLAH, a town of Hindoostan, in the Carnatic; 13 miles N.E. of Ongole.

RAPHA, in *Anatomy*. See RAPHE.

RAPHAEL, one of the seven archangels, who are said to be continually before the throne of God, and ready to perform his commands. We have no such name in the Old or or New Teftament; but his hiftory occurs in the book of Tobit, c. xii.

If the ftory of Tobit be true, it is not improbable that the angels, both good and bad, whofe names do not appear to have been known before the Babylonifh captivity, are figurative perfonages; and Raphael might only denote the falutary protecting agency of divine providence, fo difpofing events as to produce a happy iffue.

Raphael Sanzio, da Urbino, in *Biography*, during whofe life, and by the exertion of whofe talents, in conjunction with thofe of Lionardo da Vinci, Titian, Michael Angelo, and fome few others, the art of painting reached its acme in modern times, was born in the city of Urbino, on the morning of Good Friday, in the year 1483. He was defcended from a refpectable family, and many of his anceftors had been painters; as was his father Giovanni Sanzio, whofe talents, however, did not elevate him to the firft rank. He cultivated with care the inclination which his fon Raphael exhibited, at an early age, for painting; and was foon repaid by the affiftance he acquired from him, in feveral of the pictures he was employed to paint in his native city of Urbino. But finding that the tafte of Raphael merited more fkilful guidance than he was able to give it, he placed him under the tuition of Corradini, better known by the name of Carnevale, for a fhort time, till he could be received as a pupil by Pietro Perugino, at Perugia.

This mafter was then in very high efteem, though his ftyle was dry and meagre, in comparifon with that of Mafaccio, and others of the Florentine fchool. It is not furprifing that Raphael, endowed as he was by nature, and trained as he had been in art, fhould foon become the rival, rather than the pupil, of fuch an artift. Accordingly we find, that his aptitude for the practice of art enabled him quickly to acquire his mafter's manner, and that in fo perfect a degree, that connoiffeurs were puzzled in their judgments upon the works which proceeded from Perugino's ftudio; and ordinary obfervers completely deceived. Vafari fpeaks of an Affumption of the Virgin, crowned by her Son, and the twelve apoftles below, round her tomb, contemplating the celeftial glories; with three fmall pictures in the fame frame below it, of the Annunciation, the Adoration of the Magi, and Simon embracing the Saviour, painted at this period by Raphael, as being wrought with extreme beauty, and precifely like the work of Perugino.

We have to lament that we are left ignorant of the time when Raphael went as a pupil to Pietro, how long he remained with him, or when he left him, or rather was left by him; as that mafter returned to Florence, to finifh fome pictures he had begun there fome time before. He muft certainly have been very young, from the number of pictures which he fubfequently executed, previous to his going to Rome in his 25th year, and probably not more than 16 or 17, when he acquired his liberty by the departure of Perugino.

From Perugia he went to Citta di Caftello, where he painted a St. Nicola crowned by the Virgin and St. Auguftin, for the church of St. Auguftine; and for that of St. Dominico, a picture of the Crucifixion of Chrift, accompanied by angels, the Virgin, St. John, &c.; which would certainly have been confidered as Perugino's, if Raphael had not fet his name to them. But he was confidered to have much furpaffed him in another work, reprefenting the marriage of the Virgin and St. Francifco, for the church of St. Francifco, in the fame city. He acquired by thefe productions a great and deferved extent of fame, and thus early entered with fuccefs that courfe, which conducted him to the higheft pinnacle of renown as an artift.

Attached to his perfon by friendfhip, and attracted by his fkill as a defigner, Pinturiccio, then employed by pope Pius II. to adorn the library of the Duomo at Sienna, fought the affiftance of Raphael, and engaged him to compofe defigns for his work. This he undertook, but proceeded only to the preparation of fome of the cartoons, when his ambition and his curiofity were ftimulated, and his work interrupted, by the renown fpread through the country of the cartoons painted by thofe great rivals, Lionardo da Vinci and M. Angelo, for the council-hall at Florence. He immediately determined, in conjunction with almoft all his brother artifts of the day, upon going to fee and form his judgment upon them for himfelf; and confequently left his engagement with Pinturiccio, and proceeded to Florence.

In this city he found fo many attractive beauties, both of nature and art, that he refolved to fix his refidence there for fome time. His agreeable perfon and manners, combined with the extraordinary talents he had manifefted, infured him friends; and he became intimate with feveral artifts of celebrity, among whom were Ghirtandaio, St. Gallo, and Taddeo Taddi; the latter of them, a learned man, and friend of cardinal Bembo, took the youthful painter to his houfe and table, and thus afforded him the beft introduction to the world, while he purfued his more immediate ftudies. This kindnefs the gentle heart of Raphael accepted with grateful emotion; and as he painted feveral pictures during his refidence in that city, he prefented two of them to Taddi. One of thefe pictures, a Madonna with the Child, and St. John bringing a little bird to him, the heirs of Taddi fold to the archduke Ferdinand Charles of Auftria at a great price: the other is loft fight of. He alfo prefented a picture to his friend Lorenzo Nafi, which afterwards found a place in the Medicean gallery, and a duplicate in that of the monaftery of Valombrofa.

From Florence Raphael was recalled to Urbino, by the death of both his father and mother; and there, when he had arranged his private affairs, he was engaged by Giudobaldo de Montefeltro, and feveral others, to paint religious fubjects for the altars of their chapels: and among thofe he painted at this time, were the two little St. Georges, now in the gallery of the Louvre. Thefe commiffions he executed with great tafte and delicacy; and Vafari, who enumerates them, more particularly fpeaks of one of Chrift praying in the garden, painted for Francefco Maria, duke of Urbino, as being finifhed with all the neatnefs of a miniature. What is become of moft of thefe pictures, it is not eafy to afcertain; but it is a curious fact, that not one of them remains at this time to adorn the native city of this great artift.

Thence he returned to Perugia, and painted feveral pictures. For the church of the Frati de Servi, one of the Virgin, with St. John Baptift, and St. Nicholas. For that of St. Stevens, in the chapel of our Lady, he painted in frefco a picture of Chrift in glory, with God the Father, furrounded by angels and fix faints, three on each fide. Upon this picture he wrote his name in large letters of gold, and very confpicuoufly, as if he himfelf was pleafed with the performance of it. He alfo painted here a picture for the nuns of St. Antonio da Padua, of our Lady with the Infant upon her lap clothed, and near her St. Peter, St. Paul, Sta. Cecilia, and Sta. Catherina. The airs and attire of the two female heads were regarded as the moft tafteful work of the time, wrought with the greateft degree of beauty and grace. Above the picture, in a femicircle, was reprefented

reprefented the Almighty Father; and at the foot of it, in three compartments, were the fcenes of our Lord's fufferings, *viz.* his agony in the garden, carrying his crofs, and dead upon the lap of the Virgin. It is not known what is become of the centre picture, or the uppermoft compartment; the lower ones formed a part of the Orleans collection. The execution of thefe works was performed in a ftyle much improved upon that of Perugino; with more breadth, more foftnefs, and more freedom and variety of action; proving that he had not ill fpent the time he had devoted at Florence to the ftudy of the works of other painters. Hence we may date the commencement of what is termed his fecond manner, from his firft vifit to that city.

Soon after he had produced thefe works at Perugia, that zeal for cultivation, which always accompanies true genius, led him to determine upon again vifiting Florence, at that time the emporium of fcience and of art. Though the native ftrength and purity of his mind were fuch as to conduct him, under favourable circumftances, to his future prominent ftation; yet he does not appear to have been fo extraordinary and original an inventor in the art itfelf as M. Angelo, or his great predeceffor and rival, Lionardo da Vinci. He knew how to take a hint of what was offered to his view, and to cultivate and improve it to his purpofe; but it yet remains a problem, whether Raphael, alone, and without the leading aid of thofe great and original artifts, would have ever feen the fublime of painting. His power may rather be faid to have confifted in ability to employ the materials furnifhed by their invention, *viz.* the ftyle of Michael Angelo, in form; and of Lionardo da Vinci, in chiaro-fcuro and colour; in beautiful conceptions, illuftrative of the character and paffions of man; and in an admirable felection of fubject, and mode of conveying it.

He himfelf appears to have been confcious of this; for we find him in the midft of honourable employment, leaving the profecution of it, to ftudy and improve himfelf by a conftant obfervation of the works of other renowned artifts, and again repairing to Florence, where alone he could find the true fource of found cultivation, and in which he made fo good ufe of his time, as to fit him in great meafure for the glorious field of exertion which awaited him.

On his return to the renowned abode of thefe great artifts, from whofe works he fought improvement, he had a letter of recommendation and introduction from the duchefs of Urbino to Pietro Soderini Gonfaloniere of the city; and was thus introduced to the beft circle of improvement and information.

It would have been highly gratifying to have been enabled to trace the fteps of a man fo diftinguifhed in the art, from the earlieft commencement of his ftudies; but the neglect of dates, by his hiftorians, counteracts every wifh to follow them more clofely; and the record of facts leaves us only the means of conjecture. That he began to paint original pictures very foon after he was placed with Perugino is evident, and he muft then have been very young, for it is on record, that the pictures by Pinturiccio, for which he made the cartoons at Sienna, were completed in 1503, at which time he was 20. If we allow, as we reafonably may, two years for their execution, it will place his firft vifit to Florence in 1501, at the age of 18; and it certainly cannot have been far from that period. In every part of his life, modefty, ingenuity, and the ardour of a mind entirely devoted to his art, characterized his conduct. His induftry and ingenuity feem to have kept equal pace; and the rapidity and certainty with which he muft have painted, to produce fo many pictures in fo fhort a fpace of time as he lived, are not the leaft extraordinary part of his hiftory.

On this, his fecond abode at Florence, he ftudied deeply the works of Mafaccio, and the cartoons of Angelo and Da Vinci; and attached himfelf in friendfhip to Baccio della Porta, better known by the name of Fra. Bartolomeo; than whom no one was better qualified to direct him rightly in whatever was grand and dignified, and from whofe judicious information in the art of cafting draperies and of colouring, Raphael evidently improved exceedingly; while he had the pleafure, in return, of communicating to his friend the principles of perfpective. Yet notwithftanding thefe helps, he did not entirely free himfelf from the formal and dry manner of his mafter, though he painted affiduoufly both in portrait and hiftory. In the former he produced the portraits of Angelo Doni and his lady Maddalena Strozzi; and in the latter he painted for Dominico Caneggiani, a Madonna, with the Infant playing with St. John brought by Elizabeth, who regards St. Jofeph as he ftands near, leaning both his hands upon a ftick, and inclining his head towards her. This picture appears to have been re-touched, or poffibly completed only in 1516, as the name of Raphael, with that date, in letters of gold, is written upon the drapery of the Virgin. He alfo made a cartoon during his refidence in Florence for a picture which he had previoufly engaged to paint for the Baglioni family at Perugia, and left the city to go and paint it in the church of St. Francefco in that place. The fubject of it was our Saviour carried to the fepulchre, accompanied by the Virgin, St. John, &c.; and it was exceedingly admired for the beauty and expreffion of the figures, and the fkill and perfection of the draperies. This picture was removed from Perugia by pope Paul V., and a copy, by Cefare d'Arpino, placed in its ftead: it afterwards found a ftation in the Borghefe palace at Rome.

When Raphael had completed this work, he returned to renew his ftudies at Florence, and was employed by the family of Dei, to paint a picture for their altar in Santo Spirito, which he began, and conducted through the preparatory parts; and in the mean time painted another for the city of Sienna, of the Madonna in an open country, with the Child ftanding by her, and St. John kneeling before him, but was interrupted, in its execution, by a fummons from pope Julius II. to Rome, and left it in the hands of his friend Ghirlandaio, to finifh a piece of blue drapery which it wanted. This picture was afterwards fold to Francis, king of France, and is at prefent in the French collection, known by the name of the Belle Jardinière. The unfinifhed fketch of the picture begun for the Dei family, was bought, after the death of Raphael, from his heirs, by Baldaffare Turini, and placed by him, in its original ftate, at the altar of his country church; it afterwards came into poffeffion of the houfe of Buonvicini di Pefcia, and was fold, by that family, to the grand duke Ferdinand, who, on removing it, placed a copy by Carlo Sacconi in its ftead. This was done at night, and with the utmoft fecrecy, for fear of a difturbance among the populace, by whom it was highly prized.

Raphael was indebted for the high patronage of the pope, which placed him in the proper fphere for the exercife of talents fuch as he poffeffed, to the friendfhip of his relation Bramante d'Urbino the architect; and never was recommendation better fupported by ability. Upon his arrival in Rome, in 1508, he was received with great courtefy by Julius, and the Camera della Segnatura, in the Vatican, affigned to him. He immediately began the preparation for his firft picture, which was the School of Theology, better known by the name of the Difpute of the Sacrament, and in obferving which, it is worthy of remark how his mind enlarged, in regard to ftyle in the art, as he became accuftomed to confider largely of his work; and according to the field of employment which he found before him. The difference in ftyle between one part of the picture, and that of the other, evidently points out where he began it; *viz.* on the right of the upper part, where the remains of the fchool of Perugino appears, and is fpread through the centre, where the glory which furrounds our Saviour is reprefented in the Gothic manner, by rays of gold. As he proceeded, his ftyle enlarged, and the lower part of the picture exhibits an immenfe improvement, and is almoft equal to any of his fubfequent productions.

In the fame room are the pictures of the School of Athens, the Parnaffus, painted in 1512, (where, furrounding Apollo and the Mufes, he has introduced portraits of the great poets, both of antiquity and of his own time,) and the Jurifprudence, comprizing two fubjects, one of the emperor Juftinian delivering the digeft of his code of laws to Tribonius, and another of pope Gregory IV. giving the decretal to a member of the confiftory. Over each of thefe fubjects, refpectively, are painted circular ones of fingle figures, reprefenting Theology, Philofophy, Poetry, and Juftice.

When pope Julius faw the fuperior tafte and talent with which Raphael produced the former of thefe works, he immediately ordered the whole of the ftanze, or chambers, which it was intended to decorate, to be entrufted to him; and all that had previoufly been done by Perugino, Pietro del Borgo, Il Soddoma, and Bramante di Milano, to be removed. But of this order Raphael made only a partial ufe; preferving entire the work of his firft mafter, and, partially, the ornamental labours of Il Soddoma.

While he was engaged upon thefe great works, he was not altogether indifferent to the more agreeable exercife of the pencil, and he painted for the church of the Auguftines, the pictures of the prophet Ifaiah, and the Sibyls who are fuppofed to have predicted the coming of Chrift. He alfo painted the portrait of his great patron, Julius, now in the Louvre, and feveral fmaller eafel pictures of Madonnas, and other religious fubjects. By thefe labours he acquired the renown they fo well merited, and his manners appear to have been in perfect accordance with the beauties of his mind. His perfon alfo was handfome, and he was beloved, efteemed, and admired. Yet he continued to ftudy, and to improve his talents, employing perfons to collect fpecimens and make drawings from Grecian remains. Full of tafte and feeling, he fpared no pains to perfect his powers by a thorough knowledge of all that had been done in art, both ancient and modern. In confequence, however, the fact, related by Vafari, may be doubted, of his being admitted, while Michael Angelo was abfent, to fee the work of that great artift in the chapel of Sixtus IV.; the tafte in which he wrought became aggrandized, and fimilar to that introduced by M. Angelo. About this time he painted the Galatea for Agoftini Ghigi, and the Madonna di Foligno, at the defire of Sigifmondo Conti, fecretary of pope Julius II., for the great altar of the church at Araceli, and which is now at the Louvre.

In another chamber of the Vatican he painted four other large pictures, the fubjects of which are, the miracle of Bolfenna, when the officiating prieft, who doubted of the real prefence in the Euchariſt, is offering up the hoft, and perceiving, with aftonifhment, that it diftils drops of blood; the releafe of St. Peter from prifon; the Heliodorus; and Attila arrefted, in his journey to Rome, by a vifion of St. Peter and St. Paul; thefe were completed in 1512, 13, and 14.

In thefe pictures his great improvement in colouring and ftyle is moft evident, and he continued to carry it ftill further into practice in another room, for which alfo he had compofed four other fubjects, known as the Incendio del Borgo; the coronation of Charlemagne by Leo III.; the fame pope defending his conduct to the fame emperor; and the defcent of the Saracens at the port of Oftia.

Whilft Raphael was engaged on the Heliodorus, his firft great patron, Julius II., died; but fortunately for the arts, if not for the tiara, he was fucceeded by another, Leo X., who was even more attached to them, and more fond of the renown arifing from the cultivation of whatever adorns fociety. By him, therefore, Raphael was ardently encouraged to proceed with his labours, and he continued to make defigns for other apartments, particularly for the great hall of Conftantine, as it is now called; but he did not live to execute them. The Incendio del Borgo was the laft upon which he himfelf wrought; the reft were completed by Julio Romano. He was alfo employed by Leo to make the cartoons now at Hampton Court, as exemplars for works in tapeftry, to be executed in Flanders, and which were completed at the expence of 70,000 crowns. Fortunately for us the originals were never returned to Rome, and were purchafed afterwards by Charles I.

Upon the death of Bramante, in 1514, the fuperintendance of the architectural concerns of the Vatican was entrufted to Raphael, who had already exhibited his knowledge and tafte in that art, by the introduction he had made of it in his pictures. He invented and began a palace for himfelf, and made feveral defigns for others.

Notwithftanding the immenfe application neceffary for the invention and completion of thefe important labours, together with the defigns he compofed for the ornamental parts, and the fcriptural fubjects on the ceilings and the covings of the loggia and ftanze of the Vatican, he found time to execute in frefco the defigns which adorn the palace of Agoftino Ghigi; the capital portrait of his great friend Leo X., with the cardinals de Medici and Roffi, now in the Louvre; the St. Michael, and the vifion of Ezekiel, both in the fame grand depôt; a Madonna, Child, and St. Anne, for Florence; and a large picture of Chrift bearing his Crofs, for the monaftery of St. Maria della Spafimo, at Palermo. Of this picture it is reported, that being fent on fhipboard to go to Sicily, the veffel was beaten from its courfe by a tempeft, and the mariners loft; when it drifted to Genoa, and of courfe its prefervation was attributed to the divine influence of this great work. The Genoefe chofe alfo to fuppofe that the hand of God had thus pointed out their city as the proper place for its refidence; and would not relinquifh it for a length of time, till the papal influence interfered, when it was configned to its original deftination. He alfo painted the picture of St. John, which adorned the Orleans collection; and laft of all, the Transfiguration; which indeed he had not quite finifhed when the unrelenting hand of death fet a period to his labours, and deprived the world of further benefit from his talents, when he had only attained an age at which moft other men are but beginning to be ufeful.

The immediate caufe of his death is allowed to have been brought on by too great an indulgence in gallantry, and, Vafari adds, by mifmanagement of his phyficians, who bled him when they ought to have adminiftered reftoratives. On his death bed he made his will, leaving his favourite pupils, Julio Romano and Il Fattore, his heirs, and ordering his

burial

burial to take place in the Pantheon (the church of Santa Maria Rotunda), where a monument still remains to his honour. He died on the same day of the year on which he was born, Good Friday, in 1520, at the age of 37, deeply lamented by all who knew his value. His body lay for a while in state, in one of the rooms wherein he had displayed the powers of his mind, and he was honoured by a public funeral; his last produce, the Transfiguration, being carried before him in the procession: and, that Rome might not be deprived of so noble a memorial of this extraordinary man, it was placed by the cardinal de Medici in the church of St. Pietro à Montorio, instead of being sent to France, as was originally intended.

Mr. Fuseli, in his edition of Pilkington, has given so discriminating and just an idea of the peculiar excellencies of Raphael, that we shall conclude our history of him by quoting it. "The general opinion has placed Raphael at the head of his art, not because he possessed a decided superiority over every other painter in every branch, but because no other artist ever arrived at uniting with his own peculiar excellence all the other parts of the art in an equal degree with him.

"The drama, or in other words the representation of character in conflict with passion, was his sphere; to represent this, his invention in the choice of the moment, his composition in the arrangement of his actors, and his expression in the delineation of their emotions, were, and are, and perhaps will be unrivalled. And to this he added a style of design dictated by the subject itself, a colour suited to the subject, all the grace which propriety permitted, or sentiment suggested, and as much chiaro-scuro as was compatible with his supreme desire of perspicuity and evidence. It is therefore only when he forsook the drama, to make excursions into the pure epic or sublime, that his forms become inadequate, and were inferior to those of M. Angelo: it is only in subjects where colour from a vehicle becomes the ruling principle, that he is excelled by Titian; he yields to Correggio only in that grace and that chiaro-scuro which is less the minister of propriety and sentiment, than its charming abuse, or voluptuous excess; and which sacrifices to the eye what was claimed in vain by the mind.

"Michael Angelo appears to have had no infancy: if he had, we are not acquainted with it: his earliest works equal in principle and elements of style the vigorous offsprings of his virility: Raphael we see in his cradle, we hear him stammer: but propriety rocked the cradle, and character formed his lips. Even the trammels of Pietro Perugino, dry and servile in his style of design, formal and gothic in his composition, he traced what was essential, and separated it from what was accidental, in figure and subject. The works of Lionardo, and the cartoon of Pisa, invigorated his eye, but it was the antique that completed the system which he had begun to establish on nature. From the antique he learned discrimination and propriety of form. He found that in the construction of the body, the articulation of the bones was the true cause of ease and grace in the action of the limbs, and that the knowledge of this was the true cause of the superiority of the antients. He discovered that certain features were fitted for certain expressions, and peculiar to certain characters: that such a head, such hands, and such feet, are the stamen or the growth of such a body, and on physiognomy established uniformity of parts. When he designed, his attention was immediately directed to the primary intention and motive of his figure, next to its general measure, then to the bones and their articulation, from them to the principal muscles or those eminently wanted, to their attendant nerves, and at last to the more or less essential minutiæ; but the character part of the subject is infallibly the characteristic part of his design, whether it be a rapid sketch, or a more finished drawing. The strokes of his pen or pencil themselves are characteristic: they follow the direction and texture of the part; flesh in their rounding, tendons in straight, bones in angular lines.

"Such was the felicity aud propriety of Raphael, when employed in the dramatic evolutions of character! both suffered when he attempted to abstract the forms of sublimity and beauty; the painter of humanity, not often wielded with success super-human weapons. His gods never rose above prophetic or patriarchal forms; if the finger of Michael Angelo impressed the divine countenance oftener with sternness than awe, the gods of Raphael are sometimes too affable or mild, like him who speaks to Jacob, in a ceiling of the Vatican; or too violent, like him who separates light from darkness, in the loggia of the same place. But though, to speak with things, he was chiefly made to walk with dignity on earth, he soared above it in the conception of Christ on Tabor, and still more in the frown of the angelic countenance that withers the strength of Heliodorus.

"Of ideal female beauty, though he himself, in his letter to count Castiglione, tells us, that from its scarcity in life, he made attempts to reach it by an idea formed in his own mind, he certainly wanted that standard which guided him in character: his goddesses and mythologic females are no more than aggravations of the generic forms of Michael Angelo. When the drama inspired Raphael, his women became definitions of grace and pathos at once. Such is the exquisite line and turn of the half-averted kneeling female with two children, among the spectators of the punishment inflicted on Heliodorus; her attitude, the turn of her neck, supplies all face, and intimates more than he ever expressed by features."

Raphael, in *Geography*, a fertile and healthy district, being the westernmost in the Spanish part of St. Domingo. Its northern boundary is found in part of the French parish Gonsalves. The air round St. Raphael in very salubrious, but the town, which is in a hollow, is very hot; 10 leagues S. of Cape François.

Raphael, *St.*, *Cape*, lies at the S. end of St. Domingo, and is the S.E. limit of Samana bay.

RAPHANEA, in *Ancient Geography*, a city of Syria, between which and Arca, or Arac, a city of Judea belonging to the kingdom of Agrippa, the Sabbatical river flowed. Joseph. de Bell. l. vii. c. 24. Raphanea is, perhaps, the Arpal of scripture. 2 Kings, xviii. 34. xix. 13. If. x. 9. xxxvi. 19. xxxvii. 13. Jerem. xlix. 23.

RAPHANIA, in *Medicine*, an appellation given by Linnæus, and afterwards by Dr. Cullen and others, to a severe and fatal disease, which has been described as epidemic in Sweden at particular seasons, and imputed to the use of the *raphanus* raphanistrum of Linnæus as food.

It is not necessary to describe the symptoms of this disease in this place; since it is, in fact, the same malady which has been epidemic in various other countries of Europe, during seasons of scarcity; and has been attributed to various other species of unwholesome grain, but more especially to diseased rye, affected with the *ergot*, to the *lolium temulentum*, to charlock, &c. We have already entered at great length into the history of the symptoms and imputed causes of this formidable malady, which has been more commonly denominated *ergot*, from one of its supposed sources. (See Ergot.) We have endeavoured also to shew, that it constituted one of the varieties of epidemic disease, described by the ancients, under the appellation of Ignis *Sacer* (which see); and that, instead of being properly imputed to the admixture

admixture of any of these substances with the corn used for food, the disease is to be ascribed with more probability to the insufficient nourishment afforded by damaged corn, or the actual dearth of it, which usually occur together; especially as these diseases have commonly been epidemic in years of scarcity, which is the only circumstance that can be observed in common to all the epidemics described by authors. In addition to the works on ergot and ignis facer, formerly referred to, consult, for an account of raphania, Pulteney's View of the Writings of Linnæus; Rothman's Paper, in the Amœnitates Academ. of Sweden; Tissot. Epistolæ Med. Pract.

RAPHANIS, in *Botany*, the name by which the Attics, among the Greeks, called the radish; for the word *raphanos*, or *raphanus*, with them, does not express the radish, but the cabbage. The Greek of all other places concurred in calling the radish *raphanos*, and the cabbage *crambe*; and it is owing to this that we have many authors who confound together these two plants, though so very unlike one another in appearance and use. It is generally to be understood, that wherever Theophrastus mentions the word *raphanos*, he means by it the cabbage; and the same being observed, in regard to all the other Attic writers, the whole danger of confusion and error will cease.

RAPHANISTRUM, a name given by botanists to the wild radish, and designed to express its affinity to the cultivated one. See RAPHANUS.

RAPHANUS, an ancient name for the Radish, a species of this genus, derived from ῥα, *easily*, or *quickly*, and φαινομαι, *to appear*, or *come forth*, in allusion to the quickness of its vegetation.—Linn. Gen. 343. Schreb. 445. Willd. Sp. Pl. v. 3. 560. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 129. Sm. Fl. Brit. 723. Prodr. Fl. Græc. Sibth. v. 2. 32. Juss. 238. Tourn. t. 114. Lamarck Illustr. t. 566. Gærtn. t. 143. (Raphanistrum; Tourn. t. 115. Gærtn. t. 143.)—Class and order, *Tetradynamia Siliquosa*. Nat. Ord. *Siliquosæ*, Linn. *Cruciferæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, erect, of four oblong, parallel, converging, deciduous leaves, gibbous at the base. *Cor.* cruciform, of four inversely heart-shaped, spreading petals, whose claws are rather longer than the calyx. Nectariferous glands four; one at each side, between the shorter stamen and the pistil; and one at each of the opposite sides between the longer stamens and the calyx. *Stam.* Filaments six, awl-shaped, erect; two opposite ones the length of the calyx; the rest as long as the claws of the corolla; anthers simple. *Pist.* Germen oblong, tumid, tapering, the length of the stamens; style scarcely any; stigma capitate, undivided. *Peric.* Pod oblong, pointed, swelling here and there, imperfectly jointed, without valves. *Seeds* roundish, smooth.

Obs. *Raphanus* of Tournefort and Gærtner has a spongy fruit, of two cells, not bursting. *Raphanistrum* of the same authors has a jointed fruit, separating at the joints.

Ess. Ch. Calyx closed. Nectariferous glands four. Pod swelling out into knobs, imperfectly jointed, without valves.

1. R. *sativus*. Common Garden Radish. Linn. Sp. Pl. 935. Willd. n. 1. Ait. n. 1. Ger. Em. 237. (R. primus; Matth. Valgr. v. 1. 399.)—Leaves lyrate. Pod roundish, tumid, of two cells.—The native country of this well-known plant, so commonly cultivated in gardens, is not ascertained. Linnæus mentions China; but his authority does not appear. Its chief value with us consists in the root, esteemed for its grateful pungency, mixed with a watery coolness. The shape of this part varies, from its natural spindle-like figure, to a globular one, and the colour of the skin from purple to white. We doubt much whether the *R. niger* of Bauhin, commonly called the Black Spanish Radish, which Linnæus marks β, can belong to this species. Its firmness, and black rugged coat, seem to indicate more than a mere variety. We have not examined the herbage. The *leaves* of *R. sativus* are lyrate, notched, and rough, especially the lower ones; the upper part of the herb is smoother, and somewhat glaucous. *Stem* branched. *Flowers* purple, corymbose; soon racemose. *Pods* erect, tumid, juicy, pale, glaucous, smooth, slightly striated, various in length and thickness, tipped with an awl-shaped beak. Linnæus cultivated at Upsal a Chinese variety, or possibly species, whose *leaves* are broader and smoother, and its whole habit more lax. The oil of the *seeds* is said to be used in China.

2. R. *caudatus*. Long-tailed Radish. Linn. Mant. 95. Linn. fil. Plant. Rar. fasc. 1. 19. t. 10. Willd. n. 2.—Leaves lyrate. Pod compressed, of one cell, wavy, longer than the whole plant.—Native of Java, where, according to the younger Linnæus, it is cultivated, and the pickled pods known by the name of Mougri. In Sweden, as well as in England, it may be treated as a hardy annual, like the foregoing; but the present species does not occur in Hort. Kew., though Mr. Lambert met with it last year in a country garden in Wiltshire. The appearance of the plant, weighed down to the ground by its immoderately long serpentine *pods*, is altogether extraordinary. The lobes and indentations of the *leaves* are sharper than in the Common Radish, but the *flowers* and other parts, except the *pods*, scarcely betray any difference.

3. R. *Raphanistrum*. Wild Radish, or Jointed Charlock. Linn. Sp. Pl. 935. Willd. n. 3 Ait. n. 2. Fl. Brit. n. 1, α, β. Eng. Bot. t. 856. Curt. Lond. fasc. 4. t. 46. Mart. Rust. t. 71. Fl. Dan. t. 678. (R. sylvestris; Ger. Em. 240.)—Leaves simply lyrate. Pod round, jointed, even, of one cell.—A troublesome weed in the cornfields of Europe, flowering in June and July. The *root* is annual, small, and tapering. *Stem* branched, round, glaucous, rough with prominent bristles, leafy. *Leaves* rough, lyrate; the upper ones oblong, simply toothed. *Flowers* numerous, lemon-coloured, changing to white in decay, with purple veins; sometimes the petals are white from the first. *Pods* cylindrical, or rather tapering, beaked, knobbed or imperfectly jointed, smooth, becoming striated as they ripen. In a young state they are divided into two cells, but the partition is obliterated, and confounded in one spungy mass, as they ripen. Linnæus was of opinion that the seeds of this plant caused a convulsive disease, thence termed by him *Raphania*, of which he has given a history in Amœn. Acad. v. 6. 430, with a figure, and elaborate synonymy of the plant. We have never met with any circumstance to corroborate this hypothesis.

4. R. *maritimus*. Sea Radish. Sm. Engl. Bot. t. 1643. Ait. n. 3. (R. Raphanistrum γ; Fl. Brit. 723. R. maritimus, flore luteo, siliquis articulatis, secundum longitudinem eminenter striatis; Raii Syn. 296. Raphanistrum siliquâ articulatâ striatâ maximâ; Moris. v. 2. 266. Raii Hist. v. 1. 806.)—Radical leaves interruptedly lyrate. Pod round, jointed, smooth, deeply furrowed, of one cell.—Found on the sea-shore in various parts of Britain, flowering in May. The late Rev. Dr. Walker, and Mr. J. Mackay, observed it on the western coasts of Scotland; and the former cultivated this plant, till his death, as an esculent root, preferable to horse radish; he also found that cattle were very fond of the leaves. Mr. Turner and Mr. W. Borrer gathered the same on rocks, near Beachy Head, Sussex. The *root* is large and succulent, lasting two or three

three years. *Stems* three or four feet high, round, roughest at the base. *Leaves* all rough, and rather sharply toothed; the radical ones interruptedly lyrate, which we have never observed in the last described species. *Flowers* of a deeper yellow, and less veiny. *Pods* strongly jointed, and very deeply furrowed longitudinally, destitute of hairs or other roughness. There can be no doubt of this being a distinct species from the former, though generally confounded therewith.

5. R. *sibiricus.* Siberian Radish. Linn. Sp. Pl. 935. Murray Comment. Gott. for 1775. 48. t. 11. (R. n. 28; Gmel. Sib. v. 3. 266.)—Leaves pinnatifid, somewhat toothed. Pod round, beaded, downy, of one cell.—Native of Siberia. The seeds were sent by Professor Pallas to the Goettingen garden, where the plant flowered in June. *Root* annual, long, and slender. *Stems* from three to six inches high; or more, as the seeds ripen, ascending, leafy, hairy, simple or branched. *Leaves* sometimes elegantly and neatly pinnatifid, almost pectinate, either in a simple or interrupted manner, roughish at the edge only, sometimes more dilated, with distant and broader lobes. *Flowers* large, yellow, sweet-scented in an evening, their *petals* strongly emarginate. *Pods* inflexed, copiously and neatly beaded in appearance, rather than distinctly jointed, downy, each with a sharp taper beak.

6. R. *tenellus.* Slender Purple Radish. Pallas Trav. v. 3. append. 741. t. L. f. 3. Willd. n. 5. Ehrh. Sel. n. 38. (Chorispermum tenellum; Brown in Ait. H. Kew. v. 4. 129.)—Leaves smooth, oblong, toothed; the lowermost pinnatifid. Pod awl-shaped, jointed, smooth, of two cells.—Native of deserts near the Caspian sea. A hardy annual in our gardens, flowering in June and July. *Root* long, simple, tapering, and slender. *Herb* smooth, scarcely branched, leafy. *Leaves* elliptic-oblong, toothed or pinnatifid, tapering down into longish footstalks. *Flowers* small, purple. Beak of the *pod* very long and slender. The ingenious Mr. Brown separates this from *Raphanus* chiefly, as it seems, because the cotyledons are flat, not folded.

7. R. *arcuatus.* Curve-podded Radish. Willd. n. 6.—"Leaves oblong-lanceolate, toothed. Pod awl-shaped, curved, two-celled, smooth."—Native country unknown. Willdenow cultivated the plant, which he describes as annual, with an erect branched *stem*, hardly a span high. *Leaves* stalked, oblong-lanceolate, very smooth, with broad shallow teeth. *Flowers* small, violet. *Pods* round, of two cells, jointed, curved, smooth, striated, with an awl-shaped beak. The figure of *Hesperis arenaria*, Desfont. Atlant. v. 2. t. 162, answers exactly to this plant, except the pods. *Willdenow.*

8. R. *lanceolatus.* Lanceolate Radish. Willd. n. 7.—"Leaves oblong-lanceolate, somewhat toothed at the apex. Pod tumid, smooth, two-celled, with a squarish beak."—Native of the West Indies. *Stem* a foot and half high, erect, zigzag, with short branches, smooth like every other part of the plant. *Leaves* stalked, oblong-lanceolate; the uppermost lanceolate, narrow, entire; the lower ones bluntly toothed at the extremity. *Flowers* of a middling size, yellow, in a terminal cluster, six inches long. *Pods* half an inch long, with a long, obtuse, obscurely quadrangular beak. *Willdenow.*

9. R. *pilosus.* Hairy-stalked Radish. Willd. n. 8.—"Leaves lanceolate-linear, pinnatifid at the base. Stem rough with bristly hairs. Pod round, smooth, jointed, of one cell."—Native of Guinea. *Stem* two feet, or perhaps more, in height, branched, divaricated. *Leaves* three inches long, narrow, smooth, pointed; pinnatifid at the base; toothed in the middle; entire at the extremity. *Cluster* axillary from every leaf, of few flowers. *Pods* an inch and half long, round, jointed, of one cell, with a short beak, all of them turned one way. *Willdenow.*

R. *erucoides*, Linn. Suppl. 299, is rightly referred by Mr. Brown, in Ait. H. Kew. v. 4. 126, to *Sinapis Allionii*, Jacq. Hort. Vind. v. 2. t. 168. Willd. Sp. Pl. v. 3. 557. (See Sinapis.) Willdenow cites it, doubtingly, under *Brassica Cheiranthus* of Villars, a very different plant; for which he also by mistake quotes Barrel. Ic. t. 1016, a synonym properly belonging to *Sisymbrium Barrelieri.*

Linnæus once referred *Bunias Cakile* to this genus of *Raphanus.*

Raphanus, in *Gardening*, contains plants of the herbaceous, annual, esculent kind, of which the species cultivated is, the common garden radish (R. sativus).

There are several varieties; some of which have the appearance of distinct species, from their shape, size, and colour of the roots; as the *long-rooted*, which is that commonly cultivated in kitchen-gardens for its roots. Of this there are several subordinate variations: as the small-topped, and the long-topped striped radish. The small-topped is most commonly preferred by the gardeners near London, as they require much less room than those with large tops; for as forward radishes are what produce the greatest profit to the gardener, and these are commonly sown upon borders near hedges, walls, or pales, the large-topped sorts would be apt to grow mostly at top, and not swell so much in the root as the other, especially if the plants should be left pretty close.

The *small round-rooted*, which is not very common here, but in many parts of Italy it is the only one cultivated; the roots of this are very white, round, small, and very sweet. It is now frequently brought to the London markets in the spring, generally in bunches, and is sometimes mistaken there for young turnips: when eaten young, it is crisp, mild, and pleasant.

The large *turnip-rooted*, or *white Spanish*, which has a moderately large, spheroidal white root, and is esteemed chiefly for eating in autumn and the early part of winter. Both these sorts are commonly called indiscriminately turnip radishes.

The *black turnip-rooted Spanish*, which has a root like the preceding, white within, but with a black skin; and is greatly esteemed by many for autumn and winter eating.

There are likewise some other subvarieties of the radish noticed by gardeners, as the common *salmon radish*, and the short-topped early *salmon radish*. Also the small red *turnip-rooted radish*. Gardeners, too, often call the long-topped sort the *sallad radish*.

Method of Culture.—These are raised from seed by different sowings from the end of October till April, or the following month. They should have a light fine mould, and the more early sowings be made on borders, under warm walls, or other similar places, and in frames covered by glasses. The common spindle-rooted, short-topped sorts are mostly made use of in these early sowings, the seed being sown broadcast over the beds after they have been prepared by digging over and raking the surface even, being covered in with a slight raking. Some sow carrots with the early crops of radishes.

It is usual to protect the early sown crops in the borders, during frosty nights and bad weather, by mats or dry wheat straw, which should be carefully removed every mild day. By this means they are brought more forward, as well as form better roots. When mats are used, and supported by pegs or hoops, they are readily applied and removed.

 A second

A ſecond more general ſowing ſhould be made in January or February. When the crops have got their rough leaf, they ſhould be thinned out, where they are too thick, to the diſtance of two inches, as there will be conſtantly more thinning by the daily drawing of the young radiſhes.

When the weather is dry in March, or the following month, the crops ſhould be occaſionally well watered, which not only forwards the growth of the crops, but increaſes the ſize of the roots, and renders them more mild and criſp in eating.

And the ſowings ſhould be continued at the diſtance of a fortnight, till the latter end of March, when they ſhould be performed every ten days, until the end of April or beginning of the following month. In ſowing theſe later crops, it is the practice of ſome gardeners to ſow coſs-lettuces and ſpinach with them, in order to have the two crops coming forward at the ſame time, but the practice is not to be much recommended, where there is ſufficient room.

But in ſowing the main general crops in the open quarters, the market-gardeners generally put them in on the ſame ground where they plant out their main crops of cauliflowers and cabbages, mixing ſpinach with the radiſh-ſeed as above, ſowing the ſeeds firſt, and raking them in, then planting the cauliflowers or cabbages; the radiſhes and ſpinach come in for uſe before the other plants begin to ſpread much, and as ſoon as thoſe ſmall crops are all cleared off for uſe, hoe the ground all over to kill weeds and looſen the ſoil, drawing earth about the ſtems of the cauliflowers and cabbages.

The turnip radiſh ſhould not be ſown till the beginning of March, the plants being allowed a greater diſtance than for the common ſpindle-rooted ſort. The ſeeds of this ſort are apt to degenerate, unleſs they are ſet at a diſtance from that kind.

The white and black Spaniſh radiſhes are uſually ſown about the middle of July, or a little earlier, and are fit for the table by the end of Auguſt, or the beginning of September, continuing good till froſt ſpoils them. Theſe ſhould be thinned to a greater diſtance than the common ſort, as their roots grow as large as turnips, and ſhould not be left nearer than ſix inches.

To have theſe roots in winter, they ſhould be drawn before hard froſt comes on, and laid in dry ſand, as practiſed for carrots, carefully guarding them from wet and froſt; as in this way they may be kept till the ſpring.

In regard to the culture of the general crops, they require very little, except occaſional thinning where they are too thick, when the plants are come into the rough leaf, either by hoeing or drawing them out by hand: though for large quantities, ſmall hoeing is the moſt expeditious mode of thinning, as well as moſt beneficial to the crop by looſening the ground; in either method thinning the plants to about two or three inches diſtance, clearing out the weakeſt, and leaving the ſtrongeſt to form the crop.

In order to ſave the ſeed, about the beginning of May ſome ground ſhould be prepared by digging and levelling; then drawing ſome of the ſtraighteſt and beſt-coloured radiſhes, plant them in rows three feet diſtant, and two feet aſunder in the rows; obſerving, if the ſeaſon be dry, to water them until they have taken root: after which they will only require to have the weeds hoed down between them, until they are advanced ſo high as to overſpread the ground.

When the ſeed begins to ripen, it ſhould be carefully guarded againſt the birds. When it is ripe, the pods will turn brown: then it muſt be cut, and ſpread in the ſun to dry; after which it muſt be thraſhed, and laid up for uſe where no mice can come at it.

Method of Culture on Hot-beds.—This method is ſometimes practiſed in order to have the roots early, as in January or the following month. They ſhould have eighteen inches depth of dung to bring them up, and ſix or ſeven inches depth of light rich mould. The ſeed ſhould be ſown moderately thick, covering it in half an inch thick, and putting on the lights: the plants uſually come up in a week or leſs; and when they appear, the lights ſhould be lifted or taken off occaſionally, according to the weather; and in a fortnight thin the plants to the diſtance of an inch and half or two inches, when in ſix weeks they will be fit to draw. Where there are no frames to ſpare, the beds may be covered with mats over hoops, and the ſides ſecured by boards and ſtraw-bands. And when in want of dung, if the beds be covered with frames, and the lights put on at night and in bad weather, the plants may be raiſed for uſe a fortnight ſooner than in the open borders.

RAPHE, in *Anatomy*, a Greek term, ſignifying future, applied to ſome parts of the body; thus we have the raphe corporis calloſi in the brain (ſee BRAIN); raphe perinei, ſcroti, and penis. See GENERATION.

RAPHELENGIUS, ſometimes called RAULENGHIEN, FRANCIS, in *Biography*, a learned orientaliſt, was born in 1539 at Lanoy, near Lille, in Flanders. He had the early part of his education at Ghent, but on the death of his father, it was intended to bring him up to trade, and for that purpoſe he was ſent to Nuremberg. Here he had acceſs to books, reſumed his ſtudies, and took an opportunity of going to Paris, where he made great progreſs in the Greek and Hebrew languages. The civil wars obliged him to quit France, and he came to England, where, for ſome time, he taught Greek in the univerſity of Cambridge. After this he returned to the Low Countries, and became a corrector of the preſs to the celebrated printer Plantin, whoſe daughter he married in the year 1565. He made himſelf very ſerviceable in the printing office, eſpecially with reſpect to the famous Antwerp Polyglot Bible, printed in 1571 by order of Philip II. of Spain. When Plantin removed to Leyden, he left his buſineſs at Antwerp under the care of Raphelengius, and upon his return the latter went to Leyden. The curators of the univerſity of that place conferred upon him the profeſſorſhip of Hebrew, to which was added that of Arabic. He died in 1597. His literary works were "Variæ Lectiones et Emendationes in Chaldaicam Bibliorum Paraphraſin;" "Grammatica Hebræa;" "Dictionarium Chaldaicum;" and "Lexicon Arabicum." He had a ſon of the ſame name, a man of talents and learning, who publiſhed "Notes upon Seneca's Tragedies," and "Eulogies, in Verſe, of fifty Perſons, with their Portraits."

RAPHIA, in *Botany*, from ῥαφὶς, *a point* or *needle*, ſo that it ought to have been *Rhaphia*, a genus of Palms, with a very pointed fruit, eſtabliſhed by Paliſot Beauvois, in his *Flore d'Oware et de Benin*, faſc. 8.

RAPHIA, in *Ancient Geography*, a famous city in the Mediterranean, between Gaza and Rhinocorura. This was perhaps Gath of the Rephiam. Raphia is famous for the victory of Philopator, king of Egypt, over Antiochus the Great, king of Syria. (3 Maccab. i. 11.) Joſephus ſays (Antiq. l. xiii. c. 21.) that Raphia was taken by Alexander Jannæus, and after being ruined in the wars, was repaired by Gabinius. There are extant ſome ancient medals ſtruck at Raphia, and ſome biſhops of this city are found in the liſts of the eaſtern councils.

RAPHIDIA, in *Entomology*, a genus of inſects of the order Neuroptera, of which there are two ſpecies. The generic character is as follows; Mouth with a curved toothed

toothed horny mandible; the thorax is long and cylindrical; it has three ſtemmata; the wings are deflected; the antennæ filiform, as long as the thorax, the anterior part is elongated and cylindrical: it has four feelers, which are ſhort and filiform; the tail of the female is terminated by a large recurved briſtle.

* Ophiosus. The wings of this ſpecies are immaculate. It inhabits divers parts of Europe in woods, and preys on other inſects.

* Notata. Wings with a brown marginal ſpot. It inhabits England, and has been thought to be only a variety of the former. The body is black; the head is alſo black with a teſtaceous ſpot; the legs are teſtaceous; the appendage of the female is as long as the body.

RAPHOE, in *Geography*, a biſhopric of Ireland, in the eccleſiaſtical province of Armagh, which comprifes the greater part of the county of Donegal, being 44 miles in length from north to ſouth, and 32 in breadth, comprehending 515,250 Iriſh acres. It contains 31 pariſhes, in which are 32 churches. The dean, archdeacon, and four prebendaries, compoſe the chapter. The patronage of 6 pariſhes, which form the corps of the deanery, is in the crown; of 15 others, in the biſhop; of 7, in the univerſity of Dublin; and of 3, in lay hands. It is not preciſely known at what time this ſee was founded, but it muſt have been as early as the ninth century, ſince biſhops of Raphoe are mentioned at that time. Beaufort.

Raphoe, a ſmall poſt-town of Ireland, the pariſh church of which ſerves as a cathedral, where is the biſhop's palace. It is 107 miles N. by W. from Dublin.

Raphoe, a townſhip in Lancaſter county, Pennſylvania, containing 2814 inhabitants.

RAPHON, in *Ancient Geography*, a city beyond Jordan, on a brook, not far from Carnaim.

RAPICIO, Grovita, in *Biography*, an Italian man of letters, was born about the year 1480, at Chiari, in the territory of Breſcia. Devoting himſelf to the inſtruction of youth in literature, he firſt opened a ſchool at Bergamo, where he wrote a Latin treatiſe on the education of youth, which was afterwards printed at Venice. He next taught at Vicenza, and various other cities in Italy, and was for many years employed at Venice in inſtructing, in polite literature, the youths deſtined for public life, and among others, the care and inſtruction of the ſons of cardinal Bembo were devolved upon him. Cardinal Pole, in one of his letters, ſpeaks of Rapicio in high terms of commendation. He died at Venice in 1553. He was author of various harangues, poems, and epiſtles, but his chief work was entitled "De numero Oratorio," in five books, printed at Venice in 1544. "In this," ſays his biographer, "he minutely inveſtigates the principles of writing the Latin language with ſweetneſs and harmony, and he replies to Melancthon's aſſertion, that rules of this kind are rendered uſeleſs by our ignorance of the ancient pronunciation. Moreri."

RAPID Ann, in *Geography*, a ſmall river of Virginia, which runs into the Rappahanock, about 10 miles above Fredericksburg.

Rapid *Plat*, *Iſle au*, a ſmall iſland of Upper Canada, in the river St. Lawrence, in front of the townſhip of Matilda, containing about 200 acres.

Rapid *River*, a river which runs into Hudſon's Bay.

RAPIDES, a county of the territory of Orleans, containing three pariſhes, *viz*. Rapides, including 2200 inhabitants, Catahula 1164, and Avoyelles 1209.

RAPIER, properly denotes a long, ordinary, old-faſhioned cutting ſword, ſuch as thoſe worn by the common ſoldiers.

The word is formed from the French *rapiere*, of the Greek ῥαπίζειν, *cædere*, *to ſmite*, or *ſtrike*.

In this ſenſe do the French ſtill uſe the term; ſo that among them, to *take the rapier*, is to enter in the army.

Rapier, in a modern ſenſe among us, uſually denotes a ſmall ſword, as contradiſtinguiſhed from a back-ſword, or cutting-ſword.

RAPILLO, in *Mineralogy*, the name given by the Italians to the ſand or powders (improperly called aſhes) thrown from the craters of volcanoes in immenſe quantities, towards the concluſion of an eruption. See Volcano, and Volcanic *Products*.

RAPIN, René, in *Biography*, a Jeſuit, was born at Tours in 1621. He entered the ſociety in 1639, and was a teacher of the belles lettres in it during nine years. He became eminent by ſeveral publications in the Latin and French, and obtained a high rank among the literary characters of his time. It is, however, as a Latin poet that he is chiefly known: his didactic poem on *Gardens*, entitled "Hortorum, lib. iv." firſt printed in 1665, has paſſed through many editions, and has been regarded as one of the moſt elegant and claſſical pieces of modern Latin verſe. By others it has been thought a work of art and ſtudy, rather than an effuſion of poetical feeling and fancy, and treats on gardening more as a branch of rural economy than as one of the fine arts. His other Latin poems are ſacred eclogues, heroic, elegiac, and lyric poems. Father Rapin died at Paris in 1687. He was no leſs eſteemed for his virtues and amiable qualities, than admired for his talents; and he poſſeſſed all that poliſh and fitneſs for the ſociety of the great world, which have diſtinguiſhed this order from other religious communities. His works were collected and publiſhed, in 3 vols. 12mo. 1681. There is a fine edition of his "Hortorum," publiſhed by Brotier at Paris, in 1780. Rapin was great as a critic, in which line he is known by his "Reflexions ſur l'Eloquence, ſur la Poeſie, ſur l'Hiſtoire, et ſur la Philoſophie;" and alſo by his "Comparaiſons de Virgile et d'Homere," printed in 2 vols. 4to. Bayle. Moreri.

Rapin de Thoyras, Paul, well known as the hiſtorian of England, was born at Caſtres, in Languedoc, in 1661. He was deſcended from a noble family of Savoy, which came into France in the reign of Francis I. for the ſake of profeſſing the reformed religion. The ſubject of this article, after having received his education, went to his father, who was an advocate in the chamber of the edict at Nantes, for the purpoſe of ſtudying the law. He was in due time admitted an advocate, but the chamber being ſuppreſſed in the ſame year, he went with his father to Toulouſe. On the revocation of the edict of Nantes, in 1685, he withdrew to England, after which he went to Holland, and entered into a company of French cadets at Utrecht. In 1689 he followed the prince of Orange into England, and obtained an enſigncy in lord Kingſton's regiment, which went to Ireland. He was engaged in ſeveral battles, particularly at the ſieges of Carrickfergus and Limerick, and at the battle of the Boyne, and ſo much diſtinguiſhed himſelf, that he obtained a captain's commiſſion. In 1693 he was nominated governor to the ſon of the earl of Portland, reſigned his commiſſion to a younger brother, and received from the crown, for his paſt ſervices, 100*l*. a-year. He travelled to different countries in company with his pupil, and reſided with him ſome time at the Hague. By the death of king William he was deprived of his penſion, and his engagement as private tutor being over, he retired, in 1707, to Weſel, in the duchy of of Cleves, where he devoted himfelf to the compofition of the hiftory of England. Here he died in 1725. He had, previoufly to his deceafe, publifhed in the year 1717, "Differtation fur les Whigs et Torys," which was tranflated into Englifh. His great work, "L'Hiftoire de Angleterre," was printed at the Hague in 9 vols. 4to. in the years 1725—6. It commences with the remoteft periods, and is brought down to the proclamation of William and Mary. It has been twice tranflated into our own language, and was, till the appearance of Hume, the moft popular hiftory of England, and Tindal's, or rather Birch's, and other continuations, have been adapted to it. It is written in a prolix and unanimated ftyle, but deferves the praife of much folid information. "His work," fays an excellent writer, "is of great authority, on account of his perpetual references to original documents, and the ample quotations which he frequently makes from important ftate papers, confer upon it additional value. He has fo copioufly detailed the matters which were agitated in the turbulent, but prudent parliament of Charles I., as to give a clear view of the rife of thofe parties which to this day divide the people of England. On the dark and horrible tranfactions of the reign of Charles II. he perhaps throws as much light as it is now poffible to obtain. In reference to that important period, he has ftated hiftorical difficulties with candour, and in difcuffing the merits and demerits of parties, he has weighed evidence with laudable fcrupulofity." (See Shepherd's Syftematic Education.) Rapin, during the collection of his materials, undertook the ufeful labour of making an "Abridgment of Rymer's Foedera," which was publifhed in Le Clerc's "Bibliotheque Choifie;" and tranflated into the Englifh by Mr. Stephen Whatley, and publifhed in 1733, under the title of "Acta Regia," and in folio.

RAPINE, Rapina, in *Law*. To take a thing in private, againft the owner's will, is properly *theft*; but to take it openly or by violence, is *rapine*, or *robbery*.

RAPINIA, in *Botany*, was fo called by Loureiro, Fl. Cochinch. 127, after father René Rapin, a French Jefuit, author of an elegant Latin poem on gardens, who died in 1687, aged 66. If this writer contributed nothing to improve the fcience of botany, he has, doubtlefs, helped to promote a love of plants, and may therefore claim a botanic wreath. A Jefuit of his day is doubly entitled to refpect, for having, like the good Loureiro, turned his mind to an elegant and improving purfuit, from thofe two corruptors of the human heart and underftanding, political intrigue, and fcholaftic divinity; in which moft of his brethren fought their temporal, and oftenfibly their eternal, good. The *Rapinia* of Loureiro however, proved, on the examination of his fpecimens by the late Mr. Dryander, to be the Sphenoclea of other authors; and this laft-mentioned name is now generally adopted. See that article.

RAPINO, in *Geography*, a town of Naples, in Abruzzo Citra; nine miles S. of Civita di Chieti.

RAPISTRUM, in *Botany*, originally the wild turnip, fo called from its affinity to *Rapa*, the cultivated one. Tournefort, however, ufes the word generically, for fome fpecies referred by other botanifts to *Myagrum*. In this he is followed, as far as concerns *M. paniculatum*, by Gærtner, and by the writer of the prefent article, in the Prodr. Fl. Græc.—Tourn. t. 99. Gærtn. v. 1. 285. t. 141. Sm. Prodr. Fl. Græc. Sibth. v. 2. 1. Brown in Ait. Hort. Kew. v. 4. 74.—Clafs and order, *Tetradynamia Siliculofa*. Nat. Ord. *Siliquofæ*, Linn. *Cruciferæ*, Juff.

Gen. Ch. *Cal.* Perianth inferior, of four oblong, fpreading, deciduous leaves, gibbous at the bafe. *Cor.* cruciform, of four obovate, entire, fpreading petals, whofe claws are fhorter than the calyx. *Stam.* Filaments fix, about the length of the calyx, the four oppofite ones rather the longeft; anthers fimple. *Pift.* Germen oblong; ftyle awl-fhaped, the length of the calyx; ftigma obtufe. *Peric.* Pouch lenticular, pointed, corrugated, of two cells, and two cohering, not fpontaneoufly feparating, coriaceous valves; partition membranous. *Seeds* roundifh, folitary in each cell; cotyledons flat.

Eff. Ch. Calyx fpreading. Pouch of two cells, and two convex valves, not burfting.

1. R. *paniculatum*. Panicled Rapiftrum. Ait. n. 2. (R. arvenfe, folio auriculato acuto; Tourn. Inft. 211. Myagrum paniculatum; Linn. Sp. Pl. 894. Willd. Sp. Pl. v. 3. 409. Fl. Dan. t. 204. Myagro fimilis, filiquâ rotundâ; Bauh. Prodr. 52.)—Native of cultivated fields in various parts of Europe, from Sweden to Greece, but not, as yet, obferved in Britain. *Root* annual, tapering. *Stem* about two feet high, erect, round, roughifh, leafy, branched. *Leaves* oblong, acute, undivided, rough, fomewhat toothed, clafping the ftem with their arrow-fhaped bafe. *Flowers* fmall, yellow, in numerous clufters, which become greatly elongated when in fruit. *Pouch* fcarcely bigger than muftard-feed, a little abrupt, finely reticulated. One of the *feeds* is often, but not always, abortive. Mr. Brown refers to this genus the *Bunias ægyptiaca* of Linnæus, which agrees with our *R. paniculatum* in having flat, not fpiral, cotyledons, but has otherwife the characters of *Bunias*.

Rapistrum is alfo a fpecies of the *fea-cabbage*, or *crambe*.

RAPOLLA, in *Geography*, a town of Naples, in Bafilicata, the fee of a bifhop, united to Melfi; fix miles W. of Venofa. N. lat. 40° 58′. E. long. 15° 44′.

RAPORE, a town of Naples, in Principato Ultra; 9 miles E. of Conza.

RAPOSO, a town of South America, in the country of Popayan.—Alfo, a river of Popayan, which runs into the Pacific ocean, N. lat. 3° 48′.—Alfo, a fmall ifland in the Pacific ocean, near the coaft of Popayan. N. lat. 4°.

RAPPAHANOCK, a large navigable river of Virginia, which rifes in the Blue Ridge, and runs about 130 miles from N.W. to S.E., and ente[illegible] Chefapeak bay, between Windmill and Stingr[illegible]. It waters, in its courfe, the towns of Falmo[illegible]ericksburg, Port-Royal, Leeds, Tappahannock, and Urbanne.

RAPPE, in *Commerce*, a money of account in Switzerland, 10 of which are equal to a good batze; and 6 are equal to a plappert, fhilling, or efcalin. This is the cafe at Bafil, but at Lucern the plappert is only 3 rappen, and the Zurich efcalin = $3\frac{3}{4}$ rappen.

Rappe, in *Ichthyology*, a name given by fome to the *capito fluviatilis rapax* of Gefner, more frequently known by the name of the *corvus pifcis*.

RAPPERSCHWEIT, in *Geography*, a town of Switzerland, and capital of a diftrict to which it gives name; fituated on the N. fide of the lake of Zurich, over which there is a bridge, 1852 paces in length, built in 1358 by the counts of Habfburg. The town was founded in 1091, and formerly had its own counts. In 1358 it was fold to the fons of Albert, archduke of Auftria. In 1464 it put itfelf under the cantons of Uri, Schweitz, Unterwalden, and Glarus, with a referve of its liberties; but the cantons gradually made themfelves mafters of it. At the peace of Arau in 1712, its liberties were reftored, though the country remains fubject to the fovereignty of Zurich and Berne; 15 miles S.E. of Zurich.

RAPPIN, a town of Anterior Pomerania; 7 miles N. of Bergen.

RAPPO RAPPO, a bay on the coaſt of Mowee, one of the Sandwich iſlands.

RAPPOLTSKIRCHEN, a town of Auſtria; five miles S. of Tuln.

RAPPORT, Fr. in *Muſic*, is ſometimes uſed for proportion, and ſometimes for relation, words which will be explained in their places.

RAPPS, in *Geography*, a town of Auſtria, on the river Taya; four miles S.W. of Droſendorf.

RAPSO, a town of Iſtria; 52 miles S.E. of Capo d'Iſtria.

RAPTEC, a river of Hindooſtan, which runs into the Dewah, five miles S.W. of Sellimpour.

RAPTU HÆREDIS, in *Law*, an ancient writ which lies for taking away an heir, holding in ſocage; of which there are two ſorts; one when the heir is married, the other when not. See RAVISHMENT.

RAPTURE, RAPTURA, an extaſy, or tranſport of mind. See EXTASY, ENTHUSIASM, RHAPSODY, &c.

RAPUNCULUS, in *Botany*, the Rampion, owes its name to a reſemblance in the root to a Rape, or oblong Turnip. This root, *Campanula Rapunculus* of Linnæus, is biennial, ſcarcely larger than a radiſh, which it reſembles alſo in ſhape, but the colour is white. Its flavour is ſweet and mild, notwithſtanding ſome degree of milkineſs in the juices, in which it accords with other, uſually bitter and acrid, ſpecies of its genus. The Rampion is now much leſs cultivated than formerly, and almoſt a ſtranger at our tables.

RAPUNTIUM, a name uſed by Tournefort and Moriſon for ſome plants referred to *Lobelia* by Linnæus. See LOBELIA.) Gærtner, having adopted Plumier's *Lobelia*, the Linnæan *Scævola*, reſtores *Rapuntium;* but ſuch a meaſure could now lead to inconvenience only.

RAPUTIA, ſo called by Aublet, becauſe the plant grows in the foreſts of *Orapu* in Guiana. Juſſieu and Lamarck have retained this curious name. Schreber has changed it for SCIURIS; ſee that article hereafter.

RARAKIT, in *Geography*, a town of the iſland of Ceram, at the foot of a mountain covered with trees, which ſerves as a harbour for pirates.

RARE, in *Phyſics*, denotes a body that is very porous, whoſe parts are at a great diſtance from one another, and which contains but little matter under a great deal of bulk.

In this ſenſe *rare* ſtands oppoſed to *denſe*.

The corpuſcular philoſophers, *viz.* the Epicureans, Gaſſendiſts, Newtonians, &c. aſſert that bodies are rarer ſome than others, in virtue of a greater quantity of vacuity included between their pores. The Carteſians hold, that a greater rarity only conſiſts in a greater quantity of materia ſubtilis included in the pores. Laſtly, the Peripatetics contend, that rarity is a new quality ſuperinduced upon a body without any dependence, either on vacuity, or ſubtile matter.

RARECOURT, in *Geography*, a town of France, in the department of the Meuſe; 10 miles S.W. of Verdun.

RAREE, a town of Hindooſtan, in Concan; 20 miles N.N.W. of Goa.—Alſo, a town of Hindooſtan, in Bahar; 11 miles N.N.W. of Durbungah.

RAREFACTION, RAREFACTIO, in *Phyſics*, the act by which a body is rendered *rare;* that is, is brought to poſſeſs more room, or appear under a larger bulk, without acceſſion of any new matter.

Rarefaction is oppoſed to *condenſation*.

Our more accurate writers reſtrain rarefaction to that expanſion of a maſs into a larger bulk, which is effected by means of heat. All expanſion from other cauſes they call *dilatation*.

The Carteſians deny any ſuch thing as abſolute rarefaction: extenſion, with them, conſtituting the eſſence of matter, they are obliged to hold all extenſion equally full.

Hence, they make rarefaction to be no other than an acceſſion of freſh, ſubtile, and inſenſible matter, which, entering the parts of the body, ſenſibly diſtends them. See this diſproved under VACUUM.

It is by rarefaction that gunpowder has its effect; and to the ſame principle alſo we owe our æolipiles, thermometers, &c.

The degree to which the air is rarefiable exceeds all imagination: Merſennus, long ago, by means of an intenſe heat, found that air might be rarefied ſo as to poſſeſs more than ſeventy times its former ſpace.

Mr. Boyle afterwards found, that air, by its own elaſticity, and without the help of any heat, would dilate itſelf ſo as to take up nine times its former ſpace; then 31 times; then 60; then 150: at length, by many degrees, he found it would reach to 8000 times, then 10,000, and finally to 13,679.

Such is the rarefaction of common air, from its own principle of elaſticicity, and without any previous condenſation; but if it be compreſſed, the ſame author found its greateſt ſpace when moſt rarefied, is to its leaſt when moſt condenſed, as 55,000 to 1.

Such an immenſe rarefaction, ſir Iſaac Newton ſhews, is inconceivable on any other principle than that of a repelling force inherent in the air, by which its particles mutually fly from one another.

This repelling force, he obſerves, is much more conſiderable in air than in other bodies, as being generated from the moſt fixt bodies, and that with much difficulty, and ſcarcely without fermentation; thoſe particles being always found to fly from each other with the moſt force, which, when in contact, cohere the moſt firmly. See AIR.

The members of the French Royal Academy have beſtowed much attention on the different rarefactions, or rather the different rarities of the air at different heights. M. Mariotte eſtabliſhed this as a principle, from experiments, that the different rarefactions, or condenſations, of the air, follow the proportion of the weights with which it is preſſed.

Hence, ſuppoſing the mercury in the level of the ſea ſuſpended to twenty-eight inches, which is the weight of the whole atmoſphere; and that ſixty feet height of air are equivalent to a line, or one-twelfth of an inch of mercury; ſo that the barometer, at the height of ſixty feet from the ſea, would fall a line; it is eaſy finding what height of air would be equal to a ſecond, or any other line of mercury: for as twenty-eight inches of mercury one-twelfth are to twenty-eight inches, ſo is the height of ſixty feet of air to a fourth term, which is the height of air correſponding to a ſecond line of mercury.

And after the ſame manner may the height of air correſponding to each line be found; which will make a geometrical progreſſion, the ſum of which will be the whole *height of the* ATMOSPHERE (which ſee); and, of conſequence, a certain part of that ſum will be the height of a mountain, at whoſe top the barometer ſhall have ſunk a certain quantity.

Meſſrs. Caſſini and Maraldi, upon meaſuring the heights of ſeveral mountains, found, that this progreſſion of M. Mariotte was defective; that it always gave the height of the mountains, and conſequently the rarefactions, leſs than they really were; and from ſome farther experiments, M. Amon-

M. Amontons found, that the principle will only hold in the mean rarefactions, not in the extremes. See BAROMETER.

RAREN, or RARON, in *Geography*, a town of the Valais, and capital of a tithing; 21 miles E. of Sion.

RARGIARA, a town of Hindooltan, in Bahar; 32 miles S.W. of Bahar.

RARITON, a river of America, in New Jersey, formed by two considerable streams, called the north and south branches; the one rises in Morris county and the other in the county of Hunterdon. This river passes by Brunswick and Amboy, and, uniting with the waters of the Arthur Kull sound, helps to form the fine harbour of Amboy. At Rariton hills, through which this river passes, is a small cascade, with a fall of water from fifteen to twenty feet, romantically situated between two rocks. Copper ore has been found upon the upper part of this river.

RARITON, a town of New Jersey, situated between the mouth of the N. branch of the above river and Boundbrook; 12 miles N.W. of Brunswick.

RARO, a town of Hungary; 8 miles E.S.E. of Altenburg.

RARONGHAKON, a large lake of Thibet. N. lat. 31° 4′. E. long 85° 52′.

RARUM, *Non-Spissum*, in the *Ancient Music*. See APYCNON.

RAS, in *Geography*, a town of Syria, anciently called "Conna," situated near the source of the Orontes; 24 miles N. of Balbec.

RAS *Abad*, or *Baba*, a cape on the coast of Arabia, in the Red sea; 10 miles S.S.W. of Jiddah.

RAS-*Acon-natter*. See CAXINES.

RAS *Adder*. See *Cape* BON.

RAS *Ahabaz*, a cape on the coast of Arabia, in the Red sea. N. lat. 18° 19′. E. long. 37° 48′.

RAS *Ain*, or *Ain Verdeh*, a town of Asiatic Turkey, in the province of Diarbekir; 80 miles S. of Diarbekir. N. lat. 36° 34′. E. long. 39° 48′.

RAS *el Amoushe*, a cape of Africa, on the coast of Algiers; 42 miles E. of cape Tennes. N. lat. 36° 41′. E. long. 2° 48′.

RAS *Assah*, a cape on the coast of Abyssinia, in the Red sea. N. lat. 13° 8′. E. long. 43° 10′.

RAS *el Camir* or *Kansir*, or cape of the wild boar, a town of Syria, in the pachalic of Aleppo, near a cape on the sea-coast; 16 miles W. of Alexandretta.

RAS *el Doar*, a cape on the coast of Nubia, in the Red sea. N. lat. 21° 21′. E. long. 36° 9′.

RAS *el Anf* or *Enf*, *i. e.* cape of the Rose, a cape on the coast of Egypt, in the Red sea; without tree or herb; in the front of the point are the remains of a large temple. N. lat. 23° 57′.

RAS *Fartach*. See FARTACH.

RAS *Fillam*, a cape on the E. coast of Arabia; 18 miles S.E. of cape Mozendum. N. lat. 29° 59′.

RAS *Ibrahim*, a cape of Arabia, in the Red sea; 6 miles S. Ghunfude.

RAS *Iggidid*, or *Ras el Jidid*, a cape of Nubia, in the Red sea; near which is a harbour, resembling a cauldron, and round as the arch of a circle; the entrance is formed by two points, N. and S. of each other, with 18 fathoms of water, and in the harbour 13. This port is subject to no inconvenience, except from the east. N. lat. 22° 15′. E. long. 36°.

RAS *al Mahbees*, a cape of Africa, on the coast of Tripoli. N. lat. 32° 18′. E. long. 11° 49′.

RAS *Mohammed*, a cape on the coast of Arabia, in the Red sea. N. lat. 27° 54′.

RAS *al Mar*, a town of Persia, in the province of Segestan; 200 miles S.W. of Zareng.

RAS *al Nashef*, a cape of Egypt, in the Red sea. N. lat. 23° 16′.

RAS *Rouzé*, a cape on the E. coast of Arabia. N. lat. 21° 55′.

RAS *Viré*, a cape on the coast of Arabia, forming the S. point of the gulf of Curia Muria. N. lat. 17° 25′.

RAS *Zafrane*, a cape on the coast of Egypt, in the Red sea; 32 miles S.S.E. of Suez. N. lat. 29° 14′.

RASA, a small island in the Indian sea, near the coast of Africa. S. lat. 17° 8′.

RASAIN, a town of Persia, in the province of Fars or Farsistan; 110 miles N.W. of Schiras or Shirauz.

RASAL, or RASAL-SEM, *Cape*, a cape of Africa, on the coast of Tripoli. N. lat. 32° 36′. E. long. 21° 10′.

RASALEMA, a river of Africa, which waters the city of Fez.

RASALGATA, CAPE, or *Ras Rouse*, a cape on the E. coast of Arabia. N. lat. 22° 25′. E. long. 58° 15′.

RASANT, or RAZANT *flank*, in *Fortification*. See FLANK.

The defence of the bastion is rasant.

RASANT *Fire*. See FIRE.

RASCA, in *Geography*, a river of Servia, which joins the Ibar; 16 miles N.E. of Jenibasar.

RASCETA, a word used by the Arabian physicians to express the wrist or ankle.

RASCH, in *Geography*, a town of Bavaria, in the territory of Nuremberg; two miles S.S.E. of Altorf.

RASCHNA, or RIZANA, a town of Servia; eight miles S. of Parakin.

RASCHOWITZ, a town of Bohemia, in the circle of Leitmeritz; four miles E. of Ausche.

RASCIA, a port of Servia, watered by the Rasca.

RASCINES, a town of Spain, in the province of Biscay; 21 miles S.E. of Santander.

RASE, RASARIUM, in our *Old Writers*, seems to have been a measure of corn now disused; toll shall be taken by the rase, and not by the heap or cantel.

RASE, in the *Manege*. *To rase*, or glance upon the ground, called in French *razer le tapis*, is to gallop near the ground, as our English horses do.

RASEB, AL, in *Geography*, a fortified pass in the mountains of Grand Bucharia; 60 miles N. of Vashgberd.

RASEBORG, a sea-port town of Sweden, in the gulf of Finland; 30 miles S.E. of Abo.

RASEC, a town of Persia, in the province of Segestan; 60 miles S.W. of Zareng.

RASGRAD, or RASGRAT. See HRASGRAD.

RASH, in *Clock-Work*. See RATCH.

RASH, in *Medicine*, an eruption or efflorescence upon the skin, thrown out in fevers, or surfeits.

RASHAUA, in *Geography*. See RASSAGU.

RASHED, a town of Nubia, in Sennaar; 15 miles N. of Giessim.

RASICULMO, CAPE, a cape on the N. coast of Sicily. N. lat. 38° 18′. E. long. 12° 49′.

RASIERE, or RAZIERE, in *Commerce*, a measure of corn in Dunkirk and Flanders. At Dunkirk, they have the sea rasiere, and the land rasiere; 8 of the former being = 9 of the latter; 54 sea rasieres or 60¾ land rasieres answer to 31 English quarters. Each sea rasiere contains 9884 inches, and each land rasiere contains 8786 inches; 17.40 of the former, and 19.57 of the latter, are equal (each) to 10 English

Engliſh quarters. At Dixmude 29.51 raſieres are equal to 10 Engliſh quarters, and each raſiere contains 5821 inches. At Gravelines 21.29 raſieres are equal to 10 Engliſh quarters, and each contains 8080 inches. At Nieuport 16.93 raſieres are equal to 10 Engliſh quarters, and each raſiere contains 10157 cubic inches. At Oſtend 16.02 raſieres are equal to 10 Engliſh quarters, and each of them contains 10733 inches. At St. Omer 21.77 raſieres = 10 Engliſh quarters, and each contains 7900 cubic inches. At Liſle or Lille, the raſiere is divided into 8 parts; of theſe there are two ſorts, one, uſed for wheat or rye, the other, called raſiere de Mars, for oats or beans; 38 of the former, and 40 of the latter, are reckoned for one laſt. The raſiere of wheat weighs about 128lbs., and 41 of theſe are equal to 19 ſetiers, Paris meaſure, or about $10\frac{1}{3}$ Engliſh quarters; 39.64 raſieres of Liſle are equal to 10 Engliſh quarters, and each contains 4339 cubic inches.

RASILIS ÆRUGO, in the *Materia Medica of the Ancients*, one of their kinds of verdigris. It was prepared in the following manner; they ſet ſome ſharp vinegar over the fire in a ſtrong earthen veſſel, and covered it with a braſs pot inverted, well cleaned, and without any vent-hole. And after ſome time the veſſels were to be ſeparated; and the verdigris, which was found concreted on the inſide of the braſs pot, was ſcraped off, and put up for uſe.

RASILITA, in *Geography*, a town of Italy, in Friuli; 26 miles S.S.E. of Friuli.

RASIN, a town of Hindooſtan, in Dowlatabad; 18 miles W.S.W. of Carmullah.

RASINTA, a town of Italy, in Friuli; 14 miles N. of Udina.

RASKOW, a town of Poland, in the palatinate of Braclaw; 54 miles S. of Braclaw.

RASMAN, an iſland in the Red ſea. N. lat. 13° 58′.

RASMEND, a mountain of Perſia, in the province of Irak; 60 miles N.E. of Nehavend.

RASNO, an iſland in the Adriatic. N. lat. 44° 6′. E. long. 15° 25′.

RASO, or Ell of Turin, in *Commerce*, is equal to $2\frac{2}{5}$ Genoeſe palmi, or $23\frac{1}{5}$ Engliſh inches; the foot 143.2 French lines, or $3\frac{4}{11}$ Engliſh inches; hence 180 Piedmonteſe raſi are equal to 119 Engliſh yards, and 33 Piedmonteſe feet = 35 Engliſh feet. At Cagliari, 166.7 raſi = 100 Engliſh yards, and each of them equal to 21.6 Engliſh inches. At Chamberry 158.5 raſi = 100 Engliſh yards, and each = 22.7 Engliſh inches. At Nice, 166.7 raſi = 100 Engliſh yards, and each = 21.6 Engliſh inches; 154.5 raſi of Turin = 100 Engliſh yards, and each = 23.3 Engliſh inches.

RASP, a coarſe ſort of file.

RASPACH, in *Geography*, a town of Auſtria; eight miles E. of Zwetl.

RASPATORIUM, (from *rado*, to ſcrape,) a ſurgical inſtrument with which the perioſteum was, by the old practitioners, ſcraped from the bones, and the bones themſelves ſometimes raſped.

RASPBERRY BUSH, in *Botany*. See RUBUS.

For the dietetic and medicinal uſe of raſpberries, ſee SUMMER *Fruits*.

RASPECON, in *Ichthyology*, a name given by ſome to the uranoſcope, or ſtar-gazer.

RASPENBURG, in *Geography*, a town of Germany, in the principality of Weimar, near which are ſome medicinal ſprings; 12 miles N. of Weimar. N. lat. 51° 13′. E. long. 11° 35′.

RASPHUYS, or *Raſp-houſe*, a celebrated work-houſe, or houſe of correction, at Amſterdam. See WORK-*houſe*.

RASPUGLY, in *Geography*, a town of Bengal; four miles S. of Calcutta.

RASSADES, a cluſter of ſmall iſlands, in the river St. Lawrence. N. lat. 48° 15′. W. long. 68° 48′.

RASSAGU, one of the Kurile or Kurilſkoy iſlands, lying 40 verſts from Mutova, and in extent about 30 verſts meaſured either way. It has lofty mountains and ſteep rocky ſhores, with very few ſandy bogs. On the mountains, here and there, is a good foreſt of birch, alders, and the nut-bearing pine; the vales and flats abound in herbs. On the land is no other animal beſides the fox, but the cliffs of the rock afford neſting-places for all kinds of ſea-birds; and the beavers and ſeals lie ſcattered on ſeveral parts of the ſtrand. Here are no ſtreams that yield fiſh. The Kurils on this iſland are not numerous, and ſome of them are baptized. N. lat. 48° 20′. E. long. 154° 14′.

RASSE CORONDE, in *Natural Hiſtory*, a name given by the Ceyloneſe to a peculiarly fine kind of cinnamon, which is the bark of a tree, growing no where but in that iſland. The name they give it ſignifies *ſharp* or *biting cinnamon.* This choice kind was formerly exported annually, in conſiderable quantity, by the Dutch Eaſt India company, who prohibited the mixing any other kind of cinnamon with it, under a very ſevere penalty. Phil. Tranſ. N° 409.

RASSOOLPOUR, in *Geography*, a town of Hindooſtan, in the circar of Nagore; 22 miles N.W. of Didwana.—Alſo, a town of Hindooſtan, in the circar of Gohud, on the Jumnah; 40 miles E. of Gohud.

RASSOVAT, or AXIOPOLI, a town of European Turkey, in Bulgaria; 24 miles N. of Driſtra. N. lat. 44° 25′. E. long. 27° 37′.

RASTADT, a town of the duchy of Baden, ſituated on a large plain on the river Merg; the town is new, and regularly built, and the principal ſtreet is broad and handſome; 16 miles S.W. of Durlach. N. lat. 48° 52′. E. long. 8° 15′.—Alſo, a town of Bavaria, in the biſhopric of Bamberg; five miles N.W. of Bamberg.—Alſo, a town of the duchy of Wurzburg; three miles S. of Melrichſtadt.

RASTAGARA, a town of Egypt; 90 miles E. of Cairo.

RASTEDE, a town of Germany, in the country of Oldenburg; 11 miles N. of Oldenburg.

RASTENBURG, a town of Pruſſia, in the province of Natangen, founded in 1329, and after having been deſtroyed by the Lithuanians in 1348, was rebuilt, together with its caſtle, and put into a better ſtate of defence; it is encloſed by a wall, and, in 1669, ſurrounded by a rampart. The burghers, moſt of whom are Lutherans, are about 200. The inhabitants derive their ſubſiſtence from a little commerce, brewing, agriculture, and mechanic trades; 46 miles S.E. of Königſberg. N. lat. 53° 58′. E. long. 21° 27′.

RASTICO HARBOUR, *Grand*, a bay in the gulf of St. Lawrence, on the N. coaſt of the iſland of St. John. N. lat. 46° 25′. W. long. 62° 50′.

RASTORFF, a town of Auſtria; ſeven miles E. of Ehrnſprunn.

RASTOWICA, a river of Poland, which runs into the Drieper, on the borders of Ruſſia.

RASURA, a word uſed by the pharmaceutic writers to expreſs the ſhavings of woods, or other hard ſubſtances, to make them readily yield their virtues by decoction. Phyſicians alſo uſe it to expreſs the corroſion of acrid humours.

RASURE *in a Deed*, in *Law*. See DEED.

RASZNA, in *Geography*, a town of Servia; 24 miles N. of Niſſa.

RAT, in *Zoology*. See MUS.

It has been obferved that this country was formerly infefted with two kinds of rats, the *houfe*-rat and the *water*-rat; but that it is believed that the latter, within this laft half century, has deftroyed the former. This is probably, however, only imaginary, fince it is well known that the houfe-rats are frequently brought, in great abundance, into the different fea-ports of the kingdom, in corn, and other veffels. It feems not improbable, but that thefe different varieties of rats may intercopulate, and by that means the latter become houfe-rats, as there is confiderable diverfity in the colours of the houfe-rats, fome approaching to nearly black, which is the natural colour of the water-rat, while the genuine houfe-rat is always of a darkifh or dapple brown. In their habits they have fome circumftances in which they agree, as in that of making burrows in the ground; but the water-rat is capable of living much in the water, and of feeding on fifh and other aquatic animals, while the houfe-rat moftly lives upon grain, and other produce of that kind. The water-rats are alfo faid, by Dr. Darwin, to eat the foliage as well as the feeds and fruits of vegetables, as he has feen a young rat of this kind devour a large leaf of the water-plantain (alifma plantago). They likewife, as well as the houfe-rats, are deftructive of young animals, fuch as ducklings, goflings, chickens, and rabbits. But the great mifchief which the water-rats produce, is in feeding on, and deftroying, the roots of a great variety of vegetables, in their innumerable burrows. The above writer remembers to have feen fome new-planted apple-trees taken out of the ground with nearly the whole of their fmaller roots eaten, and the larger ones peeled by them. With the houfe kind, they are, likewife, extremely deftructive of the food of poultry, and fwine, and of courfe are highly detrimental near waters. It is remarked by the above able writer, that as thefe animals, like the dog, are of a lafcivious nature, and, as fome materials have a ftrong fcent, refembling, perhaps, that of their venereal orgafm, they are liable to be attracted by fuch fmells, as dogs are, on the fame account, he fuppofes, inclined to roll themfelves in putrid carrion; and male cats to eat marum valerian, and cat-mint. It is of this principle that rat-catchers avail themfelves, and by indulging the propenfity, deceive them to their deftruction, by blending with their favourite foods different ftrong-fcented fubftances, fuch as the effential oil of rhodium, or mufk, with the poifonous powders of ftrychnos nux vomica, or of delphinium ftavifagria, or perhaps of arfenic.

The firft ftep taken by rat-catchers, in order to clear a houfe, &c. of thofe vermin, is to allure them all together, to one proper place, before they attempt to deftroy them; for there is fuch an inftinctive caution in thefe animals, accompanied with a furprifing fagacity in difcovering any caufe of danger, that if any of them be hurt, or purfued, in an unufual manner, the reft take the alarm, and become fo fhy and wary, that they elude all the devices and ftratagems of their purfuers for fome time after. The place where the rats are to be affembled, fhould be fome clofet, or fmall room, into which all the openings, but one or two, may be fecured; and this place fhould be, as near as may be, in the middle of the houfe, or buildings. It is the practice, therefore, to attempt to bring them all together in fome fuch place before any attempt be made to take them; and even then to avoid any violence, hurt, or fright to them, before the whole be in the power of the operator. In refpect to the means ufed to allure them to one place, they are various; one of thofe moft eafily and efficacioufly practifed is the trailing fome piece of their moft favourite food, which fhould be of the kind that has the ftrongeft fcent, fuch as toafted cheefe, or broiled red-herring, from the holes or entrances to their acceffes in every part of the houfe, or contiguous buildings, whence it is intended to allure them. At the extremities, and in different parts of the courfe of this trailed tract, fmall quantities of meal, or any other kind of their food, fhould be laid, to bring the greater number into the tracks, and to encourage them to purfue it to the centre place, where they are intended to be taken; at that place, where time admits of it, a more plentiful repaft is laid for them, and the trailing repeated for two or three nights. But befides this trailing, and way-baiting, fome of the moft expert of the rat-catchers have a fhorter, and, perhaps, more effectual method of bringing them together, which is, the calling them, by making fuch a kind of whiftling noife as refembles their own call, and by this means, with the affiftance of the way-baits, they call them out of their holes, and lead them to the repaft prepared for them at the place defigned for taking them. But this is much more difficult to be practifed than the art of trailing; for the learning the exact notes, or cries, of any kind of beafts or birds, fo as to deceive them, is a peculiar talent, not eafily attained to in other cafes.

And in practifing either of thefe methods great caution muft be ufed by the operator to fupprefs, and prevent, the fcent of his feet and body from being perceived; which is done by overpowering that fcent by others of a ftronger nature. In order to this the feet are to be covered with cloths rubbed over with affafœtida, or other ftrong fmelling fubftances; and even oil of rhodium is fometimes ufed for this purpofe, but fparingly, on account of its dearnefs, though it has a very alluring, as well as difguifing effect. If this caution of avoiding the fcent of the operator's feet, near the track, and in the place where the rats are propofed to be collected, be not properly obferved, it will very much obftruct the fuccefs of the attempt to take them; for they are very fhy of coming where the fcent of human feet lies very frefh, and intimates, to their fagacious inftinct, the prefence of human creatures, whom they naturally dread. To the above-mentioned means of alluring by trailing, way-baiting, and calling, is added another of very material efficacy, which is the ufe of oil of rhodium, which, like the marum fyriacum in the cafe of cats, has a very extraordinary fafcinating power on thefe animals. The oil is extremely dear, and therefore very fparingly ufed. It is exhaled in a fmall quantity in the place, and at the entrance of it, where the rats are intended to be taken, particularly at the time when they are to be laft brought together in order to their deftruction; and it is ufed alfo, by fmearing it on the furface of fome of the implements ufed in taking them, by the method before defcribed, and the effect it has in taking off their caution and dread, by the delight they appear to have in it, is very extraordinary.

It is ufual, likewife, for the operator to difguife his figure as well as fcent, which is done by putting on a fort of gown or cloak, of one colour, that hides the natural form, and makes him appear like a poft, or fuch inanimate thing; which habit muft likewife be fcented as above, to overpower the fmell of his perfon; and befides this he is to avoid all motion, till he has fecured his point of having all the rats in his power. When the rats are thus enticed and collected, where time is afforded, and the whole in any houfe or out-buildings are intended to be cleared away, they are fuffered to regale on what they moft like, which is ready prepared for them; and then to go away quietly for two or three nights; by which means thofe which are not allured the firft night are brought afterwards, either by their fellows, or the effects of the trailing, &c. and will not fail to come duly again, if they are not disturbed or molested. But many of the rat-catchers make shorter work, and content themselves with what can be brought together in one night or two; but this is never effectual, unless where the building is small and entire, and the rats but few in number.

With respect to the means of taking them when they are brought together, they are various. Some entice them into a very large bag, the mouth of which is sufficiently capacious to cover nearly the whole floor of the place where they are collected; which is done by smearing some vessel, placed in the middle of the bag, with oil of rhodium, and laying in the bag baits of proper food. This bag, which before laid flat on the ground, with the mouth spread open, is to be suddenly closed when the rats are all in it. Others drive or frighten them, by slight noises or motions, into a bag of a long form, the mouth of which, after all the rats are come in, is drawn up to the opening of the place by which they entered, all other ways of retreat being secured. Others, again, intoxicate or poison them, by mixing with the repast prepared for them the cocculus indicus, or the nux vomica. A receipt for this purpose has appeared, which directs four ounces of cocculus indicus, with twelve ounces of oatmeal, and two ounces of treacle or honey, to be made up into a moist paste with strong beer; but if the nux vomica be used, a much less proportion will serve than is here given of the cocculus. Any similar composition of these drugs, with that kind of food the rats are most fond of, and which has a strong flavour, to hide that of the drugs, will equally well answer the end. If, indeed, the cocculus indicus be well powdered, and infused in strong beer for some time, at least, half the quantity here directed will serve as well as the quantity before mentioned. When the rats appear to be thoroughly intoxicated with the cocculus, or sick with the nux vomica, they may be taken with the hand, and put into a bag or cage, the door of the place being first drawn to, lest those which have strength and sense remaining should escape. By these methods, when well conducted, a very considerable part of the rats in a farm, or other house, and the contiguous buildings, may be taken and destroyed. But various other methods have been practised.

In the Transactions of the Bath Agricultural Society, the following compositions are advised for destroying these mischievous creatures, and which are stated to have been attended with great success. First, to a quart of oatmeal, add six drops of oil of rhodium, one grain of musk, and two or three of the nuts of nux vomica finely powdered; make them into pellets, and put them into the rat-holes. This, it is said, was at first greedily eaten, and did great execution; but the wise animals, after a time, ceased to eat it. Secondly; this consisted of three parts of oatmeal and one of stave's-acre, mixed well into a paste with honey. Pieces of this paste were laid in their holes, and again did great execution. Thirdly; this is a method of destroying them by laying a large box down on its front side, with the lid supported open by a string over a pulley; and by trailing toasted cheese and a red-herring from their holes to this box, and placing oatmeal and other food in it, which they are for a few nights to be permitted to eat unmolested; and finally to watch them by moon-light, the inside of the box being painted white; and, when many of them are seen, to let down the lid; by which contrivance sixty of them are stated to have been taken at one time.

But though the usual ways of destroying rats are by traps and poison, Mr. Forsyth advises never to use arsenic, or corrosive sublimate, for that purpose, except under particular circumstances, as they are deadly poisons: nux vomica will, he thinks, generally answer the end as well, without the danger. He suggests it as a very good plan, to prevent accidents, to enclose the traps in cases, having holes in the ends of them large enough to admit rats, but small enough to exclude dogs, cats, &c. And that, as a bait for rat-traps, the following composition may be made use of with advantage. Take a pound of good flour, three ounces of treacle, and six drops of the oil of carraways: put them all in a dish; and rub them well together till they are properly mixed: then add a pound of crumb of bread. The traps baited with this mixture should be set as near their haunts as possible; but, for two or three days, so as not to fall or strike on the rats going in, but letting them have free liberty to go in and out at pleasure, as this makes them fearless. Some of the bait should also, he thinks, be laid at the rat-holes, and a little of it scattered quite up to the traps, and so on to the bridge of each trap, where a handful may be placed. It may also, he thinks, be proper to scent the traps with the following mixture, for the purpose of enticing the rats into them. Take twenty drops of the oil of rhodium, six or seven grains of musk, and half an ounce of oil of aniseed; put them in a small phial, and shake it well before using; then dip a piece of twisted paper or rag in the mixture, and rub each end of the trap with it, if a box trap, and put two or three drops on the bridge, leaving the paper or rag in the trap. Of whatever kind the trap is, it should be scented; but once in a twelvemonth will be sufficient. Then throw some chaff mixed with a little wheat about the bottom of the trap, in order to deceive the rats; for they are very sagacious, and will not enter a suspicious place. This will be necessary to be done only at the first time of setting the traps; for, after some rats have been caught and have watered and dunged in them, rats will enter boldly when they find others have been there before them: do not, therefore, wash or clean out the trap, as some people do before they set it again, but let the dung and urine remain in it. Keep the places where the traps are set as private as possible; and when they are set for catching, mix no bread with the bait, as the rats will, in that case be apt, to carry it away.

And it is useful, this writer remarks, when the holes are found quiet, and that no rats use them, to stop them up with the following composition. Take a pint of common tar, half an ounce of pearl-ashes, an ounce of oil of vitriol, and a good handful of common salt, mix them all well together in an old pan or pot. Take some pieces of paper, and lay some of the above mixture very thick on them; then stop the holes well up with them, and build up the mouth of the holes with brick or stone, and mortar; if this be properly done, rats will, he asserts, no more approach these while either smell or taste remains in the composition.

But with a view to destroy rats in places where traps cannot be set, it is recommended to take a quart of the above bait, then to rasp into it three nuts of nux vomica, and add a quarter of a pound of crumb of bread, if there was none before; mix them all well together, and lay it into the mouth of their holes, and in different places where they frequent; but first give them of the bait without nux vomica, for three or four succeeding nights; and when they find it agrees with them, they will eat that mixed with the nut with greediness.

However, as it is frequently found that rats are very troublesome in sewers and drains, in such cases arsenic may be used with success in the following manner. Take some dead rats, and having put some white arsenic, finely powdered, into an old pepper-box, shake a quantity of it

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on the fore-parts of the dead rats, and put them down the holes, or avenues, by the fides of the fewers at which they come in; this puts a ftop to the live ones coming any further: for when they perceive the arfenic, they will retire immediately; whereas, if they were put down without the arfenic, the live ones would eat them.

It is by means of arfenic, notwithftanding the above obfervations, that the moft certain method of deftroying thefe troublefome vermin, (provided they can be made to eat it,) takes place; which we have found to anfwer beft, when it is prepared by being finely levigated, and mixed up with very ftrong old cheefe and oatmeal.

In a note in the Agricultural Survey of Lancafhire, it is ftated, that it is greatly to be lamented that Mr. Heathcote's method of deftroying rats and mice is not generally known and practifed; if it were, there would be a total extirpation of thofe obnoxious and deftructive animals; for in one night he totally deftroys them (where he is employed), be they ever fo numerous, as can be well attefted by hundreds in the neighbourhood of Ormfkirk, who have employed him. And it is added, that the compofition he makes ufe of he puts in their holes and burrows, and from the fmall quantity he ufes, it is aftonifhing it fhould have fuch an effect: it will keep good two years. It is alfo ftated, that a farmer recommends, for the deftruction of rats, one ounce of pounded quick-lime to four ounces of tallow cake, to be beaten together and made into balls, and placed in their runs, which has cleared many buildings. But it has been proved by experience, is is faid, that an ounce of aerated barytes finely powdered, mixed with the tallow, in place of lime, is more effectual. And it has been remarked by the author of Phytologia, with the view of deftroying the water-rats, that they poffefs fome kind of ingenuity fimilar to the beaver in the conftruction of their houfes near the brinks of rivers and pools; which have two apertures, one above ground amongft the grafs, and the other beneath the furface of the water; and unlefs they can hide their upper opening amid weeds, or grafs, they forfake the fituation. Thus, if a rim, three or four feet in breadth, round a fifh-pond be kept fo low as to rife only two, three, or four inches above the level of the water; and if this be kept clean from high grafs or weeds, the rats will defert the pond.

But after all, it is probable that this highly deftructive animal, and great peft to the farmer, might be moft readily exterminated by parifhes uniting for the purpofe, and raifing certain fums of money to be applied in this way, under the direction of a proper perfon who is fully acquainted with the bufinefs.

In many grain and other diftricts in the kingdom thefe animals prevail very much, efpecially the grey kind, particularly in all thofe where there are no regular raifed ftaddles or ftands for the grain ftacks to reft upon, which is the cafe in a great number. The mifchief, injury, and deftruction of grain which is produced in this way, is fcarcely to be calculated; and they are befides very mifchievous, troublefome, and inconvenient in feveral others; fo that they fhould be every where extirpated as much as poffible. And in corn tracts, ftands or ftaddles fhould every where be provided in order to prevent mifchief being done by them. See Vermin, and Stand, *Corn*.

Rat, *Beaver*. See Mus *Coypus*.

Rat, *Black*. See Mus *Rattus*.

Rat, *Blind*. See Mus *Typhlus*.

Rat, *Field*. See Mus *Silvaticus*.

Rat *Mole*. See Mus.

Rat, *Mountain*. See Marmot *Talpinus*, &c.

Rat, *Mufk*. See Mus *Zibethicus*.

Rat, *Norway* or *brown*, *mus Norwegicus*, (*Mus decumanus*) is a rat whofe head, back, and fides are of a light brown colour, mixed with tawny and afh-colour; the breaft and belly are of a dirty white; the feet naked, and of a dirty flefh-colour; the fore-feet are furnifhed with four toes, and a claw inftead of the fifth: the length from the nofe to the tail is nine inches, and the tail is of the fame length. This animal is more ftrongly made than the common black rat, or *mus rattus*.

This fpecies of rat, which is the fame animal that is called in the Eaft Indies a *bondicote*, now inhabits moft parts of Europe; whither it is fuppofed to have been brought within the laft century, in fome of the India fhips. It came into Great Britain about 70 or 80 years ago, but has not been known in the neighbourhood of Paris above half that time. They fwarm in Peterfburg, and are known in Pruffia; but have not yet reached the oppofite fide of the Baltic, as Linnæus takes no notice of this fpecies. Thefe were probably the *mures Cafpii* of Ælian, which made periodical vifits in great multitudes to the countries bordering on the Cafpian fea, fwimming boldly over the rivers, holding by one another's tail. (Ælian. Hift. An. 17. cap. 17.) They burrow, like the water rat, on the fides of ponds and ditches; fwim and dive well; live on grain and fruits, but will deftroy poultry and game; increafe faft, producing from fourteen to eighteen young at a time; are very bold and fierce; will turn, when clofely purfued, and faften on the ftick or hand that offers to ftrike them: they have deftroyed the common black rat in moft places: they inhabit the fields part of the year, but migrate in great numbers into houfes, and do much mifchief. The bite of thefe rats is not only fevere but dangerous; the wound being immediately attended with a great fwelling, and healing very flowly. Pennant. See Mus *Decumanus*.

Rat, *Norway*, is alfo a name given by fome writers to the lemming, or fable moufe. See Mus *Lemmus*, and *Sable* Mouse.

Rat, *Water*. See Mus *Amphibius*.

Rat, in the *Sea Language*, is ufed to exprefs a part of the fea, where there are rapid and dangerous currents, or counter-currents.

Rat-*Goofe*, in *Ornithology*, the name of a fmall fpecies of wild goofe, common in fome of the northern counties of England.

Rat-*Tails*, in the *Manege*. See Arrets.

Rat-*Tailed*. A horfe is thus called that has no hair upon his tail.

Rat-*Tailed Worms*, in *Natural Hiftory*, a fpecies of flyworms with long tails, refembling thofe of rats, whence they have their name. They are of feveral fizes, and found alfo in different places, but all change into two-winged flies, having very much the refemblance of bees, and commonly called *bee-flies*. See Drone-*Fly*.

Rat, *Cape*, in *Geography*, a cape of Africa, in the Red fea. N. lat. 14° 55'.

Rat *Ifland*, a fmall ifland in Milford Haven.—Alfo, an ifland in the Red fea. N. lat. 14° 55'.—Alfo, a fmall ifland in the Eaft Indian fea, near the W. coaft of Sumatra. S. lat. 3° 57'. E. long. 101° 55'.—Alfo, a fmall ifland in the Mergui Archipelago, S.W. of Olive ifland.

RATA *pro* Rata. See Pro *rata*.

Onerando pro Rata portionis. See Onerando.

RATAFIA, a fine fpirituous liquor, prepared from the kernels, &c. of feveral kinds of fruits, particularly of cherries and apricots.

Ratafia of cherries is prepared by bruifing the cherries, and putting them into a veffel in which brandy has been long kept;

kept; then adding to them the kernels of cherries, with ſtrawberries, ſugar, cinnamon, white pepper, nutmegs, cloves; and to twenty pounds of cherries, ten quarts of brandy. The veſſel is left open ten or twelve days, and then ſtopped cloſe for two months before it be tapped.

Ratafia of apricots is prepared two ways; *viz.* either by boiling the apricots in white wine, adding to the liquor an equal quantity of brandy, with ſugar, cinnamon, mace, and the kernels of apricots; infuſing the whole for eight or ten days; then ſtraining the liquor, and putting it up for uſe: or elſe by infuſing the apricots, cut in pieces, in brandy, for a day or two; paſſing it through a ſtraining-bag, and then putting in the uſual ingredients.

RATAN, in *Geography*, a ſmall iſland on the W. ſide of the gulf of Bothnia. N. lat. 63° 58′. E. long 20° 39′.

RATCH, or RASH, in *Clock Work*, a ſort of wheel having twelve fangs, which ſerve to lift up the detents every hour, to make the clock ſtrike.

RATCHETS, in a *Watch*, are the ſmall teeth at the bottom of the fuſee, or barrel, which ſtop it in winding up.

RATCHIN LOPA, in *Geography*, a large lake of Thibet. N. lat. 30° 43′. E. long. 82° 27′.

RATCLIFF, a town of America, in Maryland; 22 miles S. of Saliſbury.

RATE, a ſtandard or proportion, by which either the quantity or value of a thing is adjuſted.

The rates of bread, &c. in London, are fixed by authority. See *Aſſiſe of* BREAD.

The rate of intereſt, as now eſtabliſhed by law in England, is five *per cent.* The rate of intereſt in Italy, is three *per cent.*; in Sweden, ſix; in France, five; in Spain, ten; in Barbadoes, ten; in Ireland, twelve; in Turkey, twenty. Low rates of intereſt advance the prices of land.

The rates or fares of hackney-coachmen, chairmen, and watermen, are fixed by act of parliament. See *Hackney* COACHES, &c.

The rates of exchange, factorſhip, &c. are different. See EXCHANGE, FACTORAGE, &c.

RATE *of a Ship of War*, is its order, degree, or diſtinction, as to magnitude, burden, force, &c.

The Britiſh fleet is accordingly diſtributed into ſix rates, excluſive of the inferior veſſels that uſually attend on naval armaments; as ſloops of war, armed ſhips, bomb-ketches, fire-ſhips, and cutters or ſchooners, commanded by lieutenants.

Ships of the *firſt* rate mount a hundred cannon, and ſome more, having forty-two-pounders on the lower deck, twenty-four-pounders on the middle deck, twelve-pounders on the upper deck, and ſix-pounders on the quarter-deck and forecaſtle. They are manned with eight hundred and fifty men, including their officers, ſeamen, marines, and ſervants.

In general, the ſhips of every rate, beſides the captain, have the maſter, the boatſwain, the gunner, the chaplain, the purſer, the ſurgeon, and the carpenter; all of whom, except the chaplain, have their mates or aſſiſtants, in which are comprehended the ſail-maker, the maſter at arms, the armourer, the captain's clerk, the gunſmith, &c. The number of other officers is always in proportion to the rate of the ſhip. Thus, a firſt rate has ſix lieutenants, ſix maſter's mates, twenty-four midſhipmen, and five ſurgeon's mates, who are conſidered as gentlemen; beſides the following petty officers: quarter-maſters, and their mates, fourteen; boatſwain's mates, and yeomen, eight; gunner's mates and aſſiſtants, ſix; quarter-gunners, twenty-five; carpenter's mates, two, beſides fourteen aſſiſtants; with one ſteward, and ſteward's mate to the purſer.

Ships of the *ſecond* rate carry ninety-eight and ninety guns upon three decks; of which thoſe on the lower battery are thirty-two-pounders; thoſe on the middle, eighteen-pounders; on the upper deck, twelve-pounders; and thoſe on the quarter-deck, ſix-pounders, which uſually amount to four or ſix. Their complement of men is ſeven hundred and fifty, in which there are ſix lieutenants, four maſter's mates, twenty-four midſhipmen, and four ſurgeon's mates, fourteen quarter-maſters and their mates, eight boatſwain's mates and yeomen, ſix gunner's mates and yeomen, with twenty-two quarter-gunners, two carpenter's mates, with ten aſſiſtants, and one ſteward and ſteward's mate.

Ships of the *third* rate carry from ſixty-four to eighty cannon, which are thirty-two, eighteen, and nine-pounders. The eighty-gun ſhips, however, begin to loſe their repute, and give way to thoſe of ſeventy-four, ſeventy, &c. which have only two whole batteries; whereas the former have three, with twenty-eight guns planted on each; the cannon of their upper deck being the ſame as thoſe on the quarter-deck and forecaſtle of the latter, which are nine-pounders. The complement in a ſeventy-four is ſix hundred and fifty; and in a ſixty-four, five hundred men: having in peace, four lieutenants, but in war, five, and when an admiral is aboard, ſix. They have three maſter's mates, ſixteen midſhipmen, three ſurgeon's mates, ten quarter-maſters and their mates, ſix boatſwain's mates and yeomen, four gunner's mates and yeomen, with eighteen quarter-gunners, one carpenter's mate with eight aſſiſtants, and one ſteward and ſteward's mate under the purſer.

Ships of the *fourth* rate mount from ſixty to fifty guns, upon two decks and the quarter-deck. The lower tier is compoſed of twenty-four-pounders; the upper tier, of twelve-pounders; and the cannon on the quarter-deck and forecaſtle are ſix-pounders. The complement of a fifty-gun ſhip is three hundred and fifty men, in which there are three lieutenants, two maſter's mates, ten midſhipmen, two ſurgeon's mates, eight quarter-maſters and their mates, four boatſwain's mates and yeomen, one gunner's mate and one yeoman, with twelve quarter-gunners, one carpenter's mate and ſix aſſiſtants, and a ſteward and ſteward's mate.

All veſſels of war under the fourth rate, are uſually comprehended under the general name of frigates, and never appear in the line of battle. They are divided into the *fifth* and *ſixth* rates, the former mounting from forty to thirty-two guns, and the latter from twenty-eight to twenty. The largeſt of the fifth rate have two decks of cannon, the lower battery being of eighteen-pounders, and that of the upper deck of nine-pounders; but thoſe of thirty-ſix and thirty-two guns have only one complete deck of guns, mounting twelve-pounders, beſides the quarter-deck and forecaſtle, which carry ſix-pounders. The complement of a ſhip of forty-four guns is two hundred and eighty men; that of a frigate of thirty-ſix guns, two hundred and forty men. The firſt has three, and the ſecond two lieutenants; and both have two maſter's mates, ſix midſhipmen, two ſurgeon's mates, ſix quarter-maſters and their mates, two boatſwain's mates and one yeoman, one gunner's mate and one yeoman, with ten or eleven quarter-gunners, and one purſer's ſteward.

Frigates of the ſixth rate carry nine-pounders; thoſe of twenty-eight guns having three-pounders on their quarter-deck, with two hundred men for their complement; and thoſe of twenty-four, one hundred and ſixty men: the former has two lieutenants; the latter, one; and both have two maſter's mates, four midſhipmen, one ſurgeon's mate, four quarter-maſters and their mates, one boatſwain's mate and one yeoman, one gunner's mate and one yeoman, with ſix or ſeven quarter-gunners, and one purſer's ſteward.

The

The floops of war carry from eighteen to eight cannon: the largeft of which have fix-pounders; and the fmalleft, *viz.* thofe of eight or ten guns, four-pounders. Their officers are generally the fame as in the fixth rates, with little variation; and their complements of men are from one hundred and twenty to fixty, in proportion to their force or magnitude.

Bomb-veffels are on the fame eftablifhment as floops; but fire-fhips and hofpital-fhips are on that of fifth rates. If the dimenfions of all fhips of the fame rate were equal, it would be eafy to collect them into one point of view in a table; but as there is no invariable rule for the general dimenfions, we fhall felect thofe of fome of a late conftruction in each rate.

		Guns.	Length of the keel.		Length of the lower deck.		Extreme breadth.		Depth in the hold.		Burthen in tons.
Rates.			Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	
1ft	Victory	100	151	3	186	0	51	10	21	6	2162
2d	Barfleur	90	144	$0\frac{3}{4}$	177	6	50	0	21	0	1934
3d	Arrogant	74	138	0	168	3	47	4	19	9	1644
	Europa	64	139	0	159	0	44	4	19	4	1366
4th	Salifbury	50	120	8	146	0	40	4	17	4	1044
5th	Phœnix	44	116	11	140	9	37	$1\frac{3}{8}$	16	0	856
	Venus	36	106	3	128	$4\frac{1}{2}$	35	9	12	4	722
6th	Carysfort	28	97	$3\frac{1}{2}$	118	4	33	8	10	6	586
	Dolphin	24	93	4	113	0	32	1	11	0	511
Sloop	Nautilus	16	80	$7\frac{5}{8}$	98	0	27	2	12	8	316

Ships of one hundred guns, and above, and downwards to fixty-four, are termed fhips of the line.

Ships of the line, fifties, frigates, and royal yatchs, are commanded by poft-captains; floops of war, bombs, fire-fhips, armed fhips, ftore-fhips, and armed *en flute*, under fifty guns, by commanders; fchooners, cutters, &c. by lieutenants; flop-fhips occafionally by mafters; and fmall craft by midfhipmen, who have paffed for lieutenants.

Ships of the fecond rate, and thofe of the third, which have three decks, carry their fails remarkably well, and labour very little at fea. They are excellent in a general action, or in cannonading a fortrefs. Thofe of the third rate, which have two tiers, are fit for the line of battle, to lead the convoys and fquadrons of fhips of war in action; and, in general, to fuit the different exigencies of the naval fervice. The fourth rates may be employed on the fame occafions as the third rates; and may be alfo deftined for fervice among the foreign colonies, or on expeditions of great diftance; fince thefe veffels are ufually excellent for keeping and fuftaining the fea. Veffels of the fifth rate are too weak to fuffer the fhock of a line of battle; but they may be deftined to lead the convoys of merchant fhips, to protect the commerce in the colonies, to cruife in different ftations, to accompany fquadrons, or be fent exprefs with neceffary intelligence and orders. The fame may be obferved of the fixth rates.

The frigates which mount from twenty-eight to thirty-eight guns upon one deck, with the quarter-deck, are extremely proper for cruifing againft privateers, or for fhort expeditions, being light, long, and ufually excellent failers. Falconer.

Rates, *Books of.* See Book and Customs.

Rate, *Poor.* See Poor.

Rate-*Tythe.* When fheep, or other cattle, are kept in a parifh for lefs time than a year, the owner muft pay tythe for them *pro rata*, according to the cuftom of the place.

Rate, in *Geography*, a town of Hindooftan, in Myfore; 25 miles E. of Rattinghery.

RATEEN, or Ratten, in *Commerce*, a thick woollen ftuff, quilled, woven on a loom with four treddles, like ferges, and other ftuffs that have the whale or quilling.

There are fome rateens dreffed and prepared like cloths; others left fimply in the hair; and others where the hair, or knap, is frized.

Rateens are chiefly manufactured in France, Holland, and Italy; and moftly ufed in linings.

The frize is a fort of coarfe rateen; and the drugget is a rateen half linen, half woollen.

RATEL, in *Zoology*, a name given by the Hottentots to an animal inhabiting the Cape of Good Hope, which lives on honey, and is a great enemy to bees: hence called the Viverra *Mellivora:* which fee. It has a blunt black nofe; no external ears, but a fmall rim round the orifice; a rough tongue, fhort legs, very long claws, which are ftraight like thofe of a badger, and guttered beneath: the colour of the forehead, crown, and whole upper part of the body, is a cinereous grey; the cheeks, and fpace round the ears, throat, breaft, belly, and limbs, black; from each ear to the tail extends along the fides a dufky line, leaving beneath another of grey. Its length from the nofe to the tail is forty inches, and the tail twelve.

This animal preys in the evening, and afcends to the higheft parts of the defert to look about; and will then put one foot before its eyes, to prevent the dazzling of the fun. The reafon of its going to an eminence is for the fake of feeing or hearing the honey-guide cuckoo, or cuculus indicator, which lives on bees, and, as it were, conducts it to their haunts. Pennant.

RATENSTADT, in *Geography*, a town of Hungary; 16 miles S.E. of Baes.

RATESPONTE *de Mulher*, a town of Portugal, in the province of Entre Duero e Minho; 15 miles N.E. of Villa de Conde.

RATH, a word ufed in the compofition of names of places in Ireland, as Rathdrum, &c. It fignifies an intrenchment, or fort.

Rath, *ripe*, in *Agriculture*, a term applied to fome early ripe corn crops, and which have a degree of rednefs in the ftraw; fuch as fome varieties of barley, &c.

RATHANGAN, in *Geography*, a poft-town of the county of Kildare, Ireland, fituated on the Athy branch of the Grand Canal; $28\frac{1}{2}$ miles W. from Dublin, and 5 miles N.N.W. from Kildare.

RATHCONRATH, a fmall town of the county of Weftmeath, Ireland, which gives name to a barony. It is 44 miles N. by W. from Dublin, on the road to Lanefborough, and 6 miles W. from Mullingar.

RATHCOOLE, a fmall poft-town of the county of Dublin, Ireland, where fairs are holden for cattle and pedlars' wares. It is on the great fouthern road, $7\frac{3}{4}$ miles S.W. from Dublin.

RATHCORMUCK, a poft-town of the county of Cork, Ireland, which returned two members to the Irifh parliament, before the union. It has gone much to decay, in confequence of the profperity of Fermoy, which is little more than three miles diftant. It is near the river Bride, 111 miles S.W. from Dublin, and $13\frac{1}{2}$ N.E. from Cork.

RATHDOWNY, a poft-town of the Queen's county, Ireland; 59 miles S.W. from Dublin.

RATHDRUM, a poft-town of the county of Wicklow, Ireland, fituated on the river Ovoca. It has a monthly fair

fair for flannels, of which there is a confiderable manufacture. The adjoining country is very interefting, and the Wicklow copper-mines are not far diftant. Rathdrum is 29 miles S. from Dublin.

RATHENAU, or RATEMAO, a town of the middle mark of Brandenburg, on the Havel; 38 miles W. of Berlin. N. lat. 52° 38′. E. long. 12° 30′.

RATHER, or NEITHER, a river of England, which runs into the Lune, four miles N. of Kirkby Lonfdale, in the county of Weftmoreland.

RATHERIUS, in *Biography*, a very learned prelate in the tenth century, commenced his ecclefiaftical career by embracing a monaftic life at the abbey of Lobbes, or Laubes, in Flanders. Here he diftinguifhed himfelf by his abilities and acquirements. In the year 928, after Hilduin had been driven out of the fee of Liege, he accompanied him into Italy; and in 931 he was, by the exprefs order of the pope, put in poffeffion of the fee of Verona. As, however, this was in direct hoftility to the king of the country, he was expofed to much perfecution, and at length banifhed from Italy. After fpending five years in exile, he returned with the hope of regaining his bifhopric: but he was unfuccefsful, and was ordered to withdraw. He obeyed, and retired into Provence: from this place he went to the abbey of Lobbes, where the recollection of the honour, which he had formerly reflected on that eftablifhment, fecured him a welcome reception. Shortly after this, he was fent for by the emperor Otho, who placed him near the perfon of his brother Bruno. This prince, having been made archbifhop of Cologne in the year 953, prefented Ratherius to the bifhopric of Liege; from which, however, he was driven in about two years. As the emperor Otho was at this time in Italy, our prelate made an effort to recover his former fee of Verona. Accordingly he laid his cafe before a fynod affembled at Pavia, which paffed a decree that he fhould be re-eftablifhed in that bifhopric. His peace was foon interrupted by controverfies with the clergy, who could not endure his reproofs of their irregularities and corruptions; till at length they became fo irkfome to him, that he determined to take his final leave of Italy. He accordingly went to France, where he purchafed fome eftates, and obtained the abbies of St. Amand, Aumont, and of Aunay. He died at Namur, about the year 973. His works are numerous, fome of which are inferted in father d'Achery's "Spicilegium." They are faid to afford evident proofs of great fagacity and judgment, while they breathe throughout an ardent love of virtue. They alfo fhew, that he was moft zealous and intrepid in expofing the irregularities and vices of the times, and particularly the corrupt morals of ecclefiaftics. Moreri. Mofheim.

RATHFRILAND, in *Geography*, a poft-town of the county of Down, Ireland. It is fituated on a rifing ground, and has four great ftraight roads leading up to it, and centering in the town. It is on the road to Downpatrick, and much frequented. The neighbourhood abounds with granite of a clofe texture, and fit for building. On the fummit of the hill are the ruins of a caftle, formerly one of the refidences of the Magennifes, lords Iveach. Rathfriland is $57\frac{1}{2}$ miles N. from Dublin, and $7\frac{1}{2}$ miles N.E. from Newry.

RATHKEALE, a poft-town of Ireland, in the county of Limerick. It is fituated on the river Deel, and was formerly a corporation town, and of much more confequence than at prefent. It has feveral fairs, one of which for horfes is much frequented, as are alfo its races. In the reign of queen Elizabeth, it fuftained an attack of the Englifh army. The ruins of a priory, founded by a perfon of the name of Harvey, are ftill remaining. Rathkeale is 108 miles S.W. from Dublin, and 14 miles W.S.W. from Limerick.

RATHLACKEN, a poft-town of the county of Mayo, Ireland, on the fea-coaft, nor far from Rathlacken or Relakin head, and weft of the entrance to Killala bay. It is 132 miles W.N.W. from Dublin, and 5 miles N. from Killala.

RATHLIN, RAGHLIN, or *Raghery*, an ifland fituated between the north coaft of Antrim, in Ireland, and Scotland, and confidered as belonging to the former. It is about five miles in length, and three quarters of a mile in breadth, being bent in an angle towards the middle. This angle lies oppofite to Ballycaftle, and forms a tolerable bay, called Church bay; but in a wefterly wind, though the anchorage is good, few veffels can ride it out, from the fwell along the coaft. The number of plantation acres is about 2000, which fupport a population of about 130 or 140 families, amounting to about 1100 perfons. The cultivated land is kindly enough, and produces excellent barley. But kelp is the great fource of wealth to this ifland, 100 tons of which have been exported from it in one year. The horfes, as well as the fheep, are fmall, but ferviceable; and the black cattle are not large, though they do well when brought to the main land, and better foil. The inhabitants are a fimple, laborious, and honeft race of people, much attached to their own ifland, and regarding Ireland as a foreign country. The monuments of antiquity are fmall tumuli, in one of which, when opened, a ftone coffin was found, befide which an earthen veffel ftood. Within the tumuli lay a confiderable number of human bones, which might have been the remains of more ignoble men than the perfon whofe remains the coffin covered. Brazen fwords and fpear-heads have alfo been found. The remains of a fortrefs are vifible, where Robert Bruce is faid to have defended himfelf for fome time, when obliged to fly from his country. N. lat. 55° 20′. W. long. 6° 6′.

RATHMANSDORF, a town of Silefia, in the principality of Neifs; 4 miles N.N.W. of Weidenau.

RATHOWEN, a poft-town of the county of Weftmeath, Ireland, near the borders of Longford; 48 miles W.N.W. from Dublin.

RATHSCHACH, or RADESCHE, a town of the duchy of Carniola, on the Save; 9 miles W.N.W. of Gurckfeld.

RATHSPRÆSENTGERS, in *Commerce*, filver coins of Aix-la-Chapelle, being double, fingle, or half pieces of 22, 16, and 8 marks. By the affay, the rathfpræfentger is worfe than the Englifh ftandard of 11 oz. 2 dwts., by 4 oz. 2 dwts. Its weight is 4 dwts. $1\frac{1}{2}$ gr.; its content in pure filver 56.9 grs.; and its value in fterling 8*d*. The double of the fame is worfe by 2 oz. 15 dwts.; its weight 6 dwts. $23\frac{1}{4}$ grs.; its content in pure filver 116.3 grs.; and its value in fterling 1 *s*. $4\frac{1}{4}$*d*. This coin bears on one fide an eagle within a circle, marked 16 on his breaft, (32 on the double piece,) and within another circle the legend, REGUM CURIA PRINCIPALIS PRIMA; and next the edge, URBS AQUENSIS. URBS REGALIS. REGNI SEDES: on the other fide, or reverfe, an altar, with two fwords and a crown over it, on the double piece; but on the fingle, a crown and the date within a circle: the legend on both is LOCUS CÆSAREA CORONATIONIS; Cæfar being a general title for the emperor. Kelly's Un. Cambift.

RATI, in *Geography*, a fmall ifland in the Grecian Archipelago, near the S. coaft of Nicaria.

RATIBOR, a town of Silefia, in a principality of its name, on the Oder, which here becomes navigable; 70 miles

miles S.E. of Breflau. N. lat. 50°. E. long. 18° 5′. The principality is bounded N. by the principality of Oppeln, on the E. by Poland, on the S. by Tefchen, and on the W. by the principality of Jagendorf. Its foil is better than that of Oppeln, as it produces a fufficient fupply of wheat, rye, and barley, with fruits; and befides, it has alfo good pafture grounds. Its only river is the Oder, which paffes through its weftern part; but it is abundantly watered in all its parts with ftreams, ponds, and lakes. It contains only three cities, and the inhabitants are univerfally Polifh. It became a principality in 1288, and about 200 years afterward it was united to Oppeln, from which it has never been feparated.

RATIFICATION, Ratificatio, an act, approving of, and confirming, fomething done by another, in our name.

A treaty of peace is never fecure till the princes have ratified it.

All procuration imports a promife of ratifying and approving what is done by the proxy, or procurator: after treating with a procurator, agent, factor, &c. a ratification is frequently neceffary on the part of his principal.

Ratification is particularly ufed, in our *Laws*, for the confirmation of a clerk in a benefice, prebend, &c. formerly given him by the bifhop, &c. where the right of patronage is doubted to be in the king.

Ratification is alfo ufed for an act confirming fomething we ourfelves have done in our own name.

An execution, by a major, of an act paffed in his minority, is equivalent to a ratification.

RATING. See Raiting.

RATINGEN, or Rattingen, in *Geography*, a town of the duchy of Berg; 4 miles N.E. of Duffeldorp. N. lat. 51° 15′. E. long. 6° 47′.

RATINO, a town of Naples, in the county of Molife; 6 miles S.E. of Molife.

RATIO, in *Arithmetic* and *Geometry*, that relation of homogeneous things, which determines the quantity of one from the quantity of another, without the intervention of any third.

The homogeneous things, thus compared, we call *the terms of the ratio;* particularly that referred to the other, we call the *antecedent;* and that to which the other is referred, the *confequent.*

Thus, when we confider one quantity by comparing it with another, to fee what magnitude it has in comparifon of that other; the magnitude this quantity is found to have in comparifon with it, is called the *ratio* of this quantity to that: which fome think would be better expreffed by the word *comparifon.*

Euclid defines ratio by *a mutual relation of two magnitudes of the fame kind in refpect of quantity.* But this definition is found defective; there being other relations of magnitudes which are conftant, yet are not included in the number of ratios: fuch as that of the right fine, to the fine of the complement in trigonometry.

Hobbes endeavoured to improve Euclid's definition of ratio, but without fuccefs: for in defining it, as he does, by *the relation of magnitude to magnitude,* his definition has not only the fame defect with Euclid's, in not determining the particular kind of relation; but it has this farther, that it does not exprefs the kind of magnitudes which may have a ratio to one another.

Ratio is frequently confounded, though very improperly, with *proportion.* Proportion, in effect, is an identity or fimilitude of two ratios.

Thus, if the quantity A be triple the quantity B; the relation of A to B, *i. e.* of 3 to 1, is called the ratio of A to B. If two other quantities, C, D, have the fame ratio to one another that A and B have, *i. e.* be triple one another, this equality of ratio conftitutes *proportion;* and the four quantities A : B :: C : D, are in proportion, or proportional to one another.

So that ratio exifts between two terms; proportion requires more.

There is a twofold comparifon of numbers: by the firft, we find how much they differ, *i. e.* by how many units the antecedent exceeds, or comes fhort of, the confequent.

This difference is called the *arithmetical* ratio, or exponent of the arithmetical relation or habitude of the two numbers. Thus, if 5 and 7 be compared, their arithmetical ratio is 2.

By the fecond comparifon, we find how oft the antecedent contains, or is contained in, the confequent; *i. e.* as before, what part of the greater is equal to the lefs.

This ratio, being common to all quantity, may be called ratio in the general, or by way of eminence: but is ufually called *geometrical* ratio; becaufe expreffed, in geometry, by a line, though it cannot be expreffed by any number.

Modern authors diftinguifh ratio, with regard to quantity in the general, into *rational* and *irrational.*

Ratio, *Rational,* is that which is as one rational number to another; *e. gr.* as 3 to 4.

Ratio, *Irrational,* is that which cannot be expreffed by rational numbers.

Suppofe, for an illuftration, two quantities, A and B; and let A be lefs than B. If A be fubtracted as often as it can be from B, *e. gr.* five times, there will either be left nothing, or fomething. In the former cafe, A will be to B, as 1 to 5; that is, A is contained in B five times; or $A = \frac{1}{5} B$. The ratio here, therefore, is *rational.*

In the latter cafe, either there is fome part, which, being fubtracted certain times from A, *e. gr.* 3 times, and likewife from B, *e. gr.* 7 times, leaves nothing; or there is no fuch part: if the former, A will be to B as 3 to 7, or $A = \frac{3}{7} B$; and therefore the ratio, *rational.* If the latter, the ratio of A to B, *i. e.* what part A is of B, cannot be expreffed by rational numbers; nor any other way than either by lines, or by infinite approaching feries.

The *exponent of a geometrical ratio* is the quotient arifing from the divifion of the antecedent by the confequent. Thus, the exponent of the ratio of 3 to 2, is $1\frac{1}{2}$; that of the ratio of 2 to 3, is $\frac{2}{3}$: for when the lefs term is the antecedent, the ratio, or rather the exponent, is a proper fraction. Hence the fraction $\frac{3}{4} = 3 \div 4$. If the confequent be unity, the antecedent itfelf is the exponent of the ratio: thus, the exponent of 4 to 1, is 4. See Exponent.

If two quantities be compared, without the intervention of a third; either the one is equal to the other, or unequal: hence, the ratio is either of *equality* or *inequality.* If the terms of the ratio be unequal, either the lefs is referred to the greater, or the greater to the lefs: that is, either the lefs to the greater, as a part to the whole, or the greater to the lefs, as the whole to a part. The ratio, therefore, determines how often the lefs is contained in the greater, or how often the greater contains the lefs; *i. e.* to what part of the greater the lefs is equal.

The following diftinctions of ratios are fometimes found in early authors.

The ratio which the greater term has to the lefs, *e. gr.* 6 to 3, is called the *ratio of the greater inequality:* the ratio which the lefs term has to the greater, *e. gr.* 3 to 6, is called the *ratio of the leffer inequality.*

This ratio correfponds to quantity in the general, or is admitted

admitted of by all kinds of quantities, discrete or continued, commensurable or incommensurable: but discrete quantity, or number, does likewise admit of another ratio.

If the less term of a ratio be an aliquot part of the greater, the ratio of the greater inequality is said to be *multiplex*, multiple; and the ratio of the less inequality, *submultiple*.

Particularly, in the first case, if the exponent be 2, the ratio is called *duple*; if 3, *triple*, &c. In the second case, if the exponent be $\frac{1}{2}$, the ratio is called *subduple*; if $\frac{1}{3}$, *subtriple*, &c.

E. gr. 6 to 2 is in a triple ratio; because 6 contains two thrice. On the contrary, 2 to 6 is a subtriple ratio; because 2 is the third part of 6.

If the greater term contains the less once, and over and above an aliquot part of the same; the ratio of the greater inequality is called *superparticularis*, and the ratio of the less *sub-superparticularis*.

Particularly, in the first case, if the exponent be $1\frac{1}{2}$, it is called *sesquialterate*; if $3\frac{1}{3}$, *sesquitertial*, &c. In the other, if the exponent be $\frac{2}{3}$, the ratio is called *subsesquialterate*; if $\frac{3}{4}$, *subsesquitertial*, &c.

E. gr. 3 to 2 is in a sesquialterate ratio; 2 to 3 in a subsesquialterate.

If the greater term contains the less once, and over and above several aliquot parts; the ratio of the greater inequality is called *superpartiens*; that of the less inequality is *subsuperpartiens*.

Particularly, in the former case, if the exponent be $1\frac{2}{3}$, the ratio is called *superbipartiens tertias*; if the exponent be $1\frac{3}{4}$, *supertripartiens quartas*; if $1\frac{4}{7}$, *superquadripartiens septimas*, &c. In the latter case, if the exponent be $\frac{3}{5}$, the ratio is called *subsuperbipartiens tertias*; if $\frac{4}{7}$, *subsupertripartiens quartas*; if $\frac{7}{11}$, *subsuperquadripartiens septimas*.

E. gr. the ratio of 5 to 3 is *superbipartiens tertias*; that of 3 to 5, *subsuperbipartiens tertias*.

If the greater term contains the less several times, and, besides, some quota part of the same; the ratio of the greater inequality is called *multiplex superparticularis*; and the ratio of the less inequality, *submultiplex subsuperparticularis*.

Particularly, in the former case, if the exponent be $2\frac{1}{2}$, the ratio is called *dupla sesquialtera*; if $3\frac{1}{4}$, *tripla sesquiquarta*, &c. In the latter case, if the exponent be $\frac{2}{3}$, the ratio is called *subdupla subsesquialtera*; if $\frac{4}{13}$, *subtripla subsesquiquarta*, &c.

E. gr. the ratio of 16 to 5 is *tripla sesquiquinta*; that of 4 to 9, *subdupla subsesquiquarta*.

Lastly, if the greater term contains the less several times, and several aliquot parts of it besides; the ratio of the greater inequality is called *multiplex superpartiens*; that of the less inequality, *submultiplex subsuperpartiens*.

Particularly, in the former case, if the exponent be $\frac{2}{3}$, the ratio is called *dupla superbipartiens tertias*; if $3\frac{4}{7}$, *tripla superbiquadrapartiens septimas*, &c. In the latter case, if the exponent be $\frac{3}{8}$, the ratio is called *subdupla subsuperbipartiens tertias*; if $\frac{7}{25}$, *subtripla subsuperquadripartiens septimas*, &c.

E. gr. the ratio of 25 to 7 is *tripla superquadripartiens septimas*; that of 3 to 8, *subdupla subsuperbipartiens tertias*.

These are the various kinds of *rational* ratios; the names of which, though they occur but rarely among the modern writers (for in lieu of them they use the smallest terms of the ratios, *e. gr.* for *duple* 2 : 1, for *sesquialterate* 3 : 2); yet are they absolutely necessary to such as converse with the ancient authors.

Clavius observes, that the exponents denominate the ratios of the greater inequality, both in deed and name; but the ratios of the less inequality, only in deed, not in name: but it is easy finding the name in these, if you divide the denominator of the exponent by the numerator.

E. gr. if the exponent be $\frac{5}{8}$, then $5 : 8 = 1\frac{3}{5}$; whence it appears, the ratio is called *subsupertripartiens quintas*. As to the names of irrational ratios, nobody ever attempted them.

Same, or *identic* ratios, are those whose antecedents have an equal respect to their consequents, *i. e.* whose antecedents divided by their consequents, give equal exponents. And hence may the identity of irrational ratios be conceived.

Hence, first, as oft as the antecedent of one ratio contains its consequent, or whatever part it contains of its consequent, so oft, or such part of the other consequent does the antecedent of the other ratio contain: or, as oft as the antecedent of the one is contained in its consequent, so oft is the antecedent of the other contained in its consequent.

Secondly, if A be to B as C to D; then will A : B :: C : D; or A : B = C : D. The former of which is the usual manner of representing the identity of ratios, the latter is that of the excellent Wolfius; which has the advantage of the former, in that the middle character, =, which denotes the sameness, is scientifical; *i. e.* it expresses the relation of the thing represented, which the other, ::, does not. See CHARACTER.

Two *equal* ratios, *e. gr.* B : C = D : E, we have already observed, constitute a proportion: of two *unequal* ratios, *e. gr.* A : B and C : D, we call A : B the *greater*, if A : B > C : D; on the contrary, we call C : D the *lesser*, if C : D > A : B.

Hence, we express a greater and less ratio thus: *e. gr.* 6 to 3 has a greater ratio than 5 to 4; for, 6 : 3 (= 2) > 5 : 4 (= $1\frac{1}{4}$). But 3 to 6 has a less ratio than 4 to 5; for $\frac{3}{6} = \frac{1}{2} > \frac{4}{5}$. Compound ratio is that made up of two or more other ratios, which the factum of the antecedents of two or more ratios has to the factum of their consequents. Thus, 6 to 72 is in a ratio compounded of 2 to 6, and 3 to 12.

Particularly if it be compounded of two, it is called a *duplicate* ratio; if of three, a *triplicate*; if of four, *quadruplicate*; and, in the general, *multiplicate*, if it be composed of several similar ratios. Thus 48 : 3 is a duplicate ratio of 4 : 1 and 12 : 3.

RATIO, *Additive*. See ADDITIVE.

RATIO, *Alternate*. See ALTERNATE.

RATIO, *Ordinate*. See ORDINATE.

RATIO *Modularis* and *Modulus*, were terms introduced into use by Cotes, but more modern authors do not use them always in the same sense: according to Cotes, the modulus in logarithms is that number which connects any system of logarithms with the hyperbolic system, or that number by which the hyperbolic number of a logarithm must be multiplied, or by the reciprocal of which it must be divided, in order to transform it to another system; and this modulus is, therefore, always the reciprocal of the hyperbolic logarithm of the radix of that system to which the modulus belongs.

This is what Cotes calls the modulus, to whom we owe the introduction of the term; and the reciprocal of it he calls the *ratio modularis*: but some modern authors, as Lagrange, &c. use the term modulus to denote the ratio modularis of Cotes.

The modulus of the hyperbolic system is 1, this being the reciprocal of the hyperbolic logarithm of 2.71828182, the radix of this system; and the modulus of the common logarithmic

logarithmic fyftem is .43429448, which is the reciprocal of 2.3025809, the hyperbolic logarithm of 10, the radix of this fyftem.

It is fhewn under the article LOGARITHMS, that

$$\log. a = \frac{(a-1) - \frac{1}{2}(a-1)^2 + \frac{1}{3}(a-1)^3, \&c.}{(r-1) - \frac{1}{2}(r-1)^2 + \frac{1}{3}(r-1)^3, \&c.}$$

where r is the radix, and may be affumed at pleafure, and the reciprocal of this whole denominator is called the modulus. In the hyperbolic fyftem the whole denominator is affumed 1, which makes $r = 2.71828182$; and in the common fyftem r is affumed 10, and the whole feries becomes $= 2.3025809$, which is the reciprocal of the modulus; and fince, in the former cafe, we have

$$\text{hyp. log. } a = (a-1) - \tfrac{1}{2}(a-1)^2 + \tfrac{1}{3}(a-1)^3, \&c.$$

it follows alfo that in any other

$$\text{hyp. log. } r = (r-1) - \tfrac{1}{2}(r-1)^2 + \tfrac{1}{3}(r-1)^3, \&c.$$

whatever be the value of r; therefore, in every fyftem, the modulus is the reciprocal of hyp. log. of the radix. See LOGARITHMS.

RATIO, *Denominator of a.* See DENOMINATOR.

RATIO, *Properties of.*—1. Ratios fimilar to the fame third are alfo fimilar to one another; and thofe fimilar to fimilar, are alfo fimilar to one another.

2. If A : B :: C : D; then, inverfely, B : A :: D : C.

3. Similar parts P and p have the fame ratio to the wholes T and t; and if the wholes have the fame ratio, the parts are fimilar.

4. If A : B :: C : D; then, alternately, A : C :: B : D. And hence, if B = D, A = C; hence, alfo, if A : B :: C : D; and A : F :: C : G; we fhall have B : F :: D : G. Hence, again, if A : B :: C : D; and F : A :: G : C; we fhall have F : B :: G : D.

5. Thofe things which have the fame ratio to the fame, or equal things, are equal; and *vice verfâ.*

6. If you multiply any quantities, as A and B, by the fame, or equal quantities; their products D and E will be to each other as A and B.

7. If you divide any quantities, as A and B, by the fame or equal quantities, the quotients F and G will be to each other as A and B.

8. The exponent of a compound ratio is equal to the factum of the exponents of the fimple ratios.

9. If you divide either the antecedents or the confequents of fimilar ratios, A : B, and C : D, by the fame E; in the former cafe, the quotients F and G will have the fame ratio to the confequents B and D; in the latter, the antecedents A and B will have the fame ratio to the quotients H and K.

10. If there be feveral quantities in the fame continued ratio A, B, C, D, E, &c. the firft A is to the third C, in a *duplicate* ratio; to the fourth D, in a *triplicate;* to the fifth E, in a *quadruplicate,* &c. ratio of the ratio of the firft A, to the fecond B.

11. If there be any feries of quantities in the fame ratio, A, B, C, D, E, F, &c. the ratio of the firft A to the laft F is compounded of the intermediate ratios A : B, B : C, C : D, D : E, E : F, &c.

12. Ratios compounded of ratios, of which each is equal to each other, are equal among themfelves. Thus the ratios 90 : 3 :: 960 : 32, compounded of 6 : 3 :: 4 : 2, and 3 : 1.:: 12 : 4; and 5 : 1 :: 20 : 4.

For other properties of fimilar or equal ratios, fee PROPORTION.

RATIOS, *Reduction of.*—It is obvious that there is a variety of cafes in which the real ratio of two quantities may be expreffed in terms too great to be applied to any ufeful purpofe; of which we have an example in the conftruction of planetariums, and fimilar aftronomical inftruments. The ratios of the times in which the feveral planets perform their fidereal revolutions, are expreffed in very large numbers, far exceeding the number of teeth that can be introduced into the machinery of a planetarium; and it, therefore, becomes neceffary to find fmaller numbers, which, though they do not exprefs the true ratio, may approximate as near to the truth as the ftate of the cafe will admit. Another inftance, in which a reduction of the ratio of large numbers to others expreffed in lower terms becomes neceffary, occurs in the calendar; for, according to the common reckoning, the year is fuppofed to be 365 days, whereas it is known to be nearly 365 days 6 hours; it, therefore, becomes neceffary to have fome means of expreffing the ratio between the true and the affumed length of the years, in order that, by a proper intercalation, we may preferve an uniformity in the feafons, with reference to the months, as we fhould otherwife find the fhorteft day transferred to the middle of June, and the longeft to the month of December.

This reduction of ratios is beft performed by means of *continued* FRACTIONS, of which a fketch is given under that article, as alfo under the article INDETERMINATE *Analyfis,* but which we fhall probably treat at greater length in a fupplement to the prefent work, on which account it is not our intention to enter much into the rationale of the theory in this place, but merely to ftate the rules by which the required reduction is to be performed.

To reduce a ratio expreffed in large numbers, to others nearly equivalent, but reprefented in fimpler terms.

Rule 1.—Divide the greater of the two numbers by the lefs; then the divifor by the remainder, and fo on, as in finding the greateft common meafure of two numbers, and referve the feveral quotients, which may be denoted by $a, b, c, d,$ &c.

2. Write down the feveral quotients, thus; $a, b, c, d, e,$ &c. from which the feries of converging fractions or ratios will be derived as follows; *viz.* the firft fraction will have unity for its numerator, and the firft quotient, a, for its denominator; the fecond will have the fecond term, b, for its numerator, and for its denominator $a b + 1$; and the numerators of all the fucceeding fractions will be found, by multiplying the numerator laft obtained, by the fucceeding quotient in the above feries, and adding to the product the preceding numerator. And the denominators are obtained by precifely the fame rule, merely changing the word numerator into denominator.

In this rule we have fuppofed the ratio to be lefs than 1, or the numerator lefs than the denominator; if the denominator be lefs than the numerator, it muft be reverfed, making the numerator what we have called the denominator, and the denominator the numerator.

The laft fraction of this feries will be the fame as the original fraction propofed, and the others will be fo many approximate or converging fractions, each of which will approach nearer to the original fraction than the preceding one, and nearer than any other fraction whofe terms are not expreffed by greater numbers. This rule may be exhibited analytically as follows:

Let $\frac{A}{B}$ be the propofed fraction, and $a, b, c,$ &c. the quotients obtained by the divifions as above, then the converging

verging fractions will be $\frac{1}{a}$, $\frac{b}{ab+1}$, $\frac{bc+1}{(ab+1)c+a}$, $\frac{(bc+1)d+b}{[(ab+1)c+a].d+ab+1}$, &c. which will be found to agree with the preceding rule; and these fractions will be alternately greater and less than that proposed, which will be the last of the series.

Let us illustrate this rule by an example. Required a series of converging fractions towards $\frac{314159}{100000}$, which is the fraction commonly employed for expressing the ratio of the diameter to the circumference of a circle.

Operation by Division.

$$
\begin{array}{l}
100000)314159(3 = a \\
\quad 300000 \\
\quad\quad 14159)100000(7 = b \\
\quad\quad\quad 99113 \\
\quad\quad\quad\quad 887)14159(15 = c \\
\quad\quad\quad\quad\quad 13305 \\
\quad\quad\quad\quad\quad\quad 854)887(1 = d \\
\quad\quad\quad\quad\quad\quad\quad 854 \\
\quad\quad\quad\quad\quad\quad\quad\quad 33)854(25 = e \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad 825 \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 29)33(1 = f \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 29 \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 4)29(7 = g \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 28 \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 1)4(4 = h \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 4 \\
\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 0
\end{array}
$$

Having thus obtained our quotients, the several fractions will be easily formed by the preceding rule; thus,

$$
\begin{array}{cccccccc}
3 & 7 & 15 & 1 & 25 & 1 & 7 & 4 \\
\frac{3}{1}, & \frac{22}{7}, & \frac{333}{106}, & \frac{355}{113}, & \frac{9208}{2931}, & \frac{9563}{3044}, & \frac{76149}{2423}, & \frac{314159}{100000};
\end{array}
$$

the last of which is the same as the original fraction. These fractions are formed according to the preceding rule, which will be understood from one example; thus, the fifth fraction is formed from the two preceding fractions as follows:

$$355 \times 25 + 333 = 9208 \text{ numerator,}$$
$$113 \times 25 + 106 = 2931 \text{ denominator,}$$

and all the others are obtained in the same manner.

Each of these fractions represents an approximate ratio towards the original one, and each of them nearer than any preceding fraction in the series, and nearer than any fraction expressed in less numbers, or than any fraction having a less denominator than the succeeding fractions. Thus, $\frac{3}{1}$ is a nearer approximation than any fraction whose denominator is less than 3, and $\frac{355}{113}$ nearer than any fraction whose denominator is less than 2931; &c.

Our original fraction exhibited the ratio usually employed to denote the ratio of the diameter to the circumference of a circle, and amongst our approximations we find some of those commonly employed by former writers; as 7 to 22, being that given by Archimedes; 106 to 333, which is another ratio formerly used; also 113 to 355, being that invented by Peter Metius. Each of these ratios is alternately too small and too great, to express the ratio of the diameter to the circumference of the circle. Thus, 1 to 3 is too small a ratio, 7 to 22 too great, 106 to 333 too small, and 113 to 355 too great; and so on.

We may therefore divide the above series into two distinct classes, one of which shall exhibit the ratios all in excess, and the other all in defect, which will stand as follows: *viz.*

Ratios in defect.

$$\frac{3}{1},\ \frac{333}{106},\ \frac{9208}{2931},\ \frac{76149}{24239}.$$

Ratios in excess.

$$\frac{22}{7},\ \frac{355}{113},\ \frac{9563}{3044},\ \frac{314159}{100000}.$$

And between every two consecutive fractions we may now interpolate as many fractions of the same kind, as is one less than the number of units in the quotients from which it was formed. If we write the first of the above series, with the corresponding quotients above their terms, we shall have

$$
\begin{array}{cccc}
 & 15 & 25 & 7 \\
\frac{3}{1}, & \frac{333}{106}, & \frac{9208}{2931}, & \frac{79149}{24239}.
\end{array}
$$

We may therefore interpolate, between the two first fractions, fourteen others, which will possess the same property as the principal fractions above, *viz.* of approximating nearer to the true ratio than any other fractions expressed in less terms, but all in defect. Between the second and third we may interpolate twenty-four fractions: and between the third and fourth, six: all of them less than the proposed ratio. But if we take the second series and their corresponding quotients, they will stand thus:

$$
\begin{array}{cccc}
1 & 1 & 1 & 4 \\
\frac{22}{7}, & \frac{355}{113}, & \frac{9563}{3044}, & \frac{314159}{100000},
\end{array}
$$

which shews, that no fraction can here be interpolated either between the first and second, or between the second and third; but there may be three interpolated between the third and fourth, which will, of course, be all in excess. This interpolation is performed as follows: to the numerator and denominator of the less fraction add, once, twice, three times, &c. the numerator and denominator of the principal fraction which interposes between the two, which will form the interpolated fractions required. Thus, because $\frac{76149}{24239}$ is the principal fraction interposed between $\frac{9563}{3044}$ and $\frac{314159}{100000}$, the intermediate or interpolated fractions will be

$$\frac{9563 + 76149}{3044 + 24239} = \frac{85712}{27283}$$
$$\frac{9563 + 2.76149}{3044 + 2.24239} = \frac{161861}{51522}$$
$$\frac{9563 + 3.76149}{3044 + 3.24239} = \frac{238010}{75761}$$

And

And in the ſame manner we may interpolate fourteen fractions between $\frac{3}{1}$ and $\frac{333}{106}$; twenty-four between $\frac{333}{106}$ and $\frac{9208}{2931}$; and ſix between $\frac{9208}{2931}$ and $\frac{16149}{24339}$.

Having thus explained the nature of the operation, we ſhall enter leſs into detail in the following example.

Example 2.—According to M de la Caille, the ſolar year is $365^d\ 5^h\ 48^m\ 49^s$, and conſequently longer by $5^h\ 48^m\ 49^s$ than the common year of 365 days. If this difference were exactly 6 hours, it would make one day at the end of four common years: but if we wiſh to know exactly at the end of how many years this difference will produce a certain number of days, we muſt ſeek the ratio between 24^h and $5^h\ 48^m\ 49^s$, which we find to be $\frac{86400}{20929}$, ſo that at the end of 86400 common years, we muſt intercalate 20929 days, in order to reduce them to tropical years.

Now as the ratio of 86400 to 20929 is expreſſed in very high terms, let it be required to find ratios in lower terms, as near this as poſſible.

For this purpoſe, we muſt perform upon theſe numbers the ſame operations as in the preceding caſe; thus:

```
20929)86400(4 = a
      83716
      -----
       2684)20929(7 = b
            18788
            -----
             2141)2684(1 = c
                  2141
                  ----
                   543)2141(3 = d
                       1629
                       ----
                        512)543(1 = e
                            512
                            ---
                             31)512(16 = f
                                496
                                ---
                                 16)31(1 = g
                                    16
                                    --
                                    15)16(1 = h
                                       15
                                       --
                                        1)15(15
                                          15
                                          --
```

From which quotients we derive the following converging fractions, *viz.*

$$\begin{array}{ccccccccc} 4 & 7 & 1 & 3 & 1 & 16 & 1 & 1 & 15 \\ \frac{4}{1}, & \frac{29}{7}, & \frac{33}{8}, & \frac{128}{31}, & \frac{161}{39}, & \frac{2704}{655}, & \frac{2865}{694}, & \frac{5569}{1349}, & \frac{86400}{20929}. \end{array}$$

Now we ſee from the above fractions, that the ſimpleſt intercalation is that of one day in four common years, which is the foundation of the Julian calendar; but that we ſhould approximate with more exactneſs, by intercalating only 7 days in the ſpace of 29 common years, or 8 in the ſpace of 33 years, and ſo on.

It appears farther, that as the fractions $\frac{4}{1}$, $\frac{29}{7}$, $\frac{33}{8}$, &c. are alternately leſs and greater than the fraction $\frac{86400}{20929}$, or $\frac{24^h}{5^h\ 48^m\ 49^s}$, the intercalation of 1 day in 4 years would be too much, of 7 days in 29 years too little, of 8 days in 33 years too much again, and ſo on; but each of theſe intercalations will be the moſt exact, that it is poſſible to make in the ſame ſpace of time.

Now if we arrange in two ſeparate ſeries, the fractions that are leſs, and thoſe that are greater, than the given fractions, we may inſert or interpolate between certain of thoſe fractions, as in the preceding examples.

Taking firſt thoſe fractions that are leſs than the given one, and their correſponding quotients, we ſhall have,

$$\begin{array}{cccc} & 1 & 1 & 15 \\ \frac{4}{1}, & \frac{33}{8}, & \frac{2865}{694}, & \frac{86400}{20929}. \end{array}$$

Hence it appears, that the only interpolation that can be performed is between the two fractions $\frac{2865}{694}$ and $\frac{86400}{20929}$; which will admit of 14 intermediate fractions; which being ſupplied, as in the former example, gives the following ſeries of converging fractions, each leſs than the fraction originally propoſed, *viz.*

$$\frac{4}{1},\ \frac{33}{8},\ \frac{161}{39},\ \frac{2865}{694},\ \frac{8434}{2043},\ \frac{14003}{3392},$$
$$\frac{19572}{4741},\ \frac{25141}{6090},\ \frac{30710}{7439},\ \frac{36279}{8788},$$
$$\frac{41848}{10137},\ \frac{52986}{12835},\ \frac{58555}{14184},\ \frac{64124}{15533},$$
$$\frac{69633}{16882},\ \frac{75262}{18231},\ \frac{80831}{19580},\ \frac{86400}{20929}.$$

And as the laſt fraction is the ſame as the given fraction, it is evident that this ſeries cannot be carried farther: hence, if we chooſe to admit theſe intercalations only in which the error is too much, the ſimpleſt and moſt exact will be thoſe of 1 day in 4 years, or of 8 days in 33 years, or of 39 in 161 years, and ſo on.

Let us now conſider the decreaſing fractions:

$$\begin{array}{cccc} 7 & 3 & 16 & 1 \\ \frac{29}{7}, & \frac{128}{31}, & \frac{2704}{655}, & \frac{5569}{1349}. \end{array}$$

Here it appears, that we may place 6 fractions before the firſt, 2 between the firſt and ſecond, 15 between the ſecond and third; but between the third and fourth no ſuch fraction can be inſerted.

Theſe interpolations being made, we ſhall have the following ſeries of decreaſing fractions, *viz.*

$$\frac{5}{1},\ \frac{9}{2},\ \frac{13}{3},\ \frac{17}{4},\ \frac{21}{5},\ \frac{25}{6},$$
$$\frac{29}{7},\ \frac{62}{15},\ \frac{95}{23},\ \frac{128}{31},\ \frac{289}{70},\ \frac{450}{109},$$
$$\frac{611}{148},\ \frac{772}{187},\ \frac{933}{226},\ \frac{1094}{265},\ \frac{1255}{304},$$

$$\frac{1416}{343},\ \frac{1577}{382},\ \frac{1738}{421},\ \frac{1899}{460},\ \frac{2060}{499},$$
$$\frac{2221}{538},\ \frac{2382}{577},\ \frac{2543}{616},\ \frac{2704}{655},\ \frac{5569}{1349},$$

which are all lefs than the propofed fraction, and expreffed in lefs terms; and each of which is nearer than any other fraction that can be expreffed in lefs terms.

Hence we conclude, that if we only attend to the intercalations in which the error is too fmall, the fimpleft and moft exact are thofe of 1 day in 5 years, of 2 days in 9 years, of 3 days in 13 years, of 4 days in 17 years, and fo on.

In the Gregorian calendar, only 97 days are intercalated in 400 years; but it is evident, from the preceding table, that it would be much more exact to intercalate 109 days in 450 years.

But it muft be obferved, that in the Gregorian reformation, the determination of the year given by Copernicus was made ufe of, which is $365^d\ 5^h\ 49'\ 20''$; and fubftituting this inftead of the fraction $\frac{86400}{20929}$, we fhall have $\frac{86400}{29060}$, or rather $\frac{540}{131}$; whence we may find, by the preceding method, the quotients 4, 8, 5, 3; and from them the principal fractions

$$\begin{array}{cccc} 4 & 8 & 5 & 3 \\ \frac{4}{1}, & \frac{33}{8}, & \frac{169}{41}, & \frac{540}{131}; \end{array}$$

which, except the two firft, are quite different from thofe before determined. However, we do not find amongft thefe fractions $\frac{400}{97}$, which is that adopted in the Gregorian calendar; and this fraction cannot even be found among the interpolated fractions, which might be inferted in the two feries, $\frac{4}{1}$, $\frac{169}{41}$, and $\frac{33}{8}$, $\frac{540}{131}$: for it is evident that it could only be between the laft two fractions, between which, becaufe of the number 3, (the correfponding quotient,) there can be but two fractions interpolated, which are $\frac{202}{49}$, and $\frac{371}{90}$: whence it appears, that it would have been more exact, if, in the Gregorian reformation, they had only intercalated 90 days in the fpace of 371 years.

If we reduce the fraction $\frac{400}{37}$, fo as to have for its numerator the number 86400, it will become $\frac{86400}{20952}$, which eftimates the tropical year at $365^d\ 5^h\ 49'\ 12''$.

In this cafe, the Gregorian intercalation would be quite exact; but as obfervations fhew that the year is fhorter than this by more than 20″, it is evident that, at the end of a certain period of time, we muft introduce a new intercalation.

If we adopt the determination of de la Caille, it follows, as the denominator 97 of the above fraction, *viz.* $\frac{400}{97}$, lies between the denominators of the fifth and fixth principal fractions already found, that, from what has been ftated above, the fraction $\frac{161}{39}$ will be nearer the truth than $\frac{400}{97}$. But as aftronomers are ftill divided with regard to the exact length of the year, we fhall refrain from giving a decifive opinion on this fubject. For more on the reduction of ratios, fee Lagrange's Additions to Euler's Elements of Algebra.

RATIOS, *Prime and Ultimate*, is a fpecies of computation, which we owe to the fertile genius of Newton. The ancients, in order to extend the geometry of right lines to curvilinear figures, had recourfe to the method of *exhauftions*, in which they made ufe of what is called the *reductio ad abfurdum* method, which, though logical, is extremely tedious, and to avoid which, Cavalerius propofed his method of *indivifibles*, publifhed in 1635 under the title of "Geometria Indivifibilibus," in which he was followed by Dr. Wallis and others of the 17th and 18th centuries. In this method every line was fuppofed to confift of a number of other lines indefinitely fmall; every curve was confidered as a polygon of an indefinite number of fides, each fide being indefinitely fmall; a folid was fuppofed to confift of an infinite number of plane fections, or of indefinitely thin laminæ, and fo on; fuppofitions which in many inftances led thofe, who adopted them, into errors and inconfiftencies, which indeed it was very difficult to avoid.

To obviate both the tedioufnefs of the ancients, and the inaccuracy of the moderns, Newton introduced his method of *prime* and *ultimate* ratios, the foundation of which is contained in the firft lemma of the firft book of his "Principia." Many difficulties have been ftarted, and much controverfy concerning the proof of it; all of which would have been avoided, had either the author or his readers obferved, that he is in reality laying down the definition of a term, *viz. being ultimately equal*, and not proving a propofition. Taking, therefore, this firft lemma for a definition, it may be illuftrated as follows.

Let there be two quantities, one fixed and the other varying, fo related to each other, that, 1ft, the varying quantity continually approaches to the fixed quantity; and, 2dly, that the varying quantity never reaches or paffes beyond that which is fixed: 3dly, that the varying quantity approaches nearer to the fixed quantity than by any affigned difference. Then is fuch a fixed quantity called the *limit* of the varying quantity; or, in other words, the varying quantity may be faid to be *ultimately equal* to the fixed quantity. Thefe three conditions may be expreffed more diftinctly thus. 1. The difference between the varying quantity and the fixed quantity muft continually decreafe. 2. This difference muft never become either nothing or negative. 3. This difference muft become lefs, in refpect of the fixed quantity, than by any affigned ratio; or the difference between the two quantities muft become a lefs part of the fixed quantity than any fractional part that is affigned, however fmall the fraction expreffing fuch part may be. Wherever thefe properties are found, the fixed quantity is called the *limit* of the varying quantity, or the varying quantity is faid to be *ultimately equal* to the fixed quantity. The laft expreffion, however, muft not be underftood in its ftrict literal fenfe, there being no *ultimate ftate*, no particular magnitude, that is the *ultimate magnitude* of fuch a varying quantity. Under the word quantity in this definition, muft be included not only numbers, lines, &c., but more efpecially ratios confidered as a peculiar fpecies of quantity; but as the con-

fideration

ſideration of ratios which have limits is difficult, we ſhall begin with examples of other quantities.

1ſt. Let there be formed a ſeries, whoſe firſt term is 1; ſecond, $\frac{1}{2}$; third, $\frac{1}{4}$; fourth, $\frac{1}{8}$, and ſo on; every term being half the preceding one, *viz.*

$$1,\ \frac{1}{2},\ \frac{1}{4},\ \frac{1}{8},\ \frac{1}{16},\ \frac{1}{32},\ \&c.$$

and let the ſum of an indefinite number of terms in this ſeries be conſidered as continually increaſed by the acceſſion of a new term; thus, the ſum of the two firſt is $1\frac{1}{2}$, of three terms is $1\frac{3}{4}$, of four terms is $1\frac{7}{8}$, &c. I ſay then, that the varying ſum of the terms of this ſeries continually approximates to the fixed number 2, as its limit. For the difference between 1, 2, 3, &c. terms and the number 2, will be the numbers $1,\ \frac{1}{2},\ \frac{1}{4},\ \frac{1}{8},\ \frac{1}{16}$, &c. ſucceſſively, *in infinitum.* Here it is evident, that the terms in this laſt ſeries, which expreſs the ſucceſſive differences between the increaſing ſum of the former ſeries and the number 2, *firſt*, continually decreaſe; and *ſecondly*, no term in this ſeries of differences can become either nothing or negative; and *thirdly*, we may continue this ſeries of ſucceſſive differences, till we arrive at a term which ſhall be a leſs part of the fixed number 2, than any fractional part of it that can be aſſigned; or ſo that this difference ſhall be leſs, when compared with the number 2, than any ratio aſſigned. The number 2, therefore, having the conditions laid down in the definition, is to be called the limit of the ſum of the terms of the infinite ſeries $1,\ \frac{1}{2},\ \frac{1}{4},\ \frac{1}{8},\ \frac{1}{16}$, &c.

And the ſame is to be underſtood of any other infinite ſeries; *viz.* if a number can be ſound having the above conditions, that ſeries is ſaid to have a limit; and the finding of this limit, is what is to be underſtood when mathematicians ſpeak of finding the ſum of ſuch an infinite ſeries.

No number leſs than 2, for inſtance $1\frac{7}{8}$, can be taken for the limit; for, in this caſe, it will not anſwer the ſecond condition of the definition. In the above example, the ſum of four terms of the ſeries is equal to $1\frac{7}{8}$, and the ſum of five terms exceeds it; therefore, the difference between this ſum and the number $1\frac{7}{8}$ propoſed as a limit is, in the former caſe zero, and in the latter negative. Neither can any number greater than 2, as for example 3, be taken for the limit, becauſe here the laſt condition will be wanting; for if the ſum of any aſſigned number of terms be leſs than 2, that ſum muſt always want more than unity of the number 3, and conſequently cannot approach nearer to 3, than any aſſigned quantity, as 1.

In like manner the ſum of the ſeries $1,\ \frac{1}{3},\ \frac{1}{9},\ \frac{1}{27}$, &c. continued *in infinitum*, will be $1\frac{1}{2}$; the ſeries of ſucceſſive differences being $\frac{1}{2},\ \frac{1}{6},\ \frac{1}{18},\ \frac{1}{54}$, &c. *in infinitum.*

Now, in order to make the preceding example general, let $a:b$ expreſs the common ratio of any ſeries of numbers in continual proportion, whoſe firſt term is unity, I ſay then, if a be greater than b, ſuch a ſeries will have for its limit the quantity $\frac{a}{a-b}$; or, in other words, the ſum of all the terms of ſuch an infinite ſeries will be $\frac{a}{a-b}$.

For the terms of this ſeries will be $1,\ \frac{b}{a},\ \frac{b^2}{a^2},\ \frac{b^3}{a^3},\ \frac{b^4}{a^4}$, &c.

Whence the ſum of 1 term is - - - 1

of 2 terms - - - $\frac{a+b}{a}$

of 3 terms - - $\frac{a^2+ab+b^2}{a^2}$

of 4 terms - $\frac{a^3+a^2b+ab^2+b^3}{a^3}$

Let each of theſe ſums be ſubtracted from the limit $\frac{a}{a-b}$, and we have the ſucceſſive differences $\left(\frac{b}{a-b}\right)$, $\left(\frac{b}{a-b}\cdot\frac{b}{a}\right)$, $\left(\frac{b}{a-b}\cdot\frac{b^2}{a^2}\right)$, $\left(\frac{b}{a-b}\cdot\frac{b^3}{a^3}\right)$, &c. or if n be any aſſigned number of terms, the difference between the ſum of that number of terms and the limit $\frac{a}{a-b}$, will be $\frac{b}{a-b}\cdot\frac{b^{n-1}}{a^{n-1}}$. Whence we may obſerve, 1ſt, that as the number of terms whoſe ſum is required increaſes, this difference continually decreaſes, becauſe $\frac{b}{a}$, being a fraction leſs than unity, its powers continually decreaſe. 2dly. This difference can never become nothing or negative; the powers of a fraction, though they decreaſe, being always real and affirmative. 3dly. This difference may become leſs in reſpect of $\frac{a}{a-b}$, than by any aſſigned ratio. For $\frac{a}{a-b} : \frac{b}{a-b}\cdot\frac{b^{n-1}}{a^{n-1}}$ as $a^n : b^n$; or as $\frac{a^n}{b^n}$ to 1; or as $\left(\frac{a}{b}\right)^n$ to 1: and ſince $\frac{a}{b}$ is greater than 1, and n indeterminate, the former term of the ratio may become greater than any aſſigned quantity, and therefore the ratio itſelf leſs than any ratio aſſigned.

The quantity $\frac{a}{a-b}$, having, therefore, the required conditions, is the limit of the above ſeries, or is equal to the ſum of all the terms continued *in infinitum.*

What has been proved above may be ſhewn more conciſely by dividing a by $a-b$, in the manner of diviſion in algebra, for the quotients will be the very ſeries propoſed in the example: for inſtance,

$$
\begin{array}{l}
a-b)\ a\ \left(1+\frac{b}{a}+\frac{b^2}{a^2}+\frac{b^3}{a^3}+\&c.\right.\\
\quad\ \ a-b\\
\hline
\qquad\quad b\\
\qquad\quad b-\frac{b^2}{a}\\
\hline
\qquad\qquad \frac{b^2}{a}\\
\qquad\qquad \frac{b^2}{a}-\frac{b^3}{a^2}\\
\hline
\qquad\qquad\qquad \frac{b^3}{a^2}
\end{array}
$$

And

And it may be further confirmed by multiplying the propofed feries by $a - b$, for the product will be a, all the terms except the firft deftroying each other.

We may alfo obferve, that if every term of the foregoing feries be multiplied by any number c, it will become $c + \frac{bc}{a} + \frac{b^2 c}{a^2} + \frac{b^3 c}{a^3} +$ &c.; a feries having the fame ratio, but whofe firft term is c; and it is therefore evident, that, in this cafe, to find the fum of all the terms, we muft multiply the former limit by c, whence it will become $\frac{ac}{a-b}$.

Before we begin to confider ratios, it may not be amifs to caution the reader againft confounding the terms of a ratio with the ratio itfelf: the terms of a ratio may vary in fome cafes through all degrees of magnitude, and yet the ratio remain conftant or invariable. In other inftances, varying the terms *in infinitum*, likewife varies the ratio *in infinitum;* while in others, though varying the terms may alfo vary the ratio, yet the laft ratio can never exceed certain limits.

Let x be any varying quantity; make $4x^2 + 3x = A$, and $2x^2 + x = B$, then will A and B alfo be varying quantities, as depending upon x; when x vanifhes, A and B will both vanifh; when x is infinite, they will be both infinite. I fay then the ratio of A to B, while x decreafes *in infinitum*, approximates to the ratio of 3 to 1.

For, firft, A is to B, as $4x^2 + 3x$ is to $2x^2 + x$, or as $4x + 3$ to $2x + 1$; where it is obvious, that as x decreafes, the quantities $4x$ and $2x$ alfo decreafe, and confequently the ratio of $4x + 3$ to $2x + 1$, or of A to B, approaches to that of 3 to 1. Secondly, the ratio of A to B can never exceed 3 to 1. For $6x^2 + 3x$ is to $2x^2 + x$, as 3 to 1; but $4x^2 + 3x$ is a lefs quantity than $6x^2 + 3x$, therefore $4x^2 + 3x$ is to $2x^2 + x$, or A is to B in a lefs ratio than $6x^2 + 3x$ to $2x^2 + x$; that is, lefs than the ratio of 3 to 1. Laftly, the ratio of A to B will approach nearer to the ratio of 3 to 1, than any affigned difference. For in the terms of this ratio, $4x + 3$ to $2x + 1$, the varying parts $4x$ and $2x$, by diminifhing x, may become lefs than any affigned quantity, while the other parts, 3 and 1, remain the fame; therefore the ratio of A to B will approach nearer to the ratio of 3 to 1, than by any affigned difference.

In like manner the ratio of A to B, while x increafes *in infinitum*, approximates to the ratio of 2 to 1, as its limit. For fince A is to B as $4x + 3$ to $2x + 1$, or as $4x + \frac{3}{x}$ to $2 + \frac{1}{x}$, it is obvious, that as x increafes, the quantities $\frac{3}{x}$ and $\frac{1}{x}$ decreafe, and confequently the ratio of $4 + \frac{3}{x}$ to $2 + \frac{1}{x}$, or of A to B, approaches to the ratio of 4 to 2, or of 2 to 1. For $4x^2 + 2x$ is to $2x^2 + x$, as 2 is to 1; but $4x^2 + 3x$, is a greater quantity than $4x^2 + 2x$, therefore $4x^2 + 3x$ is to $2x^2 + x$, or A is to B always in a greater ratio than 2 to 1. Laftly, the ratio of A to B will approach nearer to that of 2 to 1, than by any affigned difference. For in the terms of this ratio, $4 + \frac{3}{x}$ and $2 + \frac{1}{x}$, the variable parts $\frac{3}{x}$ and $\frac{1}{x}$, by increafing x, may become lefs than any affigned fraction, while the parts 4 and 2 remain the fame; therefore the ratio of A to B will approach nearer to the ratio of 4 to 2, or 2 to 1, than the affigned difference. Hence then we fee that though diminifhing x, and confequently diminifhing the terms A and B, we increafe their ratio, and on the contrary increafing thefe terms, by increafing the quantity x, we decreafe their ratio, yet there is a limit both to the increafe and decreafe of this ratio, although there be none to the terms themfelves which compofe it.

The ratio of 3 to 1, which limits the ratio of A to B, when thefe terms decreafe *in infinitum*, is called the *ultimate ratio* of the evanefcent quantities A and B. The ratio of 2 to 1, which is their other limit, is called the *ultimate ratio* of the quantities A and B increafing *in infinitum.*

Another example of a fimilar kind we have as follows. Let x be a varying quantity, and d a conftant one, then will $x + d$ and x be two varying quantities capable of all degrees of magnitude, I fay that the ratio of $x + d$ to x, while x increafes, will continually decreafe, but not beyond a certain limit, which is the limit of equality. On the contrary, if x decreafe, the ratio of $x + d$ to x will continually decreafe more and more *ad infinitum*, and never come to a limit. For $x + d$ is to x, as $1 + \frac{d}{x}$ to 1; now as x increafes, the fraction $\frac{d}{x}$ decreafes, and may become lefs than any affigned fraction; but the number 1, which is the other part of the antecedent of this ratio, remains the fame, as does likewife the confequent, therefore the ratio of $1 + \frac{d}{x}$ to 1, continually approximates to a ratio of equality. Secondly, it can never reach that ratio, becaufe $\frac{d}{x}$ has always fome magnitude, and confequently $1 + \frac{d}{x}$ always greater than 1. It therefore can never reach the ratio of equality, and much lefs can it pafs it, fo as to become a ratio *minoris inæqualitatis*, or a ratio in which the antecedent is lefs than the confequent. Laftly, the varying fraction $\frac{d}{x}$, as x increafes, will become lefs than any affigned fraction, while the other part of the antecedent, and likewife the confequent of this ratio, remain the fame. Therefore the ratio of $1 + \frac{d}{x}$ to 1, will approach nearer to the ratio of equality, than by any ratio that can be affigned, however fmall fuch ratio may be; therefore the ratio of equality is the limit of the ratio of $1 + \frac{d}{x}$ to 1, and confequently the limit of the ratio of $x + d$ to x, which continually decreafes, while the terms which compofe this ratio continually increafe *in infinitum.*

If x decreafe then $\frac{d}{x}$ will increafe, and may become greater than any affigned number, while the other part of the antecedent, and likewife the confequent, remain invariable; therefore the ratio of $1 + \frac{d}{x}$ to 1, and confequently the ratio of $x + d$ to x, as x decreafes, will become greater than any affigned ratio whatever, having no limit to its increafe.

We

We may farther obferve, that though the terms of this ratio, *viz.* $x + d$ to x, never approximate nearer to each other, their conftant difference being d, yet the ratio of the terms approximates to the ratio of equality; that is, though the terms get no nearer in their difference, yet, if we may be allowed the expreffion, they get nearer in their ratio. The difference of the terms, and the ratio of the terms, are ideas very diftinct from each other, and in no wife to be fo connected, but that one may vary whilft the other is conftant. Although the ratio of equality may ftrictly be called the *limit of the varying ratio* of the quantities $x + d$ and x, yet the terms of this ratio can never be ftrictly faid to be equal, nor *ultimately equal*, as that fuppofes an ultimate ftate in which they are equal; nor equal when they *vanifh into infinity*, or, when they pafs out of finity into infinity. There is no finite quantity next to infinity, no number, for inftance, which is the next number to infinity. Nor is there any ftep from a ftate of *nothingnefs* into finite exiftence; there is no fraction fo fmall as to be the very next fraction to nothing; no fraction can be affigned fo fmall, but another fraction may be affigned that is fmaller. Neither can we fay, in ftrictnefs, that two infinitely great numbers with a finite difference are equal, it being a propofition obvioufly abfurd and contradictory. There is no fuch thing in nature as an infinitely great number; and it is contradictory to fay of any two numbers, both that they have a difference, and that they are equal. Whoever confiders that the idea of infinity is a general or abftract idea, that the idea of number is always particular, that infinity is a *property* of numbers, a *property* of extenfion, &c. itfelf, will readily perceive that thefe and fuch like expreffions have no literal meaning. (See Locke, b. ii. ch. 16. and ch. 17.) As to the metaphorical ufe of them, to avoid circumlocution, or the introduction of new terms, it may be allowed, when once the literal meaning has been explained, in this, as well as on various other occafions both in fcience and in common life.

When the difference between any two quantities decreafes, fo as to become a lefs fractional part of the one of them than any affigned fractional part whatever; or when the difference between the terms of a ratio becomes lefs in refpect of one of them (the greater for example) than any affigned ratio, this may be expreffed by faying, that fuch difference *vanifhes* in refpect of that *greater* quantity.

But if the difference between two terms vanifh in refpect to one of them, it will alfo vanifh in refpect of the other. It is true that at any affigned time, when the terms have a particular magnitude, the difference between the terms will always be a lefs fractional part of the greater term than it is of the lefs term; but as this difference continually decreafes, it will become the fame fractional part of the lefs term that it was before of the greater, however fmall that fractional part of the greater term may be; therefore, if the difference vanifh with regard to one of them, it will vanifh alfo with regard to the other. We may, therefore, inftead of the third condition of our definition, fay, that "the difference muft vanifh in refpect either of the fixed or of the varying quantity, fince one of thefe implies the other."

The above is true as well for the cafe of two variables, as for one fixed and one variable, though both of fuch variables increafe or decreafe without limit. Thus, in the example above given, in which the terms were $x + d$ and x, and where x is continually increafing, the terms themfelves both continually increafe; for in this inftance it is obvious, that if the difference vanifh with refpect to one of the terms, it will alfo vanifh with refpect to the other. Let x be to d, at any affigned point of time, as n is to 1, and d at that inftant of time will be the $\frac{1}{n+1}$th part of the greater term, and the $\frac{1}{n}$th part of the lefs term: now, though the contemporary value of thefe fractions can never be equal, yet in fucceffion the value of the latter fraction will become whatever the former has been; therefore, if $\frac{1}{n+1}$ become lefs than any affigned fraction, fo will $\frac{1}{n}$ likewife; and thus, if the difference vanifhes with refpect to one of the terms, $x + d$, fo will it alfo vanifh with refpect of the other, x. And the fame would be true if the terms were x and $x - d$, all things elfe being as before.

Again, if x by decreafing vanifh with refpect to fome fixed quantity a, then will x, multiplied by a given number n, or $n\,x$, vanifh in refpect of a; or, which is the fame, if x vanifh in refpect of a, fo likewife will the quantity $n\,x$; bearing to x the affigned ratio of n to 1. For though at any particular point of time x is a fmaller fractional part of a than $n\,x$, yet x can be no affigned fractional part of a whatever; but by farther diminifhing x, the quantity $n\,x$ may become the fame fractional part of a that x was before. If, then, x may become equal to, or lefs than, any affigned fractional part of a, fo likewife may $n\,x$; that is, if x vanifh in refpect of a, fo likewife will $n\,x$.

For a like reafon, if x vanifh in refpect of any quantity, it will likewife vanifh in refpect to that quantity multiplied or divided by any number; or it will vanifh in refpect of a quantity, bearing to a any affigned ratio, as that of m to 1. Thus, if x vanifh in refpect of a, it will alfo vanifh in refpect of $3\,a$, $2\,a$, $\frac{1}{2}\,a$, &c. Or, if any fraction vanifh in refpect to the diameter of a circle, it will likewife vanifh in refpect of the radius. For whatever part of the diameter the line x may be at any affigned point of time, let x farther decreafe, till it be half what it was at that affigned time, and it will now be the fame part of the radius that it was before of the diameter; and the fame with various other lines and quantities. We have fhewn, in the preceding part of this article, that the ratio which two quantities bear to each other may have a limit, although the terms themfelves may increafe or decreafe perpetually without limit. 1. If the terms approximate towards each other; 2, if the lefs never pafs the greater; and, laftly, if their difference vanifh in refpect of either term, then the limit of their varying ratio is that of equality: and this, whether the terms themfelves are fuch, as by increafing they both become greater than any affigned quantity, or, which is more common, fuch as by decreafing become lefs than any affigned quantity, or as it is called, *infinitely fmall*. Becaufe the idea of the terms of a ratio is lefs abftract than that of the ratio itfelf, it is more ufual to fay that the terms themfelves in this cafe are ultimately equal, though, ftrictly, it is the ratio only of the terms that comes to a limit, for the terms themfelves are fuppofed to increafe or decreafe without limit, or as we commonly fay, *ad infinitum*.

Prop.—In a circle whofe centre is C, (*Plate* XIII. *Analyfis*, *fig.* 9.) radius C A, diameter A a, let A B be the chord, F B the fine, and A D the tangent of the arc A B. I fay, that while the arc A B continually decreafes without limit; 1ft, the fine continually approximates to the tangent; 2dly, the fine never exceeds the tangent; 3dly, their difference will vanifh in refpect of either fine or tangent.

Firft; B F : D A :: C F : C A, but while the arc decreafes, C F approximates to C A; B F approximates to D A.

D A. 2dly. C F can never exceed C A; therefore B F can never exceed D A. 3dly. The arc continually decreasing without limit, vanishes in respect of the diameter, which is fixed; therefore the chord A B, which is less than the arc, likewise vanishes in respect of the diameter A *a*. But A *a* : A B :: A B : A F; therefore, if A B vanishes in respect of A *a*, A F will vanish in respect of A B; and much more will A F vanish in respect of A *a*; but if A F vanish in respect of A *a*, it will also vanish in respect of $\frac{1}{2}$ A *a*, or C A.

Now C A : C F :: A D : F B, and by division of proportion C A : A F :: A D : A D − F B. Therefore, as A F vanishes in respect of C A, so does A D − F B (the difference of the sine and tangent) vanish in respect to A D the tangent, and consequently in respect of F B the sine. Whence we see, that while the arc continually decreases without limit, the sine approximates to the tangent; 2dly, the sine never exceeds the tangent; 3dly, although the sine and tangent both vanish in respect of the radius, yet their difference vanish in respect of these quantities themselves. Therefore the ratio of equality is the limit of the varying ratio which the sine and tangent have to each other, while they both decrease perpetually without limit, or it is their *ultimate ratio*, or, as we may say, they are *ultimately equal.* The sine is less than the chord; for in the right-angled triangle A F B, the side B F is less than the hypothenuse A B; the chord is less than the arc; this is self-evident, the chord being a straight line, and the arc a curve, both terminated by the same points A and B. The arc is less than the tangent; for from the point D draw another tangent to the circle in H; and the lines A B H, A D H, will be terminated by the same points A and H; and will have the concavities turned the same way; therefore the included arc A B H will be less than the sum of the two equal tangents D A and D H; consequently half that arc, or A B, will be less than half the sum of the tangents A D.

Cor. 1.—Hence the sine, chord, arc, and tangent, are all ultimately in a ratio of equality. This may appear because the chord and arc are included between the sine and tangent, but perhaps more plainly thus. Of these four quantities, *viz.* the sine, chord, arc, and tangent, the sine is the least, and the tangent the greatest; therefore, the difference between the sine and the tangent is greater than the difference between any other two of these four quantities. If, therefore, the greatest of all those differences vanish in respect of the least of all those quantities, much more will the difference between any other two of these four quantities vanish in respect of the quantities themselves.

Cor. 2.—Join B *a*, and in the right-angled triangle B F *a*, the hypothenuse B *a* is greater than the side F *a*; therefore A *a* − B *a* is less than A *a* − F *a*, or than A F; but while the arc A B decreases continually without limit, A F vanishes in respect of A *a*; much more then does A *a* − B *a*, the difference A *a* and B *a*, vanish in respect of A *a*; therefore the ultimate ratio of A *a* to B *a* is that of equality; and the ultimate ratio of $\frac{1}{2}$ A *a*, or B C to B A, is that of 2 to 1. See other applications of these principles in Ludlam's "Rudiments of Mathematics," from which the preceding article has been abstracted; Newton's "Principia," lib. i.; Smith's "Fluxions;" and Saunderson's "Algebra."

RATIO, in our *Law Writers,* is used for a judgment given in a cause.

Hence, *ponere ad rationem* is to cite one to appear in judgment. Walsingh. 88.

RATIO *Status*, *Ragione di stato.* See REASON *of State.*

RATIO *Victus*. See VICTUS.

RATIOCINATION, the act of reasoning.

RATION, or RATIAN, in the *Army*, a pittance or proportion of ammunition, bread, drink, or forage, distributed to each soldier for his daily subsistence.

Some write the word *racion*, and borrow it from the Spanish *racion;* but they both come from the Latin *ratio.* In some parts they call it a *reason.*

The horse have rations of hay and oats, when they cannot go out to forrage. See FORRAGE.

The rations of bread are regulated by weight. The ordinary ration of a foot soldier is a pound and a half of bread *per* day. The officers have several rations, according to their quality, and the number of attendants that they are obliged to keep.

When the ration is augmented on occasions of rejoicing, it is called a *double* ration.

The ships' crews have also their rations or allowances of biscuit, water, &c. proportioned according to their stock. The usual ration at sea, particularly among the Portuguese, &c. is a pound and half of biscuit, a pint of wine, and a quart of fresh water *per* day; and each month an arrobe, or thirty-one pounds of salt meat, with some dried fish and onions.

RATIONABILES EXPENSÆ, *Reasonable Expences.* The commons in parliament, as well as the proctors of the clergy in convocation, were anciently allowed *rationabiles expensas;* that is, such allowance as the king, considering the prices of all things, shall judge meet to impose on the people to pay for the subsistence of their representatives.

This in the 17th of Edward II. was settled at ten groats *per* day for knights, and five for burgesses: afterwards, four shillings a day for knights, and two shillings for burgesses; which was then deemed an ample retribution, both for expences, for labour, attendance, neglect of their own affairs, &c. See BURGESS, and KNIGHTS *of the Shire.*

RATIONABILI *Parte Bonorum*, a writ which lies for the wife, against the executors of her husband, denying her the third part of her husband's goods, after debts and funeral expences paid.

Fitzherbert quotes Magna Charta, and Glanville, to prove, that, by the common law of England, the goods of the deceased, his debts first paid, should be divided into three parts; of which his wife is to have one, his children a second, and the executors a third; adding, that this writ lies as well for the children, &c. as the wife. Such is the general law of Scotland at this day. And whatever may have been the custom of late years, in many parts of the kingdom, or however it was introduced in derogation of the old common law, the ancient method continued in use in the province of York, the principality of Wales, and the city of London, till very modern times; when in order to favour the power of bequeathing, and to reduce the whole kingdom to the same standard, three statutes have been provided; the one 4 & 5 W. & M. c. 2. explained by 2 & 3 Ann. c. 5, for the province of York; another, 7 & 8 W. III. c. 38. for Wales; and a third, 11 Geo. I. c. 18. for London (see CUSTOM *of London*); whereby it is enacted, that persons within those districts, and liable to those customs, may, if they think proper, dispose of all their personal estates by will; and the claims of the widow, children, and other relations, to the contrary, are totally barred. Thus is the old common law now utterly abolished throughout all the kingdom of England, and a man may devise the whole of his chattels as freely as he formerly could his third part or moiety. Blackst. Com. b. ii.

Recto de RATIONABILI *Parte.* See RECTO.

RATIONABILIBUS Divisis, is a writ that lies where two lords have fignories joining together, for him that finds his wafte encroached upon, within the memory of man, againft the encroacher, thereby to rectify the bounds of the fignories: in which refpect, Fitzherbert fays, it is of the nature of a writ of right.

RATIONABILIS Dos, a third part of fuch lands and tenements as the hufband was feifed of at the time of the efpoufals, with which his wife was formerly endowed by the common law, if no fpecific dotation was made at the church porch. See Dower and Jointure.

RATIONAL, Reasonable. See Reason.

Rational *Fable*. See Fable.

Rational *Fractions*, in *Arithmetic* and *Analyfis*, are thofe fractions into which no furd or radical quantity enters; as $\frac{7}{8}$, $\frac{19}{27}$, $\frac{x^2+1}{x^3+1}$, $\frac{x^3+x^2+ax}{x^4+bx^3+cx}$, &c.

The decompofition of rational fractions into fimple fractions, that is, the decompofition of them into other fractions whofe fum is equal to that propofed, is an important problem, as connected with the integral calculus, or inverfe method of fluxions, which was firft inveftigated by Leibnitz, but has fince been much extended and fimplified by the refearches of Euler, La Grange, La Croix, and other eminent analyfts.

The decompofition of numeral fractions into their partial fractions, is, perhaps, rather a fubject of curiofity than utility, yet as connected with, and leading to, the decompofition of rational algebraic fractions, it may not be amifs to give here a fketch of the procefs by which it is accomplifhed, previous to entering upon the latter fubject.

On the decompofition of rational numeral fractions, into others having prime denominators.

It is to be obferved, that this can only be effected in the cafe of a compofite denominator, or rather, there will be no difficulty in any other cafe, as it will require only a feparation of the numerator into any parts at pleafure, the fum of which is obvioufly equal to the fraction propofed; we fhall therefore only confider thofe fractions having compofite denominators, which are to be refolved into others having prime denominators; and even in this cafe there may be fractions that will not admit of decompofition, as will appear from what follows. This decompofition is effected, when poffible, by means of the indeterminate analyfis; *viz.* let $\frac{m}{n}$ be the given fraction, and fuppofe, in the firft inftance, that its denominator confifts of two prime factors, or $n = ab$, it will then be to find $\frac{m}{ab} = \frac{p}{a} + \frac{q}{b}$, or $aq + bp = m$; p and q being the required numerators of the two partial fractions, and which values of p and q are eafily found from the above equation $aq + bp = m$, on the principles explained under the article Indeterminate *Analyfis*, fubject however to the fame limitation there mentioned; *viz.* the above equation is always poffible, provided $m > ab - a - b$, but in other cafes it may or may not admit of folution.

If the given fraction be $\frac{m}{abc}$, then we may firft refolve it into two fractions, and one of thefe into two others; thus, let $\frac{m}{abc} = \frac{p}{ab} + \frac{q}{c}$, then we have $abq + cp = m$, from which equation p and q may be found. Again, let $\frac{p}{ab} = \frac{r}{a} + \frac{s}{b}$, which gives $as + rb = p$, whence r and s may be determined, and we fhall thus obtain $\frac{m}{abc} = \frac{r}{a} + \frac{s}{b} + \frac{q}{c}$, as required. In all thefe cafes it is obvious, that the fraction may be decompofed into partial fractions, in as many different ways as the indeterminate equation on which it depends admits of different anfwers.

Example.—Find two fractions, having prime denominators, whofe fum fhall be equal to $\frac{19}{35}$, or to $\frac{19}{7 \cdot 5}$.

Let the required fractions be $\frac{p}{7} + \frac{q}{5}$, then $\frac{5p+7q}{35} = \frac{19}{35}$; therefore $5p + 7q = 19$, whence $p = 1$, and $q = 2$ (fee Indeterminate *Analyfis*); and confequently the required partial fractions are $\frac{1}{7}$ and $\frac{2}{5}$.

Example 2.—Find three fractions, whofe fum is equal to $\frac{401}{315}$.

The three factors of 315 are 5, 7, 9, which are of neceffity the denominators of the required fractions. Suppofe then firft, that $\frac{401}{315} = \frac{p}{35} + \frac{q}{9}$, whence we have $9p + 35q = 401$, which gives $p = 29$, and $q = 4$; therefore $\frac{401}{315} = \frac{29}{35} + \frac{4}{9}$. Again, let $\frac{29}{35} = \frac{r}{7} + \frac{s}{5}$, or $5r + 7s = 29$; this gives $r = 3$ and $s = 2$, fo that $\frac{29}{35} = \frac{3}{7} + \frac{2}{5}$, and confequently $\frac{401}{315} = \frac{2}{5} + \frac{3}{7} + \frac{4}{9}$, as required. And in the fame manner the decompofition may be obtained in any other cafe, which falls within the limits above ftated.

On the decompofition of rational algebraic fractions, and its application to the integral calculus.

$$\text{Let } \frac{\text{N}}{\text{D}} = \frac{a + bx + cx^2 + dx^3 + \&\text{c.} \ldots px^{m-1}}{a' + b'x + c'x^2 + d'x^3 + \ldots . p'x^{m-1} + q'x^m}$$

be any rational fraction, whofe decompofition into fimple fractions is required, and whofe numerator is at leaft one degree lower than its denominator, to which form it may always be reduced by divifion, if it fhould prefent itfelf under a different form.

The denominator of this fraction, from the known theory of equations, may be fuppofed to be made up of as many fimple factors as is equal to the higheft power of x contained in it, and which factors may be found by determining the roots of the equation formed by putting the whole denominator equal to zero. Let therefore $a' + b'x + c'x^2 + d'x + \ldots . x^m = 0$, and fuppofe the roots of this equation to be r, r', r'', r''', r'''', &c., and we fhall have $a' + b'x + c'x^2 + d'x^3 + \ldots . x^m = (x - r)(x - r')(x - r'')(x - r''')$, &c.

And therefore our propofed fraction $\frac{\text{N}}{\text{D}}$ may now be put under the form

$$\frac{\text{N}}{\text{D}} = \frac{a + bx + cx^2 + dx^3 + \ldots . px^{m-1}}{(x-r)(x-r')(x-r'')(x-r''')}, \text{ \&c.}$$

and thefe factors are now to form the denominators of the

the simple fractions sought. Let A, A′, A″, A‴, &c. represent their numerators, so that

$$\frac{N}{D} = \frac{A}{x-r} + \frac{A'}{x-r'} + \frac{A''}{x-r''} + \&c. \frac{A^{(n-1)}}{x-r^{(n-1)}}$$

Reduce now these several simple fractions to a common denominator by the usual rule, and add their several numerators together; then comparing the co-efficients of the like powers of x in the numerator of this new fraction, with those in the numerator proposed, we shall obtain sufficient equations for determining the proper values of A, A′, A″, A‴, &c. and the decomposition will be effected as proposed. This will be better understood from a partial example.

Let us therefore assume the fraction $\frac{6x^2-4x-6}{x^3-6x^2+11x-6}$, which it is required to resolve into its simple fractions.

Here the roots of the denominator, by making it equal to zero, are 1, 2, and -3, whence the proposed equation may be put under the form $\frac{x^2-4x-6}{(x-1)(x-2)(x+3)}$.

Make now this fraction $\frac{x^2-4x-6}{(x-1)(x-2)(x+3)} = \frac{A}{x-1} + \frac{A'}{x-2} + \frac{A''}{x+3}$, which being reduced to a common denominator, and added together, give $\frac{x^2-4x-6}{x^3-6x^2+11x-6}$ $= \frac{A(x-2)(x+3)+A'(x-1)(x+3)+A''(x-1)(x-2)}{x^3-6x^2+11x-6}$ $= (A+A'+A'')x^2 + (A+2A'-3A'')x - (6A + 3A' - 2A'')$ whence

$$\begin{aligned} A + A' + A'' &= 6 \\ A + 2A' - 3A'' &= -4 \\ 6A + 3A' - 2A'' &= 6 \end{aligned}$$

from which we readily draw $A = 1$, $A' = 2$, $A'' = 3$; so that the required fractions are $\frac{1}{x-1} + \frac{2}{x-2} + \frac{3}{x+3}$.

If therefore the fluent of $\frac{(6x^2-4x-6)\dot{x}}{x^3-6x^2+11x-6}$ were required, we might immediately reduce the problem to finding the fluents of $\frac{\dot{x}}{x-1} + \frac{2\dot{x}}{x-2} + \frac{3\dot{x}}{x+3}$, which are known, being hyp. log. $(x-1)$ + 2 hyp. log. $(x-2)$ + 3 hyp. log. $(x+3)$ = hyp. log. $[(x-1)(x-2)^2(x+3)^3]$

The same method may be employed for all rational fractions, whose denominators are resolvable into unequal simple factors, but as this cannot be generally effected when the highest power of the variable quantity exceeds the fourth degree, we are necessarily limited in our application of the rule, in consequence of the imperfection which still attends the general solution of equations. In the case, however, of equal factors in the denominator, a different process is required, which we will explain, after illustrating the above rule by two or three examples.

Required the fluent of $\frac{(1+x)\dot{x}}{x-x^2}$ by resolving it into its simple fractions.

Here the factors of the denominator being x and $1-x$, we make

$$\frac{(1+x)\dot{x}}{x-x^2} = \frac{A\dot{x}}{x} + \frac{A'\dot{x}}{1-x} = \frac{(A+(A'-A)x)\dot{x}}{x-x^2},$$

whence $A = 1$, and $A' - A = 1$, or $A' = 2$, therefore

$$\text{fluent } \frac{(1+x)\dot{x}}{x-x^2} + \text{flu.} \frac{\dot{x}}{x} + \text{flu.} \frac{2\dot{x}}{1-x}$$

which are known.

Required the fluent of $\frac{(x-1)\dot{x}}{1-4x+2x^2}$, or of $\frac{\frac{1}{2}(x-1)\dot{x}}{\frac{1}{2}-2x+x^2}$.

Here, by making $x^2 - 2x + \frac{1}{2} = 0$, we have $x = 1 \pm \frac{1}{2}\sqrt{2}$; make, therefore,

$$\frac{(\frac{1}{2}x-\frac{1}{2})\dot{x}}{\frac{1}{2}-2x+x^2} = \frac{A\dot{x}}{x-1-\frac{1}{2}\sqrt{2}} + \frac{A'\dot{x}}{x-1+\frac{1}{2}\sqrt{2}}$$

$$= \frac{A(x-1+\frac{1}{2}\sqrt{2})\dot{x} + A'(x-1-\frac{1}{2}\sqrt{2})\dot{x}}{\frac{1}{2}-2x+x^2}$$

Here we have $A + A' = -\frac{1}{2}(1-\frac{1}{2}\sqrt{2})A + (1+\frac{1}{2}\sqrt{2})A' = -\frac{1}{2}$, whence we have $A = -\frac{1}{4}$, and $A' = -\frac{1}{4}$, therefore fluent of $\frac{(x-1)\dot{x}}{x-x^2}$ = flu. $\frac{-\frac{1}{4}\dot{x}}{x-1+\frac{1}{2}\sqrt{2}}$ $+ \frac{-\frac{1}{4}\dot{x}}{x-1-\frac{1}{2}\sqrt{2}}$, which are known.

We have hitherto considered the factors of the denominators of the proposed fractions to be all unequal; when any number of them are equal, a little difference in the operation is then required; for it is obvious that if two of our fractions were of the same form, for example $\frac{A}{x-r} + \frac{A'}{x-r}$, these two would form, in fact, but one fraction $\frac{A+A'}{x-r}$, which leads us to no useful result.

In case of equal factors, therefore, we must proceed as follows: let the proposed fraction be

$$\frac{a+bx+cx^2+dx^3+\ldots.qx^{m-1}}{(x-p)^n(x-r)(x-r')(x-r'')} \&c.$$

Assume it equal to

$$\frac{B}{(x-p)^n} + \frac{B'}{(x-p)^{n-1}} + \frac{B''}{(x-p)^{n-2}} + \ldots. \frac{B^{(n-1)}}{x-p} +$$

$$\frac{A}{x-r} + \frac{A'}{x-r'} + \frac{A''}{x-r''} + \&c.$$

Where the upper line represents the fractions due to the n equal factors, and the lower those due to the $\frac{m}{n}$ unequal factors.

Let now these fractions be reduced to a common denominator, and the co-efficients equated as before, which will give us the required values of the several numerators sought.

Example.—It is required to convert $\frac{1-5x}{(1-x)(1+x)^2}$ into its equivalent simple fractions.

$$\text{Assume } \frac{1-5x}{(1+x)^2(1-x)} = \frac{B}{(1+x)^2} + \frac{B'}{(1+x)} + \frac{A}{(1-x)}$$

$$= \frac{B+(1+x)B'}{(1+x)^2} + \frac{A}{1-x} =$$

$$\frac{B(1-x)+B'(1-x^2)+A(1+2x+x^2)}{(1+x)^2(1-x)} =$$

$$\frac{B+B'+A+(2A-B)x+(A-B')x^2}{(1+x)^2(1-x)}$$

whence

whence $B + B' + A = 1$
$2A - B = -5$
$A - B' = 0$
therefore $B = 3$, $B' = -1$, and $A = -1$,
consequently

$$\frac{1-5x}{(1+x)^2(1-x)} = \frac{3}{1+x^2} - \frac{1}{1+x} - \frac{1}{1-x}$$

We have in both the preceding cases extended the calculation to a greater length than it is necessary to observe in practical cases, in order that the reader might see distinctly the principles on which the decomposition depends. We shall now furnish him with an easier practical method, which we have extracted from Bonnycastle's Algebra, vol. i.

1. When the factors of the denominator of the given fraction are all unequal, or of the form

$$\frac{N}{D} = \frac{A}{x-r}, \frac{A'}{x-r'}, + \frac{A''}{x-r''} + \frac{A'''}{x-r'''} + \&c.$$

take that which constitutes the denominator of the simple fraction which is to be found, and let S denote the product of all the remaining fractions; then if the root or value of x, in that factor, be substituted for x in the formula $\frac{N}{S}$, it will give the numerator of the fraction required.

2. If some of the factors are equal and others unequal, or of the form

$$\frac{N}{D} = \frac{A}{x-r}, \frac{A'}{x-r'}, \&c. \ldots + \frac{B}{(x-p)^n} + \frac{B'}{(x-p)^{n-1}} + \&c.$$

let S denote the product of all the factors in the denominator, except one, as before; then find the simple fractions due to the unequal fractions as above, and for those of the equal factors proceed as follows:

1. $B = \frac{N}{S}$, taking x in N, and $S = p$.

Let $Q = \frac{N - BS}{x-p}$, then

2. $B' = \frac{Q}{S}$, taking x in Q, and $S = p$.

Let $Q' = \frac{Q - B'S}{x-p}$, then

3. $B'' = \frac{Q'}{S}$, taking x in Q', and $S = p$.

Let $Q'' = \frac{Q' - B''S}{x-p}$, then

4. $B''' = \frac{Q''}{S}$, taking x in Q'', and $S = p$.

&c. &c.

Which operation being performed, the sum of the fractions thus obtained, together with the former, will give all the simple fractions into which the given fraction is resolvable.

Example 1.—It is required to convert the rational fraction $\frac{1+x^2}{x-x^3}$ into its equivalent simple fractions.

Here $\frac{1+x^2}{x-x^3} = \frac{A}{0+x} + \frac{A'}{1-x} + \frac{A''}{1+x}$; whence, by the preceding rule,

$$A = \frac{N}{S} = \frac{1+x^2}{1-x^2} = 1; \text{ being } 0 = x$$

$$A' = \frac{N}{S} = \frac{1+x^2}{x+x^2} = 1; \text{ being } 1 = x$$

$$A'' = \frac{N}{S} = \frac{1+x^2}{x-x^2} = -1; \text{ being } 1 = -x.$$

The required fractions are therefore

$$\frac{1}{x} + \frac{1}{1-x} - \frac{1}{1+x} = \frac{1+x^2}{x-x^3}.$$

Example 2.—It is required to convert the rational fraction $\frac{N}{D} = \frac{1}{x^3(1-x)^2(1+x)}$ into its equivalent simple fractions. Here

$$\frac{N}{D} = \frac{A}{1+x} + \frac{B}{x^3} + \frac{B'}{x^2} + \frac{B''}{x} + \frac{C}{(1-x)^2} + \frac{C'}{1-x};$$

whence for $1+x$, the first factor, we have

$$A = \frac{N}{S} = \frac{1}{x^3 - 2x^4 + x^5} = \frac{1}{4}, \ x \text{ being} = -1$$

$$B = \frac{N}{S} = \frac{1}{1 - x - x^2 + x^3} = 1, \ x \text{ being} = 0.$$

$$\text{Let now } Q = \frac{N - BS}{x+p} = \frac{x + x^2 - x^3}{x} = 1 + x - n^2$$

$$B' = \frac{Q}{S} = \frac{1 + x - x^2}{1 - x - x^2 + x^3} = 1, \ x \text{ being} = 0.$$

$$\text{Let } Q' = \frac{Q - B'S}{x-p} = \frac{2x - x^3}{x} = 2 - x^2$$

$$B'' = \frac{Q'}{S} = \frac{2 - x^2}{1 - x - x^2 + x^3} = 2, \ x \text{ being} = 0.$$

Again, for $(1-x)^2$

$$C = \frac{N}{S} = \frac{1}{x^3 + x^4} = \frac{1}{2}, \ x = \text{being} = 1.$$

$$\text{Let now } R = \frac{N - CS}{x-p} = \frac{1 - \frac{1}{2}x^3 - \frac{1}{2}x^4}{x-1} = 1 + x + x^2 + \tfrac{1}{2}x^3$$

$$C' = \frac{R}{S} = \frac{1 + x + x^2 + \frac{1}{2}x^3}{x^3 + x^4} = \tfrac{7}{4}, \ x \text{ being} = 1.$$

$$\text{Therefore } \frac{1}{x^3(1-x)^2(1+x)} = \frac{1}{x^3} + \frac{1}{x^2} + \frac{2}{x} + \frac{1}{2(1-x)^2} + \frac{1}{4(1-x)} - \frac{1}{3(0+x)}, \text{ as required.}$$

It is obvious, as we have before stated, that this decomposition of rational fractions must necessarily be affected as to its general application, by the imperfection of the theory of equations, which will not admit of a practical resolution of the denominator into its simple factors in all cases. It will also further appear, that, in case of any of the roots being imaginary, the same will necessarily enter into the numerators of the simple fractions. But this difficulty may be avoided: for since the imaginary roots of equations always enter in pairs, and the product of such pairs of roots being always real, being of the form

$$x^2 + 2\alpha x + \alpha^2 + \beta^2,$$

we may, instead of resolving the fractions into the simple fractions $\frac{A}{x-r}$, $\frac{A'}{x-r'}$, $\frac{A''}{x-r''}$, &c. resolve it into as many of these fractions as it has rational simple factors, and into as many fractions of the form $\frac{Bx + C}{x^2 + \alpha x + \alpha^2 + \beta^2}$, as it has pairs of imaginary factors, and then proceed as before.

We

We cannot extend our remarks to a greater length in this article; we muſt, therefore, refer the reader who wiſhes to ſee theſe principles more completely developed, to Euler's Analyſis Infinitorum, vol. i. ch. 2 and 11; to La Croix's Algebra, and his Calcul Differentiel et Calcul Integral. See alſo Bonnycaſtle's Algebra, and Simpſon's Fluxions.

RATIONAL or *true horizon*, is that whoſe plane is conceived to paſs through the centre of the earth; and which therefore divides the globe into two equal portions, or hemiſpheres. See HORIZON.

It is called the *rational* horizon, becauſe only conceived by the underſtanding; in oppoſition to the *ſenſible* or apparent horizon, which is viſible to the eye.

RATIONAL *integer*, or *whole number*, is that of which unity is an aliquot part. See NUMBER, and ALIQUOT *part*.

RATIONAL *mixt number* is that conſiſting of an integer, and a fraction; or of unity, and a broken number.

Commenſurable quantities are defined by being one to another as one rational number to another.

For unity is an aliquot part of a rational number; and a fraction has ſome aliquot part common with unity; in things, therefore, that are as a rational to a rational number, either the one is an aliquot part of the other, or there is ſome common aliquet part of both; therefore they are commenſurable.

Hence, if a rational number be divided by a rational, the quotient is always a rational.

RATIONAL *Phyſicians*, in ancient medical hiſtory, the phyſicians of the *dogmatic* ſect, who ſtood in oppoſition to the *empiric* ſect; the former appealing to certain theoretical principles in the application of remedies, while the latter reſted entirely upon experience, and diſclaimed all knowledge of firſt principles. The tenets of both theſe ſects have been handed down to us by a claſſic author, Celſus, and have been given at length under a former article. See EMPIRIC.

RATIONAL *Quantity*, or *number*, a quantity or number commenſurable to unity.

Suppoſing any quantity to be 1, there are infinite other quantities, ſome of which are commenſurable to it, either ſimply, or in power: theſe Euclid calls *rational quantities*. The reſt, that are incommenſurable to 1, he calls *irrational quantities*, or *ſurds*.

RATIONAL *Ratio*. See RATIO.

RATIONAL *Soul*. See SOUL.

RATIONALE, a ſolution or account of the principles of ſome opinion, action, hypotheſis, phenomenon, or the like. Hence,

RATIONALE is alſo the title of ſeveral books. The moſt conſiderable is the "Rationale of Divine Offices," by Guil. Durandus, a celebrated ſchool-divine, biſhop of Mende, finiſhed in 1286, as he himſelf tells us. See PRINTING.

RATIONALE alſo denotes an ancient ſacerdotal veſtment, worn by the high-prieſt under the old law; and called by the Hebrews, חשן, *hhoſchen*; by the Greeks, λογιον; by the Latins, *rationale* and *pectorale*; and by the Engliſh tranſlators, *breaſt-plate*.

The rationale was a piece of embroidered ſtuff worn on the breaſt, about a ſpan ſquare. Du-Cange deſcribes it as a double ſquare of four colours, interwoven with gold, and ſet with twelve precious ſtones in four rows, on which were engraven the names of the twelve tribes, and faſtened to the ſhoulder by two chains and two hooks of gold. The form of the rationale was preſcribed by God himſelf, Exod. xxviii. 15—29.

A rationale appears alſo to have been anciently worn by the biſhops under the new law. But authors are in doubt about its form; ſome will have it reſemble that of the Jews; others take it to be only the pallium.

RATIONALIS, an officer mentioned in ſeveral ancient inſcriptions.

Lampridius, in the life of Alex. Severus, uſes rationalis as ſynonimous with procurator.

The rationales were intendants or ſurveyors under the emperors; and though Lampridius pretends they were firſt eſtabliſhed by Severus, it is evident there were ſome under Auguſtus.

RATIONARIUM, among the Romans, a book which contained the accounts of the empire. It was otherwiſe called *breviarium*. See BREVIARY.

RATIONIS ENS. See ENS.

RATIONIS *Diſtinctio*. See DISTINCTIO.

RATIONIS *Os*, in *Anatomy*, the bone of the forehead, otherwiſe called os frontis.

RATISBON, or REGENSPERG, in *Geography*, an imperial city of Germany, in the circle of Bavaria, and capital of a biſhopric of the ſame name, ſituated at the conflux of the Regen and of the Danube. The town is large, populous, and fortified; and was anciently the capital of Bavaria, and the reſidence of its dukes. The emperor Frederic I. annexed it to the empire. This town is a ſtaple, but neither its manufactures nor trade are very conſiderable; corn, wood, and proviſions, are ſent by the Danube to Vienna. The number of inhabitants is about 24,000; 62 miles N.E. of Augſburg. N. lat. 48° 55′. E. long. 12° 50′.

The biſhopric of Ratiſbon comprehends about 1383 pariſhes; and was founded, as it has been ſuppoſed, by St. Boniface, in the year 736. The ſeat of the biſhop is at Ratiſbon, where, however, he has no juriſdiction.

RATISKA, a town of Immeritia; 35 miles N.E. of Cotatis.

RATKAI, GEORGE, in *Biography*, born in 1613, of a noble family, in Hungary, entered into holy orders, and was made canon of the church of Zagrab. He obtained the eſteem of the viceroy of Croatia, John Draſkovitz, who engaged him to compoſe the hiſtory of that province, and gave him free acceſs to its archives. He accordingly publiſhed, in 1652, a very learned work, entitled "Memoria Regum et Banorum regnorum Dalmatiæ, Crotiæ, Slavoniæ, inchoata ab origine ſua uſque ad annum." Gen. Biog.

RATLINES, or, as the ſeamen call them, *Rutlins*, or *Rattlings*, are certain ſmall lines which traverſe the ſhrouds of a ſhip horizontally, at regular diſtances above the dead-eyes upwards, and forming a variety of ladders, whereby to climb to any of the maſt-heads, or deſcend from them. Hence the term ſeems to be derived from *rath*, an obſolete word, ſignifying *a hill*. In order to prevent the rattling from ſlipping down by the weight of the ſailors, they are firmly attached by a knot, called a *clove-hitch*, to all the ſhrouds, except the foremoſt or aftmoſt; where one of the ends, being fitted with an eye-ſplice, is previouſly faſtened with twine-thread or pack-thread. Falconer.

RATNO, in *Geography*, a town of Lithuania, in the palatinate of Brzeſc; 50 miles S.E. of Brzeſc.

RATOATH, a poor village of the county of Meath, Ireland, which, before the union, had its repreſentatives in parliament. It gave name to a barony, and is $12\frac{1}{2}$ miles N.W. by N. from Dublin.

RATOLY, a town of Hindooſtan, in the circar of Gohud; 25 miles S.E. of Raat.

RATONES, a ſmall iſland in the river La Plata, near Monte Video.

RATSCHA, or Retzka, a fortrefs of Sclavonia, on the N. fide of the Save, oppofite to the mouth of the Drin; 35 miles S.W. of Peterwardein.

RATSCHITZ, a town of Moravia, in the circle of Brunn; 10 miles N.E. of Brunn.

RATSUR, a town of Hindooftan, in the circar of Aurungabad; 65 miles E. of Aurungabad.

RATTAK, a town of Bengal; 14 miles S.S.E. of Curruckpour.

RATTAN. See Ruatan.

Rattan *Canes*. See Canes.

RATTELSDORF, in *Geography*, a town of Bavaria, in the bifhopric of Bamberg; 9 miles N. of Bamberg.

RATTEN. See Rateen.

Ratten, in *Rural Economy*, a provincial word, ufed to fignify a rat.

RATTENBERG, in *Geography*, a town of the county of Tyrol, with a citadel on the Inn; 16 miles E.N.E. of Infpruck.

RATTKOW, a town of the duchy of Holftein; 6 miles N.N.E. of Lubeck.

RATTLE, among the *Ancients*, a mufical inftrument called by the Romans *crepitaculum*.

Mr. Malcolm takes the tintinnabulum, crotalum, and fiftrum, to have been only fo many different kinds of rattles. The invention of the rattle is afcribed to the famous mathematician Archytas; whence Ariftotle calls it Αρχυτα πλαταγη, Archytas's rattle. Diogenianus adds the occafion of the invention; *viz.* that Archytas, having children, he contrived this inftrument to prevent their tumbling over things about the houfe. So that how much foever fome inftruments have changed their ufes, the rattle, we are fure, has preferved its original application.

Rattle, or *Rattel*, in *Commerce*, a weight in Arabia; a rattle of coffee contains, at Betelfagui, $14\frac{1}{2}$ vakias, and a farcel, or frazil, of 10 maunds, or 20 rattles, contains 290 vakias; a farcel weighs 20lb. 6 oz. 4 dr. avoirdupois, and a bahar of 40 farcels $= 815\frac{1}{4}$lb. avoirdupois; 10 farcels in Betelfagui are equal to 7 in Mocha; 16 vakias of dates, candles, and iron, are reckoned to a rattle; but of all other forts of goods 15 vakias make a rattle. The rattle is ufed in the bazar, or market, only. At Jiddah, another fea-port of Arabia, in the Red fea, the bahar contains 10 frazils, 100 maunds, or 500 rattles, and the rattle 15 vakias. The bahar weighs $222\frac{1}{2}$lb. Englifh troy, or 183lb. avoirdupois; and the maund 29 oz. $4\frac{1}{2}$ dr. avoirdupois. Kelly's Un. Cambift.

Rattle-*Grafs*. See Rhinanthus.

Rattle-*Net*. See Wolf *Net*.

Rattle, *Red*. See Pedicularis.

Rattle, *Yellow*. See Rhinanthus.

RATTLE-SNAKE. See Snake.

Rattle-snake *Root*, *Senegaw*. See Milk-*wort*.

Rattle-snake *Root*, Dr. Witt's, a fpecies of *Prenanthes*; which fee.

Rattle-snake *Weed*, a fpecies of *Eryngium*; which fee.

Rattle-snake *Iflands*, in *Geography*, a clufter of fmall iflands at the weftern extremity of lake Erie.

Rattle-snake *Mountains*, mountains of New Hampfhire; 38 miles N. of Concord.

RATTLING in horfes, a term applied to a difagreeable noife produced in them by the entrance of the air between the internal parts of the fheath and the prepuce or covering, principally taking place in trotting or going faft.

RATTONNEAU, in *Geography*, a fmall ifland at the entrance of the harbour of Marfeilles, which has a fortrefs erected in the 17th century by the duke of Guife.

RATTRAY Head, a cape of Scotland, on the N.E. coaft of the county of Aberdeen; 7 miles N. of Peterhead. N. lat. 57° 12'. W. long. 1° 44'.

RATULAH, a town of Hindooftan, in Oude; 15 miles N.E. of Fyzabad.

RATWAH, a town of Hindooftan, in the circar of Gohud; 27 miles E. of Gwalior.

RATZE, in *Commerce*, the name of a fmall coin, ftruck at Friburgh, &c. nearly of the fame value with the *blare*, which, in France, is worth two fols and a denier.

RATZEBUR, in *Geography*, a town of Hinder Pomerania; 14 miles S. of New Stettin. N. lat. 53° 30'. E. long. 16° 14'.

RATZEBURG, a town of Germany, which gives name to a principality, fituated on an ifland in a large lake; the lake is 30 miles long, and 9 broad, and boats pafs by it to Lubeck with goods and paffengers. It was burnt by the Danes in 1693, and fince that difafter the ftreets have been regularly laid out, and the houfes are built after the Dutch manner. In the market-place is the regency-office, and here is held the chief court of juftice and the confiftory; the garrifon is quartered in barracks; 20 miles S. of Lubeck. N. lat. 53° 43'. E. long. 10° 46'. The principality of the fame name is fituated between Mecklenburg and Saxe-Lauenburg, and extends about 10 miles each way. The foil is fertile, and produces a confiderable quantity of wheat, befides feeding a number of cattle. It was converted from a bifhopric into a principality by the peace of Weftphalia. It belongs to Mecklenburg-Strelitz.

RATZENSTEIN, a town of the duchy of Stiria; 5 miles S. of Windifch Gratz.

RATZKNITSCHA, a town of Hungary; 10 miles N.N.W. of Cfakathurn.

RAVA. See Rawa.

RAVALEMENT, Fr. equivalent, among organ-builders and harpfichord-makers, to *compafs* in Englifh. The complete fet of keys, or whole fyftem of mufical founds, (faid Rouffeau in 1768,) inftead of confining itfelf to four octaves, like common keyed-inftruments formerly, extends now to five octaves, adding a fifth below double C, and a fourth above C in alt., including five octaves between the loweft F and the higheft. (This was the common compafs of our harpfichords made by Tabel, Kirckman, and Shudi, long before 1768.) The word *ravalement* is confined to keyed-inftruments; there are no others of fo extenfive a compafs as five octaves. But in the year 1777, when Dr. Burney firft compofed and publifhed duets "à quartre mains," or for two performers on one inftrument, the ladies, at that time wearing hoops, which kept them at too great a diftance from each other, had a harpfichord made by Merlin, exprefsly for duets, with fix octaves; extending from the octave below double C in the bafe, to the octave above C in alt. in the treble. And as duets à quatre mains have been compofed by all the great mafters in Europe fince that time, inftruments with additional keys are now become general. At firft it was only in the treble that the compafs was extended, except in the inftrument above-mentioned by Merlin; but at prefent notes are added in the bafe to complete the fix octaves: and, indeed, the additional notes in the bafe are better worth having for particular effects, than thofe in the treble; which often, from the fhortnefs of the ftrings and feeble vibration, more refemble the tone of wood than wire; whereas the tone of thofe in the bafe of large piano fortes, by the beft makers, is fo rich and full, that

that each found below double F refembles that of an organ-pipe in flow notes, more than the tranfient tone of a ftring.

Rouffeau very juftly obferves, that almoft all inftruments are limited in their compafs *below*, except harps and inftruments with keys. The violoncello can go no lower than double C, its 4th ftring, nor the violin below G. The flute and hautbois defcend only to D and C. But the notes in alt. have been extended in the acute to founds that are feldom in tune, and never pleafing. Like rapid notes of difficult execution, they *furprize*, and the performer's dexterity is applauded; but neither the harmony nor the melody of very high or rapid founds can excite rapture like thofe of moderate quicknefs, when produced with feeling and expreffion, in the middle of the fcale.

RAVALSHE, in *Geography*, a town of Sweden, in Weft Gothland; 24 miles N.W. of Uddevalla.

RAVANA, in *Hindoo Mythology*. See Ravena.

RAVANAK, in *Geography*, a town of European Turkey, in Macedonia; 16 miles E.S.E. of Saloniki.

RAUAND, a town of Perfia, in the province of Kerman; 105 miles E. of Sirgian.

RAVA-POU, in *Botany*, Rheede Hort. Malab. v. 4. 99. t. 48, a plant erroneoufly cited by Linnæus for his very different *Nyctanthes hirfuta*. See Guettarda *Speciofa*.

RAUCA Avis, in *Ornithology*, the name of a bird defcribed by Nieremberg, as common about the lakes and rivers of America, and of the kingfifher kind, but nearly as large as a duck, and black on the crown, and white on the breaft and belly. Its neck is naturally very long in proportion to its body, yet it can occafionally contract and fhorten it in a very wonderful manner. It is a native of Mexico, and is efteemed very good for the table. Mr. Ray has placed this among the birds, the accounts of which he is diftruftful of.

RAUCH, in *Geography*, a town of Germany, in the lordfhip of Schwarzenberg; 10 miles S.W. of Scheinfeld.

RAUCHENEGG, a town of Auftria; 2 miles W. of Baden.

RAUCHT, a town of Ruffia, in the government of Viborg, near lake Ladoga; 44 miles S.E. of Viborg.

RAUDANAGUR, a town of Bengal; 30 miles E. of Ramgur.

RAUDEN, a town of Pruffia, in the palatinate of Culm; 10 miles N.E. of Culm.—Alfo, a town of Silefia, in the principality of Ratibor; 12 miles N.E. of Ratibor.

RAUDNIZ, a town of Bohemia, in the circle of Schlan; 12 miles N.N.E. of Schlan.—Alfo, a town of Bohemia, in the circle of Chrudim; 16 miles N.N.W. of Chrudim.

RAUDRI, a name of the Hindoo goddefs *Parvati*, confort of *Siva*, the deftroying power. In this character fhe may be confidered as his *Sakti*, or energy in his form of *Rudra*, or Fate. *Rudri*, and *Rudrani*, are other modes of writing this name of the goddefs in her avenging character, in which fhe does not apparently differ much from her attributes, as Sakti of *Mahakala;* under which name, and the others occuring in this article, diftinguifhed by italics, farther and fufficient information may be fought. See alfo Trisakti-devi, and Tamasi.

RAUDTEN, in *Geography*, a town of Silefia, in the principality of Wohlau; 18 miles N.W. of Wohlau. N. lat. 51° 30′. E. long. 16° 15′.

RAVEL Bread, a fort of bread, called alfo *blackwhytlof*, as being of a middle finenefs betwixt white and brown.

RAVELIN, in *Fortification*, was anciently a flat baftion, placed in the middle of a curtain.

Ravelin is now a detached work, compofed only of two faces, which make a faliant angle, without and fometimes with flanks; and raifed before the curtain on the counterfcarp of the place; ferving to cover it and the joining flanks from the direct fire of an enemy.

A ravelin is a triangular work, refembling the point of a baftion, with the flanks cut off. (See *Plate* V. *Fortification*, *fig*. 4. lit. i i i. &c.) Its ufe before a curtain is, to cover the oppofite flanks of the two next baftions. It is ufed alfo to cover a bridge or a gate, and is always placed without the moat.

What the engineers call a ravelin, the foldiers generally call a demi-lune, or half-moon. See Demi-lune.

There are alfo *double* ravelins, which ferve to defend each other. They are faid to be double when they are joined by a curtain.

Ravelins, or half-moons, are conftructed by fetting off 50 toifes from the re-entering angle O of the counterfcarp (*Plate* VII. *Fortification*, *fig*. 4.) on the capital O L of the ravelin, or on the perpendicular produced, and from the point L drawing lines to the fhoulders A, B; whofe parts L M, L N, terminated by the counterfcarp, will be the faces M O, O N, the femi-gorges of the ravelin required. Others will have the faces of the ravelin to terminate on thofe of the baftions within three toifes of the fhoulders, in which cafe the ravelins cover the flanks better than the others. The ditch before the ravelin is 12 toifes, and its counterfcarp parallel to the faces of the ravelins, and made in a circular arc before the faliant angle. When the ravelins are made with flanks, the faces fhould terminate thofe of the baftions, at leaft 5 toifes from the fhoulders. Thefe flanks are made by fetting off 10 toifes from the extremities of the faces, and from the points thus determined, the flanks are drawn parallel to the capital of the ravelin. When redoubts, or keeps, are formed in the ravelin, this is done by fetting off 16 toifes from the extremities of the faces, on the femi-gorges from N to *b*, and from M to *a*; and from the points *b*, *a*, the faces are drawn parallel to thofe of the ravelin: the ditch before this redoubt is 6 toifes, and its counterfcarp parallel to the faces. This work fhould be covered in the faces by a wall, a foot or two thick, furnifhed with loopholes for the mufketry to fire through; and it will ferve to fecure a retreat for the troops who defend the ravelin; they may thus prevent the enemy from making a lodgment in the outward part of the ravelin, or at leaft greatly obftruct their attempts for this purpofe. Nor can they be drove from this place, until the enemy has erected a battery, and brought cannon on the ravelin to batter the redoubt. When the *counterguard* (which fee) is placed before the ravelin, 40 toifes are fet off on the capital of the ravelin from its faliant angle to the faliant angle of the counterguard, and 10 on the counterfcarp of the ditch. For the conftruction of crown-works before the ravelin, fee Horn-*work*. Within the ravelin are conftructed a rampart of about 16 or 20 yards, and a parapet of about 6 yards: ramps are alfo annexed in the flope of a rampart, and a barbet, when it is proper, is conftructed in a faliant angle. In wet ditches, where the troops pafs from the town to the ravelin in boats, it is proper to make, in the gorge of the ravelin, a kind of harbour, where the boats may be covered from the fire of the enemy. In dry foffes, there fhould be ramps or ftairs in the gorge of the ravelin, to preferve a free communication, if the bridges fhould be broken down by the enemy's fhot. The celebrated general Coehorn, in the ravelins which he built at Bergen-op-zoom, contrived a very good defence for the covered way before the faces of the baftions, by making retired flanks in the breafts of the ravelin, where one

one or two cannon might be placed as ſecure from the enemy's fire as thoſe behind the orillon of a baſtion. See *Military* CONSTRUCTION.

RAVELLO, in *Geography*, a ſea-port town of Naples, in Principato Citra, the ſee of a biſhop, united to Scala; 11 miles W.S.W. of Salerno. N. lat. 40° 39′. E. long. 12° 10′.

RAVELWATER, a river of the county of Antrim, Ireland, riſing in the mountains in the northern part, and flowing through Ravel glen to the river Main.

RAVEN, CORVUS, in *Aſtronomy*. See CORVUS.

RAVEN, *Corvus corax* of Linnæus, in *Ornithology*, a large bird of the crow kind, well known throughout the world, as being found in all climates, and all regions. The colour of the whole bird is black, finely gloſſed with a rich blue, the belly excepted, which is duſky. The ravens build in high trees, or upon the ruins of lofty buildings in the neighbourhood of great towns, being held in the ſame veneration as the vultures are in Egypt, and for the ſame reaſon; for devouring the carcaſes and filth that would otherwiſe prove a nuiſance. They lay five or ſix eggs, of a pale greeniſh colour, marked with ſmall browniſh ſpots. There are many fabulous ſtories of the longevity of the raven; but birds are in general long lived, and the crow kind not leſs ſo than the reſt. The raven is a very docile bird, and may be taught to ſpeak, as well as to fetch and carry. In clear weather, ravens are remarked to fly in pairs at a great height, making a deep loud noiſe, different from the common croaking; and their ſcent is remarkably good. See CORVUS *Corax*.

The quills of a raven are uſed in tuning the lower notes of a harpſichord, when the wires are ſet at a conſiderable diſtance from the ſticks.

It is rare to find this creature white, yet it happens ſometimes. Boyle mentions one. There was alſo one ſhewn to the Royal Society ſome years ago. Boyle's Works abr. vol. ii. p. 46.

RAVEN, *Night*, an Engliſh name for a heron, which flies in the night, and makes a very odd and hoarſe noiſe. It has been applied by ſome to the bittern, or *ardea ſtellaris*, but improperly, belonging of right to the ſmaller grey heron, called *nycticorax*. See HERON.

RAVEN, *Sea*, or *Corvorant*. See CORVUS *Aquaticus*.

RAVENA, in *Hindoo Mythology*, is the name of a celebrated king of Lanka, or Ceylon. Such was his proweſs, and the oppreſſion which he exerciſed over his ſubjects, that it became neceſſary for Viſhnu, the preſerving power of the deity, to deſcend on earth for his deſtruction, and the relief of the ſuffering world. He accordingly became incarnate in the perſon of Rama; and the wars that enſued between the forces of the tyrant and the divine general, for the recovery of Sita, his raviſhed ſpouſe, are the ſubject of the fine epic poem, the *Ramayana;* under which article of this work, and under *Rama*, and others thence referred to, the poem, and the hiſtorical traditions connected with theſe points, are ſufficiently deſcribed and diſcuſſed.

Although obſcured by mythological fables, theſe perſons and wars are admitted to have had hiſtorical exiſtence; and ſome important points of chronology hinge upon them. We have, therefore, in this and other articles, noticed at ſome length the legends connected with theſe ſubjects.

In the Hindoo theogony, the origin of Ravena is thus related. Two etherial warders of Viſhnu's palace carried the pride of office ſo far as to inſult the ſeven Maharſhis, (ſee MAHARSHI, or RISHI,) who had come to offer their adorations. The offended ſaints pronounced an imprecation on the inſolent warders, condemning them to be *adhoyoni*, or *born below*, thrice in mortal forms, before they could be re-admitted into the divine preſence. The imprecation of a Riſhi, even if provoked by a god, is ſcarcely to be averted; and the offenders, in conſequence, appeared in their firſt birth as Hiranyakſha, or golden-eyed, and Hiranyakaſipu, or clad in gold; ſecondly, as Ravena and Kumbhakarna; and laſtly, as Kanſa and Siſupala.

The hiſtory, if ſuch it may be called, of Ravena, Rama, &c. is perpetually alluded to in Hindoo writings: the Ramayana, containing an infinity of ſuch legends, being one of the moſt popular works of the Eaſt. Ravena, or Ravana, has become a generic name for a tyrant. He is alſo called Daſagriva, or the ten-necked; he being uſually repreſented with that number of heads, and twenty hands, ſymbolical of ſapience and prowefs. A couplet in the Ramayana may be thus tranſlated. "Where Ravana is, the ſun loſes his force, the winds ceaſe to blow, the fire ceaſes to burn: the rattling ocean, ſeeing him, ſtills its waves." Such are the hyperbolical relations of his potency, obtained by the uſual proceſs of ſelf-inflicted auſterities. So ardent was he in this irreſiſtible ſpecies of merit, that he offered to Siva nine of his ten heads ſucceſſively; and thus extorting the favour of the condeſcending deity, pleaſed with ſuch an important ſacrifice, he obtained a promiſe, with ſome equivocal ſtipulations, of whatever he ſhould deſire. This ſort of auſterity is called *Tapas*, under which word ſome account is offered of various modes of practiſing it. The gods and demi-gods, alarmed at Siva's promiſe, beſought him to recall it. But ſuch conduct is deemed unbecoming in deities, who, however, do not ſcruple to evade the performance of their promiſes by deceit or prevarication: and, on this occaſion, Nareda was deputed to ſound Ravena as to what he would demand, which, as uſual, was univerſal dominion, &c. Nareda artfully perſuaded Ravena that Mahadeva (or Siva) was drunk, and had promiſed him what he could not perform: whereupon the vindictive giant tears up Kailaſa, the paradiſe of Siva, which, being contrary to the ſtipulations, releaſes Siva from his promiſe, and he conſents to the deſtruction of Ravena, which is brought about by the avatara, or deſcent, of Viſhnu in the perſon of Rama. From this ſtory we are told to learn that all worldly affairs are the predeſtined ordainments of providence; whoſe will, that any event ſhould take place on earth, includes preſciently all the routine and detail of its accompliſhment; although we only ſee the links of a chain of cauſes leading naturally to its effect.

We will here add an extract from the Hindu Pantheon, whence a conſiderable part of this article is taken, ſhewing how unceaſingly the mythological machinery of that poetical people is introduced into their popular works. The names diſtinguiſhed by capitals imply that articles are given under thoſe words, in this work; and a reference may be made to them for any deſired information.

"Reſpecting Ravena," ſays the author of the publication adverted to, "I will notice but one more tale, as related to me by a Brahman; who, unable fully to make me feel the poetical beauties, or comprehend the morality of the Ramayana, bluſhed while he developed its follies; which, in conformity with popular taſte, or if taken ſeparately, are apparently very numerous; although it muſt be confeſſed, they are ſo contrived as to be intimately connected with the main action of the poem. The following idle tale is of this deſcription: but I ſhall not here explain the cauſes that led to the predicament, or the conſequences that enſued.

"Ravena, by his power and infernal arts, had ſubjugated all

all the gods and demi-gods, and forced them to perform menial offices about his perfon and houfhold. INDRA made garlands of flowers to adorn him withal. Agni, or PAVAKA, was his cook. SURYA, regent of the fun, fupplied light by day; and SOMA, regent of the moon, by night. VARUNA, the Hindoo Neptune, purveyed water for the palace. KUVERA, their Plutus, furnifhed cafh. The whole NAVA-GRAHA (the nine planetary fpheres, including RAHU and KETU) fometimes arranged themfelves into a ladder, by which, they ferving as fteps, the tyrant afcended his throne. BRAMA (for the great gods were there alfo, and I give this anecdote as I find it in my memoranda, without any improved arrangement) was a herald, proclaiming the giant's titles, the day of the week, month, &c. daily in the palace; a fort of fpeaking almanac. MAHADEVA, in his character or incarnation of KANDEH-RAO, performed the office of barber, and trimmed the giant's beards. VISHNU had the honourable occupation of inftructing and drilling the dancing and finging girls, and felecting the faireft for the royal bed. Ganefa, or POLLEAR, had the care of the cows, goats, and herds. VAYU fwept the houfe. YAMA wafhed the linen. And in this manner were all the gods employed in the menial offices of Ravena, who rebuked and flogged them in default of induftry and attention. Nor were the female divinities exempted: for PARVATI, in her form of SATWI, was head Aya, or nurfe, to Ravena's children. LAKSHMI and SARASWATI were alfo among them, but it does not appear in what capacity. Earthly kings and queens were alfo forced into this degrading fervitude, to the number of ninety-fix royal families; as is faid to be detailed in the RAMAYANA. But I have fome doubt if fuch a relation be actually in this fhape, in that poem: this we fhall fee, when its other books are tranflated and publifhed. In my abftract of it, however, fuch a godly predicament feems effential to the main action; RAMA being thereby impelled by every confideration of piety and duty to immediate and energetic meafures, for the relief and liberation of the degraded divinities."

Ravena, as we have noticed, is furnamed Dafagriva, or the ten-headed. He is alfo called Vifravana, or fon of Vifrava, the father likewife of Kuvera. The brothers are fometimes named *Pulaftya*, or *Paulaftya*. (See thefe articles.) Another of his names is equivalent to lord of Rakfhafhas, a race of malignant beings, common agents in the hands of fuperhuman tyrants for the annoyance of the virtuous portion of mankind, or thwarting the benificent views of the gods. Many fpecific varieties of thefe demons are enumerated in the firft book of the Ramayana, as aiding Ravena in defence of himfelf and his kingdom of Lanka. In pictures illuftrative of the Ramayana, which are very common throughout India, they are depicted efpecially ill-favoured, painted green, red, blue, &c. and engaged in fierce contefts with Rama's fimian foldiery. Several legions of thefe Rakfhas, each of 14,000, were deftroyed by Rama. See RAKSHA.

RAVENALA, in *Botany*, Adanf. Fam. des Plantes, v. 2. 67. Juff. 62. See URANIA.

RAUENBACH, in *Geography*, a town of Germany, in the principality of Anfpach; four miles S.S.W. of Anfpach.

RAVENGLASS, a market-town and fea-port in the parifh of Muncafter, Allerdale ward, above Darwent, county of Cumberland, England, is fituated on the Solway Frith, near the confluence of the rivers Efk, Mite, and Irt. Though poffeffing many advantages for trade, it is but a poor place, and chiefly fupported by its oyfter fifhery, for which it is much celebrated. This town ftands at the diftance of 57 miles S.S.W. from Carlifle, and 287 N.W. by N. from London. The manor originally conftituted part of the barony of Egremont, but was granted by Richard Lucy to the Penningtons, from whom the prefent owner, lord Muncafter, is lineally defcended. The market day is Saturday, weekly; and there are two annual fairs, one of which is held on the eve, day, and morrow, of St. James, and is remarkable for the ceremonies attending its proclamation and continuance. On the firft day, the earl of Egremont, or his proxy, attends, accompanied by the ferjeant of the borough of Egremont, with the infignia, called the Bow of Egremont; by the forefters, with their bows and arrows; and by all the tenants of the foreft of Copeland, who hold their eftates by the fpecial fervice of attending the earl, or his reprefentative, during the fair. On the third day, at noon, the earls, officers, and tenants of the foreft, depart, after proclamation; and lord Muncafter, and his tenants, take formal re-poffeffion of the place, and the day is concluded by horfe-racing, and various ruftic diverfions.

Near Ravenglafs, on the northern bank of the river Efk, ftands Muncafter-houfe, the feat of lord Muncafter; and eaft from it, on the oppofite fide of the river, are feen ruins of confiderable magnitude, refpecting which no hiftorical documents are known to exift. They are now called the *city of Barnfcar*; and its foundation is afcribed, by tradition, to the Danes, who are faid "to have gathered for its inhabitants the men of Drig, and the women of Beckermont," whence the popular faying, "let us go together like lads of Drig and laffes of Beckermont." Thefe ruins extend about three hundred yards in length from eaft to weft, and 100 in breadth, from north to fouth; and are enclofed, except at the eaft end, by a wall, nearly three feet in height. "There appears," fays Hutchinfon, "to have been a long ftreet, with feveral crofs ones; the remains of the houfefteads within the walls are not very numerous; but on the outfide they are innumerable, efpecially at the fouth fide and weft end. The circumference of the city, and fuburbs, is nearly three computed miles; the figure is an oblong fquare. There is an ancient road through the city, leading from Ulpha to Ravenglafs. About the year 1730, a confiderable quantity of filver coin was difcovered in the ruins of one of the houfes, concealed in a cavity formed in a beam." A Hiftory of the County of Cumberland, &c. by William Hutchinfon, F.S.A., two vols. 4to. Beauties of England and Wales, vol. iii., 1802, by John Britton and Edward Wedlake Brayley.

RAVENNA, a very ancient city of Italy, in the department of the Amone, feated on the river Mentone, near the Adriatic. This city, as Strabo informs us, was built by the Theffalians, on feveral iflands, long before the war of Troy, and they were driven out by the Tufcans. In the time of this Greek writer, it was fituated in the midft of a marfh, and attached to the continent, and in procefs of time the Po accumulated mud and fand, fo that the land was raifed and the fea removed to a greater diftance. The fame writer informs us, that it was made a Roman colony by Auguftus; and Dion fays, that a fleet of 250 veffels was ftationed in this port by that prince, from which circumftance it was called "portus claffis," or the port of the fleet. He ftationed, fays Suetonius, one fleet at Mifenum, and another at Ravenna, for guarding the upper and lower fea. Tiberius repaired its walls, and erected fome new gates, which ftill bear an infcription to this purpofe. Trajan alfo contributed towards embellifhing this city. Honorius made it the place of his refidence, both before and after Alaric had captured and burned Rome. When Odoacer made a conqueft of Italy, he refided at Ravenna, and fuftained here a fiege of of three years, at the termination of which he was taken and slain by Theodoric. Theodoric fixed the seat of his empire in this place, and adorned it with magnificent churches and palaces, and re-constructed the aqueduct of Trajan. His daughter Amalasoutha, and his grandson Athalaric, contributed towards the improvement of this city. When the Goths were driven from Italy by Narses, general of the emperor Justinian, he was made governor of Ravenna; and having continued in this station for 16 years, he was recalled by Justin II., successor to Justinian; and in the year 567 he was succeeded by Longinus, who took up his residence at Ravenna, under the title of exarch. (See Exarch.) The famous battle of Ravenna was fought near this town between Gaston de Foix, duke of Nemmes, and nephew of Louis XII. and the army of pope Julius II., Ferdinand, king of Spain, and the Venetians, in which the former young general, being only 24 years of age, having killed between 16 and 18,000 of the enemy, proved victorious, though he himself was killed by too ardently following the pursuit. This happened on Easter-day 1512. The French, enraged by the loss of their brave general, took Ravenna by storm, and pillaged the city with such severity that it has never recovered. On the road to Forli, by the banks of the little river Ronco, three miles from the city, a cross shews the spot where Gaston de Foix was killed. Fresh water has always been so scarce at Ravenna, that it has occasioned a pleasant epigram by Martial. This city was of late the capital of Romagna, with the title of an archbishopric. It has produced several persons of eminence, as Faustinus, often mentioned by Martial; the sophist Aspasius, who lived under the reign of Alexander Severus; Cassiodorus, chancellor to Theodoric, king of the Goths in Italy; pope John XVII.; Peter Damien, cardinal of Ossa, and several others. Ravenna was also the seat of many councils at successive periods. The three last councils, in 1311, 1314, and 1317, were summoned for the purpose of reforming the corrupted manners of the ecclesiastics, which were, in those days, very debauched. It is now a mean and inconsiderable town; the houses are old and in a ruined state, and the number of inhabitants scarcely amounts to 14 or 15,000. In the time of the Romans, it was seated on a kind of bay formed by the Adriatic, and its harbour was celebrated; but it is now three miles from the sea. The mud thrown up by the tide having formed a tract of land, which is cultivated, and on which the city itself has been enlarged towards the sea. The air is insalubrious; but has been somewhat amended by conveying along the sides of the city the rivers Mentone and Ronco, which carry off the foetid water from the marshy grounds. It contains several churches, and 24 convents; 42 miles E. of Bologna. N. lat. 44° 27'. E. long. 11° 5'.

RAVENPOINT, a headland of the county of Wexford, Ireland, at the N. side of the entrance into Wexford haven. N. lat. 52° 23'. W. long. 6° 18'.

RAVENSARA, in *Botany*, a barbarous appellation, altered by Sonnerat from the Madagascar name of the plant, *Raven-tsara*, or *Voaravendsara*, meaning, it seems, *a good leaf*, and applying to the aromatic qualities, and economical uses, of the leaves. Hence Jussieu was induced to contrive the apt generic name *Agathophyllum*, from αγαθος, *good or profitable*, and φυλλον, *a leaf;* under which this genus ought to have been described in its proper place, in our first volume. But one of our predecessors has, by mistake, referred the reader to *Ravensara*, as a genuine Linnæan name, attributing Agathophyllum to professor Martyn; see that article. To correct this error, and supply the consequent deficiency, we subjoin an account of the tree in question, under its proper and received denomination.

Agathophyllum. Juss. 431. Schreb. 806. Willd. Sp. Pl. v. 2. 842. Mart. Mill. Dict. v. 1. Lamarck Illustr. t. 825. (Ravensara; Sonnerat Ind. Occ. v. 2. 226. Euodia; Gærtn. t. 103. Lamarck Illustr. t. 404.)—Class and order, *Dodecandria Monogynia*. Nat. Ord. uncertain, perhaps akin to the *Lauri*, Juss.

Gen. Ch. *Cal.* Perianth inferior, very small, abrupt, entire, permanent. *Cor.* Petals six, ovate, inserted into the calyx, somewhat villous on the inside. *Stam.* Filaments twelve, broadish, very short, alternately inserted into the base of the petals and the inside of the calyx; anthers roundish. *Pist.* Germen superior, very small; style very short; stigma downy. *Peric.* Drupa nearly globose, umbilicated. *Seed.* Nut the shape of the drupa, tipped with a small abrupt point, divided internally half way, into six coriaceous cells; kernel convex above, six-lobed below, one lobe being received into each cell.

Eff. Ch. Calyx abrupt, entire. Petals six, inserted into the calyx. Drupa superior, nearly globose. Nut with six incomplete cells. Kernel solitary, with six lobes.

Obs. Schreber, by a casual oversight, describes the fruit as crowned with the calyx, though he justly terms the germen superior.

1. A. *aromaticum*. Willd. n. 1. (Ravensara aromatica; Sonnerat Ind. Or. v. 2. 226. t. 127. Euodia Ravensara; Gærtn. v. 2. 101.)—Native of Madagascar. A large and tufted, somewhat pyramidal tree, with a reddish aromatic *bark*, and heavy, hard, inodorous, white *wood*, intermixed with red fibres. *Leaves* alternate, stalked, simple, obovate, entire, generally obtuse; smooth on both sides; pale and rather glaucous beneath; single-ribbed, of a firm or coriaceous texture. *Flowers* very minute, numerous, in axillary panicles about the ends of the branches, shorter than the leaves. *Fruit* an inch in diameter, solitary at the end of each branch, so that, as Sonnerat remarks, one would think the *flowers* had grown on a different tree; the panicles being obliterated, probably, in consequence of one flower alone, in each, bearing fruit. The tree produces fruit at the age of five or six years, which is ten months in coming to perfection. The inhabitants of Madagascar gather it at the age of six or seven months, as being, in that state of growth, more fit for use as a spice. The kernel, when fresh, has a fine aromatic odour, but its taste is bitter, and so highly acrid as to burn the throat very disagreeably. The *leaves* are also very aromatic, and being made into a sort of garlands, are left for a month in the open air to dry; after which they are plunged, for four or five minutes, into boiling water, and then dried, either in the sun, or by a fire. The *fruits* are treated in the same manner. The *flowers* appear in January or February. The dried *leaves*, as well as the *fruit*, of this tree, are said to partake of the flavours of the four most esteemed spices. They have not, however, come into use as an article of commerce, though some of the French, resident in Madagascar, have endeavoured to call the attention of their countrymen to this object. Gærtner found the odour of the fruit, though agreeable, too weak to promise much utility.

RAVENSBERG, in *Geography*, a county of Germany, lying between the bishoprics of Munster, Osnaburgh, and Paderborn, the principality of Minden, and the counties of Schauenberg and Lippe. The soil is in some parts sandy, but in others, especially towards the principality of Minden, it produces corn, flax, and hemp; coal is found in some of the mountains, and good stone for building. Its name is derived from that of an ancient castle, and it had formerly its own counts. It lately belonged to the king of Prussia; but by the peace of Tilsit was transferred to the kingdom of Westphalia.

Westphalia. The approaching congress (1814) may possibly fix its future destination.

RAVENSBURG, a town of Bavaria, which anciently belonged to the Guelphs, counts of Altorf; but it was an imperial town before the time of king Rodolphus, and continued such till the year 1802, when it was given, among other indemnities, to the elector of Bavaria. The Roman Catholics and Lutherans are united with regard to the temporal and spiritual concerns of the place, and the magistracy is shared betwixt them. They have one church in common; but the Lutherans are exclusively possessed of another, and the Roman Catholics have also two parish-churches; 21 miles N.E. of Constance. N. lat. 47° 41′. E. long. 9° 38′.

RAVENSBURG, a town of the Rhenish palatinate, on the Elsass; 16 miles W. of Heilbronn.

RAVENSBURN, a small stream of England, which runs into the Thames between Greenwich and Deptford.

RAVENSCROFT, THOMAS, in *Biography*, an active English musician and publisher, who flourished from the beginning of the 17th century to 1635. He was the editor and composer of the best collection of psalm tunes in four parts, which had till then appeared in England. He was a bachelor of music, and a professor not only well acquainted with the practice of the art, but seems to have bestowed much time in the perusal of the best authors, and in meditation on the theory.

This book, published in small octavo, 1621 and 1633, contains a melody for every one of the hundred and fifty psalms, many of them by the editor himself, of which a considerable number is still in use; as Windsor, St. David's, Southwell, and Canterbury. There are others, likewise, which are sung by the German, Netherlandish, and French Protestants. To these the base, tenor, and counter-tenor parts have been composed by twenty-one English musicians: among whom we find the names of Tallis, Dowland, Morley, Bennet, Stubbs, Farnaby, and John Milton, the father of our great poet. The tunes which are peculiar to the measure of the 100dth psalm, the 113th, and 119th, were originally Lutheran, or perhaps of still higher antiquity. And though Ravenscroft has affixed the name of Dr. John Dowland to the parts which have been set to the 100dth psalm, yet, in the index, he has ranked the melody itself with the French tunes; perhaps from having seen it among the melodies that were set to the French version of Clement Marot and Theodore Beza's Psalms, by Goudimel and Claude le Jeune. Ravenscroft, in imitation of these harmonists, always gives the principal melody, or, as he calls it, the *playn-song*, to the tenor. This part, indeed, he sometimes erroneously terms *Fa-burden*. This is a corruption of *faux-bourdon*, and *falso bordone*, which originally implied such simple harmony as arises from a series of thirds and sixths to the base. His publication is, in some measure, historical: for he tells us not only who composed the parts to old melodies, but who increased the common stock, by the addition of new tunes; as well as which of them were orignally English, Welch, Scots, German, Dutch, Italian, French, and imitations of these.

No tunes of triple time occur in Claude le Jeune, and but five in Ravenscroft: the principal of which are Cambridge, Martyrs, Manchester, and the 81st. This last is still much used, and often played by chimes: it is called an imitation of a foreign tune, and has the name of Richard Allison prefixed to it. Muller's German edition of the psalm tunes at Frankfort is exactly that of Claude le Jeune, in two parts only; except that he has transposed some of the melodies, and inserted easy leading and connective notes, to assist, not only the singer, but sometimes the tunes themselves; which, without them, would now be very bald and uncouth. Many of these old melodies are still sung to German hymns as well as psalms.

In 1614 Ravenscroft published "A briefe Discourse of the true, but neglected, Use of characterizing the Degrees by their Perfection, Imperfection, and Diminution in measurable Musicke, against the common Practice and Custome of the Times," 4to.

Ravenscroft had been educated in St. Paul's choir, under Mr. Edward Pierce, and was particularly conversant with old authors; he, therefore, wished to revive the use of those proportions in time, which, on account of their intricacy, had been long discontinued.

Ravenscroft practised these exploded doctrines ineffectually, though to his Discourse he added examples to illustrate his precepts, expressed in the harmony of four voices, concerning the pleasure of the five usual recreations of hunting, hawking, dancing, drinking, and enamouring. He was not always very successful in his attempts at imitative harmony; and melody was then so crude and uncouth throughout Europe, as to afford little assistance in imitative strains.

Ravenscroft was also the author of a collection of songs, entitled "Melcimata, Musical Phancies, fitting the Court, City, and Country Humours, in three, four, and five Voyces," published in the year 1611.

RAVENSCROFT, JOHN, one of the waits of the Tower Hamlets, and in the band of the Goodman's-fields playhouse, was a ripieno violin; yet, notwithstanding so humble a station, he was a performer of sufficient abilities to lead in any such band as that just mentioned; and could perform with great firmness a concerto of Corelli, or an overture of Handel. He was in great request at balls and dancing parties; but excelled most others, not only in *playing* hornpipes with the true sailor's *flang*, but in *composing* them: and there are two of his compositions, that a tar, if he had any leg to stand on, would irresistibly be impelled to dance, the moment he heard them.

RAVENSPUR, or RAVENSER, in *Geography*, was formerly a noted sea-port at the mouth of the Humber. It is celebrated by our historians for the descents of Henry IV. A.D. 1399, and of Edward IV. A.D. 1471, when these princes came to contend for the crown of England. It was shortly after, however, swallowed up by the ocean, together with many villages in its vicinity. The precise spot on which it stood is now unknown; but it is usually supposed to have been placed very near to Spurn Head, the Ocellum Promontorium of Ptolemy. For some additional account of the coast here, see PATRINGTON.

RAVENSTAIN, a town of Saxony, in the circle of Erzgeburg; 8 miles N.N.W. of Wolkenstein.—Also, a town of Hinder Pomerania; 7 miles E.S.E. of Zachan.

RAVESTEIN, a town of Brabant, on the S. side of the Meuse, the capital of a signiory, including 14 towns and villages; 15 miles N.E. of Bois le Duc.

RAVI, a name, in Sanscrit, of Surya, the Hindoo regent of the sun. It means the *Riser*, and has perhaps other meanings. See SURYA.

RAVIERES, in *Geography*, a town of France, in the department of the Yonne; 27 miles E. of Auxerre.

RAUJESHI, a circar of Bengal, bounded N. by Rajemal, E. by Bettooriah, S. by Mahmudshi, Shahjole, and Kishenagur, and W. by Birboom and Hindooa; about 55 miles long, and 18 broad. The capital is *Moorshedabad*; which see.

RAVILLE, a town of France, in the department of the Moselle; 5 miles S. of Bouley.

RAVILLY, a ſmall town of the county of Carlow, Ireland, in the barony of the ſame name. It is ſituated on the river Slaney, 3 miles S. from Baltinglaſs, and 32 S. by W. from Dublin.

RAVINA, a town of European Turkey, in Albania; 52 miles E. of Valona.

RAVINE, in *Field Fortification*, a deep hollow, uſually formed by a great flood, or long continued running of water; frequently turned to good purpoſes in the field.

RAVIS, the ſame with *raucedo*. See Hoarseness.

RAVISHMENT, in *Law*, denotes an unlawful ſeducing either a woman, or an heir in ward; for which there is a remedy by a writ of raviſhment, or action of treſpaſs *vi & armis, de filio vel filia rapto vel abducto*, in the ſame manner as the huſband may have it *de uxore raptâ et abductâ*, on account of the abduction of his wife. This action lay at the common law; and thereby the huſband ſhall recover, not the poſſeſſion of his wife, but damages for taking her away: and by ſtatute Weſtm. 1. 3 Edw. I. c. 13. the offender ſhall alſo be impriſoned two years, and fined at the pleaſure of the king. Both the king and the huſband may, therefore, have this action; and the huſband is alſo entitled to recover damages in an action on the caſe againſt ſuch as perſuade and entice the wife to live ſeparate from him, without a ſufficient cauſe.

Sometimes it is alſo uſed in the ſame ſenſe as *rape;* which ſee.

Ravishment *de Gard*, is a writ which anciently lay, and ſtill lies, for the guardian in ſocage againſt him who took from him the body of his ward, or pupil: but then he muſt account to his pupil for the damages he ſo recovers. It is expreſsly provided by ſtatute 12 Car. II. c. 24. that teſtamentary guardians may maintain an action of raviſhment, or treſpaſs, for recovery of any of their wards, and alſo for damages, to be applied to the uſe and benefit of the infants.

RAVITZ, or Rawisch, in *Geography*, a town of the duchy of Warſaw, moſt of the inhabitants of which are Lutherans: it has a conſiderable manufacture of cloth; 24 miles S. of Poſen.

RAVIUS, or Rave, Christian, in *Biography*, a learned German Orientaliſt, was born at Berlin in the year 1613. From a very early period he was attached to the ſtudy of the eaſtern languages, and after ſpending eight years in different univerſities on the continent, he came over to England in the year 1638, and took up his reſidence at the univerſity of Oxford. He brought with him recommendations from Voſſius, and other learned men; and was invited to Dublin by archbiſhop Uſher, primate of Ireland, who ſettled upon him a handſome ſtipend, and engaged him to take a voyage into the Eaſt, for the purpoſe of collecting ancient manuſcripts. About the ſame time he was invited by cardinal Richelieu to enter into his employment for a ſimilar purpoſe, which he declined, having already accepted the propoſals of Uſher. In 1639 he became acquainted with our countryman, the learned Edward Pococke, at Conſtantinople, where he improved himſelf in many languages, to which he had already applied his talents; and made himſelf maſter of the Turkiſh, Arabic, and Perſian languages. In the mean time he did not neglect the main object of his miſſion, but collected more than 300 choice manuſcripts. For this ſervice he was, on his return, amply rewarded. In 1642 he taught the Oriental languages at Greſham college, in London. During the following year he went to Holland, and was appointed profeſſor of the Oriental languages at Utrecht. We find him again in England in 1648, when he took the covenant, and was made fellow of Magdalen college, Oxford, by the parliamentary viſitors. In the courſe of a few months he left England, and went to Sweden, where he obtained the appointment of profeſſor of the Oriental languages at the univerſity of Upſal. This place he was obliged to leave about the year 1657; the revenues, that ought to have been devoted to the Upſal profeſſors, having been applied towards defraying the expences of the war between Sweden and Denmark. After this he for ſome time filled the chair of Oriental literature at the univerſity of Kiel, and from thence he removed to occupy the ſame profeſſorſhip at Frankfort on the Maine. He died in 1677, about the age of 64. His works are very numerous, of which the following are titles of the principal: "Obteſtatio ad univerſam Europam pro dicendis Rebus et Linguis Orientalibus, ac conjuganda Africæ atque Aſiæ Eruditione," 1644; "Orthographiæ et Analogiæ vulgo Etymologiæ Ebraiæ Delineatio, juxta vocis partes abſtractas;" "A Diſcourſe of the Oriental Tongues, *viz.* Hebrew, Samaritan, Chaldee, Syriac, Arabic, and Ethiopic," 1649; "Concordantiarum Hebraicarum et Chaldaicarum Epitome;" "Chronologia Biblica nova;" "Epiſtolæ variæ ad doct. Viros." He gave alſo to the world a tranſlation, from the Arabic language, of Apollonius's Conic Sections. He had a brother, named John Ravius, who was profeſſor of philoſophy at Roſtock, about the year 1638. In 1664-5 he was appointed counſellor and librarian to the elector of Brandenburg. He was author of "Commentarius in Cornelium Nepotem," 1635; "Summa Studiorum pro Nobilitate Danica;" "Aphoriſmi Militares," and other learned works.

RAULIN, John, a French writer in the 15th century, was born at Toul in the year 1443. He purſued his ſtudies at the univerſity of Paris, where he obtained the degree of D.D. in 1480, and afterwards filled the profeſſor's chair in theology with great diſtinction. He was elected grand maſter of the college of Navarre, and founded a good library in that ſeminary. Becoming diſſatisfied with the world, he embraced the monaſtic life at the abbey of Cluny, in Burgundy, in 1497. He died in 1514, at he age of 71. He attracted much attention as a preacher, and ſeveral of his ſermons have been publiſhed, which exhibit ſtriking ſpecimens of the bad taſte which prevailed in France in the 15th century. The works of this author were collected, and publiſhed at Antwerp, in 6 vols. 4to., 1612. They are accompanied with a curious and valuable collection of "Letters," that illuſtrate the hiſtory, manners, and ſentiments of the age in which he lived. They were firſt publiſhed after his death, in quarto, in 1521, under the title of "Joannis Raulin Epiſtolæ Illuſtrium Virorum." Moreri.

RAULT, Felix, the favourite performer on the German flute at Paris, in 1770; where we heard him ourſelves with as much pleaſure as a flute can give, by neat execution, perfect intonation, and a mellifluous embouchure. M. Laborde has rendered his biographical article intereſting by a detail of his profeſſional merits and private character.

"M. Felix Rault was born at Bourdeaux, in 1736. He was the ſon of Charles Rault, of the king's band, and firſt baſſoon at the opera. Felix was received there in 1753, and in the king's band in 1768. His talents are ſo well known at Paris, as to be above praiſe. Since Blavet's time, no one has brought the art of playing upon the German flute to ſuch perfection, eſpecially in accompanying the voice; a much more difficult art than playing concertos of great execution, generally well ſtudied at home previous to performance. But ſuch ſtudy is uſeleſs to Rault; for no one reads music more readily and with more facility, or gives it more meaning, than this performer. The beauty of his tone, the precision of his execution, the richness of his embouchure, however extraordinary, merit still less praise than his personal qualities, which endear him to all his acquaintance." Laborde.

RAUMO, in *Geography*, a sea-port town of Sweden, in the province of Finland, on the E. coast of the gulf of Bothnia; 50 miles N. of Abo.

RAUNPIKED, in *Rural Economy*, a provincial word used to signify stag-headed, among trees, as an old overgrown oak, having the stumps of the boughs standing out.

RAURAH, in *Geography*, a town of Thibet; 26 miles N. of Jemlah. N. lat. 31° 2′. E. long. 81° 40′.

RAURAVA, a Sanscrit word meaning *dreadful*, and a name of one of the Hindoo hells; they reckoning twenty-one of these receptacles for sinners. Naraka is called Maharaurava, or most dreadful.

RAURIS, in *Geography*, a town of the archbishopric of Salzburg; 32 miles S. of Salzburg.

RAUSCHENBERG, a town of Hesse; 4 miles N. of Marburg. N. lat. 50° 53′. E. long. 8° 53′.

RAUSHENBERG, a town of Germany, in the principality of Culmbach; 7 miles N.N.E. of Neustadt.

RAUSNITZ, a town of Moravia, in the circle of Brunn; 10 miles E. of Brunn.

RAUTA Lambi, a town of Sweden, in the government of Kuopio; 27 miles S.W. of Kuopio.

RAUTENBURG, a town of Prussian Lithuania; 27 miles W. of Tilsit.—Also, a town of Prussia, in the province of Samland; 36 miles N.E. of Königsberg.

RAUTERN, a town of Austria; 6 miles W.N.W. of Drosendorf.

RAUTIO, a town of Sweden, in the government of Ulea; 36 miles S. of Braheftad.

RAUTPOUR, a town of Hindoostan, in Allahabad; 18 miles N.N.W. of Corah.

RAUTY Dungaree, a town of Hindoostan, in Guzerat, on the coast; 50 miles S.W. of Noanagur.

Rauty-*Mummy*, or *Rauty-muddum*, *stone-mummy*, a name given by the people of the East Indies to a kind of fossile substance, much valued for its medicinal virtues. It is of the nature of the selenites, and is found upon the high rocks, and supposed to be generated of the dew which falls from the heavens; but this is an idle opinion, and the formation of it is evidently the same with that of the European rhomboidal selenites. They beat it to powder, and after boiling it in milk, they give it in cases of the venereal kind. In a common clap, they give half a scruple, night and morning.

RAUVEE, in *Geography*, a river of Asia, which rises on the borders of Thibet, and joins the Chunaub in the country of Lahore, 28 miles N.E. of Moultan. The Rauvee is the "Hydraotes" of Alexander, and though it is represented as a noble river, it is somewhat inferior in bulk to the Chunaub. Its sources are in the mountains near Nagorkote, a famous place of Hindoo worship; and it enters the plains near Shahpour (called also Rajapour), from whence the famous canal of Shah Nahr was drawn to Lahore, 48½ common cosses in length. The space between the Rauvee and Chunaub, at their entry on the plains, is about 54 geographical miles; and they gradually approach each other during a course of 170 miles. The junction of the Rauvee with the Chunaub (or rather the Chunaub and Behut collectively) is effected nearly midway between Toulumba and Moultan. The Ayin Acbaree allows 27 cosses between the junction of the Behut and Chunaub, and that of the Rauvee with the Chunaub; but this distance must be applied to the course of the river, not to the road by land. When these three rivers are united, they form a stream equal to the Indus itself, at the place of confluence; which is from 20 to 30 miles below Moultan. Rennell.

RAUWOLFIA, in *Botany*, was so named by Plumier, in memory of Leonard Rauwolf, a native of Augsburg, and a pupil of Rondelet. He sailed from Marseilles, in 1573, for the Levant, and performed a laborious and dangerous journey through Syria, Mesopotamia, Palestine and Egypt; of which he has left an account in German, full of curious information relative to medical and other rare plants, with several wooden cuts. He died physician to the Austrian army, at Hatvany, in Hungary, in 1606, according to Dryander, Bibl. Banks. v. 395, though Haller says 1596. The latter writer mentions his being obliged to quit his country on account of his religion, which was Protestant. His splendid herbarium, once the property of queen Christina, and of Isaac Vossius, is preserved in the university of Leyden. From it Gronovius composed his *Flora Orientalis*.—Linn. Gen. 115. Schreb. 160. Willd. Sp. Pl. v. 1. 1217. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 2. 64. Juss. 148. Plum. Gen. 19. t. 40. Lamarck Illustr. t. 172. Gærtn. t. 52.—Class and order, *Pentandria Monogynia*. Nat. Ord. *Contortæ*, Linn. *Apocineæ*, Juss.

Gen. Ch. *Cal.* Perianth inferior, minute, with five segments, permanent. *Cor.* of one petal, salver-shaped; tube cylindrical, globular at the base; limb in five deep, roundish, emarginate, oblique segments. *Stam.* Filaments five, shorter than the tube; anthers erect, simple, acute. *Pist.* Germen roundish; style very short; stigma capitate. *Peric.* Berry nearly globose, marked with a furrow along one side, of one cell. *Seeds* two, convex at the base, tapering at the summit, compressed, divided, more or less completely, into two cells.

Ess. Ch. Corolla oblique, salver-shaped. Stamens included. Berry globose, with two seeds, each of two cells.

1. R. *nitida*. Shining Rauwolfia. Linn. Sp. Pl. 303. Hort. Cliff. 75. t. 9. Willd. n. 1. Ait. n. 1. (R. tetraphylla angustifolia; Plum. Ic. 232. t. 236. f. 1.)—Leaves in fours, lanceolate, pointed, very smooth and shining. Flowers axillary or terminal, cymose.—Native of mountainous woods in the West Indies. A *shrub* about twelve feet high, erect, very smooth and shining, abounding with viscid milk. *Leaves* four together at each joint of the branches, spreading, on short stalks, lanceolate, with a blunt point, entire, unequal in size, from two to five inches, or more, with one rib, and many fine transverse parallel veins. *Flowers* small, white, inodorous, in axillary, rarely terminal, stalked *cymes*, shorter than the leaves. *Fruit*, according to Jacquin, at first yellow, then purplish-black, thrice the size of a pea, milky. Linnæus tells us his figure in the Hortus Cliffortianus was drawn by Ehret, from a plant in the Chelsea garden; so that this *Rauwolfia* must have flowered under Miller's care, in the year 1736. In Ait. H. Kew. a later date is given. The corolla in the figure just mentioned is more concave in the limb, as well as more notched, than Plumier represents it.

2. R. *glabra*. Smooth Rauwolfia. Cavan. Ic. v. 3. 50. t. 297. Willd. n. 2.—Leaves alternate, ovato-lanceolate, smooth. Cymes opposite to the leaves, of few flowers.

Native of New Spain. The whole plant is smooth. *Stem* shrubby, a yard high, with pliant, round, leafy branches. *Leaves* scattered, rounded at the base, rather pointed, single-ribbed, two or three inches long, on shortish *footstalks*. *Flowers* small, white, about four together, in small cymes or clusters,

clusters, opposite to the leaves. *Berry* obovate, with only one *seed*; at least in garden specimens, which very probably differ in those respects from wild ones. This species flowered at Madrid from August to October.

3. R. *canescens*. Hoary Rauwolfia. Linn. Sp. Pl. 303. Willd. n. 3. Ait. n. 2. (R. hirsuta; Jacq. Amer. 47. R. tetraphylla latifolia; Plum. Ic. 232. t. 236. f. 2.)—Leaves in fours, elliptic-obovate, acute, downy. Flowers axillary or terminal. Segments of the corolla obtuse.—Native of dry, sunny, bushy places in the West India islands, as well as on the neighbouring continent. It was cultivated by Miller at the same time with the first species. We received a specimen in flower, from the stove at Kew, in June 1807. Jacquin says this species varies greatly in the size of all its parts, according to soil and situation, and in the height of its *stem* from one to eight feet. The young *branches, flower-stalks, footstalks*, and both sides of the *leaves*, are clothed with short dense pubescence, which almost entirely disappears by culture, though the upper side of the *footstalks* continues rough with bristly glands. The *leaves* are from one and a half to two inches long, obovate, more or less inclining to elliptical, acute, unequal. *Flowers* in small, axillary, downy, stalked tufts, or umbels. *Corolla* green with a tinge of red, its segments obtuse. *Fruit* cloven at the top, first red, then black, containing two *seeds*, as Jacquin well describes it. One cell of each seed is usually, according to him, abortive.

4. R. *tomentosa*. Downy Rauwolfia. Jacq. Amer. 48. Obs. fasc. 2. 9. t. 35.—Leaves in fours, obovato-lanceolate, downy, tapering at each end. Flowers axillary or terminal. Segments of the corolla acute.—Native of rocky places about Carthagena; sometimes on the stone walls of the town. Jacquin alone seems to have known this species, which principally differs from the last, as far as we can judge, in having white *flowers*, the segments of whose *corolla* are ovate and acute. The *leaves* moreover are rather tapering at each end; but that circumstance varies. *Fruit* the size of a pea, first red, then black. We have seen no specimen.

5. R. *Pulaparia*. East Indian Rauwolfia. Roxb. MSS.—Leaves in threes, elliptical, bluntly pointed, smooth and shining. Flowers terminal, in forked panicles. Corolla many times longer than the calyx. Sent by Dr. Roxburgh, from Calcutta, with the above name. We rely on him for the genus, having seen no fruit. This *shrub* is smooth in nearly every part, with round *branches*. *Leaves* about three inches long, and above one broad, coriaceous and shining; their transverse veins very fine and numerous. *Flower-stalks* very minutely downy, as well as the imbricated *bracteas*, and keeled pointed segments of the *calyx*. *Corolla* apparently white, with a red tube, which is near three quarters of an inch long, cylindrical, swelling at the top: segments of the limb rounded.

Rauwolfia, in *Gardening*, contains plants of the tender, exotic, shrubby kind for the stove, of which the species cultivated are: the shining rauwolfia (R. nitida); and the hoary rauwolfia (R. canescens).

Method of Culture.—These may be increased by the seeds or berries, which should be sown in pots filled with light mould, in the autumn or spring, plunging them in a mild hot-bed. When the plants have attained some growth, they should be removed into separate pots, and have the management of other exotic stove plants. They may likewise be raised by layers and cuttings, laid down or planted out in pots, plunged in the hot-bed in the spring and summer months, till they have stricken root, being afterwards managed as those from seed.

They afford much ornament and variety in hot-house collections, both in their foliage and flowers.

RAUZAN, in *Geography*, a town of France, in the department of the Gironde; 9 miles S.S.E. of Libourne.

RAUZZINI, Venanzio, in *Biography*, a native of Italy, who, when he arrived here in 1774, to succeed Millico at the opera, was a beautiful and animated young man, with a soprano voice. He was an excellent musician, having studied counterpoint with as much application as the art of singing: so that he may truly be said not only to know his own business, but that of a maestro di cappella; having been as able to compose an opera as to perform a principal part in it. "Piramo e Tisbe," and "La Vestale," may be instanced in proof of this assertion.

His voice was not very powerful when he came hither from Munich, where we first knew him; and where he had enjoyed the highest favour several years. His taste, governed by science, was correct and exquisite. His voice, though not of great volume, was sweet, clear, flexible, and extensive; being in compass more than two octaves. But he is supposed to have injured his chest in early youth by a rage for counterpoint. He played the harpsichord neatly, accompanied well, and had real genius for composition, which inclined him to devote that time to the pen and the improvement of his hand, which, perhaps, in his station, would have been more usefully bestowed in nursing and exercising his voice.

It was some time before the extent of his merit and science were known in this country, and favoured by the public. Nothing can so speedily convey the merits of a singer to an audience, as a *great* and powerful voice. However, his taste, fancy, knowledge, and delicacy, together with his beautiful person, and spirited and intelligent manner of acting, before the first season was over, gained him general approbation and favour. And since he has quitted the stage, and made Bath his residence. Though he has been long obliged to discontinue singing in public, it is not too much to say that he has disseminated good taste throughout the kingdom, by the numerous scholars he has taught among the nobility and gentry, as well as by those whom he has prepared for public patronage, professionally.

RAW, in *Agriculture*, any sort of plant, substance, or material, which is in a green, unripe, or undigested condition, or which is employed in its more fresh and crude state; as, for instance, dung before it has been much reduced, and lost many of its nutrient principles or properties by the process of fermentation. See Dung.

Raw *Cream*, in *Rural Economy*, such as is raised in the natural way, not *scalded* or *clouted*.

Raw *Hide*. See Hide.

Raw *Lands*, in *Agriculture*, a term applied to wet, cold, heavy lands, which are unfit to receive the seed.

Raw *Silk*. See Silk.

RAWA, or Rava, in *Geography*, a town of the duchy of Warsaw, late capital of a palatinate of the same name. The castle is appropriated for the confinement of state prisoners; 45 miles S.W. of Warsaw. N. lat. 51° 55′. E. long. 20° 17.

Rawa, a town of Poland, in the palatinate of Belz; 18 miles S.W. of Belz.

Rawa. See Rava.

RAWAK, a small island in the Pacific ocean, near the N. coast of the island of Waygoo, with which it forms a harbour. E. long. 131° 15′.

RAWAPSKITCHWOCK, a small westerly branch of Machias river. See Machias.

RAWAY, or *Bridge-town*, a truly commercial village of Middlesex county, New Jersey, on Raway river, four or five miles S.W. of Elizabeth-town, and 75 from Philadelphia.

phia. It contains a post-office, a presbyterian church, and about 50 or 60 houses.

RAWDON, a town of Nova Scotia, 40 miles from Halifax, containing about 50 or 60 houses.

RAWDON, a township of the county of Hastings, in Upper Canada, N. of Sidney.

RAWLINSON, CHRISTOPHER, in *Biography*, of Cork-Hall, in Lancashire, was born in 1677, educated in Queen's college, Oxford, and died in 1733: he was much attached to Saxon and Northern literature, and published an edition of "King Alfred's Translation of Boethius de Consolatione," 8vo. 1698.

RAWLINSON, RICHARD, a distant relation of the preceding, a learned antiquarian, was the son of sir Thomas Rawlinson, knight, and once lord mayor of London. He was educated at St. John's college, Oxford, and was admitted to the degree of doctor of the civil law in 1719. He devoted himself to antiquarian pursuits, and made large collections for a continuation of Wood's Athenæ Oxonienses, and History of Oxford, and published the life of that industrious antiquary. The principal work of Mr. Rawlinson was "The English Topographer," or, An historical account of all the pieces that have been written relating to the ancient natural history or topographical description of any part of England, 1720. He published the "Latin Letters of Abelard and Heloisa," and "A Translation of Du Fresnoy's New Method of Studying History," 2 vols. 8vo. He died at Islington in 1755, and by his will ordered that his heart should be deposited in the chapel of St. John's college, Oxford. That university was indebted to him for various benefactions of books, manuscripts, medals, &c. as well as landed property, and an endowment for an Anglo-Saxon lecture.

RAWLLOW, in *Geography*, a town of Hindoostan, in Palnaud; 27 miles W.S.W. of Timerycotta.

RAY, JOHN, in *Biography*, whom Haller terms the greatest botanist in the memory of man, and to whose transcendent merits we have already briefly adverted, in treating of the genus dedicated by Plumier to his name, see RAIANIA; was born at Black Notley, near Braintree, in Essex, Nov. 29, 1628. His father, Roger Ray, though in the humble station of a blacksmith, gave him a learned education; first at the grammar-school of his native town, at that time not very well conducted; and subsequently at Cambridge, where he entered at Catharine Hall, in his 16th year, June 28th, 1644, being designed for holy orders. In about a year and three quarters afterwards, he removed to Trinity College, where he found the young men occupied in a more liberal train of studies, with less of scholastic disputations and quibbles. Ray was fortunate in having for his tutor at Trinity, Dr. Duport, an eminent Greek scholar, under whose fostering and partial care, he soon made up for all the deficiencies of his early education, in the learned languages, including Hebrew. By this gentleman he was always mentioned with peculiar regard. He was no less happy in a youthful literary friend and fellow-student, afterwards the celebrated Dr. Isaac Barrow. Even at this early period, Ray began to cultivate natural history; and distinguished himself by many school exercises as an orator, no less than by his general taste for study, his love of virtue, and his gentleness of manners, qualities which shone brighter and brighter to the latest period of his life. His merit occasioned him to be chosen a Minor Fellow of Trinity, along with his friend Barrow, September 8th, 1649. On taking his degree of Master of Arts, he became a Major or Senior Fellow; and afterwards, October 1st, 1651, Greek Lecturer of the college. At the end of two years he was appointed Mathematical Lecturer, and in two years more, October 2d, 1655, Humanity Reader. He subsequently filled several respectable offices in his college, as Junior Dean, College Steward, &c., and during his residence in the university, became tutor to many gentlemen of rank and fortune, who were sensible of their obligations to him; amongst whom the most eminently distinguished by personal worth, and congeniality of talents with himself, was Mr. Francis Willughby, of Middleton-hall in Warwickshire, so well known by his posthumous works on Birds and Fishes, edited by the affectionate care of Ray.

At this period it was usual for young men of ability and learning, though not in orders, to deliver sermons, and common-place readings, as they were called; not only in the chapels or halls of their own colleges, but even before the university body, at St. Mary's church. In these Ray eminently distinguished himself. He was among the first who ventured to lead the attention of his hearers, from the unprofitable subtleties of scholastic divinity, and the trammels of Aristotelian philosophy, to an observation of nature, and a practical investigation of truth. The rudiments of many of his subsequent writings originated in these juvenile essays, particularly his celebrated book on the "Wisdom of God manifested in the Works of the Creation," known all over the world by its numerous editions and translations, and universally admired for its rational piety, sound philosophy, and solid instruction. This book is the basis of all the labours of following divines, who have made the book of nature a commentary on the book of revelation; a confirmation of truths, which Nature has not authority, of herself, to establish. In it the author inculcates the doctrine of a constantly superintending Providence; as well as the advantage, and even the duty, of contemplating the works of God. This, he says, is part of the business of a sabbath day, as it will be, probably, of our employment through that eternal rest, of which the sabbath is a type. Archbishop Tennison is recorded to have told Dr. Derham, that "Mr. Ray was much celebrated, in his time, at Cambridge, for preaching solid and useful divinity, instead of that enthusiastic stuff, which the sermons of that time were generally filled with." Two of his funeral discourses are mentioned with particular approbation; one on the death of Dr. Arrowsmith, master of his college; the other on that of one of his most intimate and beloved colleagues, Mr. John Nid, likewise a Senior Fellow of Trinity, who had a great share in Ray's first botanical publication, the *Catalogus Plantarum circa Cantabrigiam nascentium*, printed in 1660; which may be considered as the prototype of his *Synopsis*, hereafter mentioned. Indeed before this little volume appeared, its author had visited various parts of England and Wales, for the purpose of investigating their native plants, as he did several times afterwards; nor were his observations confined to natural history, but extended to local and general history, antiquities, the arts, and all kinds of useful knowledge. His amusing Itineraries were published, along with his life, by Dr. Derham, and a few letters to that gentleman, by the care of Dr. George Scott, F.R.S., in 1760, under the title of "Select Remains of the learned John Ray, M.A., &c." Ray's first botanical tour occupied nearly six weeks, from August 9th to September 18th, 1658. On the 23d of December 1660, he was ordained, both deacon and priest at the same time, by Dr. Sanderson, then bishop of Lincoln. In 1661 he travelled with Mr. Willughby into Scotland, returning by Cumberland and Westmoreland; and the following year, with the same companion, he accomplished a more particular investigation of Wales. How critically he studied the botany of the countries

countries he vifited, is evident from the different editions of his *Catalogus Plantarum Angliæ*, and *Synopfis Methodica Stirpium Britannicarum.*

All this while Mr. Ray continued to enjoy his fellowfhip, and to cultivate his Cambridge connections; but in September 1662, his tranquillity was difturbed by the too famous Bartholomew act, by which 2000 confcientious divines were turned out of their livings, and many fellows of colleges deprived of their maintenance, and means of literary improvement. Among the latter was the fubject of our memoir, with thirteen honeft men at Cambridge befides, of whofe names he has left us a lift. One of them, Dr. Dillingham, was mafter of Emanuel college; but Ray was the only perfon of his own college who fuffered this deprivation. The reader muft not fuppofe that he, or perhaps any other perfon in this illuftrious catalogue, was, in the leaft degree, deficient in attachment to the doctrine or difcipline of the church of England, or that they had taken the oath called the Solemn League and Covenant; which Ray certainly had neither taken nor ever approved. They were required to fwear to the infamous propofition, that the faid oath was not binding to thofe who had taken it, and on this ground they confcientioufly gave up their preferment. It is curious to read the apology made for Ray to Dr. Derham, on this fubject, by a Mr. Brokefby—"that he was at that time abfent from his college, where he might have met with fatisfaction to his fcruples; and was among fome zealous non-conformifts, who too much influenced him, by the addition of new fcruples. And we may alfo afcribe fomewhat to the prejudice of education in unhappy times." By this it appears, that the "fcruples" of non-conformifts were moft favourable to the fanctity of an oath; and that the "unhappy times" alluded to, were more advantageous to principle, than the golden days of Charles II.; whofe minifters doubtlefs valued the obedience, far more than the honefty, of any man; nor is this tafte, by any means, peculiar to them or their profligate mafter.

Mr. Ray, or, as he wrote his name, for a while, about this period, Wray, having thus the world before him, made an arrangement with Mr. Willughby for a tour on the continent; and in this plan two of his pupils were included, Mr. Nathaniel Bacon, and Mr., afterwards fir Philip, Skippon. They failed for Calais in April 1663, but being prevented, by the ftate of political affairs, from profecuting their journey through France, they traverfed the Low Countries, Germany, &c. proceeding by Venice into Italy; moft of whofe cities they vifited, either by fea or land; as well as Malta and Sicily; and returned, by Switzerland, through France, into England, in the fpring of 1666. Mr. Willughby indeed feparated from the reft of the party at Montpellier, and vifited Spain. An ample account of their obfervations was publifhed by Ray, in 1673, making a thick octavo volume. The travellers appear to have been diligent and acute in every thing relative to politics, literature, natural hiftory, mechanics, and philofophy, as well as antiquities and other curiofities; but in the fine arts they affume no authority, nor difplay any confiderable tafte or knowledge. Mr. Willughby's account of Spain makes a part by itfelf; and a rich critical catalogue of fuch plants, not, for the moft part, natives of England, as were obferved in this tour, concludes the volume. Haller gives to Ray the credit of having difcovered feveral fpecies in Switzerland, previoufly not known as natives of that country.

Ray paffed the fummer of 1666 partly at Black Notley, and partly in Suffex, ftudying chiefly the works of Hook, Boyle, Sydenham on Fevers, and the Philofophical Tranfactions, "making few difcoveries," fays he, "fave of mine own errors." The following winter he was employed at Mr. Willughby's, in arranging that gentleman's mufeum of natural hiftory and coins, and in forming tables of plants and animals for the ufe of Dr. Wilkins, in his famous work on an Univerfal Character. He now alfo began to arrange a catalogue of the Englifh native plants, which he himfelf had gathered; rather for his own ufe, than with any immediate view of publication; "at prefent," as he wrote to Dr. Lifter, "the world is glutted with Dr. Merret's bungling Pinax. I refolve never to put out any thing which is not as perfect as is poffible for me to make it. I wifh you would take a little pains this fummer about graffes, that fo we might compare notes." The above refolution of our author is, no doubt, highly commendable, but the world has rather to lament that fo many able men have formed the fame determination, at leaft in natural fcience. If it were univerfally adhered to, fcarcely any work would fee the light; for few can be fo fenfible of the defects of any other perfon's attempt to illuftrate the works of nature, as a man of tolerable judgment muft be of his own. This is efpecially the cafe with thofe who, like Ray, direct their afpiring views towards fyftem, and philofophical theory. Happily he did not try this arduous path, till he had trained himfelf by wholefome practical difcipline, in obfervation and experience. His firft botanical works affumed the humble form of alphabetical catalogues. His and Mr. Willughby's labours in the fervice of bifhop Wilkins, were indeed of a fyftematical defcription; and accordingly the authors themfelves were, more than any other perfon probably, diffatisfied with their performance. They relaxed from thefe labours in a tour of practical obfervation through the weft of England, as far as the Land's-End, in the fummer of 1667, and returning by London, Mr. Ray was folicited to become a Fellow of the Royal Society, into which learned body he was admitted November 7th. Being now requefted by his friend Wilkins to tranflate the "Real Character" into Latin, he undertook, and by degrees accomplifhed, that arduous performance, depofiting his manufcript in the library of the Royal Society, where it has ever fince repofed. The following fummer was agreeably fpent, in vifits to various literary friends, and in a folitary journey to the north; for his former companion Willughby, being juft married, ftayed at home; there Ray joined him in September 1668, and remained for moft part of the enfuing winter and fpring.

The feclufion and leifure of the country, with the converfe and affiftance of fuch a friend, were favourable to the profecution of a new fubject of enquiry, which now ftrongly attracted the attention of our great naturalift, the theory of vegetation. The firft ftep of the two philofophers, in this little-explored path, was an examination of the motion of the fap in trees; and the refult of their enquiries, communicated to the Royal Society, appeared foon after in the Philofophical Tranfactions. Their experiments clearly prove the afcent of the fap through the woody part of the tree; which is eafily detected by boring the trunk, at different depths, before the leaves are unfolded; and they obferved alfo the mucilaginous nature of the flowing fap, "precipitating a kind of white coagulum or jelly, which," fays Ray, in a note preferved by Derham, "may be well conceived to be the part which, every year, between bark and tree, turns to wood, and of which the leaves and fruit are made. It feems to precipitate more when the tree is juft ready to put out leaves, and begins to ceafe dropping, than at its firft bleeding." The accuracy of the leading facts recorded by thefe ingenious men, is confirmed by fubfequent obfervers, who have further purfued the fame fubject, which is now

fufficiently

fufficiently well underftood. They indeed, like the reft of the world till lately, feem not to have fufpected, that the fap was quiefcent till their perforations in the tree were made; nor did they advert, as they ought, to phenomena dependent on the principle of life, in the vegetable body. See CIRCULATION *of the Sap*.

At this time Ray began to prepare for the prefs his "Collection of Proverbs," a curious book in its way, by which he is perhaps better known to the generality of his countrymen, than by any other of his literary labours. The firft edition was publifhed in 1672; but the work was fubfequently much enlarged, and the author may almoft be faid to have exhaufted his fubject. From its very nature, delicacy and refinement muft often be difpenfed with; but this is evidently not the fault, or the aim, of the writer. His learning and critical acutenefs diffufe light over the whole, and make us overlook the coarfe vehicle of our inftruction.

The firft edition of the Catalogue of Englifh Plants, already mentioned, came out in 1670, and the fecond in 1677. Their great author gave his work to the world with that diffidence, for which he alone perhaps could perceive any juft foundation. We poftpone our remarks till we fpeak of the fame work in its fyftematic form hereafter.

About this period the health of Mr. Ray feems to have been confiderably impaired. He refufed a tempting offer to travel again on the continent, as tutor to three young noblemen; nor could the powerful attractions of alpine botany, which made a part of his profpect, overcome the reluctance to leaving home, which arofe from a feeble fta·e of body. Indeed this very reluctance, or liftlefsnefs, is accounted for, by the turn which his diforder took, as it terminated in the jaundice. After this depreffing complaint had left him, he refumed, with frefh alacrity, his botanical travels at home, vifiting the rich ftores of the north of England, with a companion named Thomas Willifel, whofe name and difcoveries he afterwards, on many occafions, has gratefully commemorated. Nothing forms a more ftriking feature in Ray's character, than the unreferved and abundant commendation, which he always gave to his friends and fellow-labourers. We are about to narrate an event, which called forth all his affectionate feelings of this kind, as well as his moft important and beneficial exertions; when, even to his own prejudice, he fulfilled the facred duties of friendfhip, and delighted in adorning the buft of his friend with wreaths, that he himfelf might juftly have affumed. On the 3d of July 1672, Mr. Willughby was unexpectedly carried off by an acute diforder, in the 37th year of his age. The care of his two infant fons was confided by himfelf to Mr. Ray, who was alfo appointed one of his five executors, and to whom he left an annuity of 60*l.* for life. The eldeft of thefe youths was created a baronet at the age of 10 years, but died before he was 20. Their fifter Caffandra afterwards married the duke of Chandos. Thomas, the younger fon, was one of the ten peers created, all on the fame day, by queen Anne, and received the title of lord Middleton. His early youth was much indebted to the care of his faithful guardian, who compofed, for his and his brother's ufe, and publifhed in 1672, a *Nomenclator Claſſicus*, far more exact, efpecially in the names of natural objects, than any that had previoufly appeared. The care of his pupils, and of the literary concerns of their deceafed parent, now interrupted Mr. Ray's botanizing excurfions, and caufed him alfo to decline the offer of Dr. Lifter, then a phyfician at York, to fettle under his roof. Bifhop Wilkins did not long furvive Mr. Willughby, and his death made another chafm in the fcientific and focial circle of our great natural philofopher, who felt thefe loffes as deeply and tenderly as any man. He fought confolation in a domeftic attachment, fixing his choice on a young woman, of good parentage, whofe name was Margaret Oakeley, and who refided in the family at Middleton-hall. He was married at the parifh church, June 5th, 1673, being then in the 45th year of his age, and his bride about 20. This lady took a fhare in the early education of his pupils, as far as concerned their reading Englifh. She is faid to have been recommended by her character, as well as her perfon, to the regard of her hufband. She bore him three daughters, who, with their mother, furvived him.

Ray's communications to the Royal Society became now very frequent, and extended to various fubjects relative to the natural hiftory of animals, as well as to the phyfiology, and even the botanical characters, of vegetables. He was, at the fame time, in the courfe of the years 1674 and 1675, much occupied in digefting Mr. Willughby's zoological papers. Thefe were compofed in Latin, in which language the Ornithology firft appeared in 1676, making a folio volume, accompanied by 77 plates, engraved, at the expence of the author's widow, from his own drawings. An Englifh tranflation by Ray, with ftill more additions than he had fupplied to the former publication, and one more plate, iffued from the prefs in 1678. The account which Dr. Derham received from the lips of Mr. Ray, about eight months previous to his deceafe, refpecting the primary intentions of himfelf and his late friend, and which is recorded in his life, p. 48, is too curious to be omitted here, as their project and its execution form an epocha in the hiftory of natural fcience. "Thefe two gentlemen," fays Derham, "finding the hiftory of Nature very imperfect, had agreed between themfelves, before their travels beyond fea, to reduce the feveral tribes of things to a method; and to give accurate defcriptions of the feveral fpecies, from a ftrict view of them. And forafmuch as Mr. Willughby's genius lay chiefly to Animals, therefore he undertook the Birds, Beafts, Fifhes, and Infects, as Mr. Ray did the Vegetables." Derham adds, that Mr. Willughby, during his fhort life, "profecuted his defign with as great application, as if he had been to get his bread thereby." The writer of the prefent article has elfewhere obferved, (Introductory Difcourfe, Tr. of Linn. Soc. v. 1,) that "from the affectionate care with which Ray has cherifhed the fame of his departed friend, we are in danger of attributing too much to Mr. Willughby, and too little to himfelf." His own ftatement, no doubt, was correct, as to their original aims; but it is impoffible not to perceive that the furvivor executed or perfected what his friend, in many inftances, could only have projected, or fcarcely begun. Had Willughby lived, there can be little doubt of his career being as glorious in the fequel as that of his friend; and poffibly, from the advantages of fortune which he enjoyed, even more widely beneficial to fcience. Yet who can tell that he might not have flackened his courfe? Though he glorioufly avoided the fnares of luxury and folly in his youth, who fhall fay that politics or ambition might not have dazzled his riper age? or that he would always have efcaped that ruinous vanity, which grafps at univerfal knowledge, or rather at univerfal fame; and knowing nothing deeply, is moft flattered with any praife which is leaft deferved. So often has this laft been the cafe with literary men, that one cannot but miftruft a character of the faireft promife. What Ray has done, we know and can appreciate. Equal to his friend in learning, talents, and zeal, the advantages of ample fortune were compenfated by the leifure and tranquillity of a fequeftered country life. His duties went hand in hand with his ſtudies and recreations, and he enjoyed, as Haller obſerves, the rare felicity of giving 50 years uninterruptedly to his favourite ſcience. His long-protracted ſtudies, and ripened experience, enabled him to achieve what at firſt he could but regard at a diſtance, as the great object of his wiſhes, a ſyſtematic arrangement of the animal as well as vegetable kingdoms. Every body had, hitherto, been content with Ariſtotle's claſſification of animals, of whoſe imperfections Ray, daring to think for himſelf, could not but be aware. He invented a new one, founded on the ſtructure of the heart. "The Harveian experiments, and doctrine of the circulation, had called the peculiar attention of philoſophers to every organ which has a ſhare in that phenomenon; and to this cauſe, probably, we owe the method of Ray." The mode of breathing in animals, whether by lungs or by gills, and the ſingle or double ſtructure of the heart, in the former caſe, conſtitute the baſis of his ſyſtem; which, in theſe particulars at leaſt, ſucceeding naturaliſts have adopted. His ſubordinate characters of the principal claſſes evince great ſkill and ſagacity, and the Linnæan ſyſtem of Quadrupeds is highly indebted to that of our illuſtrious countryman.

His zoological publications indeed did not follow each other in rapid ſucceſſion; for after the Ornithology had come forth in Engliſh, eight years elapſed before the *Hiſtoria Piſcium* of Willughby was given, by his care, to the world. This was printed in folio, with 188 plates of fiſhes, in 1686, at Oxford, owing to the intereſt of biſhop Fell, and the pecuniary aſſiſtance of the Royal Society. It does not appear why the relict of Mr. Willughby withheld, in this inſtance, the contributions which had ſo much benefited her huſband's former work, and which ſhe juſtly owed to his fame. It ſeems that the intimate connexion of Ray with this family, was much impaired by the death of lady Caſſandra Willughby, the mother of his friend, about the year 1675 or 1676; when the children were taken from his tuition, and he left Middleton-hall, fixing for a ſhort time at Sutton Cofeld, four miles diſtant. At Michaelmas 1677 he removed from thence to Falborne-hall, in Eſſex, not far from his native village. On the 15th of March following, his mother, at the age of 78, died at Black Notley, "in her houſe on Dewlands;" of whom he ſpeaks with that reverence and regret, which has peculiarly marked the characters of ſome of the greateſt and beſt men on the ſame occaſion. At Midſummer 1679, he finally ſettled at Black Notley, for the remainder of his days, or "for the ſhort pittance of time he had yet to live in this world," as he himſelf expreſſed it; which pittance, however, extended to more than twenty-five years.

The firſt fruit of our author's leiſure and retirement was his *Methodus Plantarum Nova*, publiſhed in 1682, making an octavo volume. His principles of arrangement are chiefly derived from the fruit. The regularity and irregularity of flowers, which take the lead in the ſyſtem of Rivinus, make no part of that of Ray. It is remarkable that he adopts the ancient primary diviſion of plants, into trees, ſhrubs, and herbs, and that he blamed Rivinus for aboliſhing it, though his own prefatory remarks tend to overſet that principle, as a vulgar and caſual one, unworthy of a philoſopher. That his ſyſtem was not merely a commodious artificial aid to practical botany, but a philoſophical clue to the labyrinth of Nature, he probably, like his fellow-labourers, for many years, in this department, believed; yet he was too modeſt, and too learned, to think he had brought this new and arduous deſign to perfection; for whatever he has incidentally or deliberately thrown out, reſpecting the value of his labours, is often marked with more diffidence on the ſubject of claſſification, than any other. He firſt applied his ſyſtem to practical uſe in a general *Hiſtoria Plantarum*, of which the firſt volume, a thick folio, was publiſhed in 1686, and the ſecond in 1687. The third volume of the ſame work, which is ſupplementary, came out in 1704. This vaſt and critical compilation is ſtill in uſe as a book of reference, being particularly valuable as an epitome of the contents of various rare and expenſive works, which ordinary libraries cannot poſſeſs, ſuch as the *Hortus Malabaricus*. The deſcription of ſpecies is faithful and inſtructive; the remarks original, bounded only by the whole circuit of the botanical learning of that day; nor are generic characters neglected, however vaguely they are aſſumed. Specific differences do not enter regularly into the author's plan, nor has he followed any uniform rules of nomenclature. So ample a tranſcript of the practical knowledge of ſuch a botaniſt, cannot but be a treaſure; yet it is now much neglected, few perſons being learned enough to uſe it with facility, for want of figures, and a popular nomenclature; and thoſe who are, ſeldom requiring its aſſiſtance. A mere catalogue or index, like the works of Tournefort and Caſpar Bauhin, which teach nothing of themſelves, are of readier uſe. The Species Plantarum of Linnæus unites the advantages of the cleareſt moſt conciſe ſpecific definition, and, by the help of Bauhin, of an univerſal index.

But if the fame or the utility of Ray's great botanical work has, neither of them, been commenſurate with the expectations that might have been formed, a little octavo volume, which he gave to the world in 1690, amply ſupplied all ſuch defects, and proved the great corner ſtone of his reputation in this department of ſcience. We ſpeak of the *Synopſis Methodica Stirpium Britannicarum*. The two editions of his alphabetical catalogue of Engliſh plants being ſold off, and ſome pettifogging reaſons of his bookſeller's ſtanding in the way of a third, with any improvements, he re-modelled the work, throwing it into a ſyſtematic form, reviſing the whole, ſupplying generic characters, with numerous additions of ſpecies, and various emendations and remarks. The uſes and medicinal qualities of the plants are removed to the alphabetical index at the end. A ſecond edition of this *Synopſis* was publiſhed in 1696, nor did its author ever prepare another. The third, now moſt in uſe, was edited twenty-eight years afterwards by DILLENIUS. (See that biographical article.) Of all the ſyſtematical and practical Floras of any country, the ſecond edition of Ray's *Synopſis* is the moſt perfect that ever came under our obſervation. "He examined every plant recorded in his work, and even gathered moſt of them himſelf. He inveſtigated their ſynonyms with conſummate accuracy; and if the clearneſs and preciſion of other authors had equalled his, he would ſcarcely have committed an error. It is difficult to find him in a miſtake or miſconception reſpecting Nature herſelf, though he ſometimes miſapprehends the bad figures, or lame deſcriptions, he was obliged to conſult." *Tr. of Linn. Soc. v.* 4. 277. Above a hundred ſpecies are added, in this ſecond edition, and the cryptogamic plants, in particular, are more amply elucidated. A controverſial letter from Rivinus to Ray, and its anſwer, with remarks upon Tournefort, are ſubjoined to this ſecond edition. Much of the diſpute turns upon the now obſolete diſtinction of plants, in a methodical ſyſtem, into trees, ſhrubs, herbs, &c. The letters are well written, in Latin: and liberal, though perhaps hypercritical, in their ſtyle. Ray took no delight in controverſy. Its inevitable

evitable afperities were foreign to his nature. We muft not omit to notice that, in the preface to both editions of his *Synopfis*, the learned author, venerable for his character, his talents, and his profeffion, as well as by his noble adherence to principle in the moft corrupt times, has taken occafion to congratulate his country, and to pour out his grateful effufions to Divine Providence, in a ftyle worthy of Milton, for the eftablifhment of religion, law, and liberty, by the revolution which placed king William on the throne. An honeft Englifhman, however retired in his habits and his purfuits, could not have withheld this tribute at fuch a time; nor was any loyalty ever more perfonally difinterefted than that of Ray.

The year 1690 was the date of the firft publication of his noble work on "The Wifdom of God in the Creation," of which we have already fpoken, and whofe fale, through many editions, was very extenfive. In 1700 he printed a book, more exclufively within the fphere of his facred profeffion, called "A Perfuafive to an Holy Life;" a rare performance of the kind, at that day, as it would be at the prefent; being devoid of enthufiafm, myfticifm, or cant, as well as of religious bigotry or party fpirit, "and employing the plain and folid arguments of reafon, for the beft of purpofes." His three "Phyfico-Theological Difcourfes, concerning the Chaos, Deluge, and Diffolution of the World," of which the original materials had been collected and prepared formerly at Cambridge, came out in 1692, and were reprinted the following year. A third edition, fuperintended by Derham, was publifhed in 1713. This able editor took up the fame fubject himfelf in a fimilar performance, the materials of which, like Ray's, were firft delivered in fermons, at Bow church, he having been appointed reader of Mr. Boyle's lectures.

While Ray was from time to time intent on thefe moral and religious performances, in which he laboured equally to imprefs and elucidate the truths of natural and revealed religion, as well as to enforce its precepts and duties, he was no lefs attentive than formerly to his fyftematical ftudies. Dr. Tancred Robinfon is recorded by Derham, as having firft prompted our great naturalift to undertake a *Synopfis Methodica*, or claffical arrangement, of the whole animal, as he had done of the vegetable, kingdom. He even wifhed him to extend his attention to foffils, anticipating, in fhort, what Linnæus afterwards performed. Nor did he fhrink from the tafk. Though now for fome time oppreffed with bodily infirmity, and particularly with very troublefome ulcers in his legs, his mind was tranquil and unimpaired. He foon finifhed his *Synopfis Methodica Animalium Quadrupedum et Serpentini Generis*, which came out in 1693, making a thin, but clofely printed, octavo volume. We have already fpoken of the originality of his method. The volume in queftion, however, is not confined to dry fyftematical arrangement. It enters deeply into the general and particular hiftory of animals, their external forms, and internal ftructure, with abundance of entertaining and curious facts and obfervations. Linnæus was poffeffed of this book from the year 1734, and appears to have ftudied it well. A fimilar volume on birds, and another on fifhes, were prepared by the author; but the manufcripts of thefe lay neglected in the hands of fome carelefs or ignorant bookfeller, till they were difcovered by Dr. Derham, and publifhed in 1713. They contain more of particular defcriptions and hiftories, than of general remarks; but otherwife accord with the plan of the Synopfis of Quadrupeds. Many things are fupplied from materials obtained fince the publication of Willughby's Ornithology and Ichthyology, and feveral figures of fifhes were added by Derham, at the perfuafion of Petiver, whofe works they fomewhat refemble.

Having accomplifhed fo many great and laborious publications, our venerable naturalift began, as Dr. Derham informs us, to enjoy the thoughts of repofing from his labours. He was neverthelefs ready, at the call of his friends, to revife a tranflation of Rauwolf's Travels, the original having even then become very fcarce, befides being unintelligible to mere Englifh readers. This tranflation, with fome other rare tracts annexed, and a catalogue of Grecian, Syrian, Egyptian, and Cretan plants, drawn up by Mr. Ray, iffued from the prefs in 1693. See RAUWOLFIA.

Poffibly the *Stirpium Europæarum extra Britannias nafcentium Sylloge*, which appeared in 1694, originated in the author's attention being recalled, by the laft-mentioned publication, to the contemplation of exotic plants. In this volume he collects from Clufius, Bauhin, Columna, and others, various additions to his own difcoveries, and the whole are difpofed in alphabetical order. A geographical view of the plants, which he had himfelf gathered in his foreign travels, is fubjoined; and the volume concludes with alphabetical catalogues, felected from Boccone's Sicilian plants, and other recent authors. It is in the preface to this book, that he firft adverts to the fyftem of Rivinus, not without juft applaufe of that author's work, a copy of which had been prefented to Ray. He commends the apt diftribution of the genera, the clearnefs and concifenefs of the ftyle, the purity of the Latin, and the beauty as well as exactnefs of the plates. He, however, contends for the ancient diftinction of plants into trees and herbs, which, as we have feen, he had himfelf mentioned as unphilofophical. In the reft of his criticifms, though "much may be faid on both fides," and though thefe controverfialifts, like others, profit of the intricacies and anomalies of Nature, to make good their arguments, concealing themfelves, like the cuttle-fifh, in their ink; ftill we cannot but give our teftimony to the greater folidity of Ray's principles, as derived from the fruits and feeds of plants, than to the feemingly more elegant ones of Rivinus, deduced from the flower; which laft undoubtedly lead, in their practical application, to fome paradoxical combinations. But on this fubject we may fay more in its proper place. (See RIVINUS.) In this preface Ray points out the importance and ufe of the ftamens and piftils, fuccinctly explaining the fexual doctrine, as now univerfally admitted.

One advantage arofe from the epiftolary altercation of Rivinus and Ray, that it led the latter to revife his own fyftem, and to republifh it, in an improved ftate. Happy if fuch were more generally the fruit of contention, that each party fhould correct himfelf, inftead of aggravating the defects of his adverfary. Some notice is taken, in the preface to this edition, both of the fyftem of Tournefort and that of Hermann, which laft was moft congenial to the principles of Ray. The work was finifhed in 1698, but not given to the public till 1703, recourfe having been had to a Dutch bookfeller, who thought it for his intereft to place an Englifh publifher's name in the title-page; a proceeding which, however harmlefs, fhocked the honeft feelings of the author; and this perhaps excited the thrifty Hollander's furprize. By his exertions, however, the book, and the fame of its author, became more widely diffufed, and continental botanifts were much further initiated into Ray's fyftem than they had previoufly been.

But now the mortal career of this eminent man was drawing towards a clofe. He complained in his letters, that, fo far from being able to vifit the London gardens, as he wifhed, in in order to make obſervations upon plants, for the greater perfection of this laſt edition of his *Methodus*, he was not able to walk into his neighbouring fields. He ſtill, nevertheleſs, kept up to the laſt his correſpondence with his friends, in the vivacity and clearneſs of ſtyle which was natural to him. Latin and Engliſh, it is ſaid, were equally ready to his pen. So indefatigable was he in the cultivation of the ſtudy of Nature, that within a year or two of his death, he began to collect his ſcattered notes for a work on Inſects, and actually drew up a *Methodus Inſectorum*, which was printed, ſoon after his deceaſe, in a little octavo of ſixteen pages, and republiſhed in the front of his *Hiſtoria Inſectorum*. This laſt book, compriſing all his own and Mr. Willughby's deſcriptions of inſects, came from the preſs in 1710, at the expence of the Royal Society, and under the ſuperintendance of Dr. Derham. It conſiſts of 375 quarto pages, beſides an appendix of twenty-three more, on Britiſh Beetles, by Liſter. Ray attributes to Willughby that part of his ſyſtem which concerns inſects ſuppoſed to undergo no metamorphoſis. Theſe are moſtly the *aptera* of Linnæus, excluding the *cruſtacea*, but admitting inteſtinal *vermes*, earth-worms, and even leeches. All the deſcriptions and remarks of his departed friend are marked with the initials F.W. This work is a maſs of accurate and authentic obſervation; but, for want of plates, has never come into popular uſe. Linnæus ſtudied it much, and has often cited the deſcriptions, the appropriation of which is, however, too difficult and uncertain to render them of general or extenſive ſervice. Thoſe which regard the *Lepidoptera*, and their caterpillars, are moſt copious.

The ſtudy of inſects was probably the laſt that engaged the attention of this great and wiſe man; who, though on the verge of eternity, in the full poſſeſſion of himſelf, and in the anticipation of the moſt glorious manifeſtations of his Creator, did not diſdain or neglect to contemplate him in his leaſt and loweſt works. Such an example might ſerve for an occaſional anſwer to thoſe who affect to think the ſtudy of any of the works of God below the dignity of their philoſophy; for the moſt inordinate vanity muſt look with reſpect on what formed the abſtruſe ſtudies of ſo diſtinguiſhed a perſon as Ray. His laſt letter to Dr. Derham, who had juſt been to viſit him, is dated Auguſt 16, 1704. He ſpeaks of having lately obtained Mr. Willughby's entomological papers, and deſcribes himſelf as then entering on his Hiſtory of Inſects. How well he employed his time during the autumn, is evident from what we have related concerning this work, for he never ſaw another ſpring. He died at Black Notley, in a houſe of his own building, Jan. 17, 1705, in the 77th year of his age. His character is thus conciſely given by Derham. "In his dealings, no man more ſtrictly juſt; in his converſation, no man more humble, courteous, and affable; towards God, no man more devout; and towards the poor and diſtreſſed, no man more compaſſionate and charitable, according to his abilities." The friend who wrote this eulogium, in his "Life of Mr. Ray," aſſerts, that he was buried, according to his own deſire, in *the church* of Black Notley; but the authors of the Biographia Britannica are probably more correct, in ſaying, that he declined the offer made him by the rector, of a place of interment in the chancel, chooſing rather to repoſe with his anceſtors, in the church-yard. He perhaps thought, with biſhop Hall, that "the houſe of God ought not to be made a repoſitory for dead carcaſes." However this might be, the latter account is confirmed by the original ſituation of his monument, erected at the expence, in part at leaſt, of biſhop Compton. The long and elegant Latin epitaph has often been publiſhed. Its author was the Rev. William Coyte, M.A., father of the late Dr. Coyte of Ipſwich, and the original manuſcript is now before us, containing the information that Ray was interred in the church-yard. In 1737, the monument in queſtion, which ſeems to have been a ſort of altar tomb, being nearly ruined, was reſtored at the charge of Dr. Legge, and removed for ſhelter into the church; where therefore it became *a cenotaph*, as an inſcription added on this occaſion terms it. Forty-five years afterwards the tomb again underwent a repair, by the care of the preſent ſir Thomas Gery Cullum and others, who ſubjoined a third inſcription, as follows:

Tumulum hunc,
a nonnullis humanitati, et ſcientiæ
naturali, faventibus,
olim conditum,
et aliorum bonâ diligentiâ
poſteà reſtauratum, 1737,
nunc e vetuſtatis ſitu et ſordibus
pauci de novo revocarunt, 1792.
ανδρων επιφανων πασα γη ταφος.

A more laſting monument was dedicated to the memory of our great Engliſh naturaliſt, in the genus of plants which bears his name. (See Raiania.) The opinion we have there, in few words expreſſed, of his high rank in botanical ſcience, it is hoped the preſent more diffuſe account will juſtify. It muſt be lamented that he made, as far as we can learn, no collection of dried plants, which might ſerve to aſcertain, in every caſe, what he deſcribed. The great Herbariums of Buddle, Uvedale, &c. ſtill kept in the Britiſh Muſeum, are indeed ſuppoſed to ſupply, in a great meaſure, this defect; they having been collected by perſons who had frequent communication with Ray, and were well acquainted with his plants. Whatever he had preſerved relative to any branch of natural hiſtory, he gave, a week before his death, to his neighbour Mr. Samuel Dale, author of the *Pharmacologia*. Nothing is ſaid of his library, which was probably inconſiderable. His pecuniary circumſtances were very limited, for he merely conformed as a layman to the church of England, and was unwilling to ſubſcribe what was requiſite for receiving preferment. He is recorded nevertheleſs to have diſapproved of ſeparatiſts from the national church; juſtly diſguſted, probably, by the contentions and fanaticiſm he had ſeen throughout the greater part of his life. His principles and feelings ſoared far above the faſtidious diſtinctions, which marked the orthodox or the heterodox of thoſe times, and his mind was uncontaminated with their paſſions. His good ſenſe might well lead him to regret, that thoſe who had ſo lately eſcaped a moſt tremendous common enemy, ſhould be ſo prone to quarrel amongſt themſelves. It is an honour to both theſe parties that they have been emulous to claim him as their ally.

In the preceding review of the literary productions of Ray, more numerous, as Haller ſays, than thoſe of any other botaniſt, Linnæus excepted, we have been obliged to paſs over ſeveral things of leſs note; ſuch as his liſts of native Britiſh plants, for Gibſon's edition of Camden's *Britannia*; and even a variety of communications to the Royal Society. Neither have we touched on the principles of his botanical ſyſtem, that ſubject being explained at length by our predeceſſor, the late Rev. Mr. Wood, under the article Classification. Thoſe who are anxious to peruſe a more full and critical inveſtigation of his works and ſtudies, than it has been poſſible to give in this place, will do well to conſult Dr. Pulteney's "Sketches of the Progreſs of Botany in England." The "Philoſophical Letters," collected and publiſhed in 1718, by Dr. Derham, containing 68 written by Ray, and many more by his correfpondents, throw much light on his character and purfuits. We cannot help remarking that his hand-writing was peculiarly fair and elegant. A fpecimen of it exifts among fir Henry Spelman's vaft and curious collection of manufcripts, now in the poffeffion of John Patterfon, efq. late M. P. for Norwich.

The portraits of Ray are not numerous. One in oil, taken at an advanced period of his life, remains in the Britifh Mufeum, and Dr. John Sims is poffeffed of a miniature, of an earlier date, of which its owner has given an engraving, by way of frontifpiece to the firft volume of the "Annals of Botany," publifhed in 1805. The latter is rather deficient in that ftrength of character which appears in the more common prints, after a picture by Faithorne, often prefixed to the third edition of the *Synopfis*, and fometimes to the *Hiftoria Plantarum*. One of thefe prints was engraved by Elder; the other by Vertue. Neither of them is ftrictly appropriated to any particular book. That in the German edition of his "Wifdom of God in the Creation," publifhed at Leipfic in 1732, appears to be copied from one of thefe, and yet is fo unlike them in expreffion, that if it were poffible, one would fuppofe it taken from fome other portrait of the fame perfon. Ray's Works. His Life by Dr. Derham. Haller's Bibl. Bot. Pulteney's Sketches. Aikin's General Biography. S.

RAY, in *Geography*, a town of France, in the department of the Upper Saone; 12 miles E. of Champlitte.

RAY, in *Geometry*. See RADIUS.

RAY, *Radius*, in *Optics*, a beam or line of light, propagated from a radiant point, through any medium.

Sir Ifaac Newton defines rays to be the leaft parts of light, whether fucceffive in the fame line, or contemporary in feveral lines.

For, that light confifts of parts of both kinds, appears hence, that one may ftop what comes this moment in any point, and let pafs that which comes the next; and again, one may ftop what comes in this point, and let pafs that in the next. Now, the leaft light, or part of light, which may be thus ftopped alone, he calls a *ray of light*.

A ray of light is, therefore, confidered as an infinitely narrow portion, or an evanefcent element of a ftream of light; and a pencil, as a fmall detached ftream, compofed of a collection of fuch rays accompanying each other. As we cannot exhibit to the fenfes a fingle mathematical line, except as the boundary of two furfaces; in the fame manner, we cannot exhibit a fingle ray of light, except as the confine between light and darknefs, or as the lateral limit of a pencil of light.

If the parts of a ray of light do all lie ftraight between the radiant and the eye, which is the cafe when it moves through the fame uniform fubftance or a vacuum, called a medium, the ray is faid to be *direct:* the laws and properties of which make the fubject of optics. If any of them be turned out of that direction, or bent in their paffage, the ray is faid to be *refracted:* and that branch of optics which treats of thefe refracted rays, is called *dioptrics;* which fee. See alfo REFRACTION.

If it ftrike on the furface, or medium attached to the furface, of any body, and be driven back, it is faid to be *reflected:* and that branch of optics which treats of thefe refracted rays, is called *catoptrics;* which fee. See alfo REFLECTION.

In each cafe, the ray, as it falls either directly on the eye, or on the point of reflection, or of refraction, is faid to be *incident:* and the angle which the incident ray makes with the perpendicular to the reflecting furface at the point of incidence, is called the angle of incidence; and the angle which the reflected ray makes with the fame perpendicular, is called the angle of reflection; and alfo, the angle which the refracted ray makes with a perpendicular to the refracting furface produced, is called the angle of refraction.

Again, if feveral rays be propagated from the radiant equidiftantly from one another, they are called *parallel* rays. If they come inclining towards each other, they are called *converging* rays. And if they go continually receding from each other, they are called *diverging* rays.

It is evident that the rays of light, which come from a luminous point, muft fall divergingly upon any given furface; yet when the object is very diftant, compared with the interval that feparates thefe rays, the divergency of the rays becomes infenfible; hence the rays of the fun, of the moon, of the ftars, &c. are deemed parallel rays. When the luminous point is near, then the rays are fenfibly diverging.

It is from the various circumftances of rays, that the feveral kinds of bodies are diftinguifhed in optics. A body, *e. gr.* that diffufes its own light, or emits rays of its own, is called a *lucid*, or *luminous* body. If it only reflect rays which it receives from another, it is called an *illuminated* body.

This diftinction, however, is not always obferved; for a luminous body, in common language, means any vifible object, whether it be vifible by the emiffion of original light, like the fun, a candle, &c. or by reflected light, like the moon, or any other celeftial or terreftrial object that has no native light, or that does not emit its own light.

If an object only tranfmit rays, it is called a *tranfparent* body. So that tranfparent bodies, fuch as water, glafs, &c. are thofe through which light will pafs, or through which our eyes can perceive objects fituated on the other fide, and all fuch bodies, as alfo a vacuum, are denominated mediums in optics.

If it intercept the rays, or refufe them paffage, fo that nothing can be feen through it, it is called an *opaque* body.

Hence no body radiates, *i. e.* emits rays, unlefs it be either luminous, or illumined.

It is by means of rays reflected from the feveral points of illumined objects to the eye, that they become vifible, and that vifion is performed; whence fuch rays are called *vifual* rays.

When an eye views any object directly, fome of the rays, which proceed from every perceivable point of the object, enter the eye, and the whole number of rays, or quantity of light, which thus enters the eye, is circumfcribed by the rays which proceed from the extreme points of the object: and the angle which thefe extreme rays form at the eye is called the *vifual angle*, from the magnitude of which we principally judge of the diftance of a known object. Thus, if the fame object is reprefented at different diftances, it is evident that the farther the object is from the eye, the fmaller will the vifual angle be. Suppofing alfo the diftance between the eye and the object to remain the fame, if by any means the rays of light are bent fo as to enlarge the vifual angle, then the object will appear larger, or it is faid to be magnified; and on the contrary, if the vifual angle be diminifhed, then the object will appear fmaller, in which cafe it is faid to be diminifhed.

In effect, we find that any point of an object is feen in all places to which a right line may be drawn from that point: but it is allowed, nothing can be feen without light; therefore every point of an object diffufes innumerable rays every way. Again, from other experiments it appears, that the images of all objects, whence right lines may be drawn to the

the eye, are painted in the eye, behind the cryſtalline, very ſmall, but very diſtinct.

And laſtly, from other experiments, that each ray produces an image of the radiating point: and that the ſeveral rays emitted from the ſame point are again united in one point, by the cryſtalline, and other humours of the eye, and thus thrown on the retina.

It is the ſpiſſitude or cloſeneſs of the rays emitted from a luminous body, that conſtitutes the intenſeneſs of the light. Yet the direction in which the rays ſtrike the eye, has a conſiderable influence. In effect, a perpendicular ray, ſtriking with more force than an oblique one, in the ratio of the whole ſine to the ſine of the angle of obliquity (as follows from the laws of *percuſſion*, which ſee,) a perpendicular ray will affect the eye more vividly than an oblique one, in that ratio.

If then the ſpiſſitude of the rays be equal, the intenſity will be as the direction: if the direction be the ſame, the intenſeneſs will be as the ſpiſſitude: if both differ, the intenſeneſs will be in a ratio compounded of the direction and the ſpiſſitude.

Hence, firſt, if light be propagated in parallel rays through an unreſiſting medium, its intenſity will not be varied by diſtance.

Secondly, if light be propagated in diverging rays through an unreſiſting medium, its intenſity will decreaſe in a duplicate ratio of the diſtances from the radiant point, reciprocally.

Thirdly, if light be propagated in converging rays through an unreſiſting medium; its intenſity will increaſe in a duplicate ratio of the diſtances from the point of concourſe, reciprocally.

Fourthly, if the breadth of an illumined plane be to the diſtance of the radiant point as 1 to 2,000,000, it is the ſame thing as if the ray ſtruck upon it parallel: and hence, ſince the diameter of the pupil of the eye, when largeſt, ſcarcely exceeds $\frac{1}{4}$th or $\frac{1}{5}$th of an inch; the rays will fall upon it parallel as to ſenſe, at the diſtance of 3860 Engliſh feet, which is nearly ſix furlongs. See LIGHT.

The effect of concave lenſes, and convex mirrors, is to make parallel rays diverge; converging rays become parallel; and diverging rays to become more divergent.

The effect of convex lenſes, and concave mirrors, is to make diverging rays become parallel; parallel rays become convergent; and converging rays to converge the more. See LENS.

The rays of light are not homogeneous, or ſimilar, but differ in all the properties with which we are acquainted; *viz.* refrangibility, reflexibility, and colour.

It is probable that from the different refrangibility the other differences have their riſe; at leaſt it appears, that thoſe rays which agree or differ in this, do ſo in all the reſt. Thus, from the different ſenſations the differently diſpoſed rays excite in us, we call them *red* rays, *yellow* rays, &c.

The effect of the priſm is to ſeparate and ſort the different kinds of rays, which come blended promiſcuouſly from the ſun; and to throw each kind by itſelf, according to its degree of refrangibility and colour, red to red, blue to blue, &c.

Beſides refrangibility, and the other properties of the rays of light already aſcertained by obſervation and experiment, ſir Iſaac Newton ſuſpects they may have many more: particularly, a power of being inflected, or bent, by the action of diſtant bodies; and thoſe rays which differ in refrangibility, he conceives likewiſe to differ in this flexibility.

In paſſing by the edges and ſides of bodies, he conceives that the rays may be bent ſeveral times backwards and forwards, with a motion like that of an eel; and that thoſe rays which appear to fall on bodies are reflected or refracted before they arrive at the bodies: and adds, that they may be refracted, reflected, and inflected, all by the ſame principle acting in different circumſtances. See INFLECTION and LIGHT. See alſo REFLECTION and REFRACTION.

Again, do not the rays, falling on the bottom of the eye, excite vibrations in the retina; which, being propagated along the fibres of the optic nerve into the brain, cauſe viſion? and do not ſeveral ſorts of rays make vibrations of ſeveral bigneſſes, which excite ſenſations of ſeveral colours, much after the manner as the vibrations of the air, according to their ſeveral bigneſſes, excite ſenſations of ſeveral ſounds?

Particularly, do not the moſt refrangible rays excite the ſhorteſt vibrations, to make a ſenſation of a deep violet; and the leaſt refrangible the largeſt, to make a ſenſation of a deep red? and the ſeveral intermediate kinds of rays, vibrations of intermediate bigneſſes, to make ſenſations of the intermediate colours?

And may not the harmony and diſcord of colours ariſe from the proportion of theſe vibrations; as thoſe of ſound depend on the vibrations of the air; for ſome colours, if viewed together, are agreeable, as gold and indigo; others diſagreeable. See COLOUR.

Again, have not the rays of light ſeveral ſides endued with ſeveral original properties? It is certain we find, that every ray of light has two oppoſite ſides, originally endued with a property, on which the unuſual refraction of iſland cryſtal depends, and other two oppoſite ſides endued with that property.

Laſtly, are not the rays of light very ſmall bodies emitted from ſhining ſubſtances?

Such bodies may have all the conditions of light: and there is that action and re-action between tranſparent bodies and light, which very much reſembles the attractive force between other bodies. Nothing more is required for the production of all the various colours, and all the degrees of refrangibility, but that the rays of light be bodies of different ſizes; the leaſt of which may make violet the weakeſt and darkeſt of the colours, and be the moſt eaſily diverted by refracting ſurfaces from its rectilinear courſe; and the reſt as they are bigger and bigger, may make the ſtronger and more lucid colours, blue, green, yellow, and red. (See COLOUR and LIGHT.) Nor is any thing more requiſite for the putting of the rays into fits of eaſy reflection, and eaſy tranſmiſſion, than that they may be ſmall bodies, which, by attraction, or ſome other force, excite vibrations in the bodies they act upon; which vibrations, being ſwifter than the rays, overtake them ſucceſſively, and agitate them ſo as by degrees to increaſe and diminiſh their velocity, and thereby put them into thoſe fits. Laſtly, the unuſual refraction of iſland cryſtal appears very much as if it were performed by ſome attractive virtue lodged in certain ſides both of the rays, and of the cryſtal.

RAYS *of Heat* denote ſeparate portions of that emanation, which proceeds from an heated body, when placed in a colder temperature, and which expands itſelf in every direction, provided it be not prevented by the interpoſition of particular ſubſtances. This appellation is adopted and thus applied, not becauſe that emanation is certainly known to conſiſt of ſeparate ſtreams, but merely for the convenience of explanation. The rays of heat are not the ſame with the rays of light. If this were the caſe, a certain quantity of of heat ought to be accompanied with the fame quantity of light; whereas it is found, that feveral fubftances emit a confiderable quantity of light without any fenfible heat, and others give out a confiderable portion of heat without any light. But that thefe are two diftinct powers of nature is a propofition, that has been amply illuftrated, and moft fatisfactorily eftablifhed by the difcoveries and experiments of Dr. Herfchel. This celebrated aftronomer cautions thofe, who perufe the account of his experiments and obfervations upon them, from concluding, that in ufing the word rays, he means to oppofe, much lefs to countenance, the opinion of thofe philofophers, who ftill believe, that light itfelf comes to us from the fun, not by rays, but by the fuppofed vibration of an elaftic ether, every where diffufed through fpace: he merely claims the fame privilege for the rays that occur in heat, which they do not fcruple to allow to thofe that illuminate objects. For in what manner foever this radiance may be effected, he undertakes to prove, that the evidence, either for rays, or for vibrations, which occafion heat, ftands on the fame foundation on which the radiance of the illuminating principle, light, is built.

Propofing to give a comparative view of the operations that may be performed on the rays that occafion heat, and of thofe which are known to have been effected on the rays that occafion light, he felects fuch facts as are well known with regard to the latter. Light, he fays, both folar and terreftrial, is a fenfation occafioned by rays emanating from luminous bodies, which have a power of illuminating objects; and, according to circumftances, of making them to appear of various colours. The rays of light are fubject to the laws both of reflection and of refraction; but they are of different refrangibility. They are liable to be ftopped in certain proportions, when tranfmitted through diaphanous bodies; and alfo to be fcattered on rough furfaces. They are alfo fuppofed to have a power of heating bodies: but this is a fubject "fub judice." The fimilar propofitions, which it is his defign to prove, and which by a variety of curious and well-conducted experiments he has confirmed, are fuch as follow. Heat, both folar and terreftrial, is a fenfation occafioned by rays emanating from candent fubftances, which have a power of heating bodies. Thefe rays are fubject to the laws of reflection and of refraction; and they are of different refrangibility. They are liable to be ftopped, in certain proportions, when tranfmitted through diaphanous bodies; and to be fcattered on rough furfaces: and in a certain ftate of energy, they may be fuppofed to have a power of illuminating objects, which latter property remains to be examined.

In the examination of the illuminating and heating power of the prifmatic colours, our author obferves, that the red-making rays are very far from having the former in an eminent degree: the orange poffeffes more of it than the red; and the yellow rays illuminate objects ftill more perfectly. The maximum of illumination lies in the brighteft yellow, or paleft green. The green itfelf is nearly equally bright with the yellow; but from the full deep green, the illuminating power decreafes very fenfibly; that of the blue is nearly upon a par with that of the red; the indigo has much lefs than the blue; and the violet is very deficient. Our author infers from other experiments, that the heating power of the prifmatic colours is very far from being equally diftributed; and that the red rays are chiefly eminent in this refpect. Allowing that the power of heating is chiefly lodged in the red-making rays, it accounts for the comfortable warmth that is thrown out from a fire, when it is in the ftate of a red glow, and for the heat which is given by charcoal, coke, and balls of fmall coal mixed up with clay, ufed in hot-houfes; all which throw out red light. It alfo explains the reafon, why the yellow, green, blue, and purple flames of burning fpirits mixed with falt, occafion fo little heat that a hand is not materially injured, when paffed through their corufcations.

Having afcertained, that radiant heat is fubject not only to the laws of refraction, but to thofe alfo of the different refrangibility of light, Dr. Herfchel is led to furmife, that this heat confifts of particles of light of a certain range of momenta, which range may extend a little farther, on each fide of refrangibility, than that of light. In a gradual expofure of the thermometer to the rays of the prifmatic fpectrum, beginning from the violet, he found that he arrived at the maximum of light long before he came to that of heat, which lies at the other extreme. By feveral experiments it appears, that the maximum of illumination has little more than half the heat of the full red rays; and from other experiments our author concludes, that the full red falls ftill fhort of the maximum of heat, which perhaps lies even a little beyond vifible refraction. In this cafe, radiant heat will at leaft partly, if not chiefly, confift, if the expreffion may be allowed, of invifible light, that is, of rays coming from the fun, that have fuch a momentum as to be unfit for vifion. Admitting it as highly probable, that the organs of fight are only adapted to receive impreffions from particles of a certain momentum, this will explain why the maximum of illumination fhould be in the middle of the refrangible rays, as thofe which have greater or lefs momenta, are likely to become equally unfit for impreffions of fight. Whereas, in radiant heat, there may be no fuch limitation to the momentum of its particles. From the powerful effects of a burning lens, however, we derive information, that the momentum of terreftrial radiant heat is not likely to exceed that of the fun; and that, confequently, the refrangibility of *calorific* rays cannot extend much beyond that of *colourific* light. Hence we may alfo infer, that the invifible heat of red-hot iron, gradually cooled till it ceafes to fhine, has the momentum of the invifible rays, which, in the folar fpectrum viewed by daylight, go to the confines of red, and this will afford an eafy folution of the reflection of invifible heat by concave mirrors.

Our author deduces from various experiments with the thermometer abundant evidence, that there are rays coming from the fun, which are lefs refrangible than any of thofe that affect the fight. They are invefted with a high power of heating bodies, but with none of illuminating objects; and on this account they have hitherto efcaped notice. At the diftance of fifty-two inches from the prifm, there was ftill a confiderable heating power exerted by the invifible rays, an inch and a half beyond the red ones, meafured upon their projection on a horizontal plane. Moreover, the power of heating is extended to the utmoft limits of the vifible violet rays, but not beyond them; and it is gradually impaired, as the rays become more refrangible. The maximum of the heating power is found to be vefted among the invifible rays, and it is probably not lefs than half an inch beyond the laft vifible ones. It is alfo fhewn, that the fun's invifible rays, in their lefs refrangible ftate, and confiderably beyond the maximum, ftill exert a heating power fully equal to that of red-coloured light; and confequently, if we may infer the quantity of the efficient from the effect produced, the invifible rays of the fun probably far exceed the vifible ones in number. The general conclufion with which Dr. Herfchel clofes his account of one feries of of experiments and his reafoning upon them, is in the following manner: "if," fays he, "we call *light* thofe rays which illuminate objects, and *radiant heat*, thofe which heat bodies, it may be inquired whether light be effentially different from radiant heat? In anfwer to which I would fuggeft, that we are not allowed by the rules of philofophizing to admit two different caufes to explain certain effects, if they may be accounted for by one. A beam of radiant heat emanating from the fun, confifts of rays that are differently refrangible. The range of their extent, when difperfed by a prifm, begins at violet-coloured light, where they are moft refracted, and have the leaft efficacy. We have traced thefe calorific rays throughout the whole extent of the prifmatic fpectrum, and found their power increafing, while their refrangibility was leffened, as far as to the confines of red-coloured light. But their diminifhing refrangibility, and increafing power, did not ftop here: for we have purfued them a confiderable way beyond the *prifmatic fpectrum* into an invifible ftate, ftill exerting their increafing energy, with a decreafe of refrangibility up to the maximum of their power; and have alfo traced them to that ftate, where, though ftill lefs refracted, their energy, on account, we may fuppofe, of their now failing denfity, decreafed pretty faft; after which the invifible *thermometrical fpectrum*, if I may fo call it, foon vanifhed."—"If this," continues our author, "be a true account of folar heat, for the fupport of which I appeal to my experiments, it remains only for us to admit, that fuch of the rays of the fun as have the refrangibility of thofe which are contained in the prifmatic fpectrum, by the conftruction of the organs of fight, are admitted, under the appearance of light and colour; and that the reft, being ftopped in the coats and humours of the eye, act upon them, as they are known to do upon all other parts of our body, by occafioning a fenfation of heat."

Although, as we have above ftated, the rays of light and thofe of heat poffefs many fimilar properties, yet Dr. Herfchel has fhewn, that there are fome ftriking and fubftantial differences between them. The rays of heat are of a much more extenfive refrangibility than thofe of light, as our author has clearly and inconteftibly demonftrated both by reafoning and experiment: nor do thofe rays agree either in their mean refrangibility, nor in the fituation of their maxima. Where we have moft light, there is but little heat, and where we have moft heat, we find no light at all. (See Refrangibility.) It is found, that the fines of refraction of the heat-making rays are in a conftant ratio to the fines of incidence; but that the focus of the rays of heat in burning glaffes is different from the focus of the rays of light: that of heat being farther removed from the lens than the focus of light, probably not lefs than a quarter of an inch: the heat at half an inch beyond the focus of light being ftill equal to that in the focus. Although light and heat are both refrangible, the ratio of the fines of incidence and refraction of the mean rays is not the fame in both. Heat is evidently lefs refrangible than light. From experiments relating to the tranfmiffion of light and heat through diaphanous bodies it appears, that no kind of regularity takes place in the proportion of rays of one fort and of another, which are ftopped in their paffage. Heat and light feem to be entirely unconnected, and the rays that occafion them are different. We have feveral tables, formed from the author's experiments, and fhewing the quantities of light and heat intercepted by different fubftances. The blueifh-white and flint-glaffes, *e. gr.* ftop nearly three times as much heat as light, whereas the greenifh crown glafs ftops only about one-fourth more of the former than of the latter.

From a table exhibiting the effects of coloured glaffes, it appears, that a yellow glafs ftops only 333 rays of heat, but ftops 819 of light; on the contrary, a pale blue ftops 812 rays of heat, and but 684 of light. Again, a dark blue glafs ftops only 362 rays of heat, but intercepts 801 of light; and a dark red glafs ftops no more than 606 rays of heat, and yet intercepts nearly all the light, fcarcely one ray out of 5000 being able to make its way through it. For the conclufions deduced from thefe tables, as they evince the non-identity of the rays of heat and thofe of light, and for the tables themfelves, we muft refer to the author's own paper, *ubi infra*. We are reftrained by our limits from purfuing this curious fubject, and from entering on a detail of Dr. Herfchel's experiments, illuftrating and confirming principles, the difcovery of which muft be allowed to be one of the greateft that has been made fince the days of Newton, although the theories of fome fpeculative philofophers might have led to it a few years earlier. Dr. Herfchel was occupied in determining the properties of various kinds of coloured glafs, which rendered them more or lefs fit for enabling the eye to view the fun through a telefcope; and for this purpofe it was neceffary to inquire which of the rays would furnifh the greateft quantity of light, without fubjecting the eye to the inconvenience of unneceffary heat. He firft obferved that the heat became more and more confiderable as the thermometer approached the extreme red rays in the prifmatic fpectrum; and purfuing the experiment, he found not only that the heat continued beyond the vifible fpectrum, but that it was even more intenfe where the thermometer was at a little diftance without the limits of the fpectrum, than in any point within it; as we have already ftated. For Dr. Herfchel's communications to the Royal Society on this fubject, we refer to the 90th volume of the Philofophical Tranfactions for the year 1800, part ii. p. 255, &c. p. 284, &c. p. 293, &c. part iii. p. 437, &c.

Sir Henry Englefield has repeated Dr. Herfchel's experiments with many precautions, and Mr. (fir H.) Davy was a witnefs of their perfect accuracy. The excefs of heat beyond the fpectrum was even confiderable enough to be afcertained by the fenfe of warmth occafioned by fhewing it on the hand.

It was firft obferved in Germany by Ritter, and foon afterwards in England by Dr. Wollafton, that the muriate of filver is blackened by invifible rays, which extend beyond the prifmatic fpectrum, on the violet fide. It is therefore probable, that thefe black or invifible rays, the violet, blue, green, perhaps the yellow, and the red rays of light, and the rays of invifible heat, conftitute feven different degrees of the fame fcale, diftinguifhed from each other into this limited number, not by natural divifions, but by their effects on our fenfes; and we may alfo conclude that there is fome fimilar relation between heated and luminous bodies of different kinds. See Young's Phil. Lect. vol. i. p. 639. See Heat and Refraction.

M. Delaroche has found, that the rays of invifible heat traverfe glafs with difficulty at a temperature below that of boiling water; but that they traverfe it with a facility, always increafing with the temperature, as it approaches the point when bodies become luminous, and from thefe experiments it would appear, that the modification, whatever it be, which muft be impreffed upon the invifible rays to render them more and more capable of paffing through glafs, makes them approach more and more to the ftate in which they muft be when they penetrate our eyes, and occafion the fenfation of vifion. The fame ingenious philofopher has likewife found, that the rays of heat which have paffed

through

through a plate of glafs are proportionably more adapted to pafs through a fecond plate; and from this circumftance we deduce a new proof of the peculiar ftate of thefe rays, and of the modification which they acquire. Meffrs. Gay-Luffac and Thenard have proved that all the changes of colour produced by light may be imitated and produced by heat, and by an elevation of temperature not exceeding 212°. Other phenomena previoufly obferved indicated, that in the comparifon of the actions of heat and light in heating bodies, or producing chemical changes in them, there is a great difference in the rays of different colours. M. Rochon announced the fact amply confirmed by Dr. Herfchel, that the heat produced by the different rays of the prifmatic fpectrum was unequal. As Dr. Herfchel fixed the maximum effect beyond the red rays, and fhewed, as we have already ftated, that the moft heating rays of the fpectrum were entirely, or nearly, invifible; Dr. Wollafton, and Meffrs. Ritter and Beckmann, having examined the oppofite, or violet end of the fpectrum, found that this likewife poffeffed peculiar properties, and that, beyond the violet, there are invifible rays, which poffefs, in greateft perfection, the power of determining chemical combinations. It has been a fubject of interefting refearch, whether the invifible, or almoft invifible rays, fituated beyond the extremities of the fpectrum, poffefs any other properties of light. *E. gr.* If the reflection of them from polifhed glafs can give them that modification which Malus has diftinguifhed by the name of "polarization." (See LIGHT.) M. Berthollet engaged Meffrs. Malus and Berard to undertake this double object. M. Malus's death prevented his profecution of the fubject; but what he began M. Berard accomplifhed with the utmoft poffible exactnefs. By means of the helioftate, which Malus caufed to be conftructed for the philofophical cabinet of M. Berthollet, he obtained a ray of light, perfectly fixed, on which he could make experiments at pleafure. By decompofing this ray with a prifm, he obtained an immoveable coloured fpectrum; and by placing very fenfible thermometers in the fpaces occupied by the different colours, he was enabled to compare their calorific effects with the utmoft certainty. He alfo afcertained their chemical properties by fubftituting, in place of the thermometers, chemical compounds eafily altered. He firft of all obferved the calorific power of the different rays, which, it is known, are in this refpect unequal. M. Rochon, who is faid to have firft obferved this inequality, placed the maximum of heat in the yellow ray, where the illuminating power is the greateft. Dr. Herfchel, as we have before fhewn, placed it out of the fpectrum, and beyond the red ray. The experiments of Herfchel have been confirmed by thofe of Berard, as far as they refpect the progreffive heating power of the rays from the violet to the red; but he found the greateft heating power at the extremity of the fpectrum itfelf, and not beyond it. He fixed it at the point, where the bulb of the thermometer was ftill entirely covered with the red ray; and he found that the thermometer funk progreffively, in proportion as the diftance of its bulb from the red ray increafed. When he placed the thermometer quite beyond the vifible fpectrum, on the fpot where Herfchel fixed the maximum of heat, its elevation above that of the ambient air was only one-fifth of what it had been in the red ray itfelf. The abfolute intenfity of the heat produced was likewife lefs in the experiments of Berard than in thofe of Herfchel.

M. Berard wifhed to know if thefe properties would exift in each of the pencils into which the ray divides itfelf in paffing through a rhomboid of Iceland fpar. In this cafe each of the two fpectra exhibited the fame properties. In both, the calorific power diminifhed from the violet to the red end; and it exifted beyond the laft vifible red rays. In this operation the luminous molecules are polarized by the cryftal. In order to determine whether the invifible rays of heat experience the fame effect, M. Berard received the folar ray upon a polifhed and tranfparent glafs, which polarized a portion of it by reflection. This reflected ray was then received upon a fecond glafs, fixed in an apparatus, which permitted it to be turned round the ray under a conftant incidence, and this incidence itfelf was determined in fuch a manner, that in a certain pofition of the glafs the reflection ceafed to take place. We know, from the experiments of Malus, that a glafs may be always difpofed in fuch a manner that this condition is fulfilled. Things being thus difpofed, by collecting with a mirror the calorific and luminous rays reflected from the fecond glafs, and directing them upon a thermometer, M. Berard found, that as long as light was reflected the thermometer was elevated, and of courfe the heat was reflected likewife; but when, from the pofition of the fecond glafs, the light was totally tranfmitted, the heat was tranfmitted at the fame time, and the thermometer was not elevated. In this experiment, then, as well as the preceding, the calorific principle, whatever it may be, never feparates from the luminous molecules.

To the ray of folar light employed in this experiment, M. Berard fubftituted a pencil of radiant heat proceeding from a body hot, but not red, and even not luminous. The effect was the fame as before. The thermometer rofe when the fecond glafs was fo fituated as to reflect light, and it did not rife when the fecond could not reflect light. Therefore the particles of invifible radiant heat are modified by reflection, precifely like light.

After having ftudied the calorific properties of the different rays of the fpectrum, M. Berard examined their chemical properties. When muriate of filver, or other white falts of filver, are expofed to light, they become dark coloured very fpeedily. Guaiac thus expofed to light paffes from yellow to green, as Dr. Wollafton obferved. Gay-Luffac and Thenard difcovered another action of this light ftill more prompt and energetic. When a mixture of oxymuriatic acid gas and hydrogen gas are expofed to the action of folar light, a detonation takes place, and water and muriatic acid are formed. Thefe different phenomena enabled M. Berard to examine the chemical powers of the different rays of the fpectrum. By expofing to the different coloured rays, pieces of card impregnated with muriate of filver, or fmall phials filled with the detonating mixture, he was enabled to judge of the energy of each by the intenfity or rapidity of the chemical change which it produced. He found that the chemical intenfity was greateft at the violet end of the fpectrum, and that it extended, as Ritter and Wollafton had obferved, a little beyond that extremity. When he left fubftances expofed for a certain time to the action of each ray, he obferved fenfible effects, though with an intenfity continually decreafing in the indigo and blue rays. Hence we muft confider it as extremely probable, that if he had been able to employ re-actives ftill more fenfible, he would have obferved analogous effects, but ftill more feeble, even in the other rays. To fhew clearly the great difproportion which exifts in this refpect between the energies of the different rays, M. Berard concentrated, by means of a lens, all that part of the fpectrum which extends from the green to the extreme violet; and he concentrated, by means of another lens, all that portion which extends from the green to the extremity of the red. This laft pencil formed a white point fo brilliant that the eyes were fcarcely able to endure it; yet the muriate of filver remained more than two hours expofed to this brilliant light without undergoing any fenfible alteration. On the other hand, when expoſed to the other pencil, which was much leſs bright, and leſs hot, it was blackened in leſs than ſix minutes. M. Berard concluded, from this experiment, that the chemical effects produced by light are not ſolely owing to the heat developed in the body by its combining with the ſubſtance of the body; becauſe, on ſuch a ſuppoſition, the faculty of producing chemical combinations ought to be greateſt in thoſe rays which poſſeſs the faculty of heating in the greateſt perfection: but perhaps we ſhould find leſs oppoſition between theſe two opinions, if we attended to the different reſults which may be produced by the ſame agent placed in different circumſtances, and if we conſidered that agents of a nature quite diſſimilar may determine the ſame combinations when they are employed.

Various hypotheſes have been ſuggeſted in order to account for the properties above ſtated. If we wiſh to conſider ſolar light as compoſed of three diſtinct ſubſtances, one of which occaſions light, another heat, and the third chemical combinations; it will follow that each of theſe ſubſtances is ſeparable by the priſm into an infinity of different modifications, like light itſelf; ſince we find, by experiment, that each of the three properties, chemical, colorific, and calorific, is ſpread, though unequally, over a certain extent of the ſpectrum. Hence we muſt ſuppoſe, on that hypotheſis, that there exiſt three ſpectrums one above another; namely, a calorific, a colorific, and a chemical ſpectrum. We muſt, likewiſe, admit that each of the ſubſtances which compoſe the three ſpectrums, and even each molecule of unequal refrangibility which conſtitutes theſe ſubſtances, is endowed, like the molecules of viſible light, with the property of being polarized by reflection, and of eſcaping from reflection in the ſame poſitions as the luminous molecules, &c.

Inſtead of this complication of ideas, let us conceive ſimply, according to the phenomena, that light is compoſed of a collection of rays unequally refrangible, and of courſe unequally attracted by bodies. This ſuppoſes original differences in their ſize and velocity, or in their affinities. Why ſhould thoſe rays, which differ already in ſo many things, produce upon thermometers, or upon our organs, the ſame ſenſations of heat or light? Why ſhould they have the ſame energy to form or ſeparate combinations? Would it not be quite natural that viſion ſhould not operate on our eyes, except within certain limits of refrangibility; and that too little or too much refrangibility ſhould render it equally incapable of producing that effect. Perhaps theſe rays may be viſible to other eyes than ours, perhaps they are ſo to certain animals, which would account for certain actions that appear to us marvellous. In a word, we may conceive the calorific and chemical faculty to vary through the whole length of the ſpectrum, at the ſame time with the refrangibility, but according to different functions; ſo that the calorific faculty is at its minimum at the violet end of the ſpectrum, and at its maximum at the red end; while, on the other hand, the chemical faculty expreſſed by another function is at its minimum at the red end, and at its maximum at the violet end, or a little beyond it. This ſimple ſuppoſition, which is only the ſimple ſtatement of the phenomena, equally agrees with all the facts hitherto obſerved, and accounts for thoſe eſtabliſhed by M. Berard, and even enables us to predict them. In fact, if all the rays, which produce theſe three orders of phenomena, are rays of light, they muſt of courſe be polarized in paſſing through Iceland cryſtal, or in being reflected from a poliſhed glaſs with a determined incidence: and when they have received theſe modifications, they muſt be reflected by another glaſs, if it is properly placed, to exert its reflecting energy on the luminous molecules. On the other hand, if that force is null on the viſible luminous molecules, the inviſible light will not be any longer reflected: for the cauſe which occaſions or prevents reflection appears to act equally upon all the molecules, whatever their refrangibility may be. It ought, therefore, to act upon the molecules of inviſible light, the condition of viſibility or inviſibility relating merely to our eyes, and not to the nature of the molecules which produce theſe ſenſations in us.

This mode of viewing the facts appeared to Meſſrs. Berthollet, Chaptal, and Biot, who made a report to the Inſtitute on the Memoire of Berard, the moſt natural and ſimple; though the modeſt reſerve of Berard reſtrained him from deciding in a caſe, not ſufficiently examined by the teſt of experiment. Annal. de Chimie, vol. lxxxv. p. 309. or Thomſon's Annals of Philoſophy, N° 9.

Ray, *Common*, in *Optics*, is ſometimes uſed for a right line drawn from the point of concourſe of the two optical axes, through the middle of the right line which paſſes through the middle of the centres of the pupils of the two eyes.

Rays, *Cone of*. See Cone.

Rays, *Deflection of*. See Deflection.

Rays, *Inclination of incident*. See Inclination.

Rays, *Optic*. See Optic.

Rays, *Reflexibility of*. See Reflexibility.

Ray, *Principal*, in *Perſpective*, is the perpendicular diſtance between the eye and the vertical plane or table, as ſome call it. See Perspective.

Rays, *Pencil of*. See Pencil *of Rays*.

Rays, *Pyramid of*. See Optic *Pyramid*.

Ray *of Curvature*, in *Geometry*, is uſed to ſignify the ſemi-diameter of the circle of curvature. See Radius and Curvature.

Ray, *Raia*, in *Ichthyology*. See Raia.

Ray, *Clavated*. See Raia *Clavata*, and Thornback.

Ray, *Eagle*. See Raia *Aquila*.

Ray, *Electric* or *Smooth*, a ſpecies of the raia. See Raia, Torpedo, and *Anatomy of* Fish.

Ray, *Fuller*, *Raia fullonica*, a ſpecies of ray, deriving its name from the inſtrument which fullers uſe in ſmoothing cloth, the back being rough and ſpiny. See Raia *Fullonica*.

Ray, *Oblong*. See Raia and Rhinobatos.

Ray, *Oculated*. See Raia and Miraletus.

Ray, *Rough*. See Raia *Rubus*. At Scarborough, where it is common, it is called the white hans or gullet.

Ray, *Shagreen*, called at Scarborough the French ray, is about the ſize of the ſkate, but narrower in its form than the common kinds. The upper part of the body is covered cloſely with ſmall ſhagreen-like tubercles, reſembling the ſkin of the dog-fiſh; and from the noſe to the beginning of the pectoral fins is a tuberculated ſpace. Pennant.

Ray, *Sharp-noſed*. See Raia *Oxyrinchus*. This fiſh makes a ſnorting noiſe, and is ſuppoſed to be the *bos* of the ancients, which Oppian deſcribes as the broadeſt among fiſhes, and fond of human fleſh; adding, that the method it takes of deſtroying men is by overlaying and keeping them down by its vaſt weight till they are drowned. Pennant.

Ray, *Sting*. See Raia *Paſtinaca*, and Pastinaca *Marina*.

Ray, in our *Old Writers*, a word appropriated to cloth never coloured, or dyed, 11 Hen. IV. c. 6. Blount, Cowel.

Rays, in *Botany*, the ſpreading marginal florets of a compound flower; ſee Radius. The ſame term is applied to the ſub-diviſions of an umbel, more properly denominated its

its general and partial ſtalks; unleſs we, like Linnæus, conſider the whole umbel as one aggregate flower. See UMBELLA, and INFLORESCENCE.

RAY-*Graſs*, in *Agriculture*, an uſeful ſort of early graſs that has long been, and ſtill is, much cultivated by the farmer in ſome diſtricts. There are ſaid to be different varieties of this graſs, but that grown by Mr. Peacey, of Devonſhire, has been found, on experience, much ſuperior to the common ſort. This graſs has ſometimes the title of rye-graſs. See LOLIUM *Perenne*.

It has been remarked by the Rev. Mr. Duncan, of Kilmarnock, in the fourth volume of Communications to the Board of Agriculture, that it has been found of late that there is an annual and perennial kind; that the latter ſhould only be ſown; but that the annual ſeed, he thinks, affords the greateſt and moſt palatable crop of hay, and may be ſown on thoſe light ſoils which more readily tend to graſs, at leaſt a conſiderable proportion of it ſhould be blended with the perennial ſeed. He adds, that the two kinds of ſeeds are readily diſtinguiſhed by a careful obſerver, as the perennial is ſmaller, and fairer in colour, than the annual, and likewiſe much lighter. Good annual ſeed weighs from 21 to 24lbs. avoirdupois weight *per* buſhel, but the perennial only from 16 to 18lbs. As no diſtinction of theſe ſorts was formerly made by farmers, he ſuggeſts it as probable that they have come to be known and diſtinguiſhed, from the circumſtance of no ray-graſs diſappearing wholly the firſt year, by which ſome perſons have been tempted, from the high price of the ſeed, to allow what remained in the ſecond year to advance to maturity, though to the great injury of the paſture. It is therefore from the ſeed of the ſecond year's crop that he ſuppoſes the perennial graſs has gradually originated; and its inferiority in point of ſubſtance ſeems, he thinks, to prove the ſuppoſition. By this means the farmer may, by allotting a ſmall portion of good land for the purpoſe, ſupply himſelf with what is ſaid to be the perennial ſeed, without ſubmitting to the impoſition of an extravagant price, and may probably enſure or improve upon the durability of it, by collecting ſeed from the third or fourth year's growth.

It is found to be an excellent graſs for paſture as well as hay. It has an early, but not very abundant, foliage. It is highly reliſhed by cattle and ſheep. From its being apt to run up into flowering ſtems, it ſhould be kept well fed down. From its ſecreting and depoſiting much ſaccharine matter in the joints of the ſtems, it affords a large proportion of nutritious matter for the ſupport of animals, both in its green ſtate and when made into hay. And it is ſaid not to affect the wind of horſes, which renders it particularly valuable for hunting and racing horſes.

It has, however, been objected to by ſome, from the quantity of flower ſtems which it ſends up; but this is aſſerted by others to be only the caſe when it grows in dry upland ſituations. It is found, of courſe, to vary much under different circumſtances and ſituations.

The ſoils that are moſt ſuitable for it are thoſe of the loamy and ſandy kinds, but it is capable of being grown on thoſe of the clayey ſorts when not too ſtiff. On the two firſt ſorts, in mixture with other graſſes, it frequently becomes permanent, and affords an uſeful ſpring food, eſpecially for ſheep ſtock.

As it is found to produce a thick well-connected ſward in ſoils of the rich fertile kinds, it has been ſuppoſed only ſuited to them, though occaſionally met with in thoſe of the poorer deſcriptions.

In Eſſex it is found very bad for the ſtrong wet heavy lands. But in other diſtricts it is moſt ſown in ſtiff clayey ſoils, where clover is liable to fail in coming up well. Some, however, find that a light ſoil is quite as ſuitable for it as one of a clayey nature; and that though it may be moſt ſown in ſtiff heavy lands, it is not from the notion that lighter ſoils are leſs ſuited to it, but that ſuch lands may be covered with this graſs, ſhould the clover crop not turn out well in conſequence of the great ſtiffneſs of theſe clayey ſoils.

On the ſtiff clayey ſoils the proportion of ſeed is uſually from one buſhel to one buſhel and a half of ray-graſs, with eight or ten pounds of red clover ſeed, to the acre. On other ſoils from ſix to ten gallons of ray-graſs, with from five to eight pounds of red clover ſeed, and from two to four pounds of trefoil ſeed, are uſed to the acre; ſome adding to theſe, two, three, or more, pounds of white clover ſeed.

In Suſſex, for a layer for one or two years, they employ of ray-graſs ſeed three gallons, and of red clover and trefoil ſeed each one gallon, to the acre.

But for permanent paſture the proportion is this. Of ray-graſs ſeed four gallons, Dutch clover and trefoil ſeed, of each two gallons to the acre. Other different proportions are made uſe of in different caſes.

It has been well remarked by Dr. Campbell, in the third volume of Communications to the Board of Agriculture, that when land is in a proper ſtate of manure, ray-graſs united with white clover, will form a perfect ſward the latter end of the ſecond year after it is ſown. A particular field, of about five acres, that was ſown with theſe two graſſes only, was, he ſays, more perfectly graſſed over, than others, which had the addition of trefoil and rib-graſs, and which were ſown at the ſame time. A neighbour of his, the only man in the county that had tried ray-graſs, told him it would not anſwer, and referred him to a particular field where ſome had been ſown. The fact was, the doctor ſays, that he had cropped his field with oats until it was no longer worth ploughing, and then, with his laſt ſeed, he ſowed ray-graſs, which certainly did not flouriſh. But his argument would, he thinks, have been equally concluſive againſt any graſs or grain whatever. The ray-graſs languiſhed, and finally died away, giving place to the vegetation ſuited to the ſtate of the land. If it be expected that ray-graſs, or any other good graſs, ſhould thrive and produce abundant crops on exhauſted or poor land, it muſt not, he ſays, be in the ſoil which occurs here. And he adds the following uſeful remarks, on converting ray-graſs into hay; it is neceſſary to cut it at a period previous to its being ſo ripe as to have perfected its ſeed, and changed to a yellow colour; for in this caſe a great part of the juices of the plant, which conſtitute a principal part of the nutriment it is to afford, will be converted into a ſpecies of ſtraw, and its nutritive properties be proportionably diminiſhed. When it is made into hay, perſons not acquainted with its qualities are apt to object to its apparent coarſeneſs, which proceeds from its conſiſting almoſt entirely of flowering-ſtems, the ray-graſs having a comparatively ſmaller proportion of leaves than any other graſs. Whether this be a defect or a merit will, he thinks, depend upon a ſolution of this queſtion: Do the ſtems and flowering parts of graſs, or the leaves taken weight for weight, contain the greater proportion of nutriment? It does not appear, he ſays, that this has been determined by experiments inſtituted for the purpoſe; but it ſeems probable, from the ſtems being ſo much ſweeter than the leaves, (which is particularly perceptible upon chewing them when about half dry,) and from thoſe vegetables which contain much ſaccharine matter being particularly nutritious, that the greater proportionate quantity of nutriment

nutriment will be found to refide in the ftalks; and if fo, the advantages of ray-grafs will be decifive. But, however this may be, it is certain that, fuppofing wet weather comes on during the procefs of hay-making, the firft part of the grafs that decays is the leaf, which foon becomes yellow, and then black, lofing all pretenfions to nutritive properties; in which cafe it is evident that almoft the whole nutriment contained in the hay muft refide, exclufively, in the flowering-ftalks. Ray-grafs then has, in unfavourable hay-feafons, an advantage, he thinks, over all others, inafmuch as from having fewer leaves it is not fo apt to be injured by a continuance of rain; and it is, befides, when in the cocks, more acceffible to the air and wind from lying more open and light; and confequently not fo apt to heat and mould as other graffes in fimilar fituations and feafons. And he concludes that it certainly poffeffes the following valuable properties. 1. That there are few graffes fo early in the fpring. 2. That there are none better relifhed by cattle, or more nutritive. 3. That it has the power of refifting the effects of bad weather, in ticklifh feafons, in a greater degree than other graffes. 4. That there is a greater facility in collecting its feed than of any other grafs.

It is fuppofed that the prejudices againft it have proceeded, 1. From its having been fown in land not capable of producing a full crop of any good vegetable. 2. From allowing it to fhoot up fo far, as to have formed the feed in the flowering-ftalk, before cattle have been turned into pafture, or that it has been cut for hay. Ray-grafs appears, he thinks, to partake more of the nature of grain than any other grafs. Hence, when it has perfected its feeds, it fhoots out no more ftalks, and but few leaves that feafon, as lord Kaimes has juftly obferved. Hence it is neceffary to turn cattle into a field of this grafs early in the fpring, and to keep it well under by a fufficient quantity of ftock; in which cafe it will continue to put out frefh flowering-ftalks and leaves during the whole feafon. 3. The hay, for the reafon juft affigned, fhould be cut before it becomes a mere ftraw. Common hay-grafs, being compofed of graffes in various ftages of growth and ripenefs, admits of greater latitude than a field of ray-grafs, becaufe many of them will generally be in a proper ftate for cutting, although others may have paffed their prime.

He adds the following facts in fupport of its nutritious properties. No hay, fays he, could be better relifhed by my horfes than this was; not a particle of it was wafted by them, or left in the rack; no animals could thrive, coat, or do their work better, than they did, whilft they had this ray-grafs hay to take to. Never was there a greater contraft than when they were put to the natural hay-grafs of the country, after they had finifhed the other. They were literally ftarved into the eating of it; and in fpite of an additional quantity of corn, they fell away (agreeable to his farming man's mode of expreffion) a limb a-piece. This year nothing can look better than his horfes do upon this hay, (with which fome red clover is mixed,) and this, with the addition of very little corn, and that moftly light, the tailings of oats and barley.

Thefe facts place the utility of this grafs in a very ftriking point of view. And the following, given by Mr. Duncan, are of the fame tendency, as he found in a comparative experiment of pieces of ground laid to pafture with it, and meadow foft-grafs alone and in mixture, that the ray-grafs portion was not only more early ready for the fcythe by nearly three weeks, but the hay of it always more greedily eaten by the horfes and cattle, as well as the pafture in fucceeding years, on the ray-grafs divifion, conftantly eaten bare before the cattle ftock would touch that of the foft grafs.

In the county of Effex the farmers in many places have, however, a very indifferent opinion of ray-grafs, believing it to do great injury to the land, efpecially when of the better kind. When fown with red clover, it does not do fo well or is fo good as a preparation for wheat, but it anfwers well for peafe. In trying it mixed and unmixed with clover, fome have found that when without it, it is all the better for the wheat; and that the wire-worm after ray is fure to deftroy the wheat.

In weaning calves it is found extremely ufeful and advantageous, as it agrees very well with them, far better than tares, which are liable to run through them, or fcour.

In Suffex this fort of grafs is employed in mixture with others, as a fheep-feed, with great benefit and fuccefs.

The farmers in the tillage parts of Oxfordfhire alfo confider ray-grafs as preparing badly for wheat; they conceive that the wheat which follows will never be found fo good where it is fown as where there is none. It is thought far from having any ameliorating effects on the land, as it *draws* too much. It is never fown alone by fome. It makes the very worft hay, unlefs cut at an early period, or very young, in the opinion of many.

In Berkfhire this grafs is fown in the chalk diftrict, and found to a certainty lefs nutritious than many other forts, as well as more exhaufting in its nature. When intended for permanent pafture, it is found, in general, to fail in a very few years; and, unlefs the feed is changed, it will degenerate under any mode of management. It, however, poffeffes the advantage of being cheap, and of producing early feed, which are objects of no inconfiderable importance on a farm. Some find that the Peacey variety furnifhes feed a fortnight or three weeks fooner than the common fort. It is feldom fown fingly, but in mixture with many other artificial graffes, in proportions to fuit the difference of foil. In fome places it is fown with different other artificial graffes in variety, every four years, on different parts of the land, fo as to prevent it getting fick of the fame kind of feeds.

In the intention of hay, it fhould be cut early, or its juices will be much exhaufted. Horfes fed on this fort of hay are found to preferve their wind better than on hay of other graffes.

In Chefhire the dairy farmers do not confider it a good grafs for producing milk, on which account it is not fo much cultivated; its earlinefs, however, has made it efteemed by many; as on almoft any foil, fome fuppofe it will be a pafture a week or ten days fooner than any other kind. And its having the property of correcting the tendency of clover to produce flatulency, renders it alfo highly worthy of the farmer's attention.

When for hay, if not cut early, the produce is fcarcely fo nutritious as ftraw.

This grafs-feed is fometimes fown alone, and the quantity of feeds which the plants afford, and the facility of collecting it, are probably the reafons of its being very common; while the advantages of its earlinefs have led to its more frequent cultivation. It is fuggefted, however, that feveral graffes, as the vernal, the fox-tail, the meadow poa, and fome others, are equally as early as this grafs, and that the meadow fefcue, the oat-grafs, and fome others, feem to be as well deferving of the attention of the farmer.

According to the ingenious experiments on this grafs, made under the direction of the duke of Bedford, as ftated in the appendix to fir Humphry Davy's Agricultural Chemiftry, the refults were as follow.

The

	lbs. per Acre.		
The quantity of produce from a rich brown loam, taken at the time of the plant's flowering, was	7827	3	0
Weight when dry	3322	4	13
Weight of produce loft by drying	4494	14	3
Quantity of nutritive matter	305	11	15
The quantity of produce taken at the time when the feed was ripe	14973	12	0
Weight when dry	4492	2	0
Weight of produce loft in drying	10481	10	0
Quantity of nutritive matter	643	6	7
Lofs of weight in nutritive matter by taking the crop at the time of flowering, nearly half its value	337	8	8

Proportional value of the flowering grafs to that taken at the time the feed is ripe, as 10 to 11.

The quantity of latter math produce	3403	2	0
Quantity of nutritious matter	53	2	12

Proportional value of the latter math grafs to that of the time of flowering, as 4 to 10, and to that of the time the feed is ripe, as 4 to 11. See GRASS.

RAYA, in *Geography*, a river on the W. coaft of Java, which runs into the fea, S. lat. 7° 27′. E. long. 107° 30′.

RAYEN, a town of the Rhenifh palatinate; 11 miles N.W. of Heilbronn.

RAYGEN, or RAYHRAD, a town of Moravia, in the circle of Brunn; 8 miles S. of Brunn.

RAYLEIGH. See RALEIGH.

RAYMANGUR, a fortrefs of Hindooftan, in Myfore, taken in 1791 by the Britifh troops; 15 miles E. of Nundydroog.

RAYMATLA, a river of Bengal, which runs into the bay of Bengal, N. lat. 21° 35′. E. long. 88° 49′.

RAYMON, a town of France, in the department of the Cher; 14 miles S.E. of Bourges.

RAYMOND DE PEGNAFORT, in *Biography*, a faint in the Roman calendar, was a Spaniard by nation, and born at the caftle of Pegnafort, in Catalonia, in the year 1175. He received the early part of his education at Barcelona, from whence he removed to the univerfity of Bologna, where he ftudied the law, took his degrees, and afterwards taught the canon law for fome time with great reputation. He was afterwards called to Barcelona, by Berenger, bifhop of that city, who made him a canon, and provoft of his cathedral church. He held thefe pofts in the year 1218, when he eftablifhed an inftitution which led the way to the foundation of the *Order of* MERCY, (fee that article.) In 1222 he refigned his dignities, and became a member of the Dominican order of preaching friars at Barcelona. In 1230, pope Gregory IX. fent for him to Rome, appointed him his chaplain and confeffor, and devolved on him the care of carrying on the compilation of the "Decretals." The pontiff would willingly have recompenfed him for his labours by prefenting him with very confiderable church preferment, but he chofe rather the quiet of a monaftery to the honours and emoluments of the richeft fees in Spain and Portugal, which were offered to him. In 1238 he was called to affume the poft of general of his order; but upon the plea of his infirmities, he was fuffered, in about two years, to return to his monaftery, where he fpent the remainder of his long life. He died in 1275, having entered on the 100dth year of his age. To his everlafting difgrace, he is faid to have been principally inftrumental in introducing the Inquifition in the kingdom of Arragon, and into Languedoc, a circumftance which probably was the means of his canonization in the year 1601. He was author of "Summa de Caffibus pœnitentialibus, feu de Pœnitentia et Matrimonio," which was long popular in the Catholic world, and went through numerous impreffions. The beft edition of it is that publifhed by father Laget, at Lyons, in 1708. Raymond's chief work is "Lib. V. Decretalium," commencing with the papacy of Alexander III., where the decretals of Gratian terminate, which was approved by pope Gregory IX., and conftitutes the fecond volume of the papal canon law. Moreri.

RAYMOND LULLY, a philofopher of much celebrity in the dark ages, was born at Majorca in 1234. He was brought up a foldier, and led the life of a man of pleafure. Falling in love with a young woman, who was deaf to his addreffes, on account of a cancer with which fhe was afflicted, and which fhe exhibited to his view, in order to make him defift from his importunities, he was fo much affected with the fight, that he retired from the world, devoting himfelf to pious purfuits, and in the fearch of a remedy for the difeafe with which the object of his affection was afflicted; this was the chief motive for the chemical ftudies for which he became fo famous. He undertook a courfe of travels into the Eaft, for the purpofe of converting the Mahometans to the Chriftian faith, and incurred very great hardfhips, and the moft ferious dangers. So great was his zeal for this object, that being unable to perfuade certain Chriftian princes to engage in it, he entered into the Francifcan order, and returned to Africa, with the hope of obtaining the honour of dying a martyr. He was accordingly thrown into prifon, and after fuffering much torture, and long imprifonment, he was freed through the intereft of fome Genoefe traders, who took him on board their fhip to convey him home. He died juft when he had arrived within fight of his native land, in the year 1315. As a chemift, his chief object was the purfuit of the philofopher's ftone, and the univerfal remedy for all diforders. Boerhaave, who had perufed the works of Lully, fpeaks highly of their merit; he finds them, he fays, "beyond all expectation, excellent, fo that he doubted whether they could be the work of that age. So full are they of the experiments and obfervations which occur in later writers, that either they muft be fuppofititious, or the ancient chemifts muft have been acquainted with many things which pafs for modern difcoveries." Lully is fuppofed to have derived his chemical knowledge from his travels in the Eaft, particularly from the writings of Geber. A complete edition of all the writings attributed to him, was printed at Mentz. Raymond Lully is chiefly celebrated for an invention by which he pretended to enable any one, mechanically, to invent arguments and illuftrations upon any fubject, and thus to reach the fummit of fcience at a fmall expence of time and labour. This "Great Art" profeffes to furnifh a general inftrument for affifting invention in the ftudy of every kind of fcience. For this purpofe, certain general terms, which are common to all fciences, are collected and arranged, not according to any natural divifion, but merely according to the caprice of the inventor. An alphabetical table of fuch terms was provided, and fubjects and predicates taken from thefe were infcribed in angular fpaces, upon circular papers. The effences, qualities, affections, and relations of things, being thus mechanically brought together, the circular papers of fubjects were fixed in a frame, and thofe of predicates were fo placed upon them as to move freely, and in their revolutions to produce various combinations of fubjects and predicates; whence would arife definitions, axioms, propofitions, varying infinitely, according to the different application of general terms to particular fubjects. Such is the general idea of the Lullian art, which, however applauded by certain writers of that period, may be pronounced as unworthy of notice, except as a ſpecimen of the artifice with which men frequently impoſe upon vulgar credulity. Enfield's Hiſtory of Philoſophy.

Raymond, in *Geography*, a townſhip of America, in Rockingham county, New Hampſhire, incorporated in 1764, containing 898 inhabitants; 12 or 14 miles W. of Exeter.

Raymond, or *Raymond-town*, a poſt-town in Cumberland county, and diſtrict of Maine, containing 825 inhabitants; 142 miles N.N.E. of Boſton. The land is generally level, excepting one large hill, called Rattleſnake-hill, from its abounding with thoſe reptiles. The greater part of the growth is pine and white oak, and the ſoil is difficult of culture.

RAYNAL, William-Francis, in *Biography*, a French writer of celebrity, was born at St. Genies, in the Rovergue, in 1713. He entered at a very early age among the Jeſuits, and by his abilities excited high expectations of his future celebrity. His diſlike of reſtraint induced him to quit the ſociety in the year 1748, although he had made his profeſſion, and had been ordained prieſt. He now entered his career of authorſhip, and diſtinguiſhed himſelf as a political, hiſtorical, and miſcellaneous writer. His firſt piece, publiſhed the ſame year in which he quitted the ſociety, was entitled "Hiſtoire du Stadhouderat;" he next publiſhed "Hiſtoire du Parlement d'Angleterre," which gained him much reputation, though it had little claim to the dignified title of hiſtory, and was, moreover, tinged with many prejudices, religious and political. He alſo compoſed "Anecdotes Literaires," in three vols. 12mo.; and "Memoires de Ninon de l'Enclos," and was much employed in the "Mercure de France." The great work of the abbè Raynal was entitled "Hiſtoire Philoſophique et Politique des Etabliſſemens et du Commerce des Europeens dans les deux Indes," to the compoſition of which he was led by his engaging in ſome commercial ſpeculations, thinking them likely to turn out more profitably than literary purſuits. His hiſtory was publiſhed in 1770, and as it contained hiſtory, deſcription, and calculation, intermixed with political and philoſophical reflections, and was, through the whole, animated by an ardent ſpirit of philanthropy, and hatred of tyranny, civil and religious, it became popular, and the author was looked up to as one of the reformers of the age. Critics, however, ſoon found that, as a literary and philoſophical work, it would not bear the teſt of examination. The ſtyle, though rich, was exceedingly declamatory; the images were frequently inflaming; and his principles vitiated by the licentiouſneſs of his country; and the facts upon which the whole was founded were derived from incorrect or dubious documents. The author, it ſhould ſeem, was ſoon made ſenſible of the imperfections of his work, and determined to improve it by travel: with this view he viſited the principal commercial towns in France, and paſſed into England and Holland, at every place making inquiries among travellers and merchants with the moſt unremitting aſſiduity. On his return, he publiſhed at Geneva an improved edition of his work, in 10 vols. 8vo. containing many additions and corrections. Its tone was unaltered, and its attacks upon exiſting authorities were ſo bold, that the parliament of Paris ordered it to be burnt, and iſſued a decree for apprehending the author. He retired to Spa, whence he travelled through Germany, and after having viſited all the principal places, he returned to France, and lived ſome time quietly in the ſouthern provinces. At the academies of Marſeilles and Lyons he founded ſeveral prizes for eſſays on given ſubjects, of which the moſt remarkable was whether the diſcovery of America had been more uſeful or prejudicial to Europe.

America has now, owing to the quarrel and war ſubſiſting between Great Britain and its colonies, become an object of peculiar intereſt; and the abbè Raynal, in 1781, publiſhed "Tableau et Revolutions des Colonies Angloiſe dans l'Amerique Septentrionale," which was commented upon and expoſed by Thomas Paine, who was a zealous and able defender of the American cauſe, againſt the mother country.

The abbè came to Paris in the important year 1788, when the revolution was juſt ready to burſt forth. He had not been long in the city, before the National Aſſembly was convoked, and one of its early acts annulled the decree paſſed againſt him; for this favour, he addreſſed a letter of thanks to the preſident, containing a retraction of certain principles contained in his work. Obſerving, afterwards, that the conſtituent aſſembly were occupied in decrees which he thought were violent infringements on the rights of property, and in others calculated to augment the popular effervescence, he wrote, in May 1791, a long letter of advice and remonſtrance. It was ſoon ſeen that the ſentiments in this letter were very different from thoſe which were generally expected from the author of the "Hiſtoire Philoſophique," their tendency being to repreſs popular licence, and to ſtrengthen the hands of civil authority. Raynal, like many other philoſophers of that day, had aided all in his power to produce the change, at which, when put into practice, he and they were greatly alarmed. But it was now too late to return: they had ſhewn the people their power, had taught them their rights, which it was in vain to expect they would be induced to abandon for any arguments he could produce. In the letter referred to, he ſays, "I have long dared to ſpeak to kings of their duty, ſuffer me now to ſpeak to the people of their errors, and to their repreſentatives of the dangers which threaten us. I am, I own to you, deeply afflicted at the crimes which plunge this empire into mourning. It is true that I am to look back with horror at myſelf for being one of thoſe who, by feeling a noble indignation againſt arbitrary power, may perhaps have furniſhed arms to licentiouſneſs. Do then religion, the laws, the royal authority, and public order, demand back from philoſophy and reaſon the ties which united them to the grand ſociety of the French nation, as if, by expoſing abuſes, and teaching the rights of the people and the duties of princes, our criminal efforts had broken theſe ties? But no!—never have the bold conceptions of philoſophy been repreſented by us as the ſtrict rule for acts of legiſlation." He next proves, that it was not the buſineſs of the aſſembly to aboliſh every ancient inſtitution; that the genius of the French people is ſuch, that they can never be happy or proſperous but under a well regulated monarchical government; and that if they wiſhed not the nation to fall under the worſt kind of deſpotiſm, they muſt increaſe the power of the king. Raynal was conſidered to be in his dotage, and himſelf and his writings were now diſregarded. He retired in the midſt of ſtorms to Paſſy, where, being reduced to a ſtate of indigence, he died in March 1794, at the age of 85. Beſides the works already mentioned, the abbè Raynal publiſhed "The Hiſtory of the Divorce of Catharine of Arragon, by Henry VIII.;" and "A Hiſtory of the Revocation of the Edict of Nantes," in four volumes; but he committed many of his papers to the flames during the bloody reign of the monſter Robeſpierre.

RAYNERIUS, a learned Italian monk, who flouriſhed moſt probably in the 13th century, was a native of Piſa. He

He acquired the character of a confummate divine and civilian, and was appointed profeffor of divinity, as well as raifed to the moft confiderable offices of truft and honour belonging to his order. It is uncertain at what period he died. He left behind him many works, of which the chief is entitled "Pantheologia, feu, Summa univerfæ Theologiæ." This is a dictionary of theology, with the fubjects difpofed of in alphabetical order; it has been held in high eftimation among the members of the Catholic communion. It has gone through feveral editions in folio and quarto. The laft edition was printed at Paris in 1655, in 3 vols. folio, with additions of father Nicolai.

RAYNHAM, in *Geography*, a townfhip of Maffachufetts, in Briftol county, taken from Taunton, and incorporated in 1731. It contains 1154 inhabitants. Befides the great river Taunton, this townfhip is watered by feveral ftreams, upon which are fix faw-mills, three grift-mills, a furnace, a forge, and fulling-mill. Here are alfo numerous ponds, of which Nippanniquit, or Nippahonfit, is two miles long and one broad. In this pond millions of alewives annually refort and leave their fpawn in it. An excellent kind of ore, and various kinds of fifh, are found in this townfhip. Befides the ufual occupations of hufbandry and mechanics, many of the inhabitants are employed in the manufactories of bar-iron, hollow ware, nails, iron for veffels, iron-fhovels, potafh, fhingles, &c. The firft forge fet up in America was introduced into this town by James and Henry Leonard, natives of England, in 1652. The fame family, in the 6th generation, now poffefs it. King Philip's hunting houfe ftood on the northern fide of Fowling pond, about one mile and a quarter from the pond. When the war broke out in 1675, which terminated in the death of the king and the ruin of his tribe, he left ftrict orders to all his Indians not to hurt the Leonards. Before Philip's time, Fowling pond was two miles long, and three miles and a quarter wide. But the water is now almoft gone, and the large tract it once covered is grown up to a thick-fet fwamp of cedar and pine. The vicinity has abounded with excellent ore, which has fupplied the forge for 80 years; it is, however, incapable of being wrought into iron of the beft quality.

RAYNOLDS, or RAINOLDS, JOHN, in *Biography*, a learned Englifh divine, was born at Pinhoe, near Exeter, in the year 1549. In 1562 he was admitted a ftudent at Merton college, Oxford, whence he was removed, in 1563, to a fcholarfhip of Corpus Chrifti college. In 1572, having taken his degrees in the arts, he was appointed Greek lecturer in his college, in which department he acquitted himfelf with great applaufe. Fuller fpeaks of him in the higheft terms as a commentator of Ariftotle's Rhetoric. He had hitherto been zealoufly attached to the Popifh religion, while his brother William was equally zealous for the Reformation. The difference in their fentiments leading them to frequent conferences and difputations, they made converts of each other, William becoming a determined Papift, and John a fteady Proteftant. He frequently appeared in the pulpit, and was greatly admired as a preacher. In the year 1588 he was admitted to the degree of doctor of divinity, and foon afterwards the fame of his great learning induced queen Elizabeth to appoint him profeffor extraordinary in that faculty at Oxford; after which fhe gave him the deanery of Lincoln, which he held only a fhort time, when he exchanged it for the prefidentfhip of Corpus Chrifti college, of which he was a fellow. He made this exchange from his attachment to an academical life, and his love of retirement and ftudy. Similar motives led him afterwards to refufe a bifhopric which queen Elizabeth offered him. He retrieved the finances of his colleges, which had been fuffered to fall into dilapidation, and he reftored its decayed difcipline, ftrictly obeying the ftatutes himfelf, and compelling all the other members to obferve them. After the acceffion of James, he was appointed, with Dr. Sparks, Mr. Chadderton, and Mr. Knewftubs, to appear on behalf of the Puritans in the pretended conferences at Hampton Court; of which we have a full account in the fecond volume of Neal's "Hiftory of the Puritans," by Dr. Toulmin, p. 10—20. Dr. Raynolds did not on this occafion act according to his ufual fpirit, and, fuffering himfelf to be browbeaten by the royal tyrant, loft much of the refpect which his character ufually laid claim to. It was at the conclufion of this conference, that the king faid to Dr. Raynolds and his friends, in anfwer to their arguments; "If this be all your party hath to fay, I will make them conform themfelves, or elfe I will harrie them out of the land, or elfe do worfe, only hang them, that's all." When James gave directions for undertaking a new and more correct tranflation of the bible, Dr. Raynolds was one of the Oxford divines who were commiffioned to give a new verfion of the four greater prophets, the book of Lamentations, and the twelve minor prophets. While employed in this great work he was feized with the gout, under which he had been a fufferer many years, and which at length proved fatal to him. In the midft of the fevereft pains, he perfevered in the tafk affigned to him, and once a-week his fellow-labourers at Oxford regularly affembled in his apartments, where they compared the fruits of their refpective ftudies, determining what appeared to them to be the moft faithful tranflation, till they had accomplifhed their tafk. Dr. Raynolds died in the year 1607, highly refpected for his erudition, his piety, his modefty, and humility. Several of his biographers fpeak of him in the higheft terms. Wood fays he was moft prodigioufly feen in all kind of learning, and had turned over all writers, profane, ecclefiaftical, and divine, all the councils, fathers, and hiftories of the church. He was author of many theological works, of which we may mention "De Romanæ Ecclefiæ Idolotria, in Cultu Sanctorum, Reliquiarum, Imaginum," &c. 1596; and "Cenfura Librorum Apocryphorum Veteris Teftamenti, adverfus Pontificios," which was a pofthumous work, and printed at Oppenheim, in Germany, 1611, in 2 vols. 4to.

RAYNPOUR, in *Geography*, a town of Hindooftan, in Bahar; 40 miles N.W. of Chuprah.

RAYNULLAH, a town of Hindooftan, in Bahar; 32 miles E. of Bahar.

RAYPOUR, a town of Bengal; 55 miles W.S.W. of Burdwan. N. lat. 22° 48′. E. long. 87° 5′.—Alfo, a large and commercial town of Hindooftan, in the country of Ruttunpour; 55 miles S. of Ruttunpour. N. lat. 21° 24′. E. long. 82° 28′.

RAYPOUR, or *Ray-Gaut*, a remarkable pafs on the Beyah river, about 17 or 18 coffes from Noorpour; fituated a confiderable way within the level country of the Panjab.

RAYTE, or RYCHE, in *Ichthyology*, a name given by Joannes Cuba, Albertus, and others, to the common fkate, or flaire. See RAIA *Batis*.

RAZANT. See RASANT.

RAZANT *Flank*. See FLANK.

RAZANT *Line of Defence*. See DEFENCE.

RAZBOINIKOVA, in *Geography*, a town of Ruffia, in the government of Irkutfk, on the Angara; 56 miles N.W. of Balaganfkai.

RAZBOINOI, a fort of Ruffia, on the Ural; 92 miles E. of Orenburg.

RAZE,

RAZE. See TOMB.

RAZE, in the *Manege*. A horfe is faid to have *razed*, whofe corner teeth ceafe to be hollow; fo that the cavity, where the black mark was, is filled up; that is, wholly difappears, and the age of the animal cannot be known with any degree of certainty. See MARK.

RAZI, in *Biography*, one of the furnames of the famous Muffulman Mohammed Ben Omar Ben Khatid Rei, Al Temini Al Bekri, a native of the city of Reï, in the Perfian Irak, of which the word Razi is the appellative. He was born in the year of the Hegira 543, correfponding with 1148 of the Chriftian era, and became one of the moft celebrated doctors. His knowledge was not confined to the learning ufually taught in the Mohammedan fchools, but it comprehended likewife the fciences imported into the Eaft with the writings of the Grecian fages. He was, moreover, a very eloquent preacher both in the Arabic and Perfian languages. By thefe qualifications he acquired the favour of feveral princes, particularly of a fultan of the Gaurid dynafty, who erected a college for him in the city of Herat in Chorafan. He was driven from this fituation by the intrigues of Cadi Abdalmegid, of the fect of Keramians, who contended that the deity was corporeal, and of human fhape. Having challenged Razi one day to a public difputation on the attributes of God, he was fo confounded by the fuperior reafoning of the latter in defence of the divine fpirituality, that he became his bitter enemy, and feized every opportunity of calumniating him to the fultan, as a man who, under the cloak of philofophy, concealed irreligious and impious notions. By his perfuafions, the prince banifhed Razi from the city, but he foon repented of his rafh decree, and recalled him. This happened in the year 606 of the Hegira. He was author of an " Introduction to the moft fubtile Myfteries for the Ufe of Men of Genius," in which he explains the principles of the Mohammedan philofophy; and feveral other pieces. " Select Aftronomical Refearches" have been attributed to him, but perhaps on infufficient authority.

RAZI is alfo the furname of a celebrated philofopher, chemift, and aftronomer, called Mohamed Ben Zakaria, a native of the fame city as the preceding, who flourifhed under the caliphate of Moctader of the dynafty of the Abaffides. He died about the year 922 of the Chriftian era.

RAZIMIERZ, in *Geography*, a town of the duchy of Warfaw, fituated between Slepezka and Pofen, where the unfortunate count Patkul was broken alive on the wheel, and impaled by order of Charles XII. of Sweden in 1708.

RAZNIPNAIA, a fort of Ruffia, in the government of Upha, on the Ural; 56 miles S.W. of Orenburg.

RAZOIS, PORT, a port at the S.W. extremity of the coaft of Nova Scotia, and N.E. of cape Negro.

RAZOR, a well-known edged inftrument ufed in fhaving. Heat appears to give a partial increafe of tenacity to a razor's edge, probably becaufe the edge cools fafteft, contracts, and is ftretched.

RAZOR-*Bill*, in *Ornithology*, the common Englifh name of the alca, a web-footed bird with no hinder toes, common on our fea-fhores. See ALCA *Torda*.

RAZOR-*Fifh*, in *Ichthyology*, the *Coryphæna novacula* of Linnæus, having the head and fins barred with blueifh lines. See NOVACULA.

RAZOR *Ifland*, in *Geography*, a fmall ifland on the coaft of Brafil; 12 miles S. of Rio Janeiro.

RAZUDA, a town of Hindooftan, in Guzerat; 40 miles E.S.E. of Chitpour.

RE', an ifland in the Atlantic, near the weft coaft of France, about 16 miles long, and 3 broad; feparated from the coaft of Vendée by the ftraits of Breton, which are about 7 miles wide. The principal town is St. Martin de Ré. N. lat. 46° 13'. W. long. 1° 20'.

RE, in *Commerce*. See REE.

RE, in *Grammar*, &c. an infeparable particle, or prepofition, prefixed to the beginning of words, to vary, double, or otherwife modify their meaning.

The modificative *re* was firft introduced by the Latins, from whom it is borrowed into moft of the modern tongues. Prifcian derives it from *retro*, backwards; others rather derive *retro* from *re*; others derive *re* from the Greek ῥεα, *eafy*; or from ῥεω, *I flow*.

The effect of the *re* is various: ufually it fignifies *again*, *rurfum*, ανα; as in *re*-join, *re*-fign, *re*-fume, *re*-courfe, *re*-bound, *re*-cite, *re*-hear, *re*-cognize, *re*-compare, *re*-double, *re*-linquifh, &c.

Sometimes it ftands for *contra*, αντι, *againft*; as in *re*-luctance, *re*-cumbent, *re*-cline, &c.

Sometimes for υπερ, *fuper*, *over*, as in *re*-dundant; fometimes for πορρω, *longe*, *far*, as in *re*-moving, &c.

RE, in *Mufic*, the name of the fecond of the keys in the three hexachords of Guido, G, C, and F. See SOLMISATION, GAMMUT, HEXACHORDS, and MUTATIONS.

RE *Alla Caccia*, *Il*, the Italian title of a comic opera, taken from our " Miller of Mansfield." It was fet to mufic for our opera-houfe in 1768, by Aleffandri, a young compofer of promifing abilities. He was hufband of La Guadagni, the original " Buona Figliuola" in Italy, and fifter to Gaetano Guadagni, the celebrated finger. But the Miller of Mansfield was firft formed into a comic opera for Paris, by Sedaine, and fet by Monfigni, under the title of " Le Roi et le Fermier," in 1762.

RE *Teodoro*, *Il*, a comic opera, founded on the adventures and viciffitudes of the unfortunate Theodore, king of Corfica. The mufic of this drama is one of the innumerable inftances of the fertility of Paefiello's pen. It had been performed all over Italy and Germany with the greateft applaufe, previous to its being brought on our ftage. The mufic, that was not changed, is extremely original and pleafing, particularly the *finales*. There was a mixture of airs by Corri, Mazzinghi, and Storace; but befides deftroying the unity of ftyle, the certainty of there being merit of fome kind or other in every compofition of Paefiello, inclines lovers of mufic to lament that any of his airs fhould be changed or omitted.

REA, in *Geography*, a river of England, which runs into the Tame, 3 miles N.E. of Birmingham.

REA, *Lough*, a lake of Ireland, in the county of Galway, on the border of which is the town of Loughrea. See LOUGHREA.

REACH, in *Sea Language*, the diftance between any two points on the banks of a river, in which the current flows in a ftraight uninterrupted courfe.

RE-ACTION, in *Phyfics*, the action by which a body acted upon, returns the action by a reciprocal one upon the agent.

The Peripatetics define re-action to be that which a paffive body returns upon the agent, by means of fome quality contrary to that received from it, in the fame part with which the agent acted, and at the fame time; as if water, while it is heated by the fire, does at the fame time cool the fire.

It was known, even in the fchools, that there is no action in nature without re-action; and it was a maxim among them, *omne agens*, *agendo repatitur*.

But the equality of the actions was not known. Sir Ifaac Newton eftablifhed it as one of the laws of nature, that *action and re-action are equal and contrary*; or that the mutual actions of two bodies, ftriking one againft another, are exactly equal, but in contrary directions; or, in other words, that by the action and re-action of bodies one on another, there are produced equal changes in each: and thofe changes are impreffed towards directly contrary parts or ways. See *Laws of* NATURE.

Some of the fchool-philofophers deny any fuch thing as re-action, properly fo called, at all; urging, that action arifes only from the ratio of the greater inequality; that is, we are only to account for action the excefs of action, or what the agent does more than is returned by the patient. But the equality between action and re-action fets afide this exception.

READ, in *Geography*, a river of England, in the county of Northumberland, which runs into the Tyne, 10 miles N. of Hexham.

READ *Head*, a cape on the E. coaft of Scotland. N. lat. 56° 35′. W. long. 2° 28′.

READFIELD, a poft-town of America, in Kennebec county, and diftrict of Maine, bounded on the E. by Hallowell, and feparated from Sterling on the W. by the eaftern branch of the Androfcoggin river; 8 miles W. of Hallowell, and 190 N.E. of Bofton. It contains 1396 inhabitants.

READING, JOHN, in *Biography*, organift, firft at Lincoln, then at Hackney, and finally of St. Dunftan's church in Fleet-ftreet, London. He was a fcholar of Dr. Blow, and Stanley's firft mafter. He publifhed Hymns early in life, for pfalmodifts in parochial congregations; and, laftly, a work engraved on copper, which he called "A Book of my Anthems, with a Thorough-bafe, for the Organ or Harpfichord." He died in 1766, far advanced in years.

READING, in *Geography*, a borough and market-town in the hundred of Reading, and county of Berks, England, is 38 miles W. by S. from the metropolis. It is a town of confiderable extent and importance, and contains, according to the parliamentary returns of 1811, 2032 houfes, and 10,788 inhabitants.

Hiftorical Events.—Reading is unqueftionably of very great antiquity; but whether it is indebted for its origin to the Britons, the Romans, or the Saxons, is unknown. Conjectures, however, have been hazarded on the fubject by various writers. Camden thinks its foundation ought to be referred to the Britons; Leland calls it the Pontes of Antoninus; and Dr. Beeke, the learned profeffor of modern hiftory at Oxford, confiders it the Calleva of Richard of Cirencefter. But the circumftances which are alleged in favour of thefe opinions, by their refpective authors, are far from being fatisfactory. This place is firft mentioned in hiftory, under its prefent appellation, in the year 871; at which time it is defcribed by Affer as being a fortified town, belonging to the Saxon kings, but then occupied by the Danifh invaders, who had retreated hither after their defeat at Englefield. The victorious Saxons immediately invefted the town; but their enemies, having received reinforcements, attacked the befiegers with fuch impetuofity, that, after an obftinate conteft, they deemed it prudent to retire to Afhdown. Hither they were followed by the Danifh forces, which were again overthrown, and driven back to Reading. Here the latter remained unmolefted till the following year, when they marched to London. In the reign of Alfred, who mounted the throne of Weffex foon after this event, the Danes once more feized upon Reading, and they doubtlefs poffeffed it occafionally during their incurfions in the tenth century. Throughout that long period of inceffant hoftility and depredation, however, this town feems to have efcaped any very ferious difafter; but in 1006 it was reduced to afhes by Sweyn, king of Denmark, along with its famous nunnery, faid to have been founded by Elfrida, widow of king Edgar, as an atonement for the murder of Edward the Martyr. Reading foon recovered from this difafter, and in the courfe of a century afterwards became a place of confiderable importance. In 1121 king Henry I. laid the foundation of its magnificent abbey, in which his remains were fubfequently interred, according to his own defire. Stephen, who ufurped the throne after Henry's death, built a caftle here, which was furrendered to his antagonift Henry Fitz-Emprefs, who no fooner obtained the crown, than he ordered it to be demolifhed; fo that even the feite of it is now uncertain. That monarch, however, otherwife evinced much partiality for Reading. Here he paffed much of his time, and convened a parliament, as alfo an ecclefiaftical convocation, in which Baldwin was elected archbifhop of Canterbury. The abbey church was finifhed in this reign, and dedicated in prefence of the king. In 1185 he came hither from London, to receive Heraclius, patriarch of Jerufalem, who prefented him with the keys of the holy fepulchre, and the royal banners of Jerufalem, which Henry returned. In the reign of his fucceffor, Richard I., a convention for the trial of Longchamp, chancellor and bifhop of Ely, who had been appointed regent of the kingdom during the king's abfence, was held here. King John alfo held a convention in this town, in 1206; and in 1212 a council was convened here by the pope's legate, for the purpofe of effecting a reconciliation between that infatuated prince and the exiled bifhops. In 1213 the king met the legate and barons at the abbey, and held a parliament. King Henry III. fpent his Chriftmas at Reading in 1226; and twice during his reign fummoned the eftates of the realm hither, for the tranfaction of national bufinefs. He was the firft monarch who granted a charter of incorporation to the town. In 1346, Edward III. held a great tournament here; and in 1359, the marriage of his fon, John of Gaunt, with Blanche, daughter of Henry, duke of Lancafter, was folemnized in the abbey church. In 1384, Richard II. and his court, together with the mayor and aldermen of London, being affembled at Reading, John Northampton, the preceding mayor of that city, was convicted before them of feditious practices, and fentenced to perpetual imprifonment. In 1389 a great council was held at Reading, at which the king and his barons were reconciled by John of Gaunt. Parliaments were held here alfo in 1440 and 1451; in the former of which the order of nobles called vifcounts was firft eftablifhed; and in the year following, the parliament adjourned hither from Weftminfter, on account of the plague. King Edward IV.'s marriage with Elizabeth, lady Grey, was firft acknowledged at Reading, in 1464; on which occafion fhe made her public appearance at the abbey, conducted by the duke of Gloucefter and the earl of Warwick. In 1466 parliament was a fecond time adjourned to Reading, to avoid the plague. King Henry VIII. frequently refided here, having converted the diffolved abbey into a palace. His fon, king Edward VI., vifited this town in 1552, when he was met by the mayor and aldermen at Coley-Crofs, and prefented with two yokes of oxen; the mayor riding before him, uncovered, to the palace. The fame ceremony was repeated, when Reading was vifited by the bigotted Mary, and her hufband, king Philip of Spain. Queen Elizabeth was a frequent vifitant here, and had a feat in the church of St. Lawrence.

Early in the reign of Charles I., when the plague raged with

with great violence at London, the courts of chancery, king's bench, and common pleas, were held here, as were likewife the court of exchequer, the court of wards and liveries, and the court of requefts. In 1642, Reading was a parliamentary poft, but the garrifon, being defective as to ordnance and ammunition, quitted the town, without refiftance, on the approach of a party of the king's horfe. In confequence of this event it became a royal garrifon, and continued to be fo till taken by the earl of Effex in April 1643, after a fiege of eight days. The king, however, again recovered it in September the fame year, and held it till May following, when he ordered the works to be demolifhed, and evacuated the town. After this event Reading was frequently occupied as the head-quarters of the parliamentary army, and was confequently much impoverifhed by the contributions levied upon its inhabitants for the fupport of the military. In 1688 the army of king James II. was quartered in this town, but quitted it on the approach of the prince of Orange. On this occafion a fkirmifh took place in the market-place between two detachments of horfe, which terminated in favour of the Proteftant intereft, and is ftill commemorated, by bell-ringing, on the anniverfary of its occurrence. Queen Anne vifited Reading in 1700, when fhe was received by the corporation in ftate, and prefented with forty broad pieces of gold in an elegant purfe made for the occafion.

Municipal Government.—Reading claims the honour of having been originally conftituted a guild, by charter from Edward the Confeffor. This claim, however, is extremely queftionable; and at all events we feel convinced that the ancient guild was nothing more than an affociation of mechanics and tradefmen for their individual benefit. The firft monarch who conferred upon Reading the privilege of feparate jurifdiction was Henry III., in the 37th year of his reign. His charter was fubfequently confirmed by all his fucceffors, but without any material alterations, till the reign of Henry VI., when the corporation is firft mentioned by the title of the mayor and burgeffes. Thus it continued to be defignated till queen Elizabeth divided the burgeffes into capital and fecondary, and declared the mayor and them to be a common council for the borough. That princefs further conferred upon the corporation confiderable eftates. Charles I. authorized aldermen to be elected, and invefted the mayor and them with ample powers for the government of the town. This charter was confirmed, after the reftoration, by his fon Charles II., and is the one under which the corporation now acts. By it the officers are declared to be a mayor, twelve aldermen, and the fame number of capital burgeffes; the mayor, and his deputy, (the preceding mayor,) the fenior alderman, the bifhop of Salifbury, and his chancellor, being juftices of the peace for the borough, and empowered to hold feffions, and a court of record. The recorder is an officer added by Charles II., who likewife firft acknowledged the town-clerk. Reading fent members to parliament from the time of the earlieft records. Before 1716 the right of election was vefted in the freemen not receiving alms, and in the inhabitants paying fcot and lot; but in that year it was limited, by a decifion of the houfe of commons, to the inhabitants paying fcot and lot only. The number of voters is eftimated at 560, and the mayor is the returning officer. The fpring affizes for the county are held at this town, as are likewife the Epiphany feffions, but the fummer affizes are held at Abingdon, and the Michaelmas, either there or at Reading, as the magiftrates may judge moft convenient.

Reading is a town of confiderable extent, fituated on both banks of the river Kennet, which feparates itfelf into feveral branches in paffing through the town. It contains three parifhes, St. Giles, St. Mary, and St. Lawrence, and is divided into five wards, called the High-ward, New-ward, Minfter-ward, Old-ward, and London-ward, for each of which a conftable is appointed. Formerly it was a place of great trade in woollens, but that manufacture fell to decay during the feventeenth century, and has never fince revived. At prefent the chief manufactured products are, coarfe linens, (fuch as fheeting, fail-cloth, floor-cloth, and facking goods,) gauze, crapes, mullinets, ribbons, hat-bands, fhoe-ftrings, and other fimilar articles. Thefe afford employment to a great portion of the inhabitants among the lower orders; but the principal fupport of the town arifes from its water communications with London, Bath, and Briftol. The articles exported are, flour, of which 20,000 facks are fent annually to the metropolis, timber, bark, ftraight hoops, linen, wool, cheefe, beer, and a variety of minor articles: in exchange are received groceries of every kind, iron, fpirits, fir timber, deals, ftaves, Portland ftone, bricks, hemp, flax, hides, leather, coals, Bath free-ftone, Birmingham goods, &c. For the convenience of trade, feveral wharfs are formed at Reading, and many improvements have been lately made in the internal navigation of the diftrict at large.

This town, from time immemorial, has been noted for its markets, which are held weekly, on Wednefday and Saturday. The Wednefday's market is chiefly for fruit; but that of Saturday embraces corn and every article of provifion. The fpot on which the corn market is held, is a fpacious piece of ground, of a triangular form, environed by commodious fhops for the accommodation of people attending the market, who may be fupplied here with colonial or manufactured goods cheaper than in any other town in the county. This market-place is kept in repair by the corporation, for which they are entitled to take one pint out of each fack of corn fold in the market, amounting to about 54,600 quarters annually. The provifion market buildings adjoin to the corn market-place, and form a long fquare, confifting, one-half of two ranges of butchers' fhops, and the other half of apartments for the market-women, who bring butter, eggs, poultry, &c. for fale. At the fouthern end of this building is a fquare open area for fifhmongers' and huckfters' ftalls, and next to this, and fronting a ftreet called Fifher-ftreet, is a large fquare gate-way, over which is the houfe occupied by the clerk of the market. Befides thefe market-places, there is another for the fale of ftore pigs, conveniently fituated between Friar-ftreet and Broad-ftreet. This is private property, but the corporation receive the toll. At Reading are four annual fairs, one on the 2d of February, another on the 1ft of May, a third on the 25th of July, and a fourth on the 21ft of September. The three firft are chiefly for the fale of horfes and cows; but the laft is alfo a ftatute fair for the hiring of fervants, and is further remarkable for the quantity of cheefe brought hither from the counties of Gloucefter and Wilts. Hops are alfo plentiful at this fair.

The houfes of Reading are moftly conftructed of brick, and are generally difpofed in regular ftreets, fome of them very narrow, which have been paved under the authority of an act of parliament, paffed in the year 1785.

The principal public buildings and inftitutions in the town are the three churches of St. Lawrence, St. Mary, and St. Giles, and feveral diffenting meeting-houfes, the town-hall and free-fchool, the blue-coat fchool, the green fchool, the foundation fchool, the fchool of induftry, the Lancaftrian fchool, the fchool for national education, the theatre, and the county gaol.

The

The church of St. Lawrence was chiefly erected towards the close of the 16th century, and is partly constructed of materials taken from the buildings of the abbey. Among the parts of it, so pilfered from the monastery, is a large door-way, which is composed of a circular arch, ornamented with rich mouldings, from which were suspended on each side the arms of the abbey; but these are now nearly obliterated. This door-way is likewise ornamented with niches, in which statues formerly stood. The advowson of the church belongs to St. John's college, Oxford. St. Mary's church is somewhat more ancient than that of St. Lawrence, having been constructed about the year 1547, in the stead of a previous one, which had gone to decay. Some portions of this building have evidently belonged to an older edifice, particularly a window over the west door, which is in the early pointed style of architecture. St. Giles's church was probably constructed at the commencement of the 12th century. The tower only is modern, the ancient one having been demolished during the civil war. The livings of both the churches last mentioned are in the gift of the lord chancellor. The principal meeting-houses for dissenters are the Calvinistic or Independent meeting-house in Broad-street, a Baptist meeting-house and a Quaker's meeting-house in Church-street, a Methodist chapel in Castle-street, and another in Minster-street, a Cudworthian and an Unitarian meeting-house in London-street, and a Catholic chapel in Vastern-lane. Another meeting-house for Baptists has also been lately erected in Sievier-street.

The town-hall and free-school form one building; the free-school occupying the ground story, and the hall, court-room, and offices, the floor above. The free-school was established in the reign of Henry VII., by John Thorne, abbot of Reading, with the funds of a suppressed alms-house. This school has two scholarships in St. John's college, Oxford, the gift of sir Thomas White, in 1557. Julius Palmer, one of the masters of this school, fell a martyr to his Protestant tenets in 1556. The blue-coat school, which is so named from the dress of the scholars, was founded in 1656, by Mr. Richard Aldworth, who bequeathed 4000*l.* for the support of a master, lecturer, and twenty boys. The present school-house is of late erection, and consists of a centre and two wings. Several donations and bequests having been made to this establishment by various persons, it now usually supports about 48 boys. The green school is situated in Broad-street, and is appropriated for the education of the daughters of decayed tradesmen, residents in the town, and of orphans, who have been left unprovided for by their parents. The inhabitants of Reading are indebted for the institution of this school to the Rev. Charles Sturges, the Rev. Dr. Nicholls, and the Hon. and Rev. W. B. Cadogan, former vicars of the three parish churches belonging to the town. It is supported by annual subscription, and the proceeds of different donations and bequests. In the foundation school, founded in 1766, eight male and eighteen female children are taught to read. It was instituted with a legacy left for that purpose by Mr. Joseph Neale. The school of industry originated under the patronage of Mrs. Cadogan, for female children, and is supported by the voluntary contributions of ladies in the town. The Lancastrian school, established in 1810, is situated in Southampton-street, and is attended by about 320 boys, who are nominated by the subscribers individually. The school for national education was opened in September, 1813. It is founded on the plan of instruction recommended by Dr. Bell, and is chiefly supported by the clergy of the town and county. Both these institutions are calculated to be highly beneficial to the rising generation. Besides these seminaries of education, there are in Reading several Sunday schools, all the children attending which receive a suit of clothes annually, from a fund provided by the bequest of Mr. Edward Simeon, who clothed them in the same manner during his life-time. The theatre of Reading is a neat and convenient building, lately erected, under the act for regulating provincial theatres. The gaol was built in 1793, on the scite of some of the abbey ruins. It is a large edifice, and contains commodious apartments for the keeper, a neat chapel, an infirmary, and a room for the reception of the magistrates, in the centre; and two wings, one for male, and the other for female prisoners, with yards, cells for refractory individuals, &c.

Besides the above public buildings and establishments, there is a public library lately established at Reading, under the name of the "Reading Institution;" also a dispensary, which is attended by some of the medical gentlemen of the town. The house is the property of the corporation, and the general expences are defrayed by subscription. The Oracle may likewise be reckoned among the public buildings of Reading. This structure was erected by the mayor and burgesses, in conformity to the will of John Kendrick, who left 7500*l.* "to build a strong house of brick, fit and commodious to set the poor to work therein." The funds of this charity having been at different periods greatly abused and misapplied, the subject has been several times before the supreme courts of justice. The testator's object, in bequeathing his large legacy, was the improvement of the woollen trade; but instead of this, it was perhaps the first occasion of the decay of that manufacture, by enabling such as could obtain its advantages to undersell those who were not so fortunate. The same complaints are made against it, with respect to the manufactures now carried on in it, and, as we suspect, not without some show of reason.

Monastic Establishments.—As already mentioned, the earliest religious institution at Reading was a monastery for nuns, founded by Elfrida, the mother-in-law of Edward the Martyr. This nunnery was founded in 979, and was destroyed, in 1009, by the Danes. The precise scite on which it stood is uncertain, but there can be no doubt of its existence. It appears from the Domesday-book, and also from Tanner's Notitia, that another nunnery was established here at a later period, but nothing of its history is known. The abbey, the ruins of which are still sufficient to attest its extent and importance, was founded by Henry I. in 1121. It occupied a spot of ground, equal, if not superior, to any in Berkshire for fertility of soil and beauty of situation. This spot comprehended about thirty acres, and was environed on three sides by a massive and lofty wall, and on the fourth by the river Kennet. Exterior to this wall was a piece of ground, about fifty yards wide, (like the pomœrium that surrounded the Roman cities,) which it was not allowable either to cultivate or build upon. It had four entrances to it, defended by arched gateways, and having battlements on their tops similar to those on the walls. Within these was the outer court, whence another gate-way led into the inner court. Part of this building remains, and is composed of bricks, chalk, and stone; and, from the dissimilarity of styles which it exhibits, has evidently undergone many alterations and repairs. Some of it is probably as late as the reign of Henry VII., though other portions of it are, undoubtedly, of much higher antiquity. The inner court conducted to the principal entrance to the abbey, the situation of which, owing to the ground having been since built upon, and the confusion occasioned by throwing up the ramparts in the civil war, cannot now be accurately determined. The only entrance on this side at present is through an arched passage, opening into the south-east corner of the cloisters, which is certainly too mean to be fuppofed to have been the grand entrance to this fuperb monaftery. On the right-hand of the paffage is a door-way, leading to a range of apartments, and within is a circular ftaircafe, which conducts to the upper part of the building. This divifion of the abbey is conjectured to have been appropriated as offices for fervants and others, as, underneath it, is a feries of arched cellars, and at its fouthern extremity was the kitchen. The great hall, or confiftory, was entered from the cloifters by three large entrance doors. It meafured 80 feet in length, 40 in width, and the fame in height, to the centre of the ceiling, which was conftructed of ftone, and fupported by arches fpringing from four pilafters, 20 feet high, placed againft each of the fide walls. Thefe walls, and probably alfo the outer ones in every part of the building, meafure twelve feet thick from the foundation to the fet-off, and fix feet thick from thence to the top, and are compofed of flints and rubbifh of various kinds, bedded in mortar, and indurated in the higheft degree. The abbey-church appears to have extended 260 feet in length, and to have been built in the form of a crofs, with a tower and fpire in the centre. The nave was 40 feet wide, and was divided from the fide-aifles by alternate piers and arches. From the maffive character of this ftructure, in general, and from the circular form of the windows in the dormitory, it is conjectured that its windows alfo had circular arches. In the ground to the eaft of the church, many fkeletons have been difcovered, a circumftance which points it out as the probable burial-place of the monks. The above-mentioned buildings conftituted the body of the abbey, but there were likewife many others, both connected with and detached from them. Among thefe were the infirmary, the ftables, and the mill. This laft is yet ftanding, and appropriated to its original purpofe. It is a fubftantial edifice, built of flint and ftone, and is probably coeval with the abbey-church.

Reading monaftery was indubitably among the moft diftinguifhed in England. The monks were of the Benedictine order, and were endowed with many privileges and immunities, not only by the founder, but by feveral of his fucceffors, and by fome of the popes. They had the right of coining granted to them by king Edward III., alfo the right of holding three annual fairs, and a market every Sunday at Thatcham. The abbot was among thofe entitled mitred, and took precedency in the houfe of peers, next after the abbots of Glaftonbury and St. Alban's. He was lord of the manor of Reading, and poffeffed otherwife much influence in the government of the borough. Many of the monks were diftinguifhed for their talents and their acquirements in the learning of their refpective ages. Robert of Reading, one of the firft monks, was particularly famous, as being, with Adelard of Bath, the only Englifhmen of their time who were mafters of the Arabic language. The abbey-church was the place of fepulture of many royal and noble perfons, among whom were Henry I., and his fecond queen, Adeliza, and probably alfo his firft queen, Matilda ; the emprefs Maud, and William, eldeft fon of Henry II. ; Conftance, grand-daughter to Edward III.; Ann, countefs of Warwick ; Richard, earl of Cornwall, and king of the Romans ; and Richard de Curtenea, natural fon of Henry II. At the diffolution, the revenues of this monaftery were eftimated at 2116*l.* 3*s.* 9*d.* annually, above 20,000*l.* according to the prefent value of money. The lands, of courfe, were feized upon by king Henry, who parcelled them off, either in gifts or in leafe, to different individuals ; but the monaftery itfelf was converted into a royal palace, and continued to be occafionally occupied by our kings till its deftruction during the grand rebellion, in the reigns of Charles I. and II.

The other monaftic inftitutions in Reading, befides thofe already noticed, were two convents for Francifcan or Grey friars, St. Edmond's chapel, and Colney chantry. One of the convents was founded about the middle of the thirteenth century, foon after the firft appearance of the Francifcan order in this country. Its original fituation was on a marfhy ground adjoining the Caverfham road, and ftill called the Friery Mead ; but in 1285 the friars removed to their fufequent refidence, at the weftern extremity of Frier-ftreet. After the diffolution this houfe was appropriated as a work-houfe for the poor ; and part of the church now forms the borough prifon. This building is in the early pointed ftyle, and has at its weftern end a very beautiful lancet window. The other convent ftood in Caftle-ftreet, probably on the fpot now occupied by the Methodift chapel. This inftitution feems to have been on a very fmall fcale, though it is mentioned by Leland as "a fayre houfe of Grey freres." St. Edmond's chapel ftood on the rifing ground, called Chapel Hill, near the borough prifon. It was founded, in 1284, by Lawrence Burgefs, then bailiff of the town. In the civil war it was converted into a fort ; and afterwards, about the year 1750, was demolifhed, and another chapel erected in its ftead on Battle-Farm. Colney chantry was inftituted by one of that family in the reign of Richard II., for the fouls of king Edward III., of Thomas Colney, John Colney, and William Catour. It had diftinct incumbents of its own, and was under the patronage of the corporation.

Reading has given birth to feveral perfons of eminence. Sir Thomas White, founder of St. John's college, Oxford, is faid to have been born here ; but Fuller affirms that he was a native of Rickmanfworth. Archbifhop Laud was born in this town in 1573, having been the fon of William Laud, then a clothier in Broad-ftreet, who, as the archbifhop himfelf told lord Say, had borne all offices in the corporation, fave the mayoralty. John Blagrave, the mathematician, is alfo commonly reputed to have been a native of Reading ; as was Jofeph Blagrave, a celebrated aftrological writer, who does not feem to have been related to the mathematician. The other diftinguifhed natives of Reading were, fir Thomas Holt ; fir John Barnard, a noted alderman of London ; James Merrick, the tranflator of the Pfalms ; William Baker, a learned printer ; fir Conftantine Phipps, lord chancellor of Ireland ; and Dr. Phanuel Bacon, author of feveral dramas, &c.

The vicinity of Reading prefents feveral objects worthy of notice. At a fhort diftance to the fouthward, clofe to a place called Catfgrove-lane, may be feen a remarkable ftratum of oyfter-fhells, imbedded in a vein of fea-fand, at leaft twenty fathoms beneath the furface of a hill. This ftratum is from one to two feet in thicknefs, and extends through a circumference of five or fix acres of ground. Mixed with the fhells is a confiderable quantity of fmall teeth, apparently of fifh. Caverfham, formerly a feat of the Craven family, and afterwards of the Cadogans, is fituated nearly oppofite the town, on the north bank of the river Thames. The houfe was built by the earl of Cadogan, in the reign of George I., but has fince undergone material alterations. In the old manfion, Anne of Denmark, queen to James I., was fplendidly entertained by lord Knowles, when on her journey to Bath, in 1613. At the time Charles I. was a prifoner at Windfor, the parliament, through the mediation of general Fairfax, permitted him to vifit Caverfham Lodge, where all his children who were in England, then refided, in the cuftody of the earl of Northumberland. In the hamlet of Woodley is a very pleafing feat, belonging to lord Sidmouth ; and two miles to the

weftward

weftward is another, the property of the Blagrave family. The park is very extenfive, and is noted for fine venifon. South-eaft, about the fame diftance, is White-Knights, the feat of the marquis of Blandford. Sunning, celebrated in hiftory as having been for fome time the feat of the fee of Wiltfhire, and fubfequently the fcite of one of the palaces of the bifhops of Salifbury, is a village three miles to the eaftward, on the road to Maidenhead. Leland mentions the bifhop's palace as ftanding in his time. It was given by bifhop Gheaft, along with the manor, to queen Elizabeth, in exchange for eftates in Dorfetfhire. The antiquity of this place is ftrongly marked by the fepulchral monuments in the church. Clofe to Sunning is an elegant manfion, the feat of Charles Fyfh Palmer, efq. Lyfons's Magna Britannia, 4to. Berkfhire. Beauties of England and Wales, vol. i. by John Britton and E. W. Brayley, 1801. The Hiftory and Antiquities of Reading, by John Mann, 4to. 1814. From the latter work, the chief and moft effential parts of this account have been obtained: and thofe who wifh to poffefs the moft copious and authentic hiftory of Reading will procure this volume.

Reading, a townfhip of America, in Fairfield county, Connecticut, S. of Danbury adjoining. It contains 1717 inhabitants.—Alfo, a large townfhip of Middlefex county, in the ftate of Maffachufetts, incorporated in 1644, and containing 2228 inhabitants, many of whom are employed in the manufacture of fhoes, from 2 to 300,000 pair being annually exported; 12 miles N. of Bofton.—Alfo, a townfhip of Vermont, in Windfor county, W. of Windfor, adjoining. It contains 1565 inhabitants.—Alfo, a beautiful poft-town, and the capital of Berks county, Pennfylvania, fituated on the N.E. fide of Schuylkill river; 54 miles N.W. of Philadelphia. This town is regularly laid out, and flourifhes: its inhabitants are chiefly German: the borough and townfhip contain 3462. The public buildings are, a ftone gaol, a court-houfe, an elegant church for German Lutherans, erected in 1793, a church for Calvinifts, one for Roman Catholics, a meeting-houfe for Friends, and a large edifice for the public offices. In the neighbourhood are 10 fulling mills, and feveral iron-works: and at the diftance of 10 miles, on the road to Harrifburgh, is a fpring, about 15 feet deep and 30 feet wide, from which iffues a copious ftream, containing fome fine trout. In 1795 the fum of 12,000*l.* was voted by the county for building a ftone arched bridge over the Schuylkill, at this town, on the high road to Harrifburgh. N. lat. 40° 21′. W. long. 75° 55′.—Alfo, a townfhip of Adams' county, in Pennfylvania, containing 732 inhabitants.

Reading. See Lectio.

Reading *of a Deed*. See Deed.

READINGS, in *Criticifm*. *Various readings*, *variæ lectiones*, are the different manners of reading the text of authors in ancient manufcripts; where a diverfity has arifen from the corruption of time, or the ignorance of copyifts.

A great part of the bufinefs of the critics lies in fettling the readings, by confronting the various readings of the feveral manufcripts, and confidering the agreement of the words and fenfe. The various readings in the bible, (fee *Hebrew* Bibles,) and in the claffic authors, are almoft innumerable.

Readings are alfo ufed for a fort of commentary or glofs on a law, text, paffage, or the like; to fhew the fenfe an author takes it in, and the application he conceives to be made of it.

READINGTON, or Riddenton, in *Geography*, a town of New Jerfey, in Hunterdon county; 17 miles N.W. by W. of New Brunfwick. It contains 1797 inhabitants.

READ'S Bay, a road for fhips on the W. coaft of the ifland of Barbadoes, between Holetown and Speight's-town; half a mile broad. Ships may anchor here in fafety, in fix to twelve fathoms water, the ground being foft ooze, defended from all winds, except the weft, which blows right into the bay. N. lat. 13° 7′. W. long. 59° 47′.

READSBOROUGH, or Reedsborough, a poft-town of America, in Bennington county and ftate of Vermont; 435 miles from Wafhington. It contains 410 inhabitants.

RE-AFFORESTED, is where a foreft, having been difafforefted, is again made a foreft. As the foreft of Dean was, by an act of parliament in the 20th of king Charles II. See Forest.

RE-AGGRAVATION, in the Romifh *Ecclefiaftical Law*, the laft monitory, publifhed after three admonitions, and before the laft excommunication.

Before they proceed to fulminate the laft excommunication, they publifh an aggravation, and a re-aggravation. Fevret obferves, that in France the minifter is not allowed to come to re-aggravation, without the permiffion of the bifhop or official, as well as that of the lay judge. See Excommunication.

REAH, in *Geography*, a town of Syria, in the pachalic of Aleppo, fituated in a country that abounds with olives, of which confiderable quantities are prepared, and fent to Perfia and other parts. This is the refidence of an Aga; 36 miles S.S.W. of Aleppo.

REAL, Reale, is applied to a being that actually exifts; in which fenfe it coincides with *actual.*

Real, in *Law*, is oppofed to *perfonal.*

Real *Action*, that by which the plaintiff lays title to land, &c. See Action.

Cuftoms are faid to be real; that is, they determine all inheritances within their extent; and none may difpofe of them, but according to the conditions allowed by the cuftoms where they are fituated.

Real *altitude*, *affets*, *character*, *chattels*, *covenant*, *diftinction*, *diftrefs*, *eftate*, *horizon*, *optic place*, *patronage*, *privilege*, *qualities*, *root*, *fervices*, *fuit*, and *writs*. See the feveral fubftantives.

Real, in *Commerce*, a Spanifh money of account, of which there are four different forts. The real *vellon* is that which is moft general; it confifts of $8\frac{1}{2}$ quartos, 17 ochavos, or 34 Maravedis vellon. Madrid, and the whole of Caftile, with moft of the adjacent provinces, and alfo Bilboa, Malaga, and Gallicia, keep accounts in reals and Maravedis vellon. The real of *new plate* (real de plata nuevo, or provincial) is double the real vellon: it is worth 17 quartos, or 34 ochavos: and it is alfo reckoned at 34 Maravedis of new plate. This real is reprefented by an effective coin of bafe filver, but books are not kept in any part of Spain in this money.

The real of *old plate* (real de plata antigua), moftly called the real of plate, is chiefly ufed in foreign commerce and exchanges: it is worth 16 quartos, or 32 ochavos: and it is alfo reckoned at 34 Maravedis of old plate. Cadiz and Seville keep accounts in reals and Maravedis of old plate.

The real of *Mexican plate* (real de plata Mexicano) is ufed in tranfactions with Spanifh America, where accounts are moftly kept in hard dollars, reals, and quarters, and fometimes in fixteenths: 8 Mexican reals make 1 hard dollar (pefo duro): this coin is worth 10 reals of new plate, $10\frac{2}{3}$ reals of old plate, or 20 reals vellon. Thus, 1 real of new plate = 2 reals vellon: and 4 reals Mexican

can = 5 reals of new plate: 64 Mexican reals = 85 reals of old plate: 2 Mexican reals = 5 reals vellon: 16 reals of new plate = 17 reals of old plate: 17 reals of old plate = 32 reals vellon. The piſtole of exchange (dobloon de plata) is worth 32 reals of old plate, or 60 reals 8 Maravedis vellon. The dollar of exchange (peſo de plata) is worth 8 reals of old plate, or 15 reals 2 Maravedis vellon. The ducat of exchange (ducado de plata) is worth 11 reals 1 Maravedi of old plate, or 20 reals $25\frac{15}{17}$ Maravedis vellon. But, in commercial tranſactions within the country, the dobloon is reckoned only at 60, the peſo at 15, and the ducat at 11 reals vellon.

The coins now current in Spain are as follow:

		Reals Vellon.	Maravedis Vellon.
In gold.—	The dobloon of 8 eſcudos, or quadruple piſtole, paſſing for - -	320	
	The dobloon of 4 eſcudos, or double piſtole -	160	
	The dobloon de Oro, or piſtole - -	80	
	The eſcudo - - -	40	
	The coronilla, or veinten de Oro - -	20	
In ſilver.—	The dollar, or peſo duro -	20	
	The half dollar, or eſcudo vellon - -	10	
	The peceta Mexicana - - -	5	
	The real of Mexican plate -	2	17
In baſe ſilver.—	The peceta provincial -	4	
	The real of provincial plate -	2	
	The real vellon - - -	1	
In copper.—	The piece of two quartos - -		8
	The quarto - - - -		4
	The ochavo - - - -		2

From 1730 to 1772, the gold was 22 carats, and the ſilver 11 dineros fine (the dinero = 24 grains): but in 1772 the gold was reduced to $21\frac{1}{2}$ carats, and the ſilver to $10\frac{3}{4}$ dineros fine, the pecetas and reals being reduced to $9\frac{3}{4}$ dineros fine. In 1786 the ſtandard of the gold was again reduced to 21 carats for the different dobloons and their diviſions; and to $20\frac{1}{4}$ carats for the coronilla or veinten de Oro. For the value of the piſtole, ſee Pistole.

The dollar (coined ſince 1772) contains $374\frac{7}{8}$ troy grains of fine ſilver, or $405\frac{4}{7}$ grains of Engliſh ſtandard ſilver: its value therefore in Engliſh ſilver coin is 4*s.* $4\frac{1}{2}$*d.*; and the half dollar in proportion. The value of the peſo of plate, or dollar of exchange, in Engliſh ſilver coin, is $39\frac{1}{2}$*d.*; of the dobloon of plate, or piſtole of exchange, 13*s.* 2*d.*: and of the ducat of plate, 4*s.* $6\frac{1}{2}$*d.* The real of old plate is worth about 5*d.*; and the real vellon $2\frac{3}{5}$*d.* nearly; or more accurately, 1*l.* ſterling = 48 reals, $20\frac{3}{5}$ Maravedis of old plate, or 91 reals 17 Maravedis vellon.

By the reports of average aſſays lately made on the quadruple and dollar at the London mint by order of the bank of England, the quadruple weighs 17 dwt. 8 gr.; its fineneſs $4\frac{1}{2}$ gr. worſe than Engliſh ſtandard: hence its value in Engliſh gold coin is 3*l.* 4*s.* $0\frac{1}{2}$*d.* The dollar weighs 17 dwt. 8 gr.; its fineneſs 8 dwt. worſe than Engliſh ſtandard: hence its value in Engliſh ſilver coin is 4*s.* $3\frac{3}{4}$*d.* See Pistole.

The value of reals of Spain, and monies of account, expreſſed in pence and decimals of pence, according to the mint price both of gold and ſilver in England, *i.e.* 3*l.* 17*s.* $10\frac{1}{2}$*d.* *per* ounce for gold, and 5*s.* 2*d.* *per* ounce for ſilver, is as follows:

	Value in Silver. D.	Value in Gold. D.
Real of old plate - -	4.93	4.57
Real of new plate - -	5.24	4.86
Real of Mexican plate - -	6.55	6.07
Real vellon - - -	2.62	2.43
The dollar of old plate, or of exchange - -	39.45	36.59

The aſſay, weight, &c. of Spaniſh ſilver coins compared with the Engliſh ſtandard of 11 oz. 2 dwt., and according to the mint price of ſilver in England, *i. e.* 5*s.* 2*d.* *per* ounce ſtandard, are as follow, W. denoting worſe than Engliſh ſtandard.

	Aſſay.			Weight.			Contents in Pure Silver.	Value in Sterling.	
		oz.	dwt.	oz.	dwt.	gr.	grains.	s.	d.
Dollar, old Mexican ſquare (1747) - - -	W.	0	$4\frac{1}{2}$	0	17	7	376.1	4	$4\frac{1}{2}$
Half ditto - - - - - -	W.	0	$4\frac{1}{2}$	0	8	$15\frac{1}{2}$	188.	2	$2\frac{1}{4}$
Dollar, old, called Sevillan (1731) - - -	W.	0	$4\frac{1}{2}$	0	17	7	376.1	4	$4\frac{1}{2}$
Old Mexican peceta, of two Mexican reals (1734) - -	W.	0	$4\frac{1}{2}$	0	4	$7\frac{1}{4}$	93.6	1	1
Real of Mexican plate (1746) - - - -	W.	0	$4\frac{1}{2}$	0	2	$3\frac{1}{2}$	46.8	0	$6\frac{1}{2}$
Dollar, Mexican, with globes and pillars (1765) - -	W.	0	$4\frac{1}{2}$	0	17	$8\frac{1}{2}$	377.	4	$4\frac{3}{4}$.
Peceta, of two reals of plate (1721) - - - -	W.	1	7	0	3	$16\frac{1}{2}$	71.9	0	10
Real of plate (1721) - - - - - -	W.	1	7	0	1	$20\frac{1}{4}$	35.9	0	5
Dollar, of late coinage, univerſally circulated under the name of the Spaniſh dollar - - -	W.	0	8	0	17	8	370.9	4	$3\frac{3}{4}$
Half dollar, ditto - - - - - - - -	W.	0	8	0	8	16	185.2	2	$1\frac{3}{4}$
Mexican peceta (1774) - - - - -	W.	0	8	0	4	$7\frac{1}{2}$	92.3	1	$0\frac{3}{4}$
Real of Mexican plate (1775) - - - -	W.	0	8	0	2	$3\frac{3}{4}$	46.1	0	$6\frac{1}{4}$
Peceta provincial, of two reals of new plate (1775) - -	W.	1	$9\frac{1}{2}$	0	3	18	72.2	0	10
Real of new plate (1795) - - - -	W.	1	$9\frac{1}{2}$	0	1	21	36.1	0	5

For the aſſay, weight, value, &c. of gold coins, ſee Pistole.

Real, or *Reali*, is alſo a money of account at Leghorn. At Zante, and alſo Cefalonia and Corfu, accounts are kept in reali, of 10 lire, or 100 ſoldi, alſo called aſpri.

Real is the name of a kind of boat in ſome places.

Real *el Novita*, in *Geography*. See Novita.

Real *Nuevo*, a town of Mexico, in the province of New Biſcay; 120 miles N.W. of Parral. N. lat. 29° 10′. W. long. 107° 20′.

REAL *del Rofario*, a town of Mexico, in the province of Chiametlan, on the Spiritu Santo; 24 miles N. of Chiametlan.

REAL *de Frayles*, a town of New Mexico, in the province of Mayo; 60 miles from Santa Cruz. N. lat. 27° 44′. W. long. 110° 22′.

REAL *de Minas*, a town of New Navarre; 180 miles S.S.E. of Cafa Grande.

REAL *de St. Juan*, a town of New Navarre; 195 miles S.S.E. of Cafa Grande.

REAL *de la Jura, El*, a town of Spain, in the province of Seville; 25 miles N.W. of Carmona.

REALE, *Knights of the*, or *Knights of the Lionefs*, owed their inftitution to the following event. Ladiflaus, fon of Charles Duras, having been proclaimed and crowned king of Naples at Gæta, the Neapolitans fet up Lewis II. duke of Anjou, and laid the foundation of the bloody wars that followed. Thefe troubles divided the Neapolitan nobles into two factions; and of thofe who declared for the houfe of Anjou, fome wore on their left arm a golden *reale* embroidered or on a red ground, by way of contempt to queen Margaret, widow of Charles III. who wanted to hold the reins of government during the minority of Ladiflaus, and called themfelves "knights of the Reale;" whilft others wore on their breaft the figure of a "lionefs, with her feet tied," pendant to a ribbon which paffed round their necks, indicating by it, that they looked upon queen Margaret as tied by the leg; and then ftyled themfelves "knights of the Lionefs."

REALEJO, in *Geography*, a town of Mexico, in the province of Nicaragua, fituated on a bay of the Pacific ocean, at the mouth of a river, both of the fame name. The river is fo deep and capacious as to be capable of receiving 200 fail of fhips. The town is defended by large intrenchments, and very fine docks for building and repairing fhips; but the place fuffered confiderably from the Buccaneers. The town is large, has three churches, and an hofpital; but the place is unhealthy, on account of the creeks and ftinking fwamps in its vicinity. Its chief trade confifts in pitch, tar, and cordage. At the mouth of the harbour is an ifland, which intercepts the fea, and renders it fafe and commodious: it forms two channels, but that on the N.W. fide is much the beft; 18 miles N.W. of Leon. N. lat. 12° 45′. W. long. 87° 30′.

REALGAR, in *Mineralogy*, fometimes called red orpiment, an ore of arfenic, confifting, according to Thenard, of

75 parts arfenic,
25 fulphur.

The colour of realgar is a bright deep red, paffing into fcarlet and orange: it occurs both maffive, and cryftallized in prifms, which have either 4, 6, 8, 10, or 12 fides, terminated by four-fided fummits. The primitive form of the cryftal is an octahedron, with fcalene triangles. The luftre of realgar is between vitreous and waxy: it is femi-pellucid, foft, fragile, and eafily fufible, burning in the air with a blue flame, and giving out arfenical and fulphureous vapours. By friction it becomes negatively electrical. Realgar is found in the vicinity of volcanos, and accompanying other metallic ores, both in primitive and fecondary mountains. This fubftance is ufed as a pigment; and is formed by the Chinefe into toys. See *Sulphurated Arfenic* under ARSENIC.

In the hiftory of the French Academy, we have an account of a cup brought to Paris by the ambaffadors of Siam, and prefented there, as a remedy ufed by that people againft all difeafes.

Upon an examination, which had like to have coft M. Homberg dear, he found it to be a kind of realgar, or red arfenic, much more cauftic than our's.

Its ufe among the Siamefe, he takes to have been the fame with that of regulus of antimony; *viz.* to give an emetic quality to the wine drank out of it.

As the dofe of medicines is much ftronger in the torrid zone than among us (the quantity of ipecacuanha, *e. gr.* ordinarily taken by the Indians, being twenty times as great as that among us), it is very poffible a cup of realgar, though enough to poifon an European, may prove a gentle medicine to a Siamefe.

REALIJO, in *Geography*, a fmall ifland in the Pacific ocean, near the coaft of Popayan. N. lat. 4° 16′.

REALIZE, in *Commerce*, a term little known in trade before the year 1719, when thofe immenfe fortunes began to be made in France and England, by the bufinefs of actions or ftock.

By *realizing* is meant the precaution many of thofe who had gained moft, took, to convert their paper into real effects: as lands, houfes, rich moveables, jewels, plate; but, above all, into current fpecies. A precaution capable of ruining the ftate; but the French regency had the wifdom to fruftrate it, by taking proper meafures to have the money, thus ready to be hoarded up, returned to the public.

REALISTS, REALISTÆ, a fect of fchool-philofophers who followed the doctrine of Ariftotle with refpect to univerfal ideas, formed in oppofition to the NOMINALISTS, (fee that article,) who embraced the hypothefis of Zeno and the Stoics upon that perplexed and intricate fubject.

Ariftotle held, againft Plato, that, previous to, and independent on, matter, there were no univerfal ideas or effences, and that the ideas or exemplars which the latter fuppofed to have exifted in the divine Mind, and to have been the models of all created things, had been eternally impreffed upon matter, and were coeval with, and inherent in, their objects. Zeno and his followers, departing both from the Platonic and Ariftotelian fyftems, maintained, that thefe pretended univerfals had neither form nor effence, and were no more than mere terms and nominal reprefentations of their particular objects.

Under the Realifts are included the Scotifts, Thomifts, and all excepting the followers of Occam.

Their diftinguifhing tenet is, that univerfals are realities, and have an actual exiftence, out of an idea and an imagination; or, as they exprefs it in the fchool-language, *a parte rei;* whereas the Nominalifts contend, that they exift only in the mind, and are only ideas, or manners of conceiving things.

Doctor Odo, or Oudard, a native of Orleans, afterwards abbot of St. Martin de Tournay, was the chief of the fect of the Realifts. He wrote three books of dialectics; where, on the principles of Boethius and the ancients, he maintained that the object of that art is things, not words; whence the fect took its rife and name.

REALITY, REALITAS, in the *Schools*, a diminutive of *res*, *thing*, firft ufed by the Scotifts to denote a thing which may exift of itfelf, or which has a full and abfolute being of itfelf, and is not confidered as a part of any other.

Yet a reality is conceived as fomething lefs than *res;* and accordingly every *res* is fuppofed to contain a number of realities, which they otherwife call *formalities*.

Thus, *e. gr.* in a man, according to the doctrine of the Scotifts, are a number of realities; *viz.* a fubftance, life, animal, and reafon.

Some

Some diſtinguiſh reality into ſubjective and objective.

REALM, Regnum, *Kingdom*, a country which gives its head or governor the denomination of king.

The word is formed of the French *royaume*, which denotes the ſame.

REALMONT, in *Geography*, a town of France, in the department of the Tarn, and chief place of a canton, in the diſtrict of Alby; 9 miles S. of Alby. The place contains 2247, and the canton 8949 inhabitants, on a territory of $247\frac{1}{2}$ kiliometres, in 19 communes.

REALVILLE, a town of France, in the department of the Lot; 8 miles N.E. of Montauban. N. lat. 44° 6'. E. long. 1° 34'.

REAMLA, a town of the Arabian Irak; 10 miles W. of Baſſora.

REAMO, a town of Naples, in Abruzzo Ultra; 6 miles W.N.W. of Teramo.

REAMUR, a town of France, in the department of the Vendée; 18 miles N. of Fontenay le Comte.

REANG, a town of Bengal; 45 miles S. of Silhet.

REAPER, a perſon whoſe buſineſs it is to reap or cut grain.

REAPING, the operation of cutting crops by means of the ſickle. It is a very laborious ſort of field-work, and one which requires conſiderable attention and care to perform it in a neat and exact manner. Reaping is performed with ſome other ſorts of crops, beſides thoſe of the grain kinds; as occaſionally for peas, beans, flax, and others of a ſimilar nature. Work of this nature is executed in many different ways, according to the differences in the cuſtoms of different diſtricts; as by ſets of men hired by the month, for this particular purpoſe, called harveſt-men; by perſons taking it by the piece, or by the acre, and by the ſheaf or ſtouk of eight ſheaves.

In ſome methods, by the piece or the quantity is unqueſtionably the beſt, in moſt caſes, on account of the very high prices which are exacted at this very buſy ſeaſon, and the very ſmall extent of labour which is performed in working by the day, which cannot be controlled by the farmer at ſuch hurrying times. Beſides, the work is, for the moſt part, the beſt and moſt expeditiouſly performed in theſe ways; which are objects of very great importance, and deſerving of much conſideration in this ſort of buſineſs. The eye of the farmer is, however, conſtantly neceſſary to ſee that all goes on in a right manner.

In the northern parts of Lancaſhire, this ſort of labour is moſtly performed by the day, or the hattock of ten ſheaves, or the ſtouk of twelve ſheaves; three-pence being often paid for the former, and four-pence or five-pence for the latter, in theſe places.

In ſome diſtricts, the reaping of the crops commences before they are quite ripe; but in others, not until this has fully taken place.

Reaping *of Corn*, the practice of cutting it with the ſickle, or otherwiſe, by perſons employed for the purpoſe. It may be obſerved, that the buſineſs of reaping or cutting grain crops differs much in the manner of performing the work, in different diſtricts of the kingdom, and kinds of crops. In the more ſouthern parts of the iſland, the crops of this ſort are moſtly cut by means of ſhort ſtiff ſcythes, made for the purpoſe, having bows formed of bent ſticks, or what in ſome places are termed *cradles*, fixed upon the lower parts of the handles, for the more readily depoſiting the ears or heads of the corn in one uniform direction, as much as poſſible, in order that it may be afterwards bound up into ſheaves. But in other caſes, the naked ſcythe is made uſe of; the corn being ſeldom bound up, being ſimply raked together into ſmall heaps, in a ſimilar manner to hay.

In the more northern parts of England, and in Scotland, the reaping of grain crops is, however, in general performed by the ſickle, or reaping hook; the different handfuls, as ſoon as cut, being depoſited upon bands, formed by twiſting together a few ſtalks of the corn at the ends next the ears, and afterwards bound up into ſheaves, in order to their being ſet up into *ſhocks* or *hattocks*. This method is, in moſt inſtances, adopted with the wheat and rye crops, in every part of the iſland; as in cutting them with the ſcythe, it is difficult to be performed without much loſs being ſuſtained by the ſhedding of the grain. And, in addition, it is of great advantage to have theſe ſorts of crops bound up regularly into ſheaves, the ſtraw being much better.

Beſides theſe, there is another mode ſometimes practiſed, which is by means of a hook with a ſharp edge, without any teeth; the labourer, in executing the work, hooking up the corn towards him. It is moſtly made uſe of in the ſouthern diſtricts, where it is known by the name of *bagging*, the grain in this way being cut very low.

In this way the reaper collects enough for one ſheaf at a time, binds it, and ſets it up in tens, called a ſhock in Middleſex. This bagging (or ſagging) practice is, to all intents and purpoſes, mowing with one hand againſt the ſtanding corn. The toothleſs hook, employed in doing it, is of nearly twice the weight of the common ſickle. It is ſharpened occaſionally, when neceſſary, in the manner of the ſcythe; and the operation of cutting the crop down is by a ſucceſſion of blows made upon the ſtraw of the ſtanding grain, very nearly in the direction down towards the ſurface of the ground. Reaping in Middleſex is moſtly all done in this way, as the proper uſe of the ſcythe is but little known.

This method has the advantage of being done cloſer, and with equal or more expedition than the hand reaping mode, beſides the ſaving in ſtraw, which is here ſuppoſed worth 7*s*. the acre.

In Eſſex wheat crops are generally reaped or cut with the ſickle, though in the vicinity of the metropolis it is not uncommon to have it mown with the ſcythe, as cloſe to the ground as other ſorts of grain crops, in the view of increaſing the quantity of ſtraw, which is there very valuable. It is thrown, in theſe caſes, with great ſkill and dexterity into ſwaths. When perfectly ripe, it is ſoon bound up into ſheaves of ſix or eight inches diameter, with bands of wheat-ſtraw of ſingle or double lengths; but when not in this ripe or dry ſtate, it is allowed to remain in the ſwaths two or three days, as neceſſary. However, in more than three quarters of the county, it is reaped or cut with the ſickle; and indeed in almoſt all places, when beaten down by the wind and rain.

In regard to the time of reaping the grain, there is conſiderable difference in different diſtricts; ſome not reaping it until it is quite ripe, while others cut it when ſomething ſhort of this ſtate. This, however, ſhould probably be regulated by the nature of the ſeaſon, and the kind ſtate or quality of the crop, as well as the uſes to which the grain is to be put.

In reſpect to the manner of reaping grain crops, whether the ſickle or ſcythe be employed for the purpoſe, there is much difference in the height at which the crops are cut in different places. In ſome it is the practice to have the buſineſs performed in as cloſe a manner as poſſible; while in others a ſtubble of eight, ten, and fifteen inches, or more, is is left. These different practices have their advocates; one party supposing that the work proceeds more slowly, where it is executed in so close a manner; while the other contend that the contrary is the case. But as the stubble which is left is not only useless to the land, but in many cases very troublesome in its succeeding culture, being frequently under the necessity of being removed, it would seem to be the best as well as cheapest practice, to have the business constantly executed in a close manner. It has been observed by a late practical writer, that by this means the agricultor will not only have more litter at command, for the bedding of his yards, stalls, and other places, and consequently an increase of manure, but have the business more expeditiously performed, with much less waste of grain, and at the same time be freed from the trouble and expence of removing the stubble. It has indeed been fully shewn, by a careful trial, made with the view of ascertaining the difference between high and low reaping, that the advantage is considerably in favour of the close method.

And the result of the trial is thus stated by the writer of the Agricultural Survey of the West Riding of Yorkshire, who observes that the experiment was made upon part of a field of wheat, two ridges of which were cut close by the ground, and the other two considerably higher, though not so high as the general run of the Yorkshire stubbles. Each of the divisions was apparently of equal quality, and measured a trifle more than a quarter of a Scotch acre, which is about one-fifth larger than the English statute acre. The crop was stacked separately, and the time taken to the part cut low was one hour and twenty-four minutes, of eight shearers; while the high cutting was performed by the same number of hands in forty-eight minutes. The wages paid that week were 18*d.* *per* day, and the supposed expence of maintenance 6*d.* or 2*s.* *per* day altogether. When threshed, the grain and straw were carefully measured and weighed, and the result of the experiment was as follows:

	£	s.	d.
Result—8 shearers, 1 hour 24 minutes, at 2*s.* *per* day, or 22½*d.* *per* hour	0	2	4
The same hands in 48 minutes	0	1	4
Difference of expence	0	1	0

In favour of high cutting one shilling, or four shillings *per* acre.

	£	s.	d.
1¼ peck of wheat more upon the low cut ridges than those cut high, at 1*s.* 4*d.* *per* peck	0	1	8
14 stones (22 avoirdupois pounds) of more straw, at 2*d.* *per* stone	0	2	4
	0	4	0

Or sixteen shillings *per* Scotch acre.

From which deduct the increased expence of cutting, there remains a benefit of twelve shillings *per* acre in favour of low cutting.

It is noticed farther, that the above trial, according to the best of the reporter's judgment, was fairly made; and the reason which urged him to make it, was to silence the objections of some neighbours, who alleged low shearing was not profitable. It is also proper to observe, that the field of wheat, on which the trial was made, was not broke down nor straggled, so was in a favourable condition for high cutting. We have seen wheat-fields, where three times the quantity might have been left, unless great pains were used.

But the methods of reaping grain crops, both with the sickle and the scythe, have each their advantages and disadvantages. In the first manner, the crops are deposited with more regularity and exactness, and consequently bound into sheaves with greater facility and dispatch. Besides, in many cases less loss is incurred by shedding, in the time the work is in performing; but the labour is executed with greater difficulty and trouble. The latter possesses the superiority of being more expeditious, and of being performed to any degree of closeness that may be required; while it has the evident disadvantage of leaving the cut grain in a more irregular and uneven situation, by which it is rendered less fit for being bound up into sheaves, which in many cases is an inconvenience of great consequence. When the grain has attained a high degree of ripeness, there may likewise be great loss sustained, by its being shed during the operation, in this way of reaping and cutting the crop. Where this method is practised, it is, however, not unfrequently the case to have it bound into sheaves; though the most common custom is to let it remain in the rows or swaths, till fit for being put into the stack. When bound, it is generally the practice to cut it inwards against the crop on which it rests: in the other case, it is cut in the manner of grass for hay. It is obvious, therefore, that when labourers are procured with difficulty, this mode of reaping is the most adviseable; while, under the contrary circumstances, the former may be had recourse to with more advantage, as the work may be executed in a neater and more exact way. See Harvesting and Sickle.

It may be remarked, that this is a sort of work that is often let by the acre to persons that go about for harvest work; and it may, in many cases, be the best performed in this manner. But great attention should be paid by the farmer, to see that the grain is cut and bound up in a proper method, and that the work be not performed in improper weather. The prices vary according to the nature of the crops, the season, and other circumstances, sometimes rising as high as eleven or twelve shillings the acre, and sometimes much higher.

Reaping *Fork*, a tool of the fork kind, invented for the purpose of raising and collecting the mown grain into sheaves, so that it may be bound up. It is constructed with two, rather long, prongs below, slightly curving upward, somewhat in the manner of the common large hay fork, to which are attached, at the upper part, near the insertion into the handle, two other upright prongs, which bend a little forward towards their tops or ends; by means of which, with the under prongs running along the ground, the tool being pushed forward by the labourer, the grain in the straw is raised up, brought together, held in a firm manner, and removed from the swathe so as to be bound into sheaves. In this way, the lower prongs perform the work of picking the strawy material from the land, while the higher upright ones prevent it from falling backwards, and determine the quantity which is necessary for a sheaf. In this manner, by this simple contrivance, the mown grain can be brought together and bound up with much greater regularity, and in a much more expeditious method than is possible to be done by mere hand labour.

Reaping *Hook*, an implement of the sickle kind, with which the business of reaping is performed in some districts.

These hooks are sometimes formed with teeth, or in a toothed manner, and sometimes with a cutting edge. In Devonshire, and some other counties, those with smooth edges are generally preferred to sickles with sawed ones: these thefe forts of hooks are ufed occafionally with either hand, the operator fhifting hands, chopping the ftraw low down, and gathering about half a fheaf at a time, which, when put together, is bound with reed, combed from former wheat-ftraw, or with a double length of the wheat which is reaping. See SICKLE.

REAPING *Machine*, a contrivance for the purpofe of reaping grain by means of animal labour. With this view, and to facilitate an operation of fuch importance to the farmer, different attempts have been made to conftruct machines, fo as to difpatch the work in a rapid manner by the affiftance of horfe labour, but the fuccefs with which they have been attended, has hitherto been far from complete. An implement of this fort has lately been made by Mr. Plunknett; it is upon a fomewhat new principle, the horfe drawing the machine inftead of pufhing it forward, as was the old mode of applying the power.

In this machine, the horfe tracks from the front fide of it, which is feen at once by the appearance of the implement, fo as to be clear of the crop, and the two large wheels, by means of the axle, drive another wheel, which communicates with the two other wheels, the latter of which is found in the axis of the cutter: a man at the handles regulates the direction, &c. This machine may be feen fully reprefented in the fecond volume of the Farmer's Dictionary; and a reaping machine for clover may be feen in the fame work in the fame plate.

Other machines of this kind have ftill more lately been invented by other perfons, but without anfwering the purpofe in that full and complete manner which is neceffary in this fort of work.

What appears to be chiefly wanting in thefe forts of machines, to render them complete and effective, as tools for the purpofe of reaping, is that of their having more power or velocity in the cutting parts, fo that the work may be performed in a perfectly clean neat manner, without the ftraw being drove or forced down in an improper manner before the inftruments which are to cut it; their cutting it out fully in the whole of its breadth; their being capable of being regulated to cut at different heights, and to different breadths; their being made capable of directing the cut ftrawy grain all in one even regular direction, fo that it may be bound up with facility; the horfes, or other animals, being fo attached to them as to permit of their walking along on the fide of the ftanding grain, where the former cut was made, or where they pufh the implements before them, the having them fo conveniently fixed in them as to admit of no fort of interruption to the labour in any way; their being made light and of ready application, as well as at a cheap rate; and their keeping the fcythes or cutting parts in a perfectly fharp ftate, without their being taken out, and undergoing the operation of whetting. There are, befides thefe, fome other points, which fhould be attended to, but thefe are, probably, the moft material.

REAPS, fmall parcels of corn, laid along on the ftubble, in reaping, to be afterwards gathered into fheaves by the binder. This is moft commonly the cafe, when the weather is moift, as in dry times the reaps of corn are ufually laid in the bands, and tied up, as foon as they are in fufficient quantity, into fheaves.

REAR, a term frequently ufed in compofition, to denote fomething behind or backward in refpect of another; in oppofition to *van*, or *avant*, *before*.

It is formed by corruption of the French *arriere*, fignifying the fame.

REAR, in a *Military Senfe*, is ufed for the hind-part of an army, &c. in oppofition to the *front*, or face of it.

REAR, in *Naval Language*, is a name given to the laft divifion of a fquadron, or the laft fquadron of a fleet, and which is accordingly commanded by a rear-admiral, or the third officer of the faid fleet or fquadron.

REAR-*admiral*. See ADMIRAL.

REAR-*guard*. See GUARD.

REAR-*half-files*, are the three hindmoft ranks of a battalion, when it is drawn up fix deep. See FILE-*leaders*.

REAR-*line* of an army encamped, is always twelve hundred feet at leaft from the centre line, both of which run parallel to the front line, and alfo to the referve.

REAR-*rank*, is the laft rank of a battalion, or fquadron, when drawn up, and generally fixteen or eighteen feet from the centre line, when drawn up in open order.

REAR-*up*, in the *Manege*, called in French *cabrer*, is the action of a horfe, when he raifes himfelf upon his houghs or hinder legs, as if he would fall quite over in a backward direction, to the great danger of his rider. This is often caufed by his having too much of the curb.

REAR, in *Rural Economy*, to raife the roof part of any fort of fhed or other building for containing fome kind of live-ftock.

REARED, or *Wale*-REARED. See WALE-*reared*.

REARING ANIMALS, in *Agriculture* and *Rural Economy*, the bufinefs of breeding and bringing them up to the moft fuitable ftates for the purpofes of the farmer. The principles of this art depend upon a variety of different circumftances and kinds of knowledge, as has been already explained. See BREEDING, and LIVE-*Stock*.

Animals of the horfe kind fhould invariably be brought up in the beft manner, without any fort of ftinting in their food, according to the ufes they are defigned to ferve, in order that they may have their full growth and power. In the labouring cattle kinds of animals, attention fhould, in fome degree, be paid to hardinefs, both in their food and their expofure, by having recourfe to the more coarfe forts of feeding in the lefs fheltered fituations, but nothing of ftinting fhould ever be allowed, as by thefe means they become large, and capable of fuftaining a greater degree of exertion. There is, likewife, much utility in good training, in rearing all forts of animals in this intention; and it requires careful, fteady, mild perfons to be employed in it, as they, for the moft part, acquire the habits and difpofitions of thofe about them, in fome meafure; and the more early they are obtained the better. This point deferves much more attention from farmers and others than it has hitherto met with, as moft of the bad habits of working animals arife from the neglect of it. Befides, good training and mild difpofitions are highly favourable to fattening animals. See HORSE.

In rearing poultry, pigeons, rabbits, and fifh, much care, management, and circumfpection, are conftantly neceffary, in order to their perfect fuccefs. Too little attention is for the moft part beftowed on the nature of the birds, in fome forts of the more wild poultry kinds, as thofe which are of the game defcription, for inftance, the galena, the pheafant, the fwan, and fome others. Thefe cannot be fo readily reared, or with fo much facility, under hens of the domeftic kind, as other forts are, fuch as the turkey, peacock, &c. This circumftance fhould therefore be always kept in mind in rearing fuch birds. See POULTRY, PIGEONS, RABBIT, &c.

A very nice attention and management is alfo requifite in the rearing and perfecting of fifh. See FISH, POND-*Fifheries*, and *Salmon* FISHERY.

In rearing birds of the game kind, fuch as the above, in the way of ornament about a refidence, Mr. Loudon has remarked, much depends upon encouraging them, when allowed

lowed to go wild, by giving them proper and abundant cover, and fowing among it fuch herbs and plants as they are particularly fond of, as thofe of the crefs, chervil, parfley, thyme, and fome other kinds. They have likewife a tendency to encourage and domefticate hares. Abundance of fearlefs game about a refidence, he thinks, give a peculiar noblenefs, and appearance of freedom, which few things elfe can communicate or afford.

REASON, Ratio, a faculty or power of the foul, by which it diftinguifhes good from evil, and truth from falfhood. Or, reafon is that principle, by which, comparing feveral ideas together, we draw confequences from the relations they are found to have.

Some of the later fchool-philofophers define reafon to be the comprehenfion of many principles which the mind fucceffively can conceive and from which conclufions may be drawn.

Others conceive reafon as no other than the underftanding itfelf, confidered as it difcourfes.

Reafon, Mr. Locke obferves, comprehends two diftinct faculties of the mind; *viz. fagacity*, by which it finds intermediate ideas; and *illation*, by which it fo orders and difpofes of them, as to difcover what connection there is in each link of the chain, by which the extremes are held together; and by them, as it were, draws into view the truth fought for.

Illation, or inference, confifts in nothing but the perception of the connection there is between the ideas in each ftep of the deduction, by which the mind comes to fee either the certain agreement or difagreement of any two ideas; as in demonftration, in which it arrives at knowledge; or their probable connection, on which it gives or withholds its affent; as in opinion.

Senfe and intuition reach but a little way; the greateft part of our knowledge depends upon deductions, and intermediate ideas. In thofe cafes, where we muft take propofitions for true, without being certain of their being fo, we have need to find out, examine, and compare, the grounds of their probability; in both cafes, the faculty which finds out the means, and rightly applies them to difcover certainty in the one, and probability in the other, is that which we call *reafon*.

In reafon, therefore, we may confider four degrees; firft, the difcovering and finding out of proofs. See Invention.

Secondly, the regular and methodical difpofition of them, and laying them in fuch order, as that their connection may be plainly perceived. See Method.

Thirdly, the perceiving of their connection (fee Judgment.) And,

Fourthly, the making a right conclufion.

Reafon fails us in feveral inftances; as, firft, where our ideas fail.

Secondly, it is often at a lofs, becaufe of the obfcurity, confufion, or imperfection, of the ideas it is employed about. Thus, having no perfect idea of the leaft extenfion of matter, nor of infinity, we are at a lofs about the divifibility of matter.

Thirdly, our reafon is often at a ftand, becaufe it perceives not thofe ideas which would ferve to fhew the certain or probable agreement or difagreement of any two other ideas.

Fourthly, our reafon is often engaged in abfurdities and difficulties, by proceeding upon falfe principles, which, being followed, lead men into contradictions to themfelves, and inconfiftency in their own thoughts.

Fifthly, dubious words, and uncertain figns, often puzzle men's reafon, and bring them to a nonplus.

Though the deducing one propofition from another be a great part of the office of reafon, and that about which it is ufually employed; yet the principal act of ratiocination is the finding the agreement or difagreement of two ideas one with another, by the intervention of a third. As a man, by a yard, finds two houfes to be of the fame length, which could not be brought together to meafure their equality by juxta-pofition. Words have their confequences as the figns of fuch ideas and things agree or difagree with what they really are; but we obferve it only by our ideas.

Hence we may be able to form an idea of that ordinary diftinction of things, into fuch as are *according to*, thofe that are *above*, and thofe *contrary to reafon*.

Thofe *according to reafon* are fuch propofitions, whofe truth we can difcover by examining and tracing thofe ideas we have from fenfation and reflection, and by natural deduction find to be true or probable.

Thofe *above reafon* are fuch propofitions, whofe truth or probability we cannot by reafon derive from thofe principles.

Thofe *contrary to reafon* are fuch propofitions as are inconfiftent with, or irreconcileable to, our clear and diftinct ideas.

Thus the exiftence of one God, is according to reafon; the exiftence of more than one God, is contrary to reafon; and the refurrection of the body after death, above reafon.

Above reafon may be alfo taken in a double fenfe; *viz.* above probability or above certainty.

They who difpute moft againft the power and privileges of human reafon, do it becaufe their own reafon perfuades them to that belief; and fo, whether the victory be on their or our fide, they are equally defeated.

They feek to terrify us with the example of many great wits, who, by following this *ignis fatuus* (fo they call the only pole-ftar God has given us to direct our courfe by), have fallen into wild and ridiculous opinions, and increafed the catalogue of herefies to fo great a number; but thefe men either followed not their reafon, but made it follow their will; or elfe they firft hoodwinked it by intereft and prejudice, and then bade it fhew them the way; or were wanting in thofe neceffary diligences required for fo doubtful a paffage: or if, without any of thefe, the weaknefs of their underftanding had deceived them, the error is neither hurtful to themfelves, nor would be to others, if this doctrine of governing ourfelves by our own reafon, and not by authority and example, were generally eftablifhed. Dif. Concern. Hum. Reaf.

It is not the ufe of fuch liberty, but the appropriating it to ourfelves, that is the caufe of all the diforders charged upon it; for thofe who lay a reftraint on other men's reafon, have firft made ufe of their own to fettle them, and to make ufe of it in this very reftraining of others. Ibid.

Reason, in *Matters of Religion*, is ufed in oppofition to *faith*.

This ufe of the word, Mr. Locke takes to be in itfelf very improper; for faith is nothing but a firm affent of the mind; which, if it be regulated, as it is our duty, cannot be afforded to any thing but upon good reafon, and fo cannot be oppofite to it.

He that believes without having any reafon for believing, may be in love with his own fancies; but he neither feeks truth as he ought, nor pays the proper obedience due to his Maker, who would have him ufe thofe difcerning faculties he has given him, to keep him out of miftake and error.

But ſince reaſon and faith are by ſome men oppoſed to one another, it may be neceſſary to conſider them together.

Reaſon, as contradiſtinguiſhed to faith, is the diſcovery of the certainty or probability of ſuch propoſitions, or truths, which it has got by the uſe of its natural faculties; *viz.* by ſenſation, or reflection.

Faith, on the other hand, is the aſſent to any propoſition upon the credit of the propoſer, as coming immediately from God; which we call *revelation*, which ſee.

Reason, in *Logic* and *Rhetoric*, denotes a neceſſary or probable argument; or an anſwer to the queſtion, *cur eſt? why is it?*

As if it be inquired, why do the ſubject and predicate agree? and it is anſwered, becauſe they are ſpoken of the ſame thing: this laſt enunciation is a reaſon. Hence, ſay the ſchoolmen, becauſe *quia* is the ſign or character of a reaſon, as *non, no,* of a negation, and *eſt, is,* of an affirmation.

They make three kinds of reaſons, *rationes;* viz. *ratio ut, that; ne, leſt;* and *quia, becauſe.* For, anſwering to a queſtion, *cur, why,* we begin with becauſe, *quia;* as, why do you ſtudy? that I may become learned; which is the *ratio ut.* Again, why do you ſtudy? leſt I ſhould be ignorant; which is the *ratio ne.* Laſtly, why is a body tangible? becauſe matter is impenetrable; which is the *ratio quia.*

The *reaſon ut* properly denotes the end, or final cauſe; and *reaſon ne* the beginning: accordingly the one is called the beginning, the other end; ſo that the *reaſon quia* is left the only reaſon, properly ſo called.

Reason, among *Metaphyſicians,* is uſed in the ſame ſenſe with eſſence; or that by which any thing is what it is.

This is ſometimes alſo called formal reaſon, as repreſenting the thing under that form or nature under which it is conceived.

Reason, in *Mathematics.* See Ratio.

Reason *of State, Ratio Status,* in *Matters of Policy,* denotes a rule or maxim, whether it be good or evil, which may be of ſervice to the ſtate.

The phraſe is borrowed from the Italians, who firſt uſed *ragione di ſtato* in this ſenſe.

Reaſon of ſtate is properly underſtood of ſomething that is neceſſary and expedient for the intereſt of the government, but contrary to moral honeſty, or juſtice.

Politicians have a long time diſputed about the *ratio ſtatus;* whether ſtates and governments are tied down to the ſame laws of morality with individual perſons; or whether things, otherwiſe immoral and unlawful, may not be practiſed on urgent occaſions, by way of reaſon of ſtate?

The queſtion is, whether any thing be unlawful, or prohibited a ſtate, that is neceſſary to the preſervation of that ſtate, or whether it be allowed to preſerve itſelf on any terms?

Reason, *Challenge upon.* See Challenge.

Reason *ſufficient of Leibnitz.* See Leibnitzian *Philoſophy.*

REASONABLE Aid, a duty which the lord of the fee anciently claimed of his tenants, holding in knight's ſervice, or on ſocage, towards the marrying his daughter, or the making his eldeſt ſon knight.

This is taken away by ſtat. 2 Car. II. See Aid.

REASONING, Ratiocination, the exerciſe of that faculty of the mind called *reaſon:* or, it is reaſon deduced into *diſcourſe;* which ſee.

The agreement or diſagreement of two ideas does not appear from the bare conſideration of the ideas themſelves, unleſs ſome third be called in, and compared, either ſeparately, or conjointly with it: the act, then, by which, from ideas thus diſpoſed and compared, we judge this or that to be ſo, or not ſo, is called *reaſoning.* Or, it is that operation of the mind, by which we infer one thing, *i. e.* one propoſition from two or more propoſitions premiſed. Or, again, it is the drawing of a concluſion, which before was either unknown, or dark, or doubtful, from ſome propoſitions which are more known and evident. It is the narrowneſs of the human mind which introduces the neceſſity of reaſoning; for if the mere perception and compariſon of two ideas would always ſhew us whether they agree or diſagree, then all rational propoſitions would be matters of intelligence, or firſt principles, and there would be no uſe of reaſoning, or drawing any conſequences. But when we are unable to judge of the truth or falſehood of a propoſition in an immediate manner, by the mere contemplation of its ſubject and predicate, we are then conſtrained to uſe a medium, and to compare each of them with ſome third idea, that by ſeeing how far they agree or diſagree with it, we may be able to judge how far they agree or diſagree among themſelves. Watt's Logic, part iii. chap. 1.

Rohault defines reaſoning to be a judgment depending on ſome antecedent judgment: thus, having judged that no even number can be compoſed of five uneven numbers, and that ten is an even number; to conclude, that ten cannot be divided into five uneven parts, is a ratiocination, or reaſoning.

This agrees with father Malebranche's doctrine, one of the great points of which is, that reaſoning, on the part of the underſtanding, is only a mere perceiving.

That ingenious author endeavours to ſhew, that, as to the underſtanding, there is no difference between a ſimple *perception,* a *judgment,* and a *reaſoning,* except in this, that the underſtanding perceives a ſimple thing without any relation to any thing elſe, by a ſimple *perception;* that it perceives the relations between two or more things in a *judgment;* and, laſtly, that it perceives the relations that are between the relations of things, in a *reaſoning.* So that all the operations of the underſtanding are no more than mere perceptions.

Thus, *e. gr.* when we conclude, that 4 being leſs than 6, twice 2 being equal to 4, are of conſequence leſs than 6, we do no more than perceive the relation of the inequality between the relation of twice 2 and 4, and the relation of 4 and 6.

The manner of proceeding juſtly in reaſoning; ſo as to arrive with the greater ſafety at the knowledge of truth, makes what we call *method.*

For the real benefit of logic to reaſoning, ſee Logic and Syllogism.

RE-ATTACHMENT, in *Law,* a ſecond attachment of him who was formerly attached, and diſmiſſed the court without day, by not coming of the juſtices, or the like caſualty.

Brook makes re-attachment either *general* or *ſpecial. General* is where a man is re-attached for his appearance on all writs of aſſize lying againſt him: *ſpecial,* for one or more certain writs.

REAU, in *Geography,* a town of Germany, in the principality of Culmbach; 9 miles S.E. of Hof.

REAVE, in *Rural Economy,* a provincial term, uſed to ſignify the unroofing or diſturbing the thatch or other covering of a building by winds, &c.

REAUMUR, René-Antoine Ferchault, *Sieur de,* in *Biography,* was born in 1683 at Rochelle. He was brought up to the ſtudy of the law, which he quitted for that

that of the mathematics, natural hiftory, and natural philofophy. In 1703 he went to Paris, and fo diftinguifhed himfelf in a few years, that in 1708 he was admitted into the Academy of Sciences. From that time he entirely gave himfelf up to the purfuits of natural hiftory in all its branches, and few men have paffed a life more actively and ufefully employed. Utility was the conftant aim in all his enquiries, even into the moft minute parts of nature; and experiment and obfervation were his perpetual guides. No one furpaffed him in the patient induftry with which he obferved natural phenomena, or followed the proceffes of art. The Memoirs of the Academy of Sciences, from 1709 to 1756, are enriched with his communications. The improvement of manufactures was a great object of his attention. In 1722 he publifhed a work, entitled "L'Art de convertir le Fer forgè en Acier, et l'Art d'adoucir le Fer fondu," which contained a minute and fcientific account of the proceffes employed in that branch of manufacture, with hints for their improvement. He introduced into France the manufacture of tinned iron, which article had before been imported from abroad; and he made a great many experiments in the manufacture of porcelain, which contributed to its perfection in France. He alfo performed numerous experiments relative to the art of hatching chickens by artificial heat, as practifed in Egypt, an account of which he publifhed in two vols. 1752. M. Reaumur rendered his name celebrated by his peculiar method of graduation on the thermometer, which is ftill the only one ufed in France and many parts of the continent. In this thermometer the freezing point is marked zero, and the boiling point at 80°. (See THERMOMETER.) Some of the moft valuable of Reaumur's phyfiological experiments were thofe relating to the concoctive powers of the ftomach in granivorous and carnivorous birds, in which he clearly eftablifhes the different modes of action in thefe two claffes, *viz.* by trituration, and by folution. In natural hiftory, he acquired the greateft fame as an entomologift. Befides a number of curious papers on this fubject in the Memoirs of the Academy, he publifhed a very elaborate work, entitled "Memoires pour fervir à Hiftoire Naturelle des Infectes," in fix vols. 4to. 1734—1742. This work was the labour of many years, and the refult of innumerable obfervations made in his garden, in which he kept infects of all kinds, that he might examine their generation, changes, and mode of life. Reaumur was a man of much private worth, of mild and amiable manners, and correct morals. He died in 1757, at the age of 75. He bequeathed his manufcripts, and cabinet of natural philofophy, to the Academy of Sciences.

REAUMURIA, in *Botany*, fo called in honour of the great French naturalift, René Antoine Ferchault de Reaumur, principally known, as a botanift, by his examination of the fructification of *Fuci*, but chiefly celebrated as a philofophical inquirer into the hiftory of infects, and their transformations, to which the fpecific name of the original fpecies, *vermiculata*, evidently alludes. Linnæus mentions Haffelquift as the author of the name *Reaumuria;* of which we can find no traces in his book, though the fpecimen of the plant in the Linnæan herbarium, has fome appearance of having been gathered by this diftinguifhed Oriental traveller. Is it poffible, that the *Anonyma dubia*, n. 15, of his Iter Palæftinum, 465, which his editor Linnæus could not make out, can be the *Reaumuria*? The defcription is not inapplicable, except what concerns the ftamens and ftyle. Yet this does not make him the author of the name, though it may poffibly account for Linnæus's mention of him in conjunction therewith. The latter appears, by his manufcripts, to have once deftined *Vermicularis* for the generic appellation.—Linn. Gen. 276. Schreb. 371. Willd. Sp. Pl. v. 2. 1249. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 3. 327. Juff. 316. Lamarck Illuftr. t. 489. Dict. v. 6. 84.—Clafs and order, *Polyandria Pentagynia*. Nat. Ord. *Succulentæ*, Linn. *Ficoideæ*, Juff.

Gen. Ch. *Cal.* Perianth inferior, of five prominent, ovate, pointed, permanent leaves. *Cor.* Petals five, oblong, equal, feffile, rather longer than the calyx, oblique, or lobed, at the extremity. Nectary of five double, fringed fcales, at the meeting of the petals, attached to their lower part. *Stam.* Filaments numerous, capillary, the length of the calyx, inferted into the receptacle; *Desfont.*; anthers roundifh, incumbent. *Pift.* Germen fuperior, roundifh; ftyles five, thread-fhaped, erect, approaching each other, on a level with the ftamens; ftigmas fimple. *Peric.* Capfule ovate, of five cells, with five flat, at length reflexed, valves; the partitions membranous, unconnected, deciduous. *Seeds* feveral, erect, oblong, entirely clothed with numerous, filky, fimple hairs, twice their own length.

Eff. Ch. Calyx of five leaves. Petals five, with ten fringed fcales at their bafe. Capfule of five cells, with five valves, and five deciduous partitions. Seeds feveral, oblong, hairy.

Obf. Specimens in feed, from profeffor Desfontaines, have enabled us to reconcile his account, and that of Linnæus, with the obfervation of Forfkall, that "the capfule has only one cell," the partitions being deciduous, and concealed among the hairy feeds. Not having examined the nectariferous fcales, we have, in adverting to Labillardiere's and Hooker's plates of the fecond fpecies, made the defcription fo general as to accord with both.

1. R. *vermiculata.* Saltwort-leaved Reaumuria. Linn. Sp. Pl. 754. Willd. n. 1. Forfk. Ægypt. Arab. 101. Desfont. Atlant. v. 1. 431. Lamarck Illuftr. t. 489. f. 1. (Sedum ficulum maritimum vermiculatum, flore Saxifragæ albæ, femine villofo; Bocc. Sic. 6. t. 4. f. C, G. S. minimum arborefcens vermiculatum; Lob. Ic. 380. Kali vermiculatum albo et amplo fedi rofei flore; Barrel. Ic. t. 888. Vermicularis frutex minor; Ger. Em. 523; at leaft the figure, which is that of Lobel. The defcription accords rather with *Salfola fruticofa*, as cited by Hudfon.)—Leaves linear-awlfhaped, convex beneath. Calyx entire.—Native of barren fandy ground towards the fea, in Sicily, Barbary, Egypt, and Syria, flowering in fummer. The habit of the plant is like a *Tamarix*, or *Salfola*. *Stem* fhrubby, bufhy, much branched, round, fmooth, whitifh, leafy. *Leaves* numerous, fcattered, feffile, from a quarter to three quarters of an inch long, fpreading, linear-awlfhaped, acute, flefhy, fmooth, glaucous; convex beneath; flat above; dotted on both fides with minute depreffions. Desfontaines compares the *leaves* to thofe of *Sedum reflexum*. *Flowers* terminal, folitary, white, not unlike thofe of *Saxifraga Cotyledon*, each encompaffed with a number of imbricated floral leaves, like thofe of the ftem or branch, but longer. *Calyx-leaves* ovate, with a narrow, entire, membranous edge, and awlfhaped leaf-like point. *Petals* terminating in three flight lobes, well reprefented by Barrelier. *Capfule* brown, very fmooth, and fomewhat fhining; its valves rigid, reflexed after the feeds are difcharged, and permanent. *Seeds* clothed with long, tawny, fhining hairs. Forfkall fays this plant is ufed at Alexandria as a cure for the itch, being applied bruifed externally, and taken internally in the form of a decoction. It is an elegant little fhrub, well worthy of a place in our gardens, or green-houfes, to which it is as yet a ftranger.

2. R. *hypericoides.* Elliptic-leaved Reaumuria. Willd. n. 2. Ait. n. 1. Lamarck f. 2. (R. linifolia; Salif. Parad.

Parad. t. 18. Hypericum alternifolium; Labillard. Syr. fasc. 2. 17. t. 10.)—Leaves elliptic-lanceolate, flat. Calyx minutely crenate.—Gathered in barren dry ground, near the desert of Syria, by M. Labillardiere, to whom we are obliged for a wild specimen. The plant is said to have been introduced into England, by the late Mr. John Bell, about 1800, and is marked by Mr. Aiton as a hardy perennial. Its true genus is well ascertained by Lamarck, Poiret, and Salisbury. The *stem* is herbaceous, about a foot high, simple, or branched, smooth, pale or reddish. *Leaves* alternate, glaucous, from half an inch to an inch in length, elliptic-oblong, or somewhat lanceolate, varying greatly in breadth, dotted all over. *Flowers* terminal, solitary, pale rose-coloured, with oblique petals. *Calyx-leaves* broader than in the former, their membranous edges finely crenate, their points very small. We know nothing of the *capsule* or *seeds*.

REAY, in *Geography*, a town of Scotland, in the county of Caithness; 6 miles W. of Thurso.

REBACH, a river of France, which runs into the Rhine, nearly opposite to Manheim.

REBAIS, a town of France, in the department of the Seine and Marne, and chief place of a canton, in the district of Coulommiers; six miles E.N.E. of it. The place contains 1256, and the canton 11,284 inhabitants, on a territory of 190 kiliometres, in 18 communes.

RE-BAPTISANTS, a religious sect, who maintain, that persons irregularly baptised are to be baptised afresh.

The Anabaptists are re-baptisants, inasmuch as they baptise those at maturity, who had been before baptised in childhood.

St. Cyprian and pope Stephen had mighty differences about the re-baptization of converted heretics.

Donatus was condemned at Rome in a council, for having re-baptized some persons, who had fallen into idolatry after their first baptism.

REBAT, in *Geography*. See RABAT.

REBATE, in *Architecture*. See JOINERY and PLANE.

REBATE, or *Rabat*, *Rebatement*, in *Commerce*, a term much used at Amsterdam for a discount or abatement in the price of certain commodities, when the buyer advances the sum in hand, for which he might have taken time. See DISCOUNT.

Rebate (among us usually called *prompt payment*) is estimated by months, and is only allowed for certain kinds of merchandizes, which, according to the custom of Amsterdam, are

15 months, or 10 *per cent.* on German, Prussian, and Polish wools.

18 months, or 12 *per cent.* on brown Muscovado sugar, pot-ashes, soda, Italian Armoisines, satin, damask, and silk stuffs.

21 months, or 14 *per cent.* on Spanish wool and lamb's wool.

33 months, or 22 *per cent.* on Italian silk and raw silk from the Levant, which silks are sold by the Antwerp weight, about 5 *per* 100 lighter than that of Amsterdam.

Dutch cloths, camlets, &c. are sold with 4 *per cent.* rabat, for ready money, or without any rabat at 9 months' credit.

Dutch silk stuffs are sold with 2 *per cent.* rabat at 6 months' credit: with 4 *per cent.* at 3 months; or with 6 *per cent.* for ready money.

In all sales of goods, except those last mentioned, a further abatement is made of 1 or 2 *per cent.* for prompt payment.

At Hamburgh, some sorts of merchandise, when sold in large quantities, have an allowance made of 7, 13, or 19 months rabat, reckoned at 8 *per cent. per annum*; which the buyer, when he pays ready money, or pays within four weeks of the day of sale, deducts from the nominal price.

Refined sugars, English and Dutch cloths, English baize, shalloons, flannels, kerseymeres, ratteens, and serges, are sold with 7 months' rabat, or $4\frac{2}{3}$ *per cent.*; that is, $4\frac{2}{3}$ are deducted from $104\frac{2}{3}$, or 7 from 157.

Cotton, cinnamon, cochineal, indigo, ginger, nutmegs, cloves, mace, rice, raw sugars, capers, currants, cumine, gall-nuts, Russian leather, linen, crape, Italian silks, table-linen, Silesia cloth, Marseilles soap, almonds, sumac, molosses, Turkish yarn, Italian tartar, are sold with 13 months' rabat, or $8\frac{2}{3}$ *per cent.*; that is, 13 is deducted from 163. Silks from the Levant, as Ardassette, Barutine, and Cerbassi, are sold with 16 months' rabat, or $10\frac{2}{3}$ *per cent.*; that is, 8 is deducted from 83. Kelly's Un. Camb. vol. i.

This interest, called *rebate*, or *rabat*, is usually regulated on the footing of 8 *per cent. per annum.*

The reason of this expedient is, that the merchants having not always wherewithal to pay for their goods in hand, by means of the rebatement, such as have, will find their account in it; and such as have not will be engaged to discharge themselves as soon as possible, for the sake of the discount.

REBATEMENT, in *Heraldry*, a diminution or abatement of the dignity of the figures or bearing in a coat of arms. See ABATEMENT.

REBEBE, in *Commerce*, a measure of corn in Egypt, particularly at Alexandria, equal to about $4\frac{1}{2}$ bushels; as *kisloz*, another measure, is equal to $4\frac{2}{3}$ bushels, English measure: 17.94 rebebes are equal to 10 English quarters, and each of them contains 9587 cubic inches; and 16.51 kislos are equal to 10 English quarters, and each contains 10418 cubic inches.

REBEC, a musical instrument resembling a fiddle, with a neck, finger-board, three strings tuned 5ths, and played with a bow.

Etymologists have tortured themselves to find a derivation for the name of a vulgar instrument, no longer in use. Some trace it from the Arabic, some from the Celtic, the Welsh, the Spanish, Italian, and old French. Indeed, so numerous, discordant, and unsatisfactory are their opinions, as neither to be worth writing, nor perusal, if we could give them a place.

Rebec and ribible seem to be the same instrument, and are often indiscriminately used by Gower, Chaucer, and the still more ancient bards of Normandy, and our own country.

As the head, or scroll-work, of old viols and violins used to be curiously carved, so seems to have been that of the rebec. Chaucer compares the face of an old woman, an old trot, to the head of a rebec. Rabelais does the same.

—"A tel menestrier tel rebec
Tenant toujours le verre au bec
Car elle avoit visage de rebec."

REBECCO, in *Geography*, a town of Italy, in the department of the Panaro; 29 miles S.W. of Modena.

REBEL, JEAN-FERRY, sen. in *Biography*, one of the 24 violins of the king of France's band, and chamber composer to his majesty. He beat time for many years at the opera, and, in his day, passed for a great composer. His music for dances is still heard with pleasure. His capriccios, freaks, and dancing characters, have enjoyed great reputation. In 1703 he set the opera of Ulysses, written by Guichard.

Rebel

Rebel left two children: Francis, who died in 1775, and Anne, the wife of the celebrated Lalande, mafter of the king's band.

Rebel, François, knight of St. Michael, mafter, like his father, of the king's band, and director of the opera, born 1702, and died in 1775. He was the fon of Jean-Ferry Rebel, director of the orcheftra at the opera, and one of the twenty-four violins of the king's band. His fon had obtained the reverfion, in 1717, of chamber mufician to the king, and in 1703, that of compofer; having given proofs of his abilities by many different works, but, above all, by his "Pyramus and Thifbe," compofed in partnerfhip with Francœur.

He was fucceffively appointed to all the mufical pofts of honour and profit under the royal patronage and that of the public. The clofe and uninterrupted friendfhip between this mufician and Francœur, does honour to the memory of both; having compofed jointly, for 50 years, fuccefsful pieces, without difcovering to which of them the greateft honour was due. Laborde. See Francœur.

REBELLION originally fignified a fecond refiftance or rifing of fuch as had been formerly overcome in battle by the Romans, and had yielded themfelves to their fubjection.

It is now generally ufed for a traiterous taking up of arms againft the king, either by his own natural fubjects, or by thofe formerly fubdued; whether their view be to deprive him of the fupreme authority, or whether they intend to refift his commands in fome particular affairs, in order to impofe conditions on him. Popular commotion is a concourfe of people, tumultuoufly affembled, and refifting the voice of their fuperiors, whether their defigns be againft thofe fuperiors themfelves, or only fome private perfons. Such violent commotions are common when the people think themfelves aggrieved, and are occafioned by no order of men fo frequently as the tax-gatherers. (See the next article.) If the rage of the malcontents be particularly levelled at the magiftrates, or others vefted with the public authority, and they proceed to a formal difobedience or violent proceedings, it is called a "fedition." When the evil fpreads, infecting great numbers in the city or provinces, and fubfifts in fuch a manner, that the fovereign is no longer obeyed, fuch a diforder cuftom has more efpecially diftinguifhed by the name of "infurrection." All thefe violences difturb the public order, and are crimes of ftate, even when arifing from juft caufes of complaint. For violent meafures are interdicted in civil fociety; the injured party fhould have recourfe to the magiftrates, to whom they may apply for redrefs; and if juftice be not obtained from them, their complaints may then be laid at the foot of the throne. Every citizen fhould even patiently fuffer fupportable evils, rather than difturb the public peace. Nothing lefs than a denial of juftice from the fovereign, or affected delays, can excufe the furious commotions of a provoked people; they in fome meafure juftify themfelves, if the evils be intolerable, and the oppreffions great and manifeft. But, it may be afked, what conduct fhall the fovereign obferve towards the infurgents? The reply in general is, that which fhall at the fame time be moft confonant to juftice, and moft falutary to the ftate. If he is to reprefs thofe who unneceffarily difturb the public peace; he is, by the fame reafoning, to fhew clemency towards unfortunate perfons, to whom juft caufe of complaint has been given, and who are guilty only in having undertaken to do themfelves juftice; fo that they have been wanting in patience rather than fidelity. The fovereign fhould confider that his rights are derived from thofe of civil fociety, from the truft repofed in him, from the obligation devolved upon him of watching over the welfare of the nation, of procuring its greateft happinefs, and of maintaining in it order, juftice, and peace. He will alfo duly diftinguifh the nature and degree of the different diforders which may difturb the ftate, oblige him to take arms, or fubftitute the means of force inftead of thofe of authority. By confiderations of this kind he will regulate his behaviour towards revolted fubjects. It cannot be queftioned, that fubjects rifing againft their prince without caufe deferve fevere punifhments; yet in this cafe the number of delinquents calls for the fovereign's clemency; fhall he depopulate a city, or defolate a province, in punifhing their rebellion? Such a chaftifement, however juft in itfelf, becomes a cruelty when extended to fo great a number of perfons. Had the infurrection of the Netherlands againft Spain been totally unwarrantable, every man of virtue would ftill execrate the memory of the duke of Alva, who made it his boaft that he had caufed above 20,000 heads to be ftruck off by the hands of the common executioner. Let not his fanguinary imitators (fays the excellent Vattel) expect to juftify their enormities by neceffity. Who was ever more undefervedly infulted by his fubjects than Henry the Great of France? His conquefts were ever accompanied by an uniform clemency, and at length that excellent prince obtained the fuccefs he deferved: he thereby gained over faithful fubjects; whereas the duke of Alva loft his mafter the United Provinces. Tyrants alone will treat, as feditious, thofe brave and refolute citizens, who exhort the people to preferve themfelves from oppreffion in the vindication of their rights and privileges; a good prince will commend fuch virtuous patriots, provided their zeal be tempered with moderation and prudence. If he has juftice and his duty at heart; if he afpires to that immortal and unfullied glory of being the father of his people; let him miftruft the felfifh fuggeftions of a minifter, who reprefents to him as rebels all thofe citizens who do not hold out their hands to chains, who refufe tamely to fuffer the ftrokes of arbitrary power.

The fafeft, and the moft juft way thoroughly to appeafe fedition, is to give the people fatisfaction; and if the infurrection has been without caufe, which perhaps has never been the cafe, ftill an amnefty is to be granted where the offenders are numerous. When this amnefty is once publifhed and accepted, whatever has paft muft be buried in oblivion. A prince who makes any confcience of his word, is faithfully to keep what he has promifed to rebels themfelves; *i. e.* to thofe fubjects who have revolted without reafon or neceffity. If his promifes are not inviolable, what fecurity have the rebels in treating with him? When they have once drawn the fword, they have nothing to do but, as one of the ancients expreffes it, to throw away the fcabbard. The prince will then want the mild and falutary means of appeafing a revolt: to exterminate the rebels will be the only expedient remaining. Thefe will become formidable through defpair: compaffion will beftow fuccours on them; their party will increafe, and the ftate will be in danger. Vattel's Law of Nations, b. iii. See *Civil* War.

Rebel is fometimes alfo ufed, in our ancient ftatutes, for a perfon who wilfully breaks a law; and fometimes for a villain difobeying his lord.

Rebellion, *Commiffion of.* See Commission.

REBELLIOUS Assembly, a gathering of twelve perfons, or more, intending, going about, or practifing, unlawfully, and of their own authority, to change any laws of the realm, or to deftroy the inclofure of any park or ground inclofed, banks of fifh-ponds, pools, conduits, &c. to the intent the fame fhall remain void, or that they fhall have way in any of the faid grounds; or to deftroy the deer in any park, fifh in ponds, coneys in any warren, dove-

houfes,

houfes, &c. or to burn ftacks of corn, or to abate rents, or prices of victuals. See RIOT, ROUT, and UNLAWFUL *Affembly*.

REBENSOE, in *Geography*, a fmall ifland in the North fea, near the coaft of Norway. N. lat. 70°.

REBHIANG, one of the Hebrew accents, anfwering to our comma, and enumerated among their kings and paufes. It is marked by a dot over the middle of a letter. See ATHNACH, SYLLUK, &c. See alfo ACCENTS.

REBINARE, was to give a fecond ftirring or ploughing to arable land that lay fallow, to prepare it for fowing wheat, &c. or to plough the ground a third time for that purpofe. "Tempus rebinandi erit poft feftum Nativitatis fancti Johannis Baptifte cum terra pullulaverit poft carucam." Fleta, lib. ii. cap. 73.

REBNITZ, in *Geography*. See RIBNITZ.

REBORDAOS, a town of Portugal, in the province of Tras los Montes; two miles S. of Bragança.

REBOUND. See RECOIL.

REBOUX, in *Geography*, a town of France, in the department of Mont Blanc; 9 miles N.W. of Chambery.

REBTORF, a town of Bavaria, in the principality of Aichftatt; 3 miles W. of Aichftatt.

REBUS, a name-device, as Camden englifhes it; or an enigmatical reprefentation of fome name, &c. by ufing figures or pictures, inftead of words, or parts of words. Such is that of the gallant mentioned by Camden, who expreffed his love to Rofe Hill, by painting in the border of his gown a rofe, a hill, an eye, a loaf, and a well; which, in the rebus ftyle, is read, *Rofe Hill I love well.*

The Picards have the honour of the invention of this notable kind of wit; whence the French, to this day, call it *rebus de Picardie.* Camden adds, that the Englifh firft learnt it of them in the reign of our Henry III. by means of the garrifons we then had in Calais, Guienne, and other places bordering on Picardy.

Its origin is by Menage, &c. afcribed to the priefts of Picardy, who, it feems, anciently, in carnival time, ufed every year to make certain libels, entitled *de rebus quæ geruntur,* being railleries on the intrigues and tranfactions that had paffed about the city; in which they made great ufe of fuch fort of equivoques and allufions, breaking and joining words, and fupplying them with paintings.

Camden tells us, the rebus was in wonderful efteem among our forefathers; and that he was nobody who could not hammer out of his name an invention by this wit-craft, and picture it accordingly.

The Sieur des Accords has made an ample collection of the moft famous rebufes de Picardie. And Mr. Camden has done fomething of the fame kind in his Remains.

Abel Drugger's device in Ben Johnfon's Alchemift, and Jack of Newbury, in the Spectator, are known to every body. But the rebus, being once raifed to fign-pofts, grew out of fafhion at court.

Yet has rebus antiquity on its fide, as having been in ufe in the pure Auguftan age: Cicero, in a dedication to the gods, infcribed Marcus Tullius, with a little pea, called by the Latins *cicer*, by us a *chich pea.* And Julius Cæfar, in fome of his coins, ufed an elephant, called *Cæfar* in the Mauritanian tongue. Add to thefe, that the two mintmafters in that age, L. Aquilius Florus, and Voconius Vitulus, ufed, the firft a flower, the fecond a calf, on the reverfe of their coins.

REBUS, in *Heraldry*, a coat of arms which bears an allufion to the name of the perfon: as three caftles, for Caftleton; three cups, for Butler; three conies, for Conifby; a kind of bearings which are of great antiquity.

Rebus is alfo ufed by the chemical writers, fometimes to fignify four milk, and fometimes for what they call the ultimate matter of which all bodies are compofed.

REBUTTER, from *re*, and the French *bouter*, to *repel*, or *bar*, in *Law*, the anfwer of the defendant in a caufe to the plaintiff's fur-rejoinder.

The plaintiff's anfwer to the defendant's rebutter, is called a *fur-rebutter*.

REBUTTER is alfo when a man warrants any land or hereditament to another, and the perfon making the warranty, or his heir, fues him to whom the warranty is made, or his heir or affignee, for the fame thing: if he, who is fo fued, plead the deed or fine with warranty, and pray judgment, if the plaintiff fhall be received to demand the thing which he ought to warrant to the party, againft the warranty in the deed, &c. this is called a rebutter.

Again, if I grant to the tenant to hold *fine impetitione vafti*, and afterwards implead him for wafte, he may debar me of the action, by fhewing my grant; which is likewife a rebutter.

REC, in *Geography*, a river of France, which runs into the Sarre, at Sarre Alb.

RECANATI, a town of the marquifate of Ancona; near which towards Macerata are feen the ruins of Helvia Ricina; a town built by the emperor Sept. Severus, and deftroyed by the Goths; 8 miles N.N.E. of Macerata. N. lat. 43° 25'. E. long. 13° 39'.

RECANGED, in *Rural Economy*, a term provincially ufed to fignify lifted or difcoloured in ftripes.

RECANTATION. See PALINODY, or RETRACTATION.

RECAPITULATION, in *Oratory*, &c. a part of the peroration, or conclufion; called alfo *anacephalæofis*.

Recapitulation is a fummary of the preceding difcourfe; or a concife, tranfient enumeration of the principal things infifted on at large in it; by which the memory of the hearer is refrefhed, and the force of the whole collected into one view.

An inftance of this may be given in the peroration of Cicero's Manilian: "Quare, cum bellum ita neceffarium fit, ut negligi non poffit: ita magnum, ut accuratiffime fit adminiftrandum; & cum ei imperatorem præficere poffitis, in quo fit eximia belli fcientia, fingularis virtus, clariffima auctoritas, egregia fortuna; dubitabitis, Quirites, quin, &c."

In order to conftitute a good repetition or recapitulation, it muft be fhort and concife: it is alfo convenient to recite things in the fame order in which they were at firft laid down; but fometimes a repetition is made, by running a comparifon between the fpeaker's own argument, and thofe of the adverfe party, and placing them in oppofition to each other; and this method Cicero takes in the conclufion of his third oration upon the Agrarian law. In fome cafes, when the difcourfe is very long, and the arguments infifted on have been many, the orator only mentions fuch things which he thinks of leaft confequence, by faying that he omits or paffes over them, till he comes to what is of greater moment, which he reprefents more fully. Ward's Orat. vol. i. fect. 18. See PRETERITION.

RECAPTION, RECAPTIO, or *Reprifal*, in *Law*, is a remedy given to the party himfelf for an injury to his perfonal property. This happens, when any one hath deprived another of his property in goods or chattels perfonal, or wrongfully detains one's wife, child, or fervant; in which cafe the owner of the goods, and the hufband, parent, or mafter, may lawfully claim and retake them, wherever he happens to find them, fo it be not in a riotous manner, or or attended with a breach of the peace. Thus, *e. gr.* if my horfe is taken away, and I find him in a common, a fair, or a public inn, I may lawfully feize him to my own ufe; but I cannot juftify breaking open a private ftable, or entering on the grounds of a third perfon to take him, except he be felonioufly ftolen, but muft have recourfe to an action at law. Recaption is unlawful, if it be done with intention to fmother or compound a larciny. See RESTITUTION *of Stolen Goods*.

RECAPTION alfo is the taking a fecond diftrefs of one formerly diftrained for the fame caufe, and alfo during the plea grounded on the former diftrefs.

Recaption is alfo the name of a writ lying for the party thus diftrained to recover damages. See REPLEVIN.

RECAPTURE, in *Naval Infurance*, denotes the recovery of a fhip, or its cargo wholly or in part, after having been taken by an enemy. For every lofs occafioned by capture, whether lawful, *i. e.* when made by a declared enemy, according to the laws of war, or unlawful, *i. e.* when it is againft the rules eftablifhed by the law of nations, whether by friends or enemies, the infurer is liable, agreeably to the comprehenfive and exprefs words of the policy: and in every cafe of capture the infurer is anfwerable, to the extent of the fum infured, for the lofs actually fuftained. This may be either *total*, as where the fhip and goods infured are not recovered; or *partial*, as where the fhip is recaptured or reftored before abandonment; in which cafe the infurer is bound to pay the falvage, and any other neceffary expence the infured may have incurred by the recovery of his property. The infurer is liable for a lofs by capture, whether the property in the thing infured be changed by the capture or not. As to the length of poffeffion by an enemy, which is deemed fufficient to diveft the property out of the original owner, or the effect of a recapture in revefting it; thefe are matters which can never now come directly in queftion between the infurer and infured, in any cafe of infurance upon real intereft. In gaming infurances, or infurances without intereft, indeed, when there was a recapture, the claim, as for a total lofs, feems formerly to have involved the queftion, whether the property in the thing infured had, by the capture, or any proceeding founded on it, been divefted out of the original owner, or not, before the recapture. Neverthelefs, when a fhip is infured "intereft or no intereft," it has been repeatedly determined, that if the fhip be taken, it is a total lofs, however illegal the capture may be, and though the fhip may be retaken and reftored to the owner. But though no queftion can now arife between the infured and the infurer, as to the effect of a capture or recapture, in diverting or revefting the property; it may not be deemed unimportant to inquire when a capture fhall be deemed to transfer the property to an enemy, and what fhall be the effect of a recapture in revefting it in the original owner. The general opinion feems to be, that by the law of nations, the property of things captured in war is changed when all reafonable hope of recovering them is gone; and, with refpect to things moveable, all reafonable hope of recovering them is prefumed to be gone when they are brought within the protection of the enemy's fortrefs. Grotius fays, that fhips or goods, taken at fea, become the property of the captors, when they are brought into the enemy's harbours, or to the place where his whole fleet is ftationed; for then all hopes of recovering them may be faid to vanifh. But, he adds, that by the law of nations, as introduced among European ftates in more modern times, things are confidered as captured, when they have been 24 hours in the power of the enemy. Others deny this rule of the law of nations, and infift on the rule of the Roman law, that the prize muft be carried "infra præfidia" before it can become the property of the captors; and by "præfidia" Bynkerfhoeck underftands the camps, the ports, the towns, and the fleets, of the enemy. In our courts of admiralty, however, it has always been holden, by the marine law of England, independent of the ftatute which commands reftitution, and fixes the rate of falvage, the property is not changed in favour of a vendee or recaptor, fo as to bar the original owner, till there has been a regular fentence of condemnation: and in the reign of king Charles II., a folemn judgment was given upon this point; and reftitution of a fhip taken by a privateer was decreed, after fhe had been fourteen weeks in the enemy's poffeffion, *becaufe fhe had not been condemned*. The fame doctrine has, in feveral inftances, prevailed in our courts of common law. In one cafe it was holden that nine days' poffeffion by the captor, and in another, that four years' poffeffion, and feveral voyages performed, will not change the property, without a fentence of condemnation.

In general, whenever a fhip is taken by the enemy, the infured may abandon, and demand as for a total lofs; and he is not bound to make any claim or appeal in the enemy's courts of admiralty, or to litigate there the validity of the capture.

But the infured is in no cafe *bound* to abandon; and, as the law now ftands, no capture by the enemy can be fo total a lofs as to leave no poffibility of recovery, for the *jus poftliminii* continues for ever, except in the cafe of a captured fhip converted into a fhip of war. (Stat. 33 G. III. c. 66. § 42.) If the owner himfelf fhould retake his fhip or goods, he will be fully intitled to them; and if they be retaken at any time, whether before or after condemnation, he will be intitled to reftitution, upon payment of a fettled falvage. Stat. 29 G. II. c. 34. § 24; and 33 G. III. c. 66. § 42.

The chance of the owner's recovering his property, does not, however, fufpend the demand of the infured, as for a total lofs: but in the cafe of a recapture, juftice is done to the infurer by putting him in the place of the infured. In queftions upon policies of infurance, the nature of the contract as an *indemnity*, and nothing elfe, is always liberally confidered.

When there has been a capture, whether legal or not, and the fhip has been recaptured or reftored, the infurer is bound to defray all neceffary expences which the infured has been put to for the recovery of his property. He is therefore liable for a fum of money paid by the infured to the captors, as a *compromife* made *bonâ fide*, to prevent the fhip being condemned as prize. See RANSOM.

It often happens that a recaptured fhip is in a ftate to profecute her original voyage; and, in that cafe, it is the intereft of the recaptors, as well as of the other parties concerned, that fhe fhould be permitted to do fo. The laft prize act (ftat. 33 Geo. III. c. 66. § 44.) has therefore very properly provided, "That if a fhip be retaken before fhe has been carried into an enemy's port, it fhall be lawful for her, if the recaptors confent thereto, to profecute her voyage; and it fhall not be neceffary for the recaptors to proceed to adjudication till fix months after the recapture, or till the return of the fhip to the port from whence fhe failed; and the mafter, owners, or agents, with the confent of the recaptor, may difpofe of their cargoes before adjudication: and in cafe the veffel fhall not return to the port from whence fhe failed, or the recaptors fhall have had no opportunity of proceeding regularly to adjudication within the fix months, on account of the abfence of the faid veffel, the court of admiralty fhall, at the inftance of the recaptors, decree reftitution to the former owners, they paying falvage, upon fuch evidence as to the court fhall, under all the circumſtances of the caſe, appear reaſonable; the expence of ſuch proceeding not to exceed *fourteen pounds.*"

We ſhall here obſerve, that there is an obvious difference between capture and arreſt of princes; the object of the one is prize, that of the other detention, with a deſign to reſtore the ſhip or goods detained, or to pay the value to the owner. When a ſhip is detained in a port after a declaration of war, or the iſſuing of letters of repriſal, this more reſembles a capture than a detention, and gives the injured an immediate right to abandon, as for a loſs by capture, even though no condemnation be pronounced, and though the ſhip be afterwards reſtored. The moſt frequent cauſe of detention is an embargo, which is a proclamation or order of ſtate, uſually iſſued in time of war or threatened hoſtilities, prohibiting the departure of ſhips or goods from ſome or all of the ports of ſuch ſtate until further order. An embargo laid on ſhips and merchandize in the ports of this kingdom by virtue of the king's proclamation, is ſtrictly legal, when the proclamation does not contravene the ancient laws, or tend to eſtabliſh new ones; but only to enforce the execution of ſuch laws as are already in being, in ſuch manner as the king ſhall judge neceſſary. But whether an embargo be legally or illegally laid, the injury to the owner, by the detention of his ſhip or goods, is the ſame; and the inſurer is equally liable for the loſs occaſioned by it. If a ſhip be ſeized after a ceſſation of arms and preliminary articles of peace are ſigned, this ſhall not be deemed a capture, but only an arreſt of princes. For the regulation of ſalvage upon a recapture, we refer to the article SALVAGE.

Capture by an enemy or a pirate, or an arreſt of princes, or even an embargo, is *primâ facie* a total loſs; and immediately upon the capture, or upon a mere arreſt, or at any time while the ſhip continues under detention, the inſured may elect to abandon, and give notice to the inſurer of his intention ſo to do; and thus entitle himſelf to claim as for a total loſs from the inſurer. For, from the moment of the capture, the owners loſe their power over the ſhip and cargo, and are deprived of the free diſpoſal of them; and, in the opinion of the merchant, his right of diſpoſal being ſuſpended or rendered uncertain, is equivalent to a total deprivation. It would therefore be unreaſonable to oblige the inſured to wait the event of capture, detention, or embargo.

There is this difference between a policy *upon intereſt*, and a *wager policy*, that in the one caſe the inſured may, if he thinks proper, abandon the moment he has notice of a capture or detention, and this will bind the underwriters, whatever may be the ultimate fate of the ſhip; but in the caſe of a wager policy there can be no abandonment, becauſe the inſured has nothing to abandon.

But a capture or arreſt does not neceſſarily, and at all events, terminate in a total loſs, ſo as to entitle the inſured to abandon; for as he cannot abandon till he has received advice of the loſs; if, at the time he receives ſuch advice, or before he has elected to abandon, he receive advice that the ſhip or goods inſured are recovered, or are in ſafety, he cannot then abandon; becauſe he can only abandon *while* it is a total loſs, and he knows it to be ſo; not after he knows of the recovery. Therefore, if a captured ſhip be retaken and permitted to proceed on her voyage, ſo that ſhe ſuffers but a ſmall temporary inconvenience; this would only be a partial, and not a total, loſs.

On the other hand, a title to reſtitution upon a recapture does not neceſſarily, and at all events, deprive the inſured of the right to abandon; for if, in conſequence of the capture, the voyage be loſt, or not worth purſuing; if the ſalvage be very high; if farther expence be neceſſary, and the inſurer will not undertake at all events to pay it, he may abandon. The rule is, that, if the thing inſured be recovered before any loſs is paid, the inſured is entitled to claim as for a total, or a partial loſs, according to the final event; that is, according to the ſtate of the caſe at the time he makes his claim. There is no veſted right to a total loſs, till the inſured, having a right to abandon, elects to do ſo; for he is only entitled to an indemnity for his loſs as it ſtands at the time of the action brought, or offer to abandon.

But if, after a total loſs has been actually paid, the thing inſured be recovered, the inſurer cannot oblige the inſured to refund the money he has received; but he ſhall ſtand in the place of the inſured, and ſo no injuſtice is done.

Caſes are mentioned by Mr. Serjeant Marſhall, which ſerve as examples to ſhew, that though a captured ſhip be recaptured, yet if the voyage be loſt, the loſs will be total, and the inſured will have a right to abandon.

By the marine law, the property was not changed by the capture, till after condemnation: and ſince the 29 Geo. II. c. 34, the "jus poſtliminii" continues for ever. A recapture does not in all caſes prevent the loſs being total. If the voyage be abſolutely loſt, or be not worth purſuing; if the ſalvage be very high; if further expence be neceſſary; if the inſurer will not engage, at all events, to bear that expence, though it ſhould exceed the value, or fail of ſucceſs: under theſe, and many other ſimilar circumſtances, the inſured may diſentangle himſelf and abandon, notwithſtanding there was a recapture. Upon a recapture the property returns to the original owner, pledged to the recaptors for the amount of the ſalvage: upon the payment of which he is intitled to reſtitution. If upon a recapture the captain, finding that the voyage cannot be purſued, and, acting fairly for the benefit of all concerned, ſell the ſhip and cargo to pay the ſalvage, and thereby put an end to the voyage, the inſured may abandon and recover as for a total loſs. However, a capture does not neceſſarily amount to a total loſs, nor does a recapture prevent its being total. If the captain purchaſe the ſhip from the captors for account of his owners, the money paid, being in the nature of ſalvage, is only partial loſs.

To this article we ſhall ſubjoin two or three remarks on the ſubject of abandonment, which do not elſewhere occur. A time ſhould be fixed when the degree of the inſurer's reſponſibility ſhould be aſcertained. In ſeveral maritime ſtates on the continent, poſitive regulations have been eſtabliſhed, limiting the time, after a loſs has happened, within which the inſured may abandon. In England we have no ſuch poſitive regulation, nor any time limited by law for abandoning. But the courts have laid down a rule, better adapted to the purpoſe; and the rule is, that as ſoon as the inſured receives advice of a total loſs, he muſt make his election whether he will abandon or not. If he determines to abandon, he muſt give the underwriters notice of this within a reaſonable time after the intelligence arrives; and any unneceſſary delay in giving this notice will amount to a waver of his right to abandon; for unleſs the owner does ſome act, ſignifying his intention to abandon, it will be only a partial loſs, whatever may be the nature of the loſs, or the extent of the damage. If the inſurers in any manner prevent the abandonment, they ſhall pay the whole loſs, to the amount of the ſum inſured. If no intelligence be received of a ſhip within a reaſonable time, it ſhall be preſumed that ſhe foundered at ſea: when the time has elapſed which affords that preſumption, the inſured may abandon, and claim as for a total loſs. Marſhall on Inſurance, vol. ii.

RECARDAINS, in *Geography*, a town of Portugal, in the province of Beira; 6 miles E. of Bragança Nova.

RECCAN. See Arracan.

RECCO, a town of the Ligurian republic, near the sea-coast; 11 miles S.E of Genoa.

RECEIF, a fort and harbour on the coast of Brazil. S. lat. 8° 10′.

RECEIPT, or Receit, in *Commerce*, an acquittance or discharge; or a written acknowledgment of having received a sum of money.

Where the receipt is on the back of a bill, &c. it is usually called an *endorsement*.

Among tradesmen the receipt usually makes the second of the three articles of an account; the receipt contains the monies received; the two others the expence, and the return or balance.

By the 44 Geo. III. c. 98, the former stamp duties were repealed, and others imposed; by the 48 Geo. III. c. 149, these last were repealed, and the following were imposed; *viz.*

	Duty. £	s.	d.
Receipt or discharge given for or upon the payment of money			
Amounting to 2*l.* and not amounting to 10*l.*	0	0	2
ditto 10*l.* - ditto - 20*l.*	0	0	4
ditto 20*l.* - ditto - 50*l.*	0	0	8
ditto 50*l.* - ditto - 100*l.*	0	1	0
ditto 100*l.* - ditto - 200*l.*	0	2	0
ditto 200*l.* - ditto - 500*l.*	0	3	0
ditto 500*l.* or upwards - - -	0	5	0
And where any sum of money whatever shall be therein expressed, or acknowledged to be received in full of all demands - - -	0	5	0

And any note, memorandum, or writing whatsoever, given to any person for or upon the payment of money whereby any sum of money, debt, or demand, or any part of any debt or demand therein specified, and amounting to 2*l.* or upwards, shall be expressed or acknowledged to have been paid, settled, balanced, or otherwise discharged or satisfied, or which shall import or signify any such acknowledgment, and whether the same shall or shall not be signed with the name of any person, shall be deemed and taken to be a receipt for a sum of money of equal amount with the sum, debt, or demand so expressed or acknowledged to have been paid, settled, balanced, or otherwise discharged, or satisfied, within the intent and meaning of this schedule, and of the foregoing act, and shall be charged with a duty accordingly.

And any receipt or discharge, note, memorandum, or writing whatever, given to any person for or upon the payment of money, which shall contain, import, or signify any general acknowledgment of any debt, account, claim, or demand, debts, accounts, claims, or demands, whereof the amount shall not be therein specified, having been paid, settled, balanced, or otherwise discharged or satisfied, or whereby any sum of money therein mentioned shall be acknowledged to be received in full, or in discharge or satisfaction of such debt, account, claim, or demand, debts, accounts, claims, or demands, and whether the same shall or shall not be signed with the name of any person, shall be deemed and taken to be a receipt for the sum of 500*l.* or upwards, within the intent and meaning of this schedule, and of the foregoing act, and shall be charged with the duty of 5*s.* accordingly.

By 43 Geo. III. c. 126, such receipt shall not be available in law or equity as such acknowledgment, or be given in evidence, unless duly stamped as aforesaid.

And all receipts, discharges, and acknowledgments of the description aforesaid, which shall be given for or upon payments made by or with any bills of exchange, drafts, promissory notes, or other securities for money, shall be deemed and taken to be receipts given upon the payment of money within the intent and meaning of this schedule and of the foregoing act.

Exemptions from the preceding Duties on Receipts.

Receipts exempted from stamp duty by any act or acts of the present session, relating to the assessed taxes.

Receipts or discharges given by the treasurer of the navy for any money imprested to or received by him for the service of the navy.

Receipts or discharges given by any agent for money imprested to him on account of the pay of the army or ordnance.

Receipts or discharges given by any officer, seaman, marine or soldier, or their representatives respectively, for or on account of any wages, pay, or pension due from the navy-office, army pay-office, or ordnance-office.

Receipts or discharges given for the consideration money, for the purchase of any share in any of the government or parliamentary stocks or funds, or in the stocks and funds of the governor and company of the bank of England, or of the East India company, or South Sea company, and for any dividend paid on any share of the said stocks or funds respectively.

Receipts given for money deposited in the bank of England, or in the bank of Scotland, or royal bank of Scotland, or in the bank of the British linen company in Scotland, or in the hands of any banker or bankers, to be accounted for on demand, provided the same be not expressed to be received of or by the hands of any other than the person or persons to whom the same is to be accounted for; but if with interest, see Promissory *Notes*.

Receipts or discharges written upon promissory notes, bills of exchange, drafts or orders for the payment of money duly stamped according to the laws in force at the date thereof, or upon bills of exchange drawn out of, but payable in Great Britain.

Receipts or discharges given upon bills or notes of the governor and company of the bank of England; letters by the general post acknowledging the safe arrival of any bills of exchange, promissory notes, or other securities for money.

Receipts or discharges indorsed or otherwise written upon, or contained in any bond, mortgage, or other security, in any conveyance, deed, or instrument whatever, duly stamped according to the laws in force at the date thereof, acknowledging the receipt of the consideration money therein expressed, or the receipt of any principal money, interest, or annuity thereby secured.

Releases or discharges for money by deeds duly stampt according to the laws in force at the date thereof.

Receipts or discharges given for drawbacks or bounties upon the exportation of any goods or merchandise from Great Britain.

Receipts or discharges for the return of any duties of customs upon certificates of over entry.

Receipts or acknowledgments of payments indorsed upon any bills, orders, remittance bills, or remittance certificates, drawn by commissioneed officers, masters, and surgeons in the navy, or by any commissioner or commissioners of the navy, under the authority of the act passed in the 35th year of his majesty's reign, for the more expeditious payment of the wages and pay of certain officers belonging to the navy.

Receipts or acknowledgments of payments indorfed upon any bills drawn purluant to any former act or acts of parliament, by the commiffioners of the navy, or by the commiffioners for victualling the navy, or by the commiffioners for managing the tranfport fervice, and taking care of fick and wounded feamen, upon and payable by the treafurer of the navy.

If any perfon fhall write or fign any receipt liable to any ftamp duty, without being firft duly ftamped as aforefaid; or with a ftamp of a lower value than is herein directed: he fhall forfeit 10*l.* if the fum paid or expreffed therein fhall not amount to 100*l.*; and 20*l.* if the fum amount to 100*l.* or upwards. 31 Geo. III. c. 27. f. 17. 35 Geo. III. c. 55. f. 8.

Every perfon who fhall give any receipt or writing acknowledging the payment of money, in which a lefs fum fhall be expreffed than the fum actually paid or received, or who fhall feparate or divide the fum actually paid or received into divers fums, or fhall write off any part of any debt, or demand, or be guilty of or concerned in any contrivance with intent to defraud his majefty, fhall forfeit 50*l.* 35 Geo. III. c. 55. f. 9.

And the perfons, or their agent, from whom any fum fhall be due or payable, and who fhall have paid fuch fum, may provide a ftamp with the proper duty, or of fome higher rate of duty than required, and demand of the perfon entitled to fuch fum, or any agent to whom the fame fhall have been paid, a receipt for fuch fum, and alfo the amount of the duty thereon as aforefaid; and if fuch perfon refufe to give fuch receipt upon demand thereof, or to pay the amount thereof, every fuch perfon fhall forfeit for each offence 10*l.* 43 Geo. III. c. 126. f. 5.

Stamps denoting the duties under former acts may be ufed, provided they be applied to receipts of the like amount as required by this act. f. 8.

And all vellum, parchment, and paper liable to any ftamp duty as aforefaid, fhall be ftamped before the fame be written or printed upon; or may be brought to the faid commiffioners or their officers to be ftamped within 14 days after fuch receipts fhall be given or bear date, and fhall be ftamped on payment of 5*l.* over and above the duty; and if brought after 14 days within one calendar month, on payment of 10*l.* over and above the duty. 31 Geo. III. c. 25. f. 19, 20. 35 Geo. III. c. 55. f. 10, 11.

All penalties by this act incurred may be fued for in the courts at Weftminfter; or any neighbouring juftice may hear and determine any offence which fubjects the offender to any pecuniary penalty; who may, on complaint made within three calendar months, fummon the party accufed, and the witneffes, and examine into the matter of fact; and on confeffion, or the oath of one witnefs, may give judgment therein, and levy fuch penalty by diftrefs on the goods of the offender, which, if not redeemed within fix days, may be fold; and fuch penalty fhall be diftributed half to the king, and half to the informer; and for want of fufficient diftrefs, the offender fhall be committed to prifon for three calendar months, unlefs fuch penalty fhall be fooner paid. 31 Geo. III. c. 25. f. 24, 25. 35 Geo. III. c. 55. f. 12, 13.

If any perfon fhall find himfelf aggrieved by the judgment of fuch juftice, he may, upon giving fecurity to the amount of fuch penalty and cofts, appeal to the next feffions, which fhall happen 14 days next after fuch conviction, on giving reafonable notice; and in cafe fuch judgment be affirmed, they may award the perfon appealing fuch cofts as to them fhall feem meet. Id.

Provided, neverthelefs, that fuch juftice may, where he fhall fee caufe, mitigate any fuch penalty, fo as not to reduce the fame to lefs than one moiety thereof over and above the cofts. 31 Geo. III. c. 25. f. 26. 35 Geo. III. c. 55. f. 14.

Witneffes not appearing, having been duly fummoned, without reafonable caufe to be allowed by fuch juftice, or refufing to give evidence, fhall forfeit 40*s.* to be recovered in like manner. 31 Geo. III. c. 25. f. 27. 35 Geo. III. c. 55. f. 15.

Perfons counterfeiting or forging any ftamp hereby directed to be made ufe of fhall be guilty of felony without benefit of clergy. 31 Geo. III. c. 25. f. 29. 35 Geo. III. c. 55. f. 17. 43 Geo. III. c. 126. f. 11.

All powers given by any former act relating to the ftamp duties fhall extend to this act. 31 Geo. III. c. 25. f. 30. 35 Geo. III. c. 55. f. 18. 43 Geo. III. c. 126. f. 12.

Perfons fued or profecuted on account of any thing done in purfuance of this act may plead the general iffue and give the fpecial matter in evidence; and if a verdict be for the defendant, or the plaintiff be nonfuited, treble damages fhall be awarded againft fuch plaintiff. f. 15.

By the 44 Geo. III. c. 98, the former duties on legacies under the care of the commiffioners for ftamp duties were repealed, and new duties were impofed. By the 45 Geo. III. c. 28, additional duties were impofed, and by the 48 Geo. III. c. 149, the following were impofed (being by f. 3. of this laft act placed under the provifions of former acts relating to fuch duties,) and thofe impofed by former acts were repealed.

Schedule, Part III.

Legacies and fucceffion to perfonal or moveable eftate upon inteftacy.

I. *Where the teftator, teftatrix, or inteftate, died before or upon the 5th of April* 1805.

For every legacy, fpecific or pecuniary, or of any other defcription, of the amount or value of 20*l.* or upwards, given by any will or teftamentary inftrument of any perfon who died before or upon the 5th day of April 1805, out of his or her perfonal or moveable eftate, and which fhall be paid, delivered, retained, fatisfied, or difcharged, after the 10th of October 1808.

Alfo for the clear refidue (when devolving to one perfon), and for every fhare of the clear refidue (when devolving to two or more perfons), of the perfonal or moveable eftate of any perfon who died before or upon the 5th of April 1805 (after deducting debts, funeral expences, legacies, and other charges firft payable thereout), whether the title to fuch refidue, or any fhare thereof, fhall accrue by virtue of any teftamentary difpofition, or upon a partial or total inteftacy; where fuch refidue, or fhare of fuch refidue, fhall be of the amount or value of 20*l.* or upwards, and where the fame fhall be paid, delivered, retained, fatisfied, or difcharged, after the 10th of October 1808.

	£	s.	d.
Where any fuch legacy, or refidue, or fhare of fuch refidue, fhall have been given, or devolved, to or for the benefit of a brother or fifter of the deceafed, or any defcendant of a brother or fifter of the deceafed; a duty at and after the rate of 2*l.* 10*s.* *per cent.* on the amount of the value thereof - - - - - - - -	2	10	0
Where to or for the benefit of a brother or fifter of the father or mother of the deceafed; or any defcendant of a brother or fifter of the father or mother of the deceafed; a duty at and after the rate of 4*l.* *per cent.* on the amount or value thereof - - - - - - - - -	4	0	0

Where

	£	s.	d.
Where to or for the benefit of a brother or fifter of a grandfather or grandmother of the deceafed, or any defcendant of a brother or fifter of a grandfather or grandmother of the deceafed; a duty at and after the rate of 5*l. per cent.* on the amount or value thereof - - -	5	0	0
Where to or for the benefit of any perfon in any other degree of collateral confanguinity to the deceafed, than is above defcribed, or to or for the benefit of any ftranger in blood to the deceafed; a duty at and after the rate of 8*l. per cent.* on the amount or value thereof - -	8	0	0

II. *Where the teftator, teftatrix, or inteftate, fhall have died after the 5th of April* 1805.

For every legacy, fpecific or pecuniary, or of any other defcription, of the amount or value of 20*l.* or upwards, given by any will or teftamentary inftrument, of any perfon who fhall have died after the 5th of April 1805; either out of his or her perfonal or moveable eftate, or out of or charged upon his or her real or heritable eftate, or out of any monies to arife by the fale, mortgage, or other difpofition of his or her real or heritable eftate, or any part thereof, and which fhall be paid, delivered, retained, fatisfied, or difcharged after the 10th of October 1808.

Alfo, for the clear refidue, (when devolving to one perfon), and for every fhare of the clear refidue (when devolving to two or more perfons), of the perfonal or moveable eftate of any perfon who fhall have died after the 5th of April 1805, (after deducting debts, funeral expences, legacies, and other charges firft payable thereout), whether the title to fuch refidue, or any fhare thereof, fhall accrue by virtue of any teftamentary difpofition thereof, or upon a partial or total inteftacy, where fuch refidue, or fhare of refidue, fhall be of the amount or value of 20*l.* or upwards, and where the fame fhall be paid, delivered, retained, fatisfied, or difcharged after the 10th of October 1808.

And alfo for the clear refidue (when given to one perfon), and for every fhare of the clear refidue (when given to two or more perfons), of the monies to arife from the fale, mortgage, or other difpofition of any real or heritable eftate, directed to be fold, mortgaged, or otherwife difpofed of, by any will or teftamentary inftrument of any perfon who fhall have died after the 5th of April 1805, (after deducting debts, funeral expences, legacies, and other charges, firft made payable thereout, if any), where fuch refidue, or fhare of refidue, fhall amount to 20*l.* or upwards, and where the fame fhall be paid, retained, or difcharged, after the 10th of October 1808.

	£	s.	d.
Where any fuch legacy or refidue, or any fhare of fuch refidue, fhall have been given, or have devolved, to or for the benefit of a child of the deceafed, or any defcendant of a child of the deceafed; a duty at and after the rate of 1*l. per cent.* on the amount or value thereof - -	1	0	0
Where to or for the benefit of a brother or fifter of the deceafed, or any defcendant of a brother or fifter of the deceafed; a duty at and after the rate of 2*l.* 10*s. per cent.* on the amount or value thereof - - - - - -	2	10	0
Where to or for the benefit of a brother or fifter of the father or mother of the deceafed, or any defcendant of a brother or fifter of the father or mother of the deceafed; a duty at and after the rate of 4*l. per cent.* on the amount or value thereof - - - - - - - -	4	0	0
Where to or for the benefit of a brother or fifter of a grandfather or grandmother of the deceafed, or any defcendant of a brother or fifter of a grandfather or grandmother of the deceafed; a duty at and after the rate of 5*l. per cent.* on the amount or value thereof - - - -	5	0	0
Where to or for the benefit of any perfon in any other degree of collateral confanguinity to the deceafed, than as above defcribed, or to or for the benefit of any ftranger in blood to the deceafed; a duty at and after the rate of 10*l. per cent.* on the amount or value thereof - -	10	0	0

And all gifts of annuities, or by way of annuity, or of any other partial benefit, or intereft, out of any fuch eftate or effects as aforefaid, fhall be deemed legacies within the intent and meaning of this fchedule.

Exemptions.

Legacies and refidues, or fhares of refidue, of any fuch eftate or effects as aforefaid, given or devolving to or for the benefit of the hufband or wife of the deceafed, or to or for the benefit of any of the royal family.

And all legacies which were exempted from duty by the 39 Geo. III. c. 73, for exempting certain fpecific legacies, given to bodies corporate or other public bodies, from the payment of duty.

By f. 43. of 48 Geo. III. c. 149, the commiffioners are authorized to remit penalties incurred before paffing this act by non-payment of the duty on legacies, if the duty in arrear fhall be paid on or before the 31ft Jan. 1809.

By f. 44, in all cafes not provided for by f. 43, where any receipt for any of the above matters fhall be brought to the head office to be ftamped after the expiration of three calendar months from the date thereof, it may be ftamped on payment of the duty, together with the penalty incurred for not ftamping the fame in due time: and if the receipt have been figned out of Great Britain, and be brought to be ftamped within 21 days after being received in Great Britain, and no penalty to be incurred.

The faid duties to be under the management of the commiffioners of the ftamp duties. 35 Geo. III. c. 52. f. 3.

And in cafe of fpecific legacies, where the refidue of any perfonal eftate fhall confift of property not reduced into money, the perfon taking adminiftration of fuch effects, or by whom the duty ought to be paid, may fet a value thereon, and offer the duty accordingly; and may, at his own expence, require the ftamp commiffioners to appoint a perfon to fet fuch value, and fuch commiffioners may accept the duty fet by fuch perfon with an appraifement, but if they fhall not be fatisfied with the value fo fet, they may appoint a perfon to appraife fuch effects, and to fet the value thereon, and require the duty to be paid accordingly; but if the perfon who ought to pay fuch duty fhall not be fatisfied with fuch valuation, he may caufe the fame to be reviewed by the commiffioners of the land-tax of the diftrict where fuch effects fhall be, at their next meeting, if fourteen days have elapfed before fuch meeting, and if not, at the next fucceeding meeting, of which appeal fix days notice fhall be given to the ftamp commiffioners; and the faid commiffioners of the land-tax may appoint a perfon to appraife fuch effects, and to fet a value thereon, and may hear and determine fuch appeal in like manner as appeals to them in other cafes, and their judgment fhall be final; and if the valuation made under the authority of fuch ftamp commiffioners fhall not be appealed from within the time aforefaid, or fhall be affirmed upon appeal, the duty fhall be paid accordingly; and if any variation fhall be made on fuch appeal,

appeal, the duty ſhall be paid according to ſuch variation; and if the duty aſſeſſed in manner aforeſaid ſhall exceed the duty offered to and refuſed by ſuch ſtamp officers, the expences ſhall be borne by the perſon liable to pay ſuch duty. If any diſpute ſhall ariſe between perſons entitled to any ſuch legacy, or reſidue, or taking adminiſtration as aforeſaid, reſpecting the value thereof, or duty to be paid thereon, the duty ſhall be aſſeſſed by ſuch ſtamp commiſſioners on reference to them by either party; and if the value of ſuch property ſhall be in diſpute, ſuch ſtamp commiſſioners ſhall cauſe an appraiſement to be made thereof, at the expence of the perſon liable to pay the duty, in manner aforeſaid; and if ſuch perſon ſhall be diſſatisfied with ſuch valuation, the ſame ſhall be reviewed and finally determined by the ſaid commiſſioners of the land-tax, upon appeal to them within the time and in the manner aforeſaid. And if the effects whereon ſuch duty is payable ſhall be ten miles from London, ſuch perſons as ſhall be deputed by the ſaid ſtamp commiſſioners ſhall act in their ſtead. ſ. 22. 36 Geo. III. c. 52.

And if it ſhall appear to the ſaid ſtamp commiſſioners, upon oath, to be adminiſtered by a juſtice, or maſter extraordinary in chancery, that leſs duty has been paid than ought to have been, by miſtake, without intention of fraud, ſuch miſtake may be rectified by ſuch commiſſioners, who may accept the duty really due within three calendar months, if no ſuit hath been inſtituted, and on payment of 10*l. per cent.* thereon by way of penalty. ſ. 30.

Every perſon paying or receiving money contrary to this act, who ſhall within twelve calendar months diſcover the other party offending, ſo as he be convicted thereof, ſhall be indemnified and diſcharged from all penalties againſt this act. ſ. 31.

And all powers of forming acts relating to the ſtamp duties, not hereby altered, ſhall be in force, in the execution of this act. ſ. 42.

Wherever any executor or adminiſtrator ſhall not have paid the ſaid duties within time, the court of exchequer may, on application from the ſtamp office on ſatisfactory affidavit, grant a rule for ſuch executor to ſhew cauſe why he ſhould not deliver to the commiſſioners an account on oath of all legacies, or of the perſonal property paid or payable by him, and why the duties thereon have not been, or ſhould not be forthwith paid, and may make ſuch rule abſolute where it appears proper. And regiſtrars of eccleſiaſtical courts ſhall, within a month of requiſition, deliver to the ſtamp office an account of wills and letters of adminiſtration in their cuſtody, with particulars relating thereto, and extracts from any wills deemed neceſſary by the commiſſioners, on payment of fees agreed on or allowed by the eccleſiaſtical court, on pain of 50*l.* recoverable by information by the attorney-general. 42 Geo. III. c. 99. ſ. 2, 3.

And by the 5 W. c. 21, the probate of the will or letters of adminiſtration of any common ſoldier or ſeaman, ſlain or dying in the ſervice, ſhall be exempt from the ſtamp duties. ſ. 6.

Receipt, or *Reſceit*, in *Law*. See Resceit.

Receipt *of Homage*. See Resceit.

Receipt *of the Exchequer*. See Court *of Exchequer*.

Receipt, in *Medicine*. See Recipe.

Receipts, *Auditor of*. See Auditor.

RECEIVER, or Recipient, in *Chemiſtry*, a globe-ſhaped veſſel, which is adapted to the neck or beak of an alembic, retort, or other diſtillatory veſſel, in order to collect, receive, and contain the products of diſtillations.

Receivers ſhould be made of glaſs, not only becauſe this matter reſiſts the action of the ſtrongeſt and moſt corroſive ſubſtances, but alſo becauſe being tranſparent, it allows the operator to ſee through it, and to judge by the frequency of the drops, if the diſtillation be too quick or too ſlow, and alſo if the quantity and nature of the ſubſtances that come over be ſuch as are required.

Almoſt all receivers are kinds of bottles of different ſizes, of a ſpherical form, the necks of which are cut ſhort, and each of which is pierced with a ſmall hole in its lateral or upper part, to give vent to the air or vapours, which are too expanſive. Receivers of this form are called *balloons*; which ſee. Some receivers are matraſſes with long necks. Theſe are generally adapted to the beaks of glaſs alembics. The long neck ſerves to keep the belly of the receiver, where the liquor is collected, at a proper diſtance from the fire.

Receivers have different forms for particular operations. Such are thoſe which have two or three beaks, either to be adapted to other receivers, or to admit at the ſame time the necks of ſeveral diſtillatory veſſels, when the intention of the operator is, that the vapours of different ſubſtances ſhould meet in the ſame receiver. Such alſo are receivers for eſſential oils, obtained from aromatic plants diſtilled with water, which are ſo made, that they are never full, but that the water runs out, and leaves the oil behind. Theſe are a kind of glaſs cucurbits, which contract as they riſe higher; ſo that their neck or upper opening is but nearly of a convenient ſize to receive the beak of the worm. Theſe receivers have another opening about the middle of the ſwelling or belly; and to this opening is joined a glaſs tube, which bends and riſes vertically along the outer part of the receiver, ſo as to be within two inches and a half as high as the upper opening. At this height the tube bends again towards the ſide oppoſite to the body of the receiver, to pour into another veſſel the liquor which ariſes there. It forms the figure of an S.

When this receiver is to be uſed, it is to be placed vertically under the beak of the worm. During the diſtillation, the liquor riſes to an equal height in the body of the receiver, and in the crooked tube: when, therefore, the height of the liquor in the receiver becomes greater than the height of the tube, it muſt begin to flow from the mouth of this tube into another veſſel placed on purpoſe to receive it; but as eſſential oils are either lighter or heavier than water, and as they are, therefore, always collected either above or under the water, and as the liquor which diſcharges itſelf through the tube is taken from the middle part of the receiver, nothing but water can be evacuated at the mouth of the pipe, while the oil always remains in the receiver. With ſuch a receiver diſtillation may be performed without the trouble of changing the veſſels. Macquer's Chem. Dict. See Distillation and Laboratory.

Receiver *of an Air-Pump*, is part of its apparatus; being a glaſs veſſel placed on the top of the plate, out of which the air is to be exhauſted. To an air-pump belong various receivers, of various forms and ſizes, and ſerving for various purpoſes. See Air-*Pump*.

Receiver, *Exhauſted*, in *Pneumatics*. See Exhausted. And for the method of repairing thoſe that are cracked, ſee Cæment.

Receiver, *Receptor*, or *Receptator*, in *Law*, is uſed commonly in the bad ſenſe, for ſuch as knowingly receive ſtolen goods from thieves, and conceal them.

This offence is only a miſdemeanor at common law: however, by the ſtatutes 3 & 4 W. & M. c. 9. and 5 Ann. c. 31. the offender is made acceſſory to the theft and felony. But becauſe the acceſſory cannot in general be tried, unleſs with the principal, or after the principal is convicted, the receivers

receivers by that means frequently eluded juſtice; to remedy which it is enacted by ſtatute 1 Ann. c. 9. and 5 Ann. c. 31. that ſuch receivers may be ſtill proſecuted for a miſdemeanor, and puniſhed by fine and impriſonment, though the principal felon be not before taken, ſo as to be proſecuted and convicted. And in caſe of receiving ſtolen lead, iron, and certain other metals, ſuch offence is, by ſtatute 29 Geo. II. c. 30. puniſhable by tranſportation for fourteen years. So that now the proſecutor has two methods in his choice: either to puniſh the receivers for the miſdemeanor immediately, before the thief is taken (Foſter. 373.); or to wait till the felon is convicted, and then puniſh them as acceſſories to the felony. But it is provided by the ſame ſtatutes, that he ſhall only make uſe of one, and not of both theſe methods of puniſhment.

By the ſame ſtatute alſo (29 Geo. II. c. 30.) perſons having lead, iron, or other metals in their cuſtody, and not giving a ſatisfactory account how they came by the ſame, are guilty of a miſdemeanor, and puniſhable by fine and impriſonment. And by ſtatute 10 Geo. III. c. 48. all knowing receivers of ſtolen plate or jewels, taken by robbery on the highway, or when a burglary accompanies the ſtealing, may be tried as well before as after the conviction of the principal, and whether he be in or out of cuſtody; and, if convicted, ſhall be adjudged guilty of felony, and tranſported for fourteen years. By ſtat. 21 Geo. III. c. 68. the receiving of any ſtolen copper, braſs, bell-metal, or utenſil fixed to any building, or any iron-rails or fencing ſet up in any court or other place, is made tranſportation for ſeven years, or three years' impriſonment to be kept to hard labour. By ſtat. 21 Geo. III. c. 69. the receiving of ſtolen pewter of any kind is ſubjected to the like penalty, although the principal has not been convicted. By ſtat. 22 Geo. III. c. 58. the receiving of any ſtolen goods, (except lead, iron, copper, braſs, bell-metal, and ſolder,) is made a miſdemeanor, puniſhable by fine and impriſonment, or whipping, as the court ſhall appoint; which ſhall exempt the offender from being puniſhed as acceſſory, although the principal be afterwards convicted, and the offence ſhall appear to be grand larceny, or ſome greater offence. (See Larceny.) For the puniſhment of receivers of goods ſtolen by bum-boats, &c. on the river Thames, ſee ſtat. 2 Geo. III. c. 28. § 12. Receivers of linen goods ſtolen from the bleaching-grounds are, by ſtat. 18 Geo. II. c. 27. declared felons without benefit of clergy. In France, receivers are puniſhed with death; and the Gothic conſtitutions diſtinguiſhed alſo three ſorts of thieves: "unum qui conſilium daret, alterum qui contrectaret, tertium qui receptaret et occultaret; pari pœna ſingulos obnoxios."

Receiver alſo denotes an officer, of which there are various kinds, denominated from the particular matters they receive, the places where, or the perſons for whom, &c.

As receiver of rents; receiver-general of the cuſtoms; receiver of the fines, upon original writs in chancery, &c.

Receiver-*General* of the duchy of Lancaſter, is he who gathers all the revenues and fines of the lands of the ſaid duchy, all forfeitures, aſſeſſments, &c.

Receiver-*General* of the public revenue is an officer appointed in every county, to receive the taxes granted by parliament, and remit the money to the treaſury.

Receiver's *Office*. See *Greenwich* Hospital.

RECENT Fruits. See Fruit.

RECEPTACLE *of Stall Manure*, in *Agriculture*, the place where the various matters from the ſtalls, and other places where animals are kept, are depoſited and laid up. Some ſuppoſe that theſe places ſhould be a little hollow or excavated; while others are of quite a different opinion, and think that they ſhould be even, or a little raiſed. A very ſlight hollowing is, however, probably the beſt. An experienced writer on this ſubject ſuggeſts, that it is not to be inferred that, becauſe they ſhould be hollow, they ſhould alſo be deep; as one principal uſe of them is to bring the rain waters, which fall within the yards or incloſed parts, into a ſtagnant ſtate, and to let them off ſuperficially, ſo as to prevent any thing of the ground current kind from carrying away the dung, either in a bodily manner, or in a thick fluid ſtate: they may, in this way, ſuffer the more watery particles only to paſs away into reſervoirs, prepared to preſerve and keep them for future uſe. It is believed that two feet on the lower ſide, or deepeſt parts, may be taken as a mean depth; but leſs may often be quite ſufficient: and the bottoms of the waſte-water channels being laid ſix or eight inches lower than the rim of the baſons, the depth of water which they can contain is, it is concluded, not more than ſixteen or eighteen inches, when empty of manure. But it is ſuggeſted, as neceſſary to good farm management, that, ſoon after the winter's manure has been removed and cleared away, floorings of marle, or ſome other earthy fertilizing material, mixed with lime, to the thickneſs of ten or twelve inches, ſhould be ſpread out over the bottoms of the baſons or hollowed parts; by which means a rich compoſt for graſs lands may be formed at ſmall expence, on which all the offal materials of manure which can be collected, free from ſeeds of weeds, during the ſummer and autumn, ſhould be depoſited. In this manner the receptacles ſhould be filled to the brims, even though no ſtable manure were put into them during the above two ſeaſons; ſo that the winter's ſtall manures may have firm platforms to reſt upon, out of the way of water, the great evil which antiquated prejudice ſo much fears in theſe manure receptacles, as the prevention of the due maturation of their different contents.

With theſe receptacles of manure there ſhould be connected drains from the cattle-houſes, ſtalls, and farm-offices, for receiving and conveying the urine, and other liquid matters, from them to theſe baſons or receptacles; and the mouths of their outlet channels ſhould be well guarded, in order to prevent their being choaked up by the manure, when piled up to conſiderable height above them. The reſervoirs, pits, or wells, which are made before them, are always to be kept free, for the ſuperfluous water, or other liquid matters of the receptacles, to drain or filtrate into; and thence to paſs away in moiſt weather; or to be pent up in them, in dry warm ſeaſons, for the purpoſe of being thrown over the piled-up manures, for the promotion of their decay and maturation.

Where there are graſs lands lying conveniently below theſe receptacles and reſervoirs for receiving their overflowings, all the different parts of the places, where they are ſituated, may be made to ſhelve gently towards them; but where land cannot be commanded for favouring this intention, the receptacles or baſons ſhould receive no other waters than what are ſupplied to them by the atmoſphere. This regulation may eaſily be accompliſhed, ſimply by raiſing their rims a few inches higher than the ſurrounding ſurfaces, which ſhould be frequently cleared from the manure and litter dropped upon them, depoſiting all ſuch ſubſtances within their rims. The rain-water which falls, in theſe caſes, is to be conveyed to the catch-pools, or the moſt contiguous common drains. In all caſes, that which falls upon the buildings ſhould be conveyed away, without being ſuffered to paſs through the receptacles or baſons, unleſs

unleſs where liquid manure is more in demand than that of the bulky kind.

From the ſlow progreſs made by manures of this ſort to maturation, in the winter ſeaſon, in the open air, even when piled up in the drieſt ſituations, on account of its being conſtantly ſoaked or ſaturated with moiſture, and expoſed to the effects of the cold atmoſphere, the plan of giving receptacles of this ſort a long oval ſquare form, and covering them with roofs, to free them wholly from rain, as well as to defend them from cold, has been hit upon, and recommended from authority. As by thus affording the articles of manure the means of paſſing into the ſtate of fermentation, in the winter months, their putrefaction and decay would be beneficially promoted, for the uſe of the more early crops of the ſpring. But how far the advantage, gained in this way, may equal or be ſuperior to the expence of building, and extra labour in the removals of the manure, is a point which is by no means yet fully decided. And the ſuperior benefits, which have lately been derived from the uſe of manure in its more raw or freſh ſtate, render all ſuch ſchemes perhaps of leſs importance than would otherwiſe be the caſe.

As it is a matter of great conſequence to prevent the exceſſive waſte of this ſort of manure, which at preſent frequently takes place in moſt parts of the country, it has been ſuggeſted by an experienced writer, who has attended much to the ſubject, and thought a great deal upon it, that piling it in ſhallow receptacles or baſons, and conducting the liquor, when not wanted for moiſtening the piles of manure, which overflows from them, to reſervoirs or catch-pools, in order to ſtop, depoſit, and arreſt the heavier and more groſs particles that may be conveyed in it, and to provide a valuable collection of liquid manure in particular ſituations, and of rich muddy matters in others, are the moſt appropriate practical means of accompliſhing the matter, in an eaſy and cheap way, that can be adopted or had recourſe to. See Dung, Farm-*Yard*, Homestal, Manure, Reservoir, and Yard *Manure*.

RECEPTACULUM, Receptacle, in *Botany* and *Vegetable Phyſiology*, is the ſeventh, or laſt, part of fructification diſtinguiſhed by Linnæus, being the common baſis, or point of connection, of the others. (See Fructification.) It is evident that ſuch a part muſt exiſt, under ſome ſhape or other; yet the receptacle is not always diſtinguiſhed by any particular figure. In ſimple flowers it is often little more than a mere point; in compound ones it is very remarkable and important, ſerving, by its differences of ſtructure, to afford very good generic diſtinctions. The receptacle of the Daiſy, *Bellis*, is conical; that of *Chryſanthemum* convex. In *Sphæranthus* this part is very nearly globular, while in ſome ſpecies of *Centaurea* and *Carlina* it is either flat, or ſlightly concave. In *Sonchus* it is naked, deſtitute of hairs or ſcales between the florets or ſeeds; while in *Carduus* it is hairy, and in *Anthemis* variouſly ſcaly. This laſt genus differs, by the character in queſtion alone, from *Chryſanthemum*, whoſe receptacle is naked; but the character is not quite ſo natural, in this caſe, as could be wiſhed. Mr. Brown has obſerved to us, that it affords not even a certain artificial diſtinction, in the *Chryſanthemum indicum* of the gardens, Curt. Mag. t. 327; which Willdenow, like M. de Ramatuelle and profeſſor Desfontaines, has referred to *Anthemis*, becauſe they found the receptacle to be ſcaly. We are convinced they are in the right, and yet this appears to be the very ſame plant with *Chryſanthemum indicum*, the ſcales of the receptacle being variable, and ſometimes almoſt, if not altogether, evaneſcent. Some genera of this claſs have a cellular, or honeycomb-like receptacle, as *Onopordum*, and *Tolpis* (*Crepis barbata* of Linnæus). In that caſe the edges of the cells are variouſly jagged, toothed, or fringed, and they now and then are ſcarcely diſtinguiſhable from the reticulations or rugoſities of ſome naked receptacles.

The *receptacle of the flower*, in Linnæan language, means the area or ſpace between the ſtamens and ſtyles, in certain genera whoſe germen is inferior; as the whole umbelliferous order, in which the part in queſtion is more or leſs tumid, often coloured, and aſſumes a glandular aſpect. The *receptacle of the ſeeds* is not unfrequently a diſtinct part from the capſule or its valves, ſerving to connect the ſeeds therewith. (See an example of it in Reduтеа.) The *rachis*, or common ſtalk of a ſpike, or ſpikelet, in *Graſſes*, is alſo termed a receptacle.

In ſome plants the receptacle undergoes great changes, acquiring a different texture in the fruit, from what it had in the flower. Thus, the whole fruit, as we call it, of the Fig, (ſee Ficus,) is a common receptacle, at firſt coriaceous, and, like the reſt of the plant, containing a milky, ſomewhat acrid, juice. It forms a bag, lined with flowers or florets, and having a ſmall aperture at the top. After the flowers are paſt, this bag becomes pulpy, coloured, and full of ſweet aromatic juice. So the fruit of the Strawberry, (ſee Fragaria,) is but an originally ſmall dry receptacle, ſubſequently enlarged, and become pulpy, whoſe outſide is ſtudded with naked ſeeds. In *Brouſſonetia*, deſcribed under our article Papyrius, the ſeparate ſtalk of each germen becomes the enlarged and pulpy ſupporter of a naked ſeed. In Pollichia, (ſee that article,) the common receptacle of the flowers, minutely ſcaly, and hardly diſcernible, in its earlier ſtate, changes to a congeries of white, juicy, ſweet, tooth-like ſcales, elevating the ſeeds in their appropriate withered perianths, and altogether conſtituting one of the moſt extraordinary pulpy fruits that we have ever met with. A ſimilar change of ſubſtance is obſervable in the calyx of the Mulberry, as well as in *Commelina Zanonia*; a change common and natural in the germen of pulpy fruits, though rare in the particular parts of which we have been ſpeaking.

Receptaculum *Chyli*, in *Anatomy*, that portion of the trunk of the abſorbing veſſels, into which the lacteal abſorbents pour the fluids which they have taken up in the alimentary canal: it is uſually rather larger than the neighbouring portions of the veſſel, and ſometimes very conſiderably ſo. See Absorbents.

RECEPTARII, a term of reproach uſed for ſuch phyſicians as wrote pompous receipts for loads of medicines, more conſulting the good of the apothecary than the patient; as alſo for ſuch as gave receipts for general medicines, to be uſed at the diſcretion of people wholly unacquainted with the nature of diſeaſes.

RECEPTION, Receptio, in *Philoſophy*, denotes the ſame with *paſſion*, conſidered as oppoſed to *action*.

Reception is alſo properly uſed for the manner of treating or entertaining a perſon; and the ſolemnities and ceremonies practiſed on that occaſion. See Entry.

The reception of ambaſſadors is uſually performed with a great deal of pomp.

Reception is ſometimes alſo uſed for the act of approving, accepting, and admitting a thing. See Acceptance.

The canon law only binds where it is *received*: the civil law is received in ſome countries, and not in others.

The French would never *receive* the council of Trent, the Spaniſh inquiſition, nor the dogmata of the ultramontane canoniſts.

Reception,

Reception, in *Astrology*, is a dignity befalling two planets when they exchange houses; *e. gr.* when the sun arrives in Cancer, the house of the moon; and the moon, in her return, arrives in the sun's house.

The same term is also used, when two planets exchange exaltation.

RECEPTITIOUS Goods. See Goods.

RECESSION *of the Equinoxes*. See Precession *of the Equinoxes*.

RECESSUS, a word used by some medical writers to express an abscess, or aposthumation.

Recessus *Imperii, Recess of the Empire*, a phrase used in speaking of the affairs of Germany; signifying a collection of the votes or determinations of a diet.

At the end of each diet, before it breaks up, they gather together all their resolutions, and reduce them into writing; the act which contains them they call the *recessus imperii*, because made when on the point of retiring.

RECEY *sur Ousce*, in *Geography*, a town of France, in the department of the Côte d'Or, and chief place of a canton, in the district of Chatillon; 15 miles S.E. of Chatillon. The place contains 880, and the canton 5913 inhabitants, on a territory of 260 kiliometres, in 17 communes.

RECHABITES, a kind of religious order among the ancient Jews, instituted by Jonadab the son of Rechab; and comprehending his family and posterity.

Their founder prescribed them three things: first, Not to drink any wine. Secondly, Not to build any houses, but to dwell under tents. Thirdly, Not to sow any corn, or plant any vines.

The Rechabites observed these rules with great strictness, as appears from Jerem. xxxv. 6, &c. Whence St. Jerom, in his thirteenth epistle to Paulinus, calls them *monachi, monks*. Jonadab, their founder, lived under Jehoash, king of Judah, contemporary with Jehu, king of Israel; his father Rechab, from whom his posterity were denominated, descended from Raguel or Jethro, father-in-law to Moses, who was a Kenite, or of the race of Ken; whence Kenite and Rechabite are used as synonimous in scripture.

The Kenites entered the promised land with the Hebrews, and dwelt in the tribe of Judah, about the Dead sea. They were distinguished from the Israelites by their retired sort of life, and by their contempt of cities and houses. Serrurius distinguishes the ancient Rechabites descended from, and instituted by, Jethro, from the new Rechabites of Jonadab. The injunction of Jonadab laid no obligation on the other Kenites, nor on the other descendants of Jethro. This they continued to observe above 300 years. Jehu began to reign A.M. 3120, and Jehoiakim, king of Judah, was put to death A.M. 3405, B.C. 599; but in the last year of Jehoiakim, king of Judah, Nebuchadnezzar coming to besiege Jerusalem, the Rechabites were forced to take refuge in the city, still, however, lodging in tents. During this siege, Jeremiah received orders from the Lord to converse with the disciples of Rechab, to invite them into the temple, and to offer them wine to drink. But the Rechabites would not accept the offer.

The Rechabites were, probably, led captive, after the taking of Jerusalem by the Chaldæans. (See Psalm lxx.) They returned from their captivity, and settled in the city of Jabez beyond Jordan. (See 1 Chron. ii. 55.) Some have suggested, that the Assidæans of the Maccabees, (1 Macc. ii. 42. vii. 13. and 2 Macc. xiv. 6.) were successors and followers of the Rechabites. Others have confounded them with the Essenes. But it is certain, that the manner of life of the Essenes was very different from that of the Rechabites, as appears from Josephus, Antiq. lib. xviii. cap. 2. who informs us, that the Essenes had fields, and inhabited houses, but had neither wives nor children; and did not perform their religious ceremonies with the other Jews at Jerusalem: all which was contrary to the practice of the Rechabites.

RECHACING, in *Hunting*, the driving back of the deer, or other beasts, into the forests, chaces, &c. which had straggled out into the copses or thickets, &c.

Anciently there were offices of rechacers of the deers bestowed by the king on gentlemen, or old hunters, with salaries for the keeping of running dogs to rechace the deer into the forests, and then to beat the dogs off, without pursuing any farther.

RECHANGE, in *Commerce*. See Re-exchange.

Rechange is also used at sea for such tackle as is kept in reserve aboard the ship, to serve in case of failure of that already in use. See Tackle.

The Levantines use the word *respect* or *respit* in the same sense.

RECHARGE *of a Fire Arm*, is a second loading, or charge. The recharge should never be so deep as the first charge, lest the piece, being over heated, should burst.

RECHBERG, in *Geography*, a town of Austria; eight miles N.W. of Grein.

RECHE, a river of France, which runs into the Amblave, near Malmedy.—Also, a town of England, in the county of Cambridge, on the river Cam, formerly a place of great trade, and before the draining of the fens, a port for vessels of considerable burthen; five miles W. of Newmarket.

RECHEAT, in *Hunting*, a lesson which the huntsman winds on the horn, when the hounds have lost their game, to call them back from pursuing a counter-scent.

RECHENBURG, in *Geography*, a town of Saxony, in the circle of Erzgeberg; four miles S.E. of Frauenstein.

RECHIA, a town of Servia; 100 miles W. of Nissa. N. lat. 43° 12'. E. long. 19° 3'.

RECHICOURT, a town of France, in the department of the Meurthe, and chief place of a canton, in the district of Sarrebourg; five miles N. of Blamont. The place contains 992, and the canton 8516 inhabitants, on a territory of $217\frac{1}{2}$ kiliometres, in 18 communes.

RECHNITZ, a town of Hungary; six miles S.S.W. of Guntz.

RECHPERG, a town of Austria; two miles N. of Stain.

RECIMUS, among the Romans, a kind of square mantle, or veil, worn by women on the head. Salmasius will have it to have been a sort of gown used by the Roman ladies, and tucked up before with a square pin, of a purple colour.

RECINA, in *Geography*, a town of the marquisate of Ancona; three miles N.W. of Macerata.

RECIPE, in *Medicine*, a prescription, or formula, of a remedy, appointed to be administered to a patient. See Prescription.

It is thus called, because always beginning with the word *recipe, take*; ordinarily expressed by the abbreviation ℞.

RECIPIANGLE, or Recipient-angle, a mathematical instrument, serving to take the quantity of angles; used especially in the drawing plans of fortifications.

The recipiangle was formerly a popular instrument among the French, but little known among us; it is usually very simple.

ſimple, in form of a ſquare, or rather a *bevel* (which ſee); conſiſting of two arms, or branches, rivetted together, and yet moveable, like a ſector, on the centre or rivet.

To take an angle with it, they lay the centre of a protractor to the joint, and the degrees cut by the edge ſhew the quantity of the angle: otherwiſe the angle made by the two rulers is drawn on paper, and then meaſured with a protractor.

Sometimes there is a circle divided into degrees added over the centre or rivet, with an index to ſhew the degrees without a protractor. At other times the under branch is divided.

To meaſure a ſaliant angle with any of the recipiangles, apply the inſides to the lines that form the angle; for a re-entering angle, apply the outſides, &c.

RECIPIENDO Excommunicato. See Excommunicato.

Recipiendo *et faciendo attornato.* See Attornato.

RECIPIENT, in *Chemiſtry*. See Receiver.

Recipient, *Italian*, a veſſel like a tea-pot, intended for the ſeparation of eſſential oils from the watery liquor on which they float.

Recipient *of an Air-pump*. See Receiver.

RECIPROCAL, Reciprocus, ſomething that is mutual, or which is returned equally on both ſides, or affects both parties alike.

The end of human ſociety is to afford each other reciprocal aid; there are reciprocal duties between the prince and his ſubjects, the huſband and wife, &c. There is a reciprocal action between the agent and patient.

The *lex talionis* eſtabliſhes a kind of reciprocation of juſtice.

If two ſimilar triangles be cut by parallel lines, the ſections of the ſides will be proportional; and reciprocally, if the ſides be cut proportionably, the triangles are ſimilar.

Reciprocal, in *Logic*, is applied to terms which have the ſame ſignification, or are convertible; as, *reaſonable animal* and *man*.

Schoolmen define *reciprocation* a converſion of the ſeveral terms in an enunciation. And terms are ſaid to be converted in an enunciation, when the predicate is put in the place of the ſubject, and, *reciprocally*, the ſubject in that of the predicate.

Thus, rationality and riſibility are ſaid to reciprocate; for we ſay equally, *a rational is riſible*, and *a riſible is rational.*

Reciprocal, in *Grammar*, is applied to certain verbs and pronouns in ſome of the modern languages; in regard of their turning or reflecting the noun, or perſon, upon himſelf.

Thus the pronoun relative, *himſelf*, refers Cato to Cato's ſelf.

The abbé de Dangeau defines reciprocal verbs to be thoſe whoſe nominative is plural, and denotes perſons acting mutually on one another: as, *Ces quatre hommes s'entrebattoient, theſe four men fought together; Pierre et toi vous vous louez, Peter and you praiſe one another*, &c.

Reciprocal verbs are a ſpecies of thoſe which that author calls *pronominals*, and which he diſtinguiſhes into reciprocal and identical.

Reciprocal, in *Poetry*, is applied to verſes which run the ſame both backwards and forwards; called alſo *recurrents.* See Retrograde.

Reciprocal, in *Arithmetic* and *Algebra*, is the quotient ariſing from the diviſion of unity by any number or quantity. Thus, the reciprocal of $a = \frac{1}{a}$, the reciprocal of $\frac{x}{y} = \frac{y}{x}$, and ſo on.

Reciprocal *Equations*, in *Algebra*, are thoſe equations which contain ſeveral pairs of roots which are the reciprocals of each other. Thus, an equation whoſe roots are $a, \frac{1}{a}$; $b, \frac{1}{b}$; &c. is called a reciprocal equation. Some authors define reciprocal equations, to be thoſe equations whoſe co-efficients proceed in the ſame order from both extremes, and reſpectively equal to each other: thus, $x^5 + a x^4 + b x^3 + b x^2 + a x + 1 = 0$, is a reciprocal equation; but this form ought rather to be conſidered as a neceſſary property of theſe equations, by which they may be readily diſtinguiſhed, than to be employed in the definition of them; it being doubtleſs the reciprocity of the roots from which they have received their peculiar appellation.

The ſolution of theſe equations may always be made to depend upon others of half the original degree, when the equation is of even dimenſions; or upon half the dimenſion *minus* 1, when it is odd.

Thus far, in fact, this property is not excluſively due to reciprocal equations, as the ſame may be done in all caſes where any ſimilar relation is known to have place between the roots of an equation, whether by multiplication, diviſion, addition, or ſubtraction; but in theſe caſes there is nothing in the form of the equation by which ſuch relations may be known to have place, whereas in reciprocal equations their reciprocity becomes immediately obvious by the peculiar order of their co-efficient, theſe being the ſame from both extremes, both with regard to ſign and magnitude. Hence any equation of the form

$$x^m + a x^{m-1} + b x^{m-2} + \ldots . b x^2 + a x + 1 = 0$$

is immediately known to be reciprocal, and we may proceed in its ſolution as follows.

Firſt, if the equation be of odd dimenſions, as

$$x^{2n+1} + a x^{2n} + b x^{2n-1} + \ldots . b x^2 + a x + 1 = 0,$$

then it is obvious that either $+ 1$, or $- 1$, is one of its roots, for either $+ 1$, or $- 1$, ſubſtituted for x, according as the ſigns of the co-efficients may require, will obviouſly render the whole expreſſion equal to zero, and is therefore a root of the equation. The equation may, therefore, be immediately reduced to another of lower dimenſions by diviſion, according to the known theory of equations; thus, let the propoſed equation be

$$x^5 - 5 x^4 + 7 x^3 + 7 x^2 - 5 x + 1 = 0.$$

Here $x = - 1$ is obviouſly one of the roots, as this ſubſtituted for x renders the whole equal to zero; and conſequently the whole equation is diviſible by $x + 1$, according to the known theory of equation, which diviſion being made, we have, for our reduced equation,

$$x^4 - 6 x^3 + 13 x^2 - 6 x + 1 = 0,$$

which is now of even dimenſion one degree leſs than the original equation, and ſtill reciprocal. We need, therefore, only conſider equations of the latter form; *viz.* thoſe of which the index of the higheſt power is an even number.

Let $x^{2n} + p x^{2n-1} + q x^{2n-2} + \text{\&c.}\ q x^2 + p x + 1 = 0$ be any reciprocal equation, whoſe roots are $a, \frac{1}{a}$; $b, \frac{1}{b}$;

c,

$c, \frac{1}{c}$, &c. Then from the theory of equations we may consider this to be made up of the factors $(x - a)\left(x - \frac{1}{a}\right)$ $(x - b)\left(x - \frac{1}{b}\right)(x - c)\left(x - \frac{1}{c}\right)$, &c.

Or, putting $a + \frac{1}{a} = m$, $b + \frac{1}{b} = n$, $c + \frac{1}{c} = r$, &c. these become

$$(x^2 + m x + 1)(x^2 + n x + 1)(x^2 + r x + 1), \text{ \&c.}$$

If, therefore, we really perform this multiplication, and equate the co-efficients, it is obvious, since the multiplication is reduced to half the number of factors, the equation by which the values of m, n, r, &c. are obtained, will be of only half the dimension of the original equation; and having found these, since

$$x^2 + m x + 1 = 0$$
$$x^2 + n x + 1 = 0$$
$$x^2 + r x + 1 = 0$$

we shall have $x = -\frac{m}{2} \pm \sqrt{\left(\frac{m^2}{4} - 1\right)}$

$$x = -\frac{n}{2} \pm \sqrt{\left(\frac{n^2}{4} - 1\right)}$$

$$x = -\frac{r}{2} \pm \sqrt{\left(\frac{r^2}{4} - 1\right)}, \text{ \&c.}$$

Thus, for example, let there be proposed the equation

$$x^4 + 5 x^3 + 7 x^2 + 5 x + 1 = 0.$$

Multiply together $x^2 + m x + 1$
and $x^2 + n x + 1$

$$x^4 + \left.\begin{matrix} m \\ +n \end{matrix}\right\} x^3 + \left.\begin{matrix} m n \\ +2 \end{matrix}\right\} x^2 + \left.\begin{matrix} m \\ +n \end{matrix}\right\} x + 1$$

Comparing the co-efficients, we have $m + n = 5$, and $m n + 2 = 7$.

Hence, $m = \frac{5 + \sqrt{5}}{2}$, and $n = \frac{5 - \sqrt{5}}{2}$

therefore, $x = \frac{5 + \sqrt{5}}{4} \pm \sqrt{\left(\frac{30 + 10\sqrt{5}}{16} - 1\right)}$

and $x = \frac{5 - \sqrt{5}}{4} \pm \sqrt{\left(\frac{30 - 10\sqrt{5}}{16} - 1\right)}$

which are the four roots of the proposed equation.

From the preceding principles are readily deduced the solution of all reciprocal equations under the 10th power.

3d degree. $x^3 + p x^2 + p x + 1 = 0$.

Find z in the simple equation $z + p - 1 = 0$, and call it r; then

$$x = -1,\ x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)}$$

4th degree. $x^4 + p x^3 + q x^2 + p x + 1 = 0$.

Find the two values of z in the equation $z^2 + p z + q - 2 = 0$, and call them r, r'; then

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)},\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$

5th deg. $x^5 + p x^4 + q x^3 + q x^2 + p x + 1 = 0$.

Find the two values of z in the equation $z^2 + (p - 1) z + q - p - 1 = 0$, and call them r, r'; then $x = -1$

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)},\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$

6th deg. $x^6 + p x^5 + q x^4 + r x^3 + q x^2 + p x + 1 = 0$.

Find the three values of z in the cubic equation $z^3 + p z^2 + (q - 3) z + r - 2p = 0$, and call them r, r', r''; then

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)}\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$
$$x = \tfrac{1}{2} r'' \pm \sqrt{(\tfrac{1}{4} r''^2 - 1)}$$

7th deg. $x^7 + p x^6 + q x^5 + r x^4 + r x^3 + q x^2 + p x + 1 = 0$

Find the three values of z in the cubic equation $z^3 + (p - 1) z^2 + (q - p - 2) z + r - p - q + 1 = 0$, and call them r, r', r''; then $x = -1$

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)};\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$
$$x = \tfrac{1}{2} r'' \pm \sqrt{(\tfrac{1}{4} r''^2 - 1)}$$

8th deg. $x^8 + p x^7 + q x^6 + \ldots\ q x^2 + p x + 1 = 0$.

Find the four values of z in the equation $z^4 + p z^3 + (q - 4) z^2 + (r - 3p) z + s - 2(q - 1) = 0$, and call them r, r', r'', r'''; then

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)};\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$
$$z = \tfrac{1}{2} r'' \pm \sqrt{(\tfrac{1}{4} r''^2 - 1)};\ x = \tfrac{1}{2} r''' \pm \sqrt{(\tfrac{1}{4} r'''^2 - 1)}$$

9th deg. $x^9 + p x^8 + q x^7 + \ldots\ q x^2 + p x + 1 = 0$.

Find the four values of z in the equation $z^4 + (p - 1) z^3 + (q - p - 3) z^2 + (r - q - 2p + 2) z + s - r - q + p + 1 = 0$, and call them r, r', r'', r'''; then $x = -1$

$$x = \tfrac{1}{2} r \pm \sqrt{(\tfrac{1}{4} r^2 - 1)};\ x = \tfrac{1}{2} r' \pm \sqrt{(\tfrac{1}{4} r'^2 - 1)}$$
$$x = \tfrac{1}{2} r'' \pm \sqrt{(\tfrac{1}{4} r''^2 - 1)};\ x = \tfrac{1}{2} r''' \pm \sqrt{(\tfrac{1}{4} r'''^2 - 1)}$$

A reciprocal equation of the 10th and higher powers, requires the general solution of equations of the 5th and higher powers, and therefore cannot be exhibited analytically. Bonnycastle's Algebra, vol. i.

Binomial equations are all reciprocal equations of a peculiar kind, which renders them all resolvable by means of certain trigonometrical formulæ.

Binomial equations are all reducible to the form $x^m \pm 1 = 0$; or $x^m = 1$; or $x^m = -1$. Where it is obvious, that if m is even, or $m = 2n$, then $x^{2n} = 1$ will have two real roots, *viz.* $+1$, and -1; and $x^{2n} = -1$ will have two of its imaginary roots $+\sqrt{-1}$, and $-\sqrt{-1}$; so that, in both cases, such an equation may be reduced two degrees lower, by dividing it by $x^2 - 1$, or $x^2 + 1$, and the resulting equation will be a reciprocal one, having each of its co-efficients equal to unity. If m be odd, then the equation will necessarily have one real root, and no more, which will be $+1$ in the first case, and -1 in the second; consequently, such an equation can be reduced but one degree, the same as those above stated. We may, therefore, find a direct solution for all binomial equations of odd dimensions as far as the 9th power, and of even dimensions as far as the 10th power, by the principles and formulæ already given, by merely making $p = 1$, $q = 1$, $r = 1$, &c. and it would, therefore, be useless to repeat them again in this place; we shall proceed immediately to the general solution of binomial equations, on the principles of analytical trigonometry.

All the imaginary roots of the equation

$$x^n - 1 = 0$$

are

are contained in the general formula

$$x^2 - 2 \text{ cos. } \frac{2 k \pi}{n} x + 1 = 0;$$

k being any integer not divisible by n, and π representing the semi-circumference. For it is a known trigonometrical property, that if

$$2 \text{ cos. } y = x + \frac{1}{x}, \text{ then } 2 \text{ cos. } n y = x^n + \frac{1}{x^n};$$

from which two equations we readily draw the two following; *viz.*

$$x^2 - 2 \text{ cos. } y \cdot x + 1 = 0$$
$$x^{2n} - 2 \text{ cos. } n y \cdot x^n + 1 = 0$$

which have necessarily one common root, being both derived from the same value of x; and since these are both reciprocal equations, if x be one root, $\frac{1}{x}$ will be another; they have therefore two roots common, and consequently, from the known theory of equations, the former is a divisor of the latter. If, now, we make $y = \frac{2 k \pi}{n}$, or $n y = 2 k \pi$, these equations become

$$x^2 - 2 \text{ cos. } \frac{2 k \pi}{n} x + 1 = 0$$
$$x^{2n} - 2 \text{ cos. } 2 k \pi x^n + 1 = 0$$

But the cos. $2 k \pi = 1$, 2π representing the whole circumference; therefore the latter equation is the same as

$$x^{2n} - 2 x^n + 1 = 0, \text{ or } (x^n - 1)^2 = 0,$$

having still for its divisor

$$x^2 - 2 \text{ cos. } \frac{2 k \pi}{n} x + 1 = 0;$$

that is, the roots of the equation

$$(x^n - 1)^2 = 0, \text{ or } x^n - 1 = 0,$$

are all contained in the general formula

$$x^2 - 2 \text{ cos. } \frac{2 k \pi}{n} x + 1 = 0;$$

and, therefore, by giving to k the successive values 1, 2, 3 . . . . $\frac{1}{2}(n - 1)$, the following formulæ will be obtained; *viz.*

$$x^2 - 2 \text{ cos. } \frac{2 \pi}{n} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{4 \pi}{n} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{6 \pi}{n} x + 1 = 0$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$x^2 - 2 \text{ cos. } \frac{(n - 1) \pi}{n} x + 1 = 0$$

which contain among them all the imaginary roots of the equation $x^n - 1 = 0$.

And if, instead of making $y = \frac{2 k \pi}{n}$, as above, we make $y = \frac{(2 k + 1) \pi}{n}$, our second formula becomes

$$x^{2n} + 2 x^n + 1 = 0, \text{ or } (x^n + 1)^2 = 0;$$

because cos. $(2 k \pi + \pi) = -1$. Consequently, the equation $x^n + 1 = 0$, or $x^n = -1$, will have for its general factor

$$x^2 - 2 \text{ cos. } \frac{(2 k + 1) \pi}{n} x + 1 = 0;$$

which, by substituting for k as above, becomes

$$x^2 - 2 \text{ cos. } \frac{1 \pi}{n} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{3 \pi}{n} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{5 \pi}{n} x + 1 = 0$$

&c. &c. &c.

which formulæ contain all the imaginary roots of the binomial equation $x^n + 1 = 0$.

Suppose, for example, all the imaginary roots of the binomial equation $x^{11} - 1 = 0$ were required.

Here we should have

$$x^2 - 2 \text{ cos. } \frac{360^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{2 \cdot 360^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{3 \cdot 360^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{4 \cdot 360^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{5 \cdot 360^\circ}{11} x + 1 = 0$$

whence,

$$x = \text{cos. } \frac{360^\circ}{11} \pm \sqrt{\left(\text{cos.}^2 \frac{360^\circ}{11} - 1\right)}$$
$$x = \text{cos. } \frac{720^\circ}{11} \pm \sqrt{\left(\text{cos.}^2 \frac{720^\circ}{11} - 1\right)}$$
$$x = \text{cos. } \&c. \qquad \&c.$$

And if the roots of $x^{11} + 1 = 0$ were required, we should have from the second general formula

$$x^2 - 2 \text{ cos. } \frac{180^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{3 \cdot 180^\circ}{11} x + 1 = 0$$
$$x^2 - 2 \text{ cos. } \frac{5 \cdot 180}{11} x + 1 = 0$$

&c. &c.

Whence,

$$x = \text{cos. } \frac{180^\circ}{11} \pm \sqrt{\left(\text{cos.}^2 \frac{180^\circ}{11} - 1\right)}$$
$$x = \text{cos. } \frac{540^\circ}{11} \pm \sqrt{\left(\text{cos.}^2 \frac{540^\circ}{11} - 1\right)}$$
$$x = \text{cos. } \&c. \qquad \&c.$$

For more on this subject, see Barlow's Theory of Numbers, Bonnycastle's Algebra, and our article POLYGON.

RECIPROCAL *Figures*, in *Geometry*, are such as have the antecedents and consequents of the same ratio in both figures. See *Plate* XII. *Geom. fig.* 2. Here

A : B :: C : D, or,
12 : 4 :: 9 : 3

That

That is, as much longer as the fide A, in the firft rectangle, is than the fide B of the fecond rectangle; fo much deeper is the fide C in the fecond rectangle, than the fide D in the firft; and, confequently, the length of one is compenfated by the depth of the other.

Alfo, as the fide A is $\frac{1}{4}$ longer than the fide C, fo the fide B is $\frac{1}{4}$ longer than D: wherefore the rectangles muft be equal.

This is the foundation of that Catholic theorem; that the rectangle of the extremes muft always be equal to that of the means; and, confequently, the reafon of the rule of three, or golden rule.

For, fuppofe there were given any three numbers, or quantities, geometrically proportional, as A, B, and C; and, that it were required to find a fourth, D, proportional to them: fince $A : B :: C : D$, therefore $A D = B C$, and, confequently, $D = \frac{B C}{A}$; that is, the fourth term is equal to the quotient of the fecond, multiplied by the third term, divided by the firft.

Or, thus in numbers: fuppofe given 12, 4, and 9, required a fourth proportional. Now as $12 : 4 :: 9 : Q$. But $12 Q = 4 \times 9 = 36$. Therefore $Q = \frac{4 \times 9}{12} = 3$, by dividing both fides by 12.

And hence it follows, that if any two triangles, parallelograms, prifms, parallelepipeds, pyramids, cones, or cylinders, have their bafes and altitudes reciprocally proportional, thofe two figures or folids are equal to one another, and, *vice verfâ*, if they are equal, their bafes and altitudes are reciprocally proportional.

Reciprocal *Proportion*, is when in four numbers the fourth is lefs than the fecond by fo much as the third is greater than the firft; and *vice verfâ*. See Proportion.

This is the foundation of the inverfe, or indirect rule of three. Thus, $4 : 10 :: 8 : 6$.

Great ufe is made of this reciprocal proportion, by fir Ifaac Newton, and others, in demonftrating the laws of motion.

Reciprocal *Theorem*. See Theorem.

RECIPROCALLY, the property of being reciprocal; thus we fay, that in bodies of the fame weight, the denfity is reciprocally as the magnitude; *viz.* the greater the magnitude the lefs the denfity; and the lefs the magnitude the greater the denfity; fo again, the fpace being the fame, the velocity is reciprocally as the time, and the contrary.

RECIPROCITY. The law of reciprocity is a term ufed by Legendre, in his "Theorie des Nombres," to denote a reciprocal law, which has place between prime numbers of different forms; which is this; that m and n being prime odd numbers,

$$\text{the remainder of } m^{\frac{n-1}{2}} \div n =$$

$$\text{the remainder of } n^{\frac{m-1}{2}} \div m$$

provided m and n are not both of the form $4x - 1$, and if they are both of this form, then

$$\text{the remainder of } m^{\frac{n-1}{2}} \div n = -$$

$$\text{the remainder of } n^{\frac{m-1}{2}} \div m,$$

or they will have only contrary figns.

RECISSION, in *Law*. See Ademption.

RECIT, Fr, a generical term in mufic, for what is fung by a fingle voice. It is likewife applicable to inftruments; as, *recit de baffe, recit de hautbois,* a folo part for the violoncello or hautbois. Indeed *recit*, in French, feems fynonimous with the word folo in Italian, to whatever vocal or inftrumental part it is applied, in oppofition to *tutti*, or chorus, in which the whole band is employed.

Recit in France is not only a technical term in mufic, but in the drama, where, at the opening of a tragedy, or fubfequent to an event, it implies an account, a narration, the recital of an event. In the French and Italian tragedies, in imitation of the Greeks, battles and murders are always recited, but never tranfacted on the ftage.

RECITAL, in *Law*, the rehearfal, or making mention, in a deed or writing, of fomething which has been done before.

A recital is not conclufive, becaufe it is no direct affirmation; and by feigned recitals in a true deed, men might make what titles they pleafed, fince falfe recitals are not punifhable. If a perfon, by deed of affignment, recite that he is poffeffed of an intereft in certain lands, and affign it over by the deed, and become bound by bond to perform all the agreements in the deed; if he is not poffeffed of fuch intereft, the condition is broken; and though a recital of itfelf is nothing, yet being joined and confidered with the reft of the deed, it is material. And where it is but a recital, that before the indenture the parties were agreed to do fuch a thing, it is a covenant, and the deed itfelf confirms it. The recital of one leafe in another, is not a fufficient proof that there was fuch a leafe as is recited. But the recital of a leafe in a deed of releafe, is good evidence of a leafe againft the releffor, and thofe who claim under him. A new reverfionary leafe fhall commence from the delivery, where an old leafe is recited, and there is none, &c. A. recites that he hath nothing in fuch lands, and in truth he has an eftate there, and makes a leafe to B. for years; the recital is void, and the leafe good. In this cafe, if the recital were true, the leafe would not bind.

RECITATION, the act of reciting, or delivering a difcourfe, either in the way of narration, rehearfal, declamation, or the like.

RECITATIVO, Ital., *Recitative.* The Crufca Dictionary gives no more early authority for the ufe of this word, as a mufical term, than that of Batifta Doni, de Præft. Muf. Veteris, publifhed in 1647; who defines it, "a mufical compofition in an andante or plain ftyle, different from air: it is ufed in narrative poetry, in imitation of reciting on the ftage."

Rouffeau's definition is more full and clear. He terms it "a difcourfe, or fpeech, in mufical and harmonical tones. It is a melody nearly approaching to common fpeech; a mufical declamation, in which the mufician ought to imitate, as much as poffible, the inflexions of voice in declaiming. This melody is called recitative, becaufe it refembles a narration, a recital; and is ufed in the dialogue of mufical dramas."

We have prefented our readers, under the article Opera, with extracts from the prefaces of the poets and compofers by whom recitative was invented, as well as from contemporary writers, who thought its origin of fufficient importance to be recorded.

Giovanni Batifta Doni, about the middle of the 17th century, (Op. Omn. tom. ii. in Firenze, 1763, folio,) a learned and elegant writer on mufic, though extremely warped in his judgment by a predilection for the mufic of the ancients, in a differtation on the Origin of Stage-finging, during his own time, gives fo curious and inftructive an account of the firft operas that were performed at Florence, that we fhall tranflate a part of it.

"Some kind of *cantilena*, or melody, has been introduced in in dramatic reprefentations, at all times, either in the form of intermezzi (interludes), between the acts; or, occafionally, in the body and bufinefs of the piece. But it is ftill frefh in the memory of every one, when the whole drama was firft fet to mufic, and fung from the beginning to the end."

The revival of theatrical mufic was brought about by the invention of recitative, as we have already ftated in our article Opera.

"The beginning of this century (1600) was the era of mufical recitation on the public ftage at Florence, though it had been ufed there in feveral private exhibitions before. There refided in that city, during thefe times, fignor Gio. Bardi de' Conti di Vernio, who was afterwards called to the fervice of pope Clement VIII., by whom he was tenderly beloved, and made his maeftro di camera. This moft accomplifhed nobleman was particularly attached to the ftudy of antiquity, and to the theory and practice of mufic, to which he had applied himfelf for many years fo clofely, that he became, for the time in which he lived, a correct and good compofer. His houfe was the conftant rendezvous of all perfons of genius, and a kind of flourifhing academy, where the young nobility often affembled to pafs their leifure hours in laudable exercifes and learned difcourfe; but particularly on mufical fubjects, when it was the wifh of all the company to recover that art of which the ancients related fuch wonders, as well as other noble inventions, which had been ruined by the irruptions of barbarians.

"During thefe difcuffions, it was univerfally allowed that as modern mufic was extremely deficient in grace, and the expreffion of words, it became neceffary, in order to obviate thefe objections, that fome other fpecies of cantilena, or melody, fhould be tried, by which the words fhould not be rendered unintelligible, nor the verfe deftroyed."

Euridice was the firft mufical drama after the invention of recitative. It was written by Ottavio Rinuccini, fet by Jacopo Peri, and performed at Florence in 1600, on occafion of the marriage of Mary of Medicis with Henry IV. of France. The poem and the mufic were publifhed feparately the fame year. The poet, in his dedication to the queen of France, fays, "It is generally imagined that the tragedies of the ancient Greeks and Romans were entirely fung; but this noble kind of finging had not till now been revived, or even attempted, to my knowledge, by any one; and I ufed to think, that the inferiority of our mufic to that of the ancient was the caufe; till hearing the compofitions of Jacopo Peri to the fable of Daphne, I wholly changed my opinion. This drama, written merely as an experiment, pleafed fo much, that I was encouraged to produce Euridice, which was honoured with ftill more applaufe, when fung to the mufic of the fame compofer Jacopo Peri, who with wonderful art, unknown before, had merited the favour and protection of the grand duke our fovereign, it was exhibited in a moft magnificent manner at the nuptials of your majefty, in the prefence of the cardinal legate, and innumerable princes and nobles of Italy and France."

Such is the abridged hiftory of recitative. The only printed copy of the mufic to this primitive opera was in the library of the marchefe Rinuccini, a defcendant of the poet at Florence: in examining and making extracts from which, we obferved that it was printed in fcore, and barred; two very uncommon circumftances at the time of its publication; that the recitative feemed to have been not only the model of fubfequent compofers of early Italian operas, but of the French operas compofed by Lulli, a native of Florence; and that the time was as frequently changed as in the old French operas.

The confufion arifing from all the parts finging different words at the fame time, together with fome other circumftances, mentioned under Opera, account for the neceffity of a recitative, or a *mufica parlante*, a fpeaking mufic, and for folo finging in general on the ftage: befides, poetry was injured, and rendered unintelligible in fugues, canons, and in chorufes, full of imitations and contrivances, all unfit for narration and dialogue.

To defcribe the characteriftic difference of recitative from air, and common fpeech: it is not air, as no time is kept; it is not fpeech, as every inflexion of voice is in tune with fome one note of the inftrument by which it is accompanied; and as to the length or fhortnefs of the notes that are written, the accompanier watches for the accents or termination of phrafes, or lines in the verfe, to give the chord to which the note that is fung belongs.

It is fometimes accompanied by the orcheftra with *ritornelli*, or interftitial fymphonies; but then a regular time muft be kept. This only happens in folemn fcenes of dignity or diftrefs, and in foliloquies.

No flats or fharps are placed at the clef in recitative: thefe are all regarded as accidental; nor is Italian recitative ever confined to any one key.

After recitative was found, it was long ere any thing like an air appeared in thefe mufical dramas. (See Opera, Air, Motivo, and Measure.) Rouffeau has treated the article recitative at large, with great intelligence and good tafte.

Recitative *Style*, is the way of writing accommodated to this fort of mufic.

RECIV, La, in *Geography*, a well-fortified town of Brafil, in the jurifdiction of Fernambuco.

RECKENITZ, a river which feparates the duchy of Mecklenburg from Pomerania, and runs into a lake, which communicates with the Baltic near Ribnitz.

RECKHEIM, or Rekum, a town of France, in the department of the Lower Meufe, which gives name to a county, fituated on the W. fide of the Meufe, and furrounded by the bifhopric of Liege; 7 miles N. of Maeftricht.

RECKLING, in *Rural Economy*, a provincial word, fignifying the laft of the farrow or brood of pigs, poultry, or other forts of domeftic birds.

RECKLINGHAUSEN, in *Geography*, a town of Germany, fortified by a caftle, and capital of a county of the fame name, which is fituated between the bifhopric of Munfter, the duchy of Cleves, and the county of Mark; 16 miles S.S.W. of Munfter.

RECKON, in *Rural Economy*, a term fometimes applied to a pair of pot-hooks of a certain make, occafionally employed in dragging wells, ponds, &c.

RECKONING, in *Navigation*, the act of eftimating the quantity of a fhip's way; or of the diftance run between one place and another.

Or, more generally, a fhip's reckoning is that account, by which at any time it may be known where the fhip is, and on what courfe or courfes fhe is to fteer to gain her port. See Log-*Board*, Log-*Book*, and Journal.

This is ufually performed by means of the log-line; the manner of applying which, fee under its proper article, Log-*Line*.

Yet this is liable to great irregularities. Vitruvius advifes an axis to be paffed through the fides of the fhip, with two large heads projecting out of the fhip, in which are to be included wheels touching the water, by whofe revolution the fpace paffed over in any given time may be meafured. The fame has fince been recommended by Snellius; but

but there are few who have written of navigation, that have not ſhewn the inſufficiency of this method.

Reckoning, *Dead.* See Dead *Reckoning.*

RECKSON, in *Geography*, a town of Bengal; 6 miles E. of Calcutta.

RECLAIMING, or Reclaming, in our *Ancient Cuſtoms*, the action of a lord purſuing, proſecuting, and recalling his vaſſal, who had gone to live in another place, without his permiſſion.

Reclaiming is alſo uſed in a ſimilar ſenſe, for the demanding of a perſon or thing to be delivered up, or ſurrendered, to the prince or ſtate it properly belongs to; when, by any irregular means, it has come into the poſſeſſion of another.

Reclaiming, in *Falconry*, is the calling of a hawk, or bird of prey, back to the fiſt.

The ſparrow-hawk, gos-hawk, &c. are reclaimed with the voice; the falcon only by ſhaking the lure. So that the term luring, with regard to the falcon, is more proper than reclaiming.

The partridge is alſo ſaid to reclaim her young ones, when ſhe calls them together upon their ſcattering too much from her.

Reclaiming is alſo uſed for taming animals that are wild by nature.

Reclaiming, in a monaſtic ſenſe. See Religious.

Reclaiming *Lands*, in *Agriculture*, the buſineſs of reſtoring and bringing them into a ſtate of cultivation and improvement. There are various kinds and ſtates of land, which admit of this ſort of amelioration and improvement; as among the wet ſorts, all thoſe of the bay or eſtuary deſcription, which are waſhed and occaſionally covered by the ſea or other waters; different deſcriptions of fen lands, and thoſe of the more firm marſhy nature, and thoſe in more interior ſituations, which are of a looſe ſwampy or watery quality, as moraſſes and boggy grounds. And among thoſe of the more dry, hard, waſte, and wild deſcriptions; all the varieties of the rough ſtony ſorts of unimproved lands; the many different kinds of rough woody grounds; and the numerous ſorts of moory lands, as well as other varieties, which are now and then to be met with in particular circumſtances and ſituations.

The firſt of the wet or watery ſorts of land, noticed above, are far from being always ready, or in a ripe ſtate for admitting improvement of this nature; yet in different ſituations and circumſtances, they occaſionally permit of its being accompliſhed, without any great difficulty or trouble. See Embankment, and Embanking *againſt the Sea.*

The fenny and marſhy lands, where, in the former, they are wholly or only in a partial manner overgrown by uſeleſs aquatic plants; and in the latter, are become ſo firm as to bear paſturing ſtock, and to afford nutritious herbage for their growth and ſupport, but are notwithſtanding ſtill liable to be overflowed by high tides, or land floods; are, of courſe, capable of very great improvement in the above ways, as well as by many other means. See Fen, Fenny *Land*, Marsh *Land*, and Salt *Marſh.*

Theſe ſorts of watery lands are not incident to the flat bays and inlets of the ſea-coaſts, or the mouths of the large rivers, in a particular manner; but are met with in the more inland ſituations of the country, accompanying the larger rivers and waters in the more central parts of the kingdom: conſequently ſuch ſorts of improvement muſt be very extenſive in their nature, and of very great importance to the nation.

The other kinds of ſwampy watery lands, which are liable to be covered with that fluid during wet ſeaſons; thoſe on the ſides of lakes and ponds; the moraſſes which are choaked and grown up with aquatic vegetables, ſo as to have ſome ſort of hardiſh cruſt formed upon them; and the ſoft boggy lands, formed in ſomewhat ſimilar ways, are all capable of allowing great improvement, by ſuitable draining, and other methods of management. See Spring and Surface *Draining*, Swamp, Bog, and Morass.

Lands of the above kinds are moſtly met with on the lower ſlopes, or at the feet of hilly grounds; being cauſed by the ſtagnation of water in their internal parts, which has the effect of chilling and rendering them too moiſt for the production of a nutritious and uſeful herbage, as well as of promoting the growth of coarſe plants of the aquatic nature, though their ſituations may occaſionally have ſome degree of relative height.

There are many valuable tracts of land of theſe kinds, in many different parts of the iſland, which have been already reclaimed by theſe methods of proceeding; which ſhould have the effect of ſtimulating the owners of ſuch lands in other places, where they ſtill remain unimproved, to exert themſelves in getting them reclaimed.

Among the more dry kinds of unreclaimed lands, the firſt, or thoſe of a rough, ſtony, waſte quality, are all thoſe in the vallies of hilly or mountainous tracts, on the ſkirts or lower parts of mountainous heights, and the rough ſtony lands, fit for cultivation, in other ſituations. They are the moſt readily reclaimed and improved, in the leſs hilly ſorts of lands and ſituations. In ſome caſes, where the ſurfaces of the ground were in a great meaſure covered by large rocks and ſtones of great ſizes, very hard in their qualities, and of ſcarcely any value, the lands have been reclaimed, and brought into an arable ſtate, and let for high rents: the ſtones which were removed paying, in a great degree, the expences of the labour; they being exported and ſold as paving-ſtones, and for other uſes to the metropolis. And though this cannot always be done, it ſhews what is capable of being performed by induſtry and perſeverance; and that, where ſurface ſtones can be turned to uſeful purpoſes, the moſt rugged and barren lands may be reclaimed with advantage, under proper modes of management. In ſuch inſtances, inſtead of leaving the ſurfaces of the grounds in worſe ſtates than they were before, by being taken up with pits, and heaps of uſeleſs rubbiſh, which buried the better moulds, as is common in working ſuperficial quarries, the pits and other hollows were levelled, and filled up to ſome height, with the coarſe and rubbiſh materials produced in the courſe of the works, and the finer mould from other parts thrown back upon the above ſub-ſoil materials, ſo as to form an even top-ſoil; the larger ſpaces of the ground being trenched over to a good depth, leaving the beſt ſoil on the ſurface. It is ſuggeſted, that by following ſimilar eaſy methods of management, in carrying on other undertakings of the ſame kind, lands of a value in proportion to that of the materials which are removed, may commonly be *created*, without incurring any very great expence. Hence it is thought to behove thoſe who have the direction and management of landed eſtates, that comprehend grounds of theſe ſorts, to examine and conſider well whether the ſtony materials which they contain, and encumber their ſurfaces, cannot be turned or converted to ſome profitable purpoſe, by the means of roads, iron railways, canals, or ſome other eaſy mode of conveyance for ſuch heavy ſubſtances.

It muſt be noticed, however, that the method of levelling and trenching over the lands by the ſpade, in ſuch circumſtances, can only be practiſed in a very few caſes, where labour is particularly cheap.

There is another deſcription of ſtony lands, of a much leſs lefs formidable nature, which frequently ftands in need of being reclaimed, and in which the furface is lefs encumbered than the interior parts of the foil. In thefe cafes, the interrupting materials are rather large ftones than rocks, though the latter may fometimes in part form them. The means which are beft fuited to the bringing of thefe into a profitable ftate of cultivation, are to be found in the more northern parts of the ifland, in the practice and exertions of particular fpirited individuals. The plan of the improvement is perfectly fimple, but it is expenfive in its performance; the whole of the lands being trenched over, by means of the fpade, to a proper depth, as from one to two feet. The ftones which are not wanted for ufe are thrown into pits, and the hollow parts, to contribute to their being made level, and fometimes into the deep trenches formed in digging, being firft covered over with the worft of the earthy materials, upon which the better moulds and turfy fubftance, which are ftirred in the work, are fpread out as a foil, by which the whole is rendered very fuitable for agricultural purpofes.

The coft of reclaiming lands in this way depends, in fome meafure, on the caft of furface in the lands, the nature of the interrupting matters, and the depth of the earthy fubftances to be removed, in raifing a fufficiency of mould for forming the furface foil: but from five to twenty pounds the acre may be confidered as the limits of the charges.

And this, it is fuppofed, leaves an ample profit in the fale of fuch lands, or otherwife, in thefe fituations where tythes are not taken, and where the rates and taxes are fo very few and trifling, and where labour and living is fo cheap. It can now, however, be done in this manner in but few inftances, as has been already noticed.

It is, notwithftanding, believed that there are very many lands, not only in thefe northern parts, but in England and Wales, that would more than repay the expences of this fpirited mode of improvement. It may be remarked, that where the ftones are very large, or where fragments of rocks are met with, in thefe undertakings, they may be got rid of either by blafting, or rending their upper parts, or by finking them in the foil, fo as to allow the plough to pafs over them with fafety.

The former method is more fuited to the foft forts of ftones; the latter to thofe of the harder kinds.

Such rocky grounds as are common in hilly and mountainous fituations, which, on account of their climate, and the compact nature of the rocky materials, as well as their quantity, are incapable of being cleared as corn-lands, or fo as to admit the plough, may often be reclaimed and improved as pafture lands for fheep, &c. or fometimes as hay lands. The plan of proceeding, in thefe cafes, is that of removing the ftony matter from the furface, and allowing it entirely to the growth of graffy herbage; the means of accomplifhing which are fimilar to thofe already noticed, but the coft confiderably lefs: the main intention here being merely the fmoothing of the furface ground, for the purpofes of pafturing or mowing; but the more the ftony fubftances are covered with good earthy mould, the better and greater will be the quantity of produce. See TILLAGE.

There are many rough woody tracts of ground, of the fhrubby or other kinds, which may be cleared and reclaimed with vaft advantage to their proprietors, as well as the community in general, as corn-lands, or for other ufes. The moft ufual method of accomplifhing this fort of improvement has been to dig out the whole of the roots, whether of low woods or timber woods, at the time of removing the tops, fo as to admit the plough immediately. In performing this in this way, however, where the ftools are of the timber kind, numerous and large, deep breaking of the ground is often neceffary, which is laborious and expenfive; and rotten wood, mould, leaves, and other furface matters, are apt to be left in mixture with the infertile or poifonous fub-ftrata. As lands, cleared and reclaimed in this manner, have been known to remain in a *raw* unprofitable condition, for feveral years, although limed, dunged, and raifed in fharp ridges, in order to its amelioration.

This improper practice has confequently been highly difadvantageous, injurious, and ruinous, and thrown much difficulty and interruption in the way of clearing and reclaiming fuch wafte lands for the growth of corn, however fuitable they may be for the purpofe in the nature of their foils and fituations, thereby tending to propagate and fupport the notion, that fuch forts of land will not repay the expences and trouble of being improved.

But from attending to what has naturally happened to the cleared parts of wood-lands, it will be feen that a depth of fertile mould, refting on lefs fertile fubftances, form a regular foil and fub-foil, which are free from the roots of trees, ready to receive the plough, and afford corn crops in due fucceffion. This is fuppofed to take place fomewhat in this way. The trees having been fuffered to become decayed, or more properly cut down in due feafon, and the brufh or underwood cut and cleared away from time to time by the occupiers, while fuch commons or other places were fully or too much ftocked with cattle and fheep, the young fhoots were of courfe browzed off and nibbled away quite to the ftumps, confequently weakened, and at length finally deftroyed. The roots and other parts foon followed this courfe, and paffed into a ftate of vegetable mould, increafing and enriching the foil at the fame time. Nay, this may, in the natural ftate, it is fuppofed, be, in fome meafure, effected alone by the grazing animals, as it is effential to their exiftence.

This natural procefs, however affifted in this way, is flow, requiring a length of time for its completion; yet by proper means of art, well applied, it may be accomplifhed in a few years; the larger roots being extracted from the ground, inftead of waiting for their reduction by a flow decay, without any unneceffary difturbance of the fub-foil; and then filling in the pits by the roughneffes of the natural furface: by which means the cleared ground will be fmoothed, and made fit in due time for being cultivated. Where the furface is much incumbered with leaves and rotten woody matters, they are to be raked up, and put into heaps to decay; or they may be burnt, and the afhes fpread out over the furface of the land. Proper draining and further levelling muft likewife take place, where neceffary; as well as harrowing or hacking the furface fward, fo as to fow it with proper grafs feeds; again raking off any rubbifh that may arife, and then rolling the whole quite fmooth for mowing. It fhould be ftocked hard, efpecially with fheep, mowing off occafionally any woody fhoots that may be permitted to arife; keeping the whole in the ftate of clofe pafturage, until the fmaller roots, which were left, be fo decayed as to become obedient to the plough-fhare. At this period, but not before, fuch pafture ground may be broken up for grain crops in proper fucceffion.

The procefs might be haftened by the ufe of lime, or other calcareous matters in union with the vegetable fubftances which were removed, as they would be fooner diffolved or reduced, and the compoft be more rich. And by fpreading them out on the land a fimilar effect might be produced, and a finer fort of herbage be encouraged, which would caufe a clofer bite, and fooner bring the land into a more

more thick fet ftate of fward, which is the prolific matrix for corn crops.

The really neceffary expence of reclaiming and bringing thefe kinds of wooded lands into a ftate of cultivation, by thefe means, is inconfiderable, particularly where fuel is dear. Where the timber wood is properly cut down by the axe, and the underwood taken off rather below the furface, the larger roots, and the ftubs which are left, will, in fome inftances, more than repay the coft of the clearing and levelling the furface. And the other expences will be repaid by the immediate production of a pafture ground, the value of which is conftantly increafing without any further charge, until it may probably be worth two or three times what the lands were while they were in the woody condition.

In cafes where fuel is cheap, and particularly when the timber wood is rapidly fallen, as in the barking feafon, they may be cut off by the faw level with the furface of the land; the ftools and large fuperficial roots being after that carefully difbarked to fome inches within the ground, fo as to prevent their throwing out fhoots to injure the furface and keep the roots alive. In this way the ftools will be fo decayed in a few years as to be capable of being removed with little trouble or expence. See Tillage.

In clearing and reclaiming moory lands where they are too wet, the firft ftep is that of properly draining them; they are afterwards brought into cultivation and to their full value by other means, fuch as in large undertakings, by fuitable divifions of the lands into fields proper for the farm or farms to which they are to be laid, and fo ditched as that the furface water may be effectually taken off, without having deep, open, expenfive troublefome drains in other parts; the furface of each field being adjufted in fuch a manner as to fhoot off the rain water into the interfecting ditches, in order to prevent injury from happening, in that way, fo as to impede the cultivation for any length of time.

As the furfaces of thefe kinds of land are moftly rugged and uneven, as well as of a loofe fpongy texture, which unfits them for the tillage proceffes, without previous affiftance from hand labour; where the moory earth, or vegetable mould, is deep, and rifes to the furface uncovered by foffile matters, fome length of time is requifite to bring it to that folidity and firmnefs of texture which is fuited to the common arable purpofes. Hence the general principle of improving deep moory lands, where there is no foffile covering, is fuppofed to be the fame as that advifed for bringing woodlands into cultivation; namely, that of converting them to a profitable ftate of herbage, before corn crops are attempted to be produced.

The procefs muft be guided and regulated by the nature and fituation of the tract to be improved. Where the furface is very irregular, full of inequalities, and of an abrupt nature, it muft firft be adjufted fo as to admit the means of tillage when they can be properly had recourfe to, and for carrying away the furface waters in the manner already noticed. Then to pare off the leffer hillocks and rifings, as the tufts and haffocks which were formed during its wet ftate, and more or lefs of its general furface, fo as to remove the coarfe plants and ftale mould which occupy it, and thereby produce a frefhnefs in the whole.

In dry feafons, when the furface has fufficient firmnefs to bear the tread of animals, the paring may be done by the plough for that purpofe, but in other cafes by the breaftplough or paring-fpade. When the furface has been cut over in this manner, and any part has the appearance of being too wet, as may be judged of by the colour of the mould, in fome degree, covered drains are to be formed in fuch places, which may commonly be made in a cheap and durable manner by the firm fibrous tufts collected from the furface. The reft of the roots and mould which were pared off fhould be burnt, and their afhes fpread evenly over the furface, being immediately raked or harrowed into the foil. At this period of the improvement almoft any kind of foffile material can be thrown over the afhes at a little expence; and a full quantity of different grafs feeds be covered in with it; leaving the furface to take on a fward without any further trouble or outlay of money.

Afterwards the graffy herbage is to be kept clofely fed down when the weather will permit, firft by fheep and then by heavier forts of ftock, until the furface becomes firm and the foil is well bound together by the fibrous roots of the herbage, fo as to be capable of affording corn crops in proper fucceffion.

It has been objected to this fummary mode of bringing the land into the ftate of herbage, that there are no immediate grofs returns for the money laid out in reclaiming and bringing it into the cultivable ftate. But although corn cannot be raifed on fuch raw loofe-textured forts of land at firft, potatoes are found to anfwer well, and rape with ftill more advantage in its culture, the labour attending it, and the profit which it affords. See Moor, Moory-*Land*, Spring and Surface *Draining*, &c. See alfo the Invernefsfhire Agricultural Report.

The reclaiming and bringing lands of thefe feveral different defcriptions into a ftate of cultivation and improvement is evidently a work of very great importance, particularly in a country where the population is getting too numerous for the produce, as by fuch means the extent of agricultural territory may be juftly faid to be increafed. Extenfive improvements of thefe kinds have lately taken place in Cornwall, and fome other fouthern diftricts.

Reclaiming *Plantations and Timber Woods*, in *Rural Economy*, the reftoring of fuch as have grown into a wild, neglected, and improper ftate from fome fort of mifmanagement, or want of attention. The caufes which have a tendency to produce this effect are very numerous, and have been the means of vaft individual as well as national lofs. One material and very frequent caufe is the neglect of their boundary fences; another is the miftaken notion of its being the beft practice to leave them entirely to nature after they are once properly planted; a third is the very abfurd fuppofition, that nothing fhould be done to them for a length of time after planting, in the way of rendering the trees more thin among themfelves, or in their branches; and laftly, an univerfal careleffnefs and difregard of them, frequently from the narrow conception of expence being incurred without the chance of any immediate return of profit. It is, on the whole, much too common to take great care in firft forming the plantations, without ever thinking or taking any fort of intereft in their after-management. But the bufinefs is by no means accomplifhed in the fimple act or operation of planting out the trees. Good examples of this kind of management are indeed few, but they occafionally exift, and much has been written on the matter, fo that information may be readily obtained. And there is every inducement to get it; as well prepared, inclofed, planted, cultivated and managed plantations, will far outgrow others that have exifted for a much longer time, but have been otherwife treated, often affording more than woods of three times their length of ftanding.

In directing the proper management in all cafes of this nature, fome attention muft be paid to the particular kinds of the plantation which they may be, in the firft place; after which, the means of reducing them to their appropriate ftates, or to fome other in the moft eafy and convenient manner,

manner, may be taken into confideration. It may often happen that their proper originally intended ftates cannot be attempted, but that which has been gradually acquired muft be promoted. With a view to the accomplifhment of thofe intentions, plantations may be confidered as confifting either of hard woods only, of evergreen or refinous trees only, or of both thefe forts of trees in mixture.

In the firft of thefe kinds, or thofe which are compofed folely of the hard-wooded forts of trees and plants, where they are to be brought to the ftate of woods, as timber trees and undergrowths, and the latter to be ufed only as fuel, the good trees of fuch kinds as are fuitable to the foil, and the probable demand of the vicinity and other parts, fhould be fixed upon, and left as ftandard trees; the whole of the others being cut over by the furface of the ground, fo that they may become ftools for fupplying the undergrowths. When this has been performed, the ground, where neceffary, fhould be dug, hoed, or trenched over, as circumftances may direct; but where the trees and underwoods have been much crowded, thefe kinds of work will feldom be required. However, if, inftead of the common underwood, oak be required, then after pitching upon the moft proper and fuitable ftandard trees for remaining, the whole of the reft are to be taken up by the roots, the land dug over, and acorns planted out upon it; which, when they are grown up, muft be kept clean and free from weeds for fome years, in order to promote their healthy growths and rifing to the ftate of young trees.

Where the whole is to be reduced to the ftate of copfe wood for fuel only, the beft way is to cut over every part by the furface of the ground; and when for bark, to root out the whole, only referving the oaks, and planting with acorns, as already noticed.

In cafe the grove forms are to be produced, the moft fuitable and appropriate trees are to be left at proper diftances, and the whole of the remainder taken out by the roots; after which the ground fhould have the proper culture, until the trees are incapable of being injured by cattle ftock; at which time the whole may be laid down with natural grafs feeds.

In the fecond forts of plantations, where they have remained, after planting, without being in any way thinned, for a great many years, they are often, in a great meafure, incapable of being remedied, as they are, for the moft part, fo overpowered by each other, that their growth is fufpended; wherever any thinning takes place, the trees all around are deftroyed. In thefe cafes it is the advice of fome to have the whole grubbed up by the roots and replanted, after the ground has been properly prepared by fallowing and repeated corn crops. But as there may fometimes be much lofs in this way, it may be proper to try the cautious thinning of them, which fhould be done during the latter fummer months in a careful manner, as fuccefs has occafionally attended this method.

With natural plantations of this kind under twenty years' growth, and artificial ones under ten, much advantage has been gained by fuitable cautious thinning and retrenching. In all thefe cafes there is no neceffity whatever for the cultivation of the ground, as the trees fuffer few or no plants to rife below them, and befides, injury may be done to their fuperficial roots.

The management in the laft or mixed kinds of plantations, where the evergreen trees are in fuch proportions as not to admit of either of the above modes, is to reduce them to the grove plan only, or to this in fome parts and the wood kind in others; the modes of accomplifhing both of which have been already laid down. However, in each of thefe methods, it will frequently happen that the tree or trees which are the moft advantageous and defirable in the parts where the plantations exift, are either very deficient, or wholly wanting. In all fuch inftances it is probably the beft and moft beneficial practice to grub up nearly the whole of fuch trees, and replant the ground with the proper fort or forts; care being taken to leave fuch a number of the old trees, either in a fcattered manner, or in narrow ftripes and fcreens, for fheltering and protecting the young trees, plants, and feeds, which have been put in, planted, or fown. See PLANTATION and WOOD.

It may be noticed that in reclaiming all kinds of wild and neglected plantations in lands which are inclined to the retention of moifture; the firft thing which is neceffary is invariably that of the removal of the ftagnant wetnefs, as where this is not properly performed, the other operations will be of but little avail, however well they may be executed. In many extenfive tracts of this nature, the injury which is fuftained by this fort of neglect is fcarcely to be calculated. There are many thoufands of acres, in different fituations in this country, which would by this means alone be brought to twenty times and more their prefent value. And as this fort of work in fuch cafes can, for the moft part, be accomplifhed by open cuts or gutters alone, at a very trifling expence in comparifon of that for arable and fome other forts of land, it fhould never be neglected where good management is in the leaft degree attended to. See SPRING and SURFACE *Draining*.

It is a material point in reclaiming all thefe forts of plantations and timber woods, to keep the furrounding ditches and fences well up and in a proper fafe ftate, as large tracts are often completely ruined in a very fhort time by inattention in this refpect, from the cropping, rubbing, and deftruction in other ways produced by the entrance of cattle of different kinds into them. There is hardly any thing fo injurious to the more young timber plantations as cattle being fuffered to get into them. See FENCE.

The retrenching of old ill-managed plantations of thefe kinds fhould conftantly be done in a very gradual manner, having due regard to their length of ftanding, the nature of the trees, the quality of the land, the fituation and expofure, as well as fome other points. Their outfide parts are in general to be left more thick and clofe, than thofe which are more in the interior, and the parts of the foil which are of a bad thin quality, fhould be left lefs thick of trees and plants than where it is of greater depth and richnefs. And open expofures fhould be kept more thick and clofe than where they are more warm and fheltered.

In retrenching the branches of the different trees, the work fhould be performed according to the length of time the trees have been growing, their particular growths and fizes, the difference of kind, and the ufes, purpofes, and intentions for which their wood or other parts are defigned. It is always proper to ftop rather fhort, than to carry it to an extreme, as there is fometimes danger in the latter cafe. See PRUNING.

It is always neceffary and effential to reclaim thefe old wild forts of plantations as foon as poffible, as the forming of new tracts of this kind chiefly benefit pofterity, while the ameliorating and improving of the other, by thefe means, are an immediate and direct gain to the prefent proprietors, of very great national importance at the prefent time, and which would otherwife be complete lofs to both.

No forts of woods of the timber kind fhould indeed ever be fuffered to remain any great length of time without being properly looked over and put into fuch ftates as that they may go on in the moft beneficial and profitable manner, as where

where they are in any way or by any means reftricted or impeded in their growths, there is a conftant and continual lofs taking place, and the ultimate difadvantage is prodigioufly great, as the timber never becomes either fo good or in fuch quantity; of courfe it is of inferior value in both refpects, which makes a difference of much confequence to the proprietors as well as to the nation at large. See Wood.

RECLINATION *of a Plane*, in *Dialling*, the number of degrees which a dial-plane leans backwards, from an exactly upright or vertical plane, *i. e.* from the zenith.

The reclination is eafily found, by means of a ruler, and a quadrant; for having drawn an horizontal line on the plane by a level or quadrant, and to it another line at right angles, apply a ruler, fo that one end of it may hang over, or reach beyond the plane; then will a quadrant, applied to the under edge of the ruler, fhew the degrees and minutes of the plane's reclination; counting from that fide of the quadrant that is contiguous to the edge of the ruler.

RECLINATUM Folium, in *Botany*, a leaf whofe point is curved downwards, below the level of the bafe. See Leaf.

RECLINATUS Caulis, a reclined ftem, is bent towards the earth, as in many fpecies of *Ficus*, *Salix*, *Rubus*, &c.

RECLINER, or Reclining *Dial*, is a dial whofe plane reclines from the perpendicular; *i. e.* leans from you when you ftand before it.

When this reclination is equal to the height of the pole, the dial is faid to be equinoctial. See Dial.

Recliner, *Declining*, or *Declining reclining dial*, is a dial which neither ftands perpendicularly, nor oppofite to one of the cardinal points. See Dial.

RECLUSE, among *Religious*, a perfon clofe fhut up in a very narrow cell of an hermitage, or other religious houfe; and cut off, not only from all converfation with the world, but even with the houfe.

The word is chiefly ufed for fuch as thus imprifon themfelves out of devotion, to do penance. It is fometimes alfo applied to incontinent wives, whom their hufbands procure to be thus kept in a perpetual prifon in fome convent.

Reclufes were anciently very numerous; they were then a kind of folitaries who fhut themfelves up in fome little cell, with a vow never to ftir out of it.

None were admitted to this oath until they had given fufficient proofs of their abftinence, and had leave from the bifhop, or the abbot of the monaftery where they were fhut up; for the cells of the reclufes were always to join to fome monaftery.

The prelate's permiffion being obtained, they were tried for a year in the monaftery; out of which, during that time, they never ftirred.

They were then admitted to their vow of ftability in the church before the bifhop; which being done, and the reclufe having entered his little cell, the bifhop fet his feal on the door.

The cell was to be very fmall, and very exactly clofed. The reclufe was to have every thing within it neceffary to life; and even, if he were a prieft, an oratory confecrated by the bifhop, with a window which looked into the church, through which he might make his offerings at the mafs, hear the finging, fing himfelf with the community, and anfwer thofe who talked to him. But this window was to have curtains before it, both withinfide and without; fo that the reclufe might neither fee, nor be feen.

Indeed he was allowed a little garden in his reclufion, to plant a few herbs, and take frefh air; adjoining to his cell was that of his difciples, which he was very rarely without; with a window, through which they ferved him with neceffaries, and received his inftructions.

When it was judged proper to have two or three reclufes together, their cells were made contiguous to each other with windows of communication; if any woman would confult them, or confefs to them, it was to be in the church, and in the face of all the world.

Where there were two or three reclufes together, they were never to hold any conference, but on fpiritual matters, and to confefs to each other; where there was but one, he was to confefs and examine himfelf.

If the reclufe fell fick, his door was opened for people to come in and affift him; but he was not allowed to ftir out on any pretence whatever.

Thefe articles are extracted from the rule, compiled for the reclufes, by Grimlaic, a prieft in the ninth century.

There were alfo women reclufes, who led the fame life, in proportion. St. Viborade lived a reclufe at St. Gall, and was there martyred by the Hungarians in 825.

RECLUSION, the ftate of a reclufe; or the cell and other appurtenances of it.

F. Helyot gives a particular account of the ceremonies practifed in the reclufion of a woman, in that of mother de Cambray, inftitutrix of the order of the reprefentation of Nôtre Dame. A cell being built for her in 1625, adjoining to the church of St. Andrew, in Tournay, the bifhop waited for her early in the morning at the church-door. Upon her arrival, proftrating herfelf at the feet of that prelate, he gave her his benediction; conducted her to the grand altar; and there bleffing a mantle, veil, and fcapular, he put them on her, and gave her a new name.

Having here made her vow, and the bifhop having harangued the people in praife of the new reclufe, he conducted her proceffionally to her reclufion; the clergy all the way finging *Veni, fponfa Chrifti*, &c.

Here the bifhop, bleffing her afrefh, confecrated the reclufion, and fhut her up in perpetual confinement.

RECOGNISANCE. See Recognizance.

RECOGNITION, Recognitio, denotes an acknowledgment. The word is particularly ufed in our law-books, for the title of the firft chapter of the ftat. 1 Jac. I. by which the parliament acknowledged the crown of England, after the death of queen Elizabeth, to have rightfully defcended to king James.

Recognitions *of Clement*, in *Ecclefiaftical Hiftory*, a fuppofititious or apocryphal book, afcribed to St. Clement, but really compofed by fome learned and eloquent man in the fecond century. Rufinus, who tranflated the ten books of Recognitions out of Greek into Latin, in whofe tranflation only we now have them, plainly fuppofes them to have been written by Clement of Rome; but that the copies, in his time, had been corrupted in fome places. The firft ecclefiaftical writer who has mentioned this work is Origen, by whom it is cited twice; but he does not feem to have held it in high eftimation. Eufebius, who is fuppofed to mention the Recognitions under the title of "The Acts of Peter," which made a part of them, rejects thefe, and owns no work for St. Clement, but his epiftle to the Corinthians. Epiphanius mentions "The Travels of Peter" as written by Clement, but corrupted by the Ebionites, fo that little was left that is genuine. St. Jerome's opinion of the works of Clement coincides with that of Eufebius. This book is, for a large part of it at leaft, fays the learned Dr. Lardner, a fiction or romance, in which divers things concerning the Chriftian religion are reprefented in a philofophical manner, in order to render them more agreeable to the Greeks. It is called the "Circuits," or "Travels and Acts of Peter," from its subject, as it contains an account of the apostle Peter's disputes with Simon Magus, and his discourses to other people, and his miracles. It is called the "Recognitions," from Clement's recognizing his father, and mother, and brethren, who had been long separated from each other.

Mr. Whiston, though he allows that this work was not written by Clement himself, supposes that it was the production of some of the hearers of Clement, and other companions of the apostles; but Dr. Lardner is of opinion, that it must be reckonod to be Clement's, or to be supposititious. With regard to the age of this work, Lardner farther adds, that the arguments here urged against Heathenism seem to imply, that the Christian was not yet the prevailing established religion. And the author often speaks of the power of Christians to heal diseases, and to expel dæmons, as if it was common in his time. That such gifts were enjoyed by many Christians in the second, and in the beginning of the third, century, we are assured by Irenæus, Tertullian, Origen, and others; after which time, or however after the end of the third century, they were not so common, if they did not quite cease. Mr. Whiston's opinion of this book is, that if it be not, in some sense or other, itself a sacred book, yet it ought certainly to be esteemed in the next degree to that of the really sacred books of the New Testament. But in the opinion of many other learned men, it is a worthless piece, of little or no use. It contains, however, as Dr. Lardner suggests, some excellent sentiments, and fine passages, intermixed with very great faults, for which no excuse can be made. This book contains passages of our four gospels, though it has been doubted whether he used the four, or some one gospel containing in it all these. Its author seems to own the first epistle of St. John, and the book of the Revelation. He was also well acquainted with the book of the Acts of the Apostles; but it is not certain how far he owned it. The passages from St. Paul's epistles are not sufficient to prove, that they were esteemed by this writer to be of authority. The author does not seem, indeed, to have any great kindness for the apostle Paul, and on this account he made little use of his epistles, and of the Acts of the Apostles. From his sly insinuations, and injurious reflections upon St. Paul, it may be suspected that he was a mere Ebionite; the ancients assuring us, that this sect of Christians rejected the authority of that apostle and his epistles. The author bears testimony to many principal facts of the New Testament. He gives an account of our Lord's temptation; he mentions the choice of the 12 apostles, and afterwards of other 72 disciples. In one place he speaks of the 12 apostles in such a manner as if he intended to exclude Paul from the honour of the apostleship, and even to deny him the character of a sufficient and faithful "preacher of Christ's word." We have also, in this book, relations of the miracles of our blessed Lord's ministry, and of his death and resurrection, and the extraordinary signs attending these events. Grabe's Preface to the Writings of St. Clement in his "Spicilegium." Coteler apud Patr. Apost. tom. i. p. 484. Lardner's Works, vol. ii. p. 342, &c. See *Clementine* HOMILIES.

RECOGNITION, in the *Drama*. See DISCOVERY.

RECOGNITIONE *adnullanda per vim et duritiem facta*, in *Law*, is a writ to the justices of the common bench for sending a record touching a recognizance, which the recognizor suggests to have been acknowledged by force and hard dealing; that, if it so appear, it may be annulled.

Transcriptio Recognitionis facta coram justitiariis itinerantibus. See TRANSCRIPTIO.

RECOGNITORS, RECOGNITORES. The jury impanelled upon an assize are called recognitors, because they acknowledge a disseisin by their verdict.

RECOGNIZANCE, or RECOGNISANCE, a bond or obligation of record acknowledged to the king; testifying the *recognizor* to owe to the *recognizee* a certain sum of money; with condition to do some particular act, as to appear at the assizes, to keep the peace, to pay a debt, or the like.

It is thus called, because recognized, or acknowleged in some court of record, or before some judge, master in chancery, or justice of the peace.

It is, in most respects, like another bond; the difference being chiefly this: that the bond is the creation of a fresh debt or obligation *de novo*, whereas the recognizance is an acknowledgment of a former debt upon record; the form of which is "A B. doth acknowledge to our lord the king, to the plaintiff, to C. D., or the like, the sum of ten pounds," with condition to be void on performance of the thing stipulated; in which case the king, the plaintiff, C. D., &c. is called the "cognizee," *is cui cognoscitur*, or recognizee, as he that enters into the recognizance is called the "cognizor," or recognizor, *is qui cognoscit*. This, being either certified to, or taken by the officer of some court, is witnessed only by the record of that court, and not by the party's seal; so that it is not in strict propriety a deed, though the effects of it are greater than a common obligation; being allowed a priority in point of payment, and binding the lands of the cognizor, from the time of enrolment on record. Stat. 29 Car. II. c. 3.

There are also recognizances for *bail* (which see), others for appearing at the sessions to prosecute a felon, others for good behaviour, &c. See GOOD *Abearing*.

There are also other recognizances of a private kind, in nature of a STATUTE *Staple*, (which see,) by virtue of the statute 23 Hen. VIII. cap. 6. which are a charge upon real property. This recognizance is a security, acknowledged before either of the chief justices, or (out of term) before their substitutes, the mayor of the staple at Westminster, and the recorder of London: by which the benefit of their mercantile transactions is extended to all the king's subjects in general by the above cited statute 23 Hen. VIII. c. 6. amended by 8 Geo. I. c. 25, which direct such recognizances to be enrolled and certified into chancery. But these, by the statute of frauds, 29 Car. II. c. 3. are only binding upon the lands in the hands of *bonâ fide* purchasors, from the day of their enrolment, which is ordered to be marked upon the record.

RECOGNIZANCE is also used, in our *Ancient Statutes*, for the verdict of the twelve jurors impanelled upon an assize; hence called *recognitors*.

RECOGNIZEE, or COGNIZEE, is he to whom one is bound in a recognizance. He that is so bound is called *recognizor*.

RECOIL, or REBOUND, the resilition of a body, chiefly a fire-arm; or the motion by which, upon explosion, it starts or flies backwards; the cause of which is the impelling force of the powder, which acts equally on the breech and on the ball; so that if the piece and ball were of equal weight, and other circumstances the same, the piece would recoil with the same velocity as that with which the ball is discharged; but the heavier any body is, the less will its velocity be, when the force impelling it continues the same. Therefore so many times as the cannon and carriages are heavier than the ball, just as many times will the velocity of the cannon be less than that of the ball; and the space through which the cannon recoils whilst the ball moves along

along the cylinder, is to the length of the cannon diminiſhed by the ſpace behind the ball, as the weight of the ball is to the weight of the cannon. Let a twenty-four pounder of ten feet be 6400 pounds weight, and when the ball quits the piece, the cannon will have recoiled $\frac{24}{6400} \times 10 = \frac{3}{80}$ of a foot, leſs than half an inch.

The greater the charge, *cæteris paribus*, the greater the rebound. By an experiment made before the Royal Society, and related in the Philoſophical Tranſactions, it was found, that cannons, charged to a certain degree, throw the ball from right to left of their own direction; but that the cannons themſelves recoil from left to right.

Some of the gentlemen of the French academy doubting the juſtneſs of the obſervation, M. Caſſini, the younger, undertook to repeat the experiment; which he did by means of a machine, as like that uſed in England as he could: and that tried over and over again.

The reſult was, that the ball, when the gun had liberty to recoil, was always thrown to the right of the point to which it was thrown when the gun was fixed without a poſſibility of rebounding; but then the recoil was always made the ſame way, *viz.* to the right; and he never found that contrariety of directions between the ball and the rebound, obſerved in the Engliſh experiment. See Hiſt. Acad. R. Scienc. A. 1703. p. 120, &c.

The cauſe of the phenomenon ſeems very difficult to aſſign; for ſuppoſing the guns of a common make, with the touch-hole on the top, we cannot ſo much as gueſs what cauſe ſhould conſtantly determine the ball from right to left; unleſs ſome very material circumſtances be omitted in the recital they have given us in the experiment.

Guns whoſe vents are a little forward in the chaſe recoil moſt. To leſſen the recoil of a gun, the platforms are generally made ſloping towards the embraſures of the battery. See PROJECTILES.

RECOLATION, a method of fining the decoctions of vegetables, &c. by repeated percolation, or ſtraining them ſeveral times ſucceſſively through a linen or woollen-bag.

RECOLLECTION, a mode of thinking, by which thoſe ideas, ſought after by the mind, are with pain and endeavour found, and brought again to view. See MEMORY and IMAGINATION.

RECOLLETS, a congregation of reformed Franciſcans, called alſo *friers minor of St. Francis, of the ſtrict obſervance.* They were eſtabliſhed about the year 1532, when ſome religious of the order of St. Francis being willing to keep his rule to the letter, Clement VII. gave them houſes, whither they might retire, and receive ſuch as were diſpoſed to follow them. The ſame year he approved the reform; and in 1584 it was carried from Italy into France, where theſe religious had already been eſtabliſhed, in the towns of Tulles in Limoiſin, and Murat in Auvergne. They had a convent at Paris in 1603; and ſince they have erected no leſs than a hundred and fifty in the whole kingdom, where they are divided into ſeven provinces.

RECOLOGNE, in *Geography*, a town of France, in the department of the Doubs; eight miles W. of Beſançon.

RECOMMENDATI. See AFFIDAVIT.

RECOMMENDATION, in a *Military Senſe*, denotes a certificate, ſtating an individual to be properly qualified for a ſituation in the army. This certificate muſt be ſigned by a field-officer in the regulars, addreſſed to the commanding officer of the regiment, by whom it is forwarded to the commander-in-chief, who lays the name of the perſon recommended before the king.

RECOMPOSITION, in *Chemiſtry*, the compounding of bodies from their ſeparated parts, or principles, ſo as to compoſe the original whole again. This is extremely difficult to effect univerſally, but in ſome caſes it may be done, and that ſo perfectly, that the recompoſed body ſhall not be diſtinguiſhable by the ſenſes from that which had never been ſeparated by the fire. If the art of chemiſtry were perfect, we ſhould thus be able, at leaſt in ſome degree, to recompoſe all the bodies we divide; but this is far from being the caſe at preſent. We can by no means do this in vegetable and animal bodies, where there is a vaſcular ſtructure, and therefore we are carefully to diſtinguiſh between the regeneration of organized, and that of unorganized bodies.

RECONCILIARI, in our *Law Books*, &c. A church is ſaid *reconciliari*, to be reconciled, when it is conſecrated afreſh, after having been polluted or profaned; as by the poſſeſſion of pagans, heretics, &c.

RECONCILIATION *of Penitents*, in *Church Hiſtory*, See POENITENTES.

RECONNOITRE, in *War*, implies to view and examine the ſtate of things, in order to make a report of them.

The word is French, ſignifying, literally, *to know, recollect.*

We ſay to reconnoitre the coaſts, to reconnoitre a port, &c. A body of horſe was ſent to reconnoitre their camp, the ground, the condition of the roads, rivers, &c.

Parties ordered to reconnoitre, are to obſerve the country and the enemy; to remark the routes, conveniencies, and inconveniencies of the firſt; the poſition, march, or forces of the ſecond. In either caſe, they ſhould have an expert geographer, capable of taking plans readily; he ſhould be the beſt mounted of the whole, that in caſe the enemy happen to ſcatter the eſcort, he may ſave his works and ideas.

All parties that go for reconnoitring only, ſhould be but few in number: never more than twelve or twenty men. An officer, be his rank what it will, cannot decline going with ſo few under his command: the honour is amply made up by the importance of the expedition, frequently of the moſt intereſting conſequence, and the propereſt to recommend the prudence, bravery, and addreſs of any officer that has the fortune to ſucceed.

It is previouſly neceſſary that the officer ordered on this duty ſhould be well acquainted with the country, the roads, and the diſtance of the enemy. His party muſt conſiſt of men of approved fidelity, part of whom ſhould be diſguiſed. This detachment muſt march off in the night. The men muſt have ſtrict orders neither to ſmoke tobacco, make a noiſe, nor ſpeak. The officer muſt be provided with two guides, who are to be ſtrictly interrogated, but are to remain ignorant of the route you intend to take. A detachment of this kind ſhould be furniſhed with ſubſiſtence for two or three days. The horſes are to be fed every two or three leagues, for it is abſolutely neceſſary that they ſhould be always freſh and fit for duty. The officer will take care never to halt, but at a diſtance from any road, and alſo take every precaution to prevent his being ſurpriſed, whilſt his horſes are feeding, &c.

RECONNOITRE is alſo uſed at ſea. To reconnoitre a veſſel, a fleet, &c. is to approach near enough to examine the rate and burden of a veſſel, &c. the force it may have aboard, what nation it is of, &c.

To reconnoitre a land, or ſhore, is to obſerve its ſituation, in order to find what land it is.

RECORD, RECORDIUM, in *Law*, an authentic teſtimony of any thing in writing, contained in rolls of parchment, and preſerved in a court of record. See COURT, and CUSTOM.

Records

Records are said to be *vetustatis & veritatis vestigia*. So early as the Conquest we find the "*præteritorum memoria eventorum*" reckoned up as one of the chief qualifications of those who were held to be "*legibus patriæ optimé instituti.*" For it is an established rule to abide by former precedents, where the same points come again in litigation; as well to keep the scale of justice even and steady, and not liable to waver with every new judge's opinion, as also because the law in that case being solemnly declared and determined, what before was uncertain, and perhaps indifferent, is now become a permanent rule, which it is not in the breast of any subsequent judge to alter or vary from, according to his private sentiments: he being sworn to determine not according to his own private judgment, but according to the known law and custom of the land; not delegated to pronounce a new law, but to maintain and expound the old one. Yet this rule admits of exception, where the former determination is most evidently contrary to reason; much more if it be clearly contrary to the divine law. But even in such cases the subsequent judges donot pretend to make a new law, but to vindicate the old one from misrepresentation. For if it be found that the former decision is manifestly absurd or unjust, it is declared, not that such a sentence was *bad law*, but that it was *not law*, that is, that it is not the established custom of the realm, as has been erroneously determined. An act committed to writing in any of the king's courts, during the term in which it is written, is alterable, being no record; but that term once ended, and the act inrolled, it is a record, and of such credit as admits no alteration, or proof to the contrary.

It is a settled rule and maxim that nothing shall be averred against a record (see COURT,) nor shall any plea, or even proof, be admitted to the contrary. (Co. Litt. 260.) And if the existence of a record be denied, it shall be tried by nothing but itself; that is, upon bare inspection whether there be any such record or no; else there would be no end of disputes. But if there appears any mistake of the clerk in making up such record, the court will direct him to amend it. Courts of record, or repositories for the public records of the kingdom, were first established by Edward I., our English Justinian, some of which are more ancient than the reign of his father, and those were by him collected.

Lawyers reckon three sorts of records; *viz.* a *judicial* record, as attainder, &c.; a *ministerial* record upon oath, as an office of inquisition found; and a record made by *conveyance* and consent, as a fine, or deed inrolled, and the like.

RECORD, *Assurances by matter of*, are such as do not entirely depend on the act or consent of the parties themselves; but the sanction of a court of record is called in, to substantiate, preserve, and be a perpetual testimony of the transfer of property from one man to another; or of its establishment, when already transferred: of this nature are private acts of parliament, the king's grants, fines, and common recoveries.

RECORD, *Court of*. See RECORD, supra, and COURT.

RECORD, *Debt of*, is a sum of money, which appears to be due by the evidence of a court of record. Thus, when a specific sum is adjudged to be due from the defendant to the plaintiff, on an action or suit at law, this is a contract of the highest nature, being established by the sentence of a court of judicature. Debts upon recognizances, together with statutes merchant, and statutes staple, &c. if forfeited by non-performance of the condition, are also debts of record; the contract, on which they are founded, being witnessed by the highest kind of evidence, *viz.* by matter of record.

RECORDS, *Imbezzling of*. See IMBEZZLE.

RECORD, *matter, muster, oyer, prisoner upon matter of*, see MATTER, MUSTER, OYER, and PRISONER, &c.

RECORD, *Trial by*, is used only in one particular instance; where a matter of record is pleaded in any action, as a fine, a judgment, or the like; and the opposite party pleads "*nul tiel record*," that is, there is no such matter of record existing: upon this, issue is tendered and joined in the following form, "and this he prays may be enquired of by *the record*, and the other doth the like;" and hereupon the party pleading the record has a day given him to bring it in, and proclamation is made in court for him "to bring forth his record, or he shall be condemned:" and, on his failure, his antagonist shall have judgment to recover. The trial of this issue is, therefore, merely by the record; for, as sir Edward Coke observes (1 Inst. 117. 260.), a record or enrolment is a monument of so high a nature, and imputeth in itself such absolute verity, that if it be pleaded there is no such record, it shall not receive any trial by witness, jury, or otherwise, but only by itself. Thus, titles of nobility shall be tried by the king's writ or patent only, which is matter of record. (6 Rep. 53.) Also in case of an alien, whether alien, friend, or enemy, shall be tried by the league or treaty between his sovereign and our's; for every league or treaty is of record. (9 Rep. 31.) And also whether a manor be held in ancient demesne or not, shall be tried by the record of Domesday in the king's exchequer. Blackst. Com. book iii.

RECORD, among *Fowlers*. A bird is said to record, when it begins to tune or sing within itself; or to form its notes and dispose its organs for singing.

The cock thrush is distinguished from the hen in recording; the first being more loud and frequent in it than the second.

Instances have been known of birds beginning to record when they were not a month old. This first essay does not seem to have the least rudiments of the future song; but as the bird grows older and stronger, one may perceive what the nestling is aiming at. A young bird commonly continues to record for ten or eleven months, when he is able to execute every part of his song, which afterwards continues fixed, and is scarcely ever altered. The term record is probably derived from a musical instrument, formerly used in England, called a *recorder*, which seems to have been a species of flute, and was probably used to teach young birds to pipe tunes. Lord Bacon describes this instrument (in his second Century of Experiments) to have been straight, to have had a lesser and greater bore, both above and below, to have required very little breath from the blower, and to have had what he calls a fipple or stopper.

RECORDARI *facias loquelam*, in *Law*, a writ directed to the sheriff to remove a cause depending in an inferior court, as hundred-court, county-court, court of ancient demesne, &c. to the king's bench, or common pleas, &c.

It is thus called, because it commands the sheriff to *make a record* of the proceedings either by himself, or others; and then to send up the cause.

RECORDE, ROBERT, in *Biography*, an early English physician, of Welsh origin, commenced his education at Oxford about the year 1525; and in 1531 was elected fellow of All-Souls' College. Directing his studies to physic, but where, or under what masters, we are not told, he was created doctor in that faculty at Cambridge in 1545. Both before and after this period he is said to have taught arithmetic at Oxford, and to have excelled all his predecessors fors in rendering this branch of knowledge clear and familiar. He is likewife mentioned as remarkably fkilled in rhetoric, aftronomy, geometry, mufic, mineralogy, and every part of natural hiftory. He was well acquainted with the Saxon language, and made large collections of hiftorical and other ancient manufcripts. To thefe various ftudies he joined that of divinity, and was attached to the principles of the Reformers. But notwithftanding he was juftly deemed a prodigy of learning and talents, it does not appear that he met with encouragement at all adequate to his merits; fince all that we know further of him is, that he died in the king's bench prifon, where he was confined for debt, in the year 1558.

He was author of feveral works, fome of which were feveral times reprinted, on the following fubjects.

"The Ground of Arts, teaching the Work and Practice of Arithmetic, both in whole Numbers and Fractions," 1540. This was dedicated to king Edward VI. "The Whetftone of Wit," a fecond part of the former. "The Path-way to Knowledge, containing the firft Principles of Geometry." "The Caftle of Knowledge, containing the Explanation of the Sphere." "The Urinal of Phyfick," 1547, which was reprinted in London in 1582, 1599, and 1665; and in the laft mentioned year, the title of "The Judicial of Urines" was given to it. This book contains a defcription of urinary veffels with figures. It is a fhort, but very methodical treatife, full of divifions and fubdivifions relative to the different kinds of urines, and the prognoftics to be deduced from them. Neverthelefs he candidly acknowledges at the beginning, that the judgment to be formed in difeafes from the urine is not fo certain as fome have reprefented; and indeed the perplexity and variety of opinions concerning this fubject are fufficiently apparent from his treatife. His other works were, "Of Anatomy;" "Of Auricular Confeffion;" "Of the Eucharift;" and "The Image of a true Commonwealth." Aikin's Biog. Memoirs of Medicine.

RECORDER, Recordator, a perfon whom the mayor, or other chief magiftrate of any city, or town corporate, having jurifdiction, and a court of record, within their precincts, does affociate with him, for his better direction in matters of juftice, and proceedings according to law. He is ufually a counfellor, or other perfon, verfed and experienced in the law. In fome towns, which have their particular affizes within themfelves, and no mayor, the recorder is the judge.

The recorder of London is one of the juftices of oyer and terminer, and a juftice of peace of the quorum, for putting the laws in execution for preferving the peace and government of the city; and being the mouth of the city, he delivers the fentences and judgments of the courts therein, and alfo certifies and records the city cuftoms, &c. He is chofen by the lord mayor and aldermen, and attends the bufinefs of the city, on any warning by the lord mayor, &c.

Recorder, in *Mufic*. See Record, fupra.

RECORDO & *proceffu mittendis*, in *Law*, is a writ to call a record, together with the whole proceedings in the caufe, out of an inferior court into the king's court.

RECOVERY, in a legal fenfe, an obtaining of any thing by judgment, or trial at law; anfwering to *evictio* among the civilians.

There is a *true* and a *feigned* recovery.

Recovery, *True*, is an actual or real recovery of any thing, or of the value of it, by judgment. As if a man fue for any land, or other thing, and have a verdict or judgment for him.

Recovery, *Feigned* or *Common*, is a fort of *fictio juris*, being a certain form or courfe prefcribed by law to be obferved for the better affuring of lands and tenements to us; the end and effect of which is, to difcontinue and deftroy eftates-tail, remainders, and reverfions, and to bar the intails of them.

Thefe common recoveries were invented by the ecclefiaftics to elude the ftatutes of mortmain; and afterwards encouraged by the fineffe of the courts of law in 12 Edw. IV. in order to put an end to all fettered inheritances, and bar not only eftates-tail, but alfo all remainders and reverfions expectant thereon.

A common recovery is fo far like a *fine* (which fee), that it is a fuit or action, either actual or fictitious; and in it the lands are *recovered* againft the tenant of the freehold; which recovery, being a fuppofed adjudication of the right, binds all perfons, and vefts a free and abfolute fee-fimple in the recoveror.

This recovery is either with a *fingle* or *double voucher*; and fometimes a treble or farther voucher, as the exigency of the cafe may require.

As a recovery is in the nature of an action at law, not immediately compromifed like a fine, but carried through every regular ftage of proceeding, its form and method are not eafily underftood by thofe who are unacquainted with the courfe of judicial proceedings. Judge Blackftone has, therefore, ftated its nature and progrefs as clearly and concifely as poffible; avoiding, to the utmoft of his power, all technical terms and phrafes not before interpreted. Of his luminous ftatement we fhall avail ourfelves in the fequel of this article.

Let us (fays he), in the firft place, fupppofe David Edwards to be tenant of the freehold, and defirous to fuffer a common recovery, in order to bar all entails, remainders, and reverfions, and to convey the fame in fee-fimple to Francis Golding. To effect this, Golding is to bring an action againft him for the lands; and he accordingly fues out a writ, called a *præcipe quod reddat*, becaufe thofe were its initial or moft operative words, when the law proceedings were in Latin. In this writ the demandant, Golding, alleges, that the defendant, Edwards, (here called the tenant) has no legal title to the land; but that he came into poffeffion of it after one Hugh Hunt had turned the demandant out of it. The fubfequent proceedings are made up into a record or recovery roll, in which the writ and complaint of the demandant are firft recited; whereupon the tenant appears, and calls upon one Jacob Morland, who is fuppofed, at the original purchafe, to have warranted the title to the tenant; and thereupon he prays, that the faid Jacob Morland may be called in to defend the title, which he fo warranted. This is called the *voucher*, *vocatio*, or calling of Jacob Morland to warranty; and Morland is called the *vouchee*. Upon this, Jacob Morland, the vouchee, appears, is impleaded, and defends the title. Whereupon Golding, the demandant, defires leave of the court to *imparl*, or confer with the vouchee in private; which is (as ufual) allowed him. And foon afterwards the demandant, Golding, returns to court, but Morland the vouchee difappears, or makes the default. Whereupon judgment is given for the demandant, Golding, now called the recoveror, to recover the lands in queftion againft the tenant, Edwards, who is now the recoveree: and Edwards has judgment to recover of Jacob Morland lands of equal value, in recompenfe for the lands fo warranted by him, and now loft by his default; which is agreeable to the doctrine of warranty. This is called the recompenfe, or *recovery in value*. But Jacob Morland having no lands of his own, being ufually the cryer of the court

court (who, from being frequently thus vouched, is called the *common vouchee*) it is plain that Edwards has only a nominal recompenſe for the lands ſo recovered againſt him by Golding; which lands are now abſolutely veſted in the ſaid recoveror by judgment of law, and ſeiſin thereof is delivered by the ſheriff of the county. So that this colluſive recovery operates merely in the nature of a conveyance in fee-ſimple, from Edwards the tenant in tail, to Golding the purchaſor.

The recovery, here deſcribed, is with a ſingle voucher only; but ſometimes it is with *double*, *treble*, or farther voucher, as the exigency of the caſe may require. And indeed it is now uſual always to have a recovery with double voucher at the leaſt: by firſt conveying an eſtate of freehold to any indifferent perſon, againſt whom the *præcipe* is brought; and then he vouches the tenant in tail, who vouches over the common vouchee. For, if a recovery be had immediately againſt tenant in tail, it bars only ſuch eſtate in the premiſes of which he is then actually ſeiſed; whereas if the recovery be had againſt another perſon, and the tenant in tail be vouched, it bars every latent right and intereſt which he may have in the lands recovered. If Edwards therefore be tenant of the freehold in poſſeſſion, and John Barker be tenant in tail in remainder, here Edwards doth firſt vouch Barker, and then Barker vouches Jacob Morland the common vouchee; who is always the laſt perſon vouched, and always makes default: whereby the demandant, Golding, recovers the land againſt the tenant Edwards, and Edwards recovers a recompenſe of equal value againſt Barker the firſt vouchee; who recovers the like againſt Morland the common vouchee, againſt whom ſuch ideal recovery in value is always ultimately awarded.

This ſuppoſed recompenſe in value is the reaſon why the iſſue in tail is held to be barred by a common recovery. For if the recoveree ſhould obtain a recompenſe in lands from the common vouchee (which there is a poſſibility in contemplation of law, though a very improbable one, of his doing) theſe lands would ſupply the place of thoſe ſo recovered from him by colluſion, and would deſcend to the iſſue in tail. This reaſon will alſo hold with equal force, as to *moſt* remainder-men and reverſioners; to whom the poſſibility will remain and revert, as a full recompenſe for the reality, which they were otherwiſe entitled to: but it will not *always* hold; and therefore, as Pigott ſays, the judges have been even *aſtuti*, in inventing other reaſons to maintain the authority of recoveries. And, in particular, it hath been ſaid, that, though the eſtate-tail is gone from the recoveree, yet it is not *deſtroyed*, but only *transferred*; and ſtill ſubſiſts, and will ever continue to ſubſiſt (by conſtruction of law) in the recoveror, his heirs, and aſſigns: and, as the eſtate-tail ſo continues to ſubſiſt for ever, the remainders or reverſions expectant on the determination of ſuch eſtate-tail can never take place.

To ſuch awkward ſhifts, ſuch ſubtile refinements, and ſuch ſtrange reaſoning, were our anceſtors obliged to have recourſe, in order to get the better of that ſtubborn ſtatute *de donis*. The deſign, for which theſe contrivances were ſet on foot, was certainly laudable; the unrivetting the fetters of eſtates-tail, which were attended with a legion of miſchiefs to the commonwealth: but, while we applaud the end, we cannot but admire the means. Our modern courts of juſtice have indeed adopted a more manly way of treating the ſubject; by conſidering common recoveries in no other light, than as the formal mode of conveyance, by which tenant in tail is enabled to aliene his lands. But, ſince the ill conſequences of fettered inheritances are now generally ſeen and allowed, and of courſe the utility and expedience of ſetting them at liberty are apparent; it hath often been wiſhed, that the proceſs of this conveyance was ſhortened, and rendered leſs ſubject to niceties, by either totally repealing the ſtatute *de donis*; which perhaps, by reviving the old doctrine of conditional fees, might give birth to many litigations: or by veſting in every tenant in tail of full age the ſame abſolute fee-ſimple at once, which now he may obtain whenever he pleaſes, by the colluſive fiction of a common recovery; though this might poſſibly bear hard upon thoſe in remainder or reverſion, by abridging the chances they would otherwiſe frequently have, as no recovery can be ſuffered in the intervals between term and term, which ſometimes continue for near five months together: or, laſtly, by empowering the tenant in tail to bar the eſtate-tail by a ſolemn deed, to be made in term time and enrolled in ſome court of record; which is liable to neither of the other objections, and is warranted not only by the uſage of our American colonies, and the deciſions of our own courts of juſtice, which allow a tenant in tail (without fine or recovery) to appoint his eſtate to any charitable uſe, but alſo by the precedent of the ſtatute 21 Jac. I. c. 19. which, in caſe of a bankrupt tenant in tail, empowers his commiſſioners to ſell the eſtate at any time, by deed indented and enrolled. And if, in ſo national a concern, the emoluments of the officers, concerned in paſſing recoveries, are thought to be worthy attention, thoſe might be provided for in the fees to be paid upon each enrolment.

The *force* and *effect* of common recoveries may appear, from what has been ſaid, to be an abſolute bar not only of all eſtates-tail, but of remainders and reverſions expectant on the determination of ſuch eſtates. So that a tenant in tail may, by this method of aſſurance, convey the lands held in tail to the recoveror, his heirs and aſſigns, abſolutely free and diſcharged of all conditions and limitations in tail, and of all remainders and reverſions. But, by ſtatute 34 and 35 Hen. VIII. c. 20. no recovery had againſt tenant in tail, of the king's gift, whereof the remainder or reverſion is in the king, ſhall bar ſuch eſtate-tail, or the remainder or reverſion of the crown. And by the ſtatute 11 Hen. VII. c. 20. no woman, after her huſband's death, ſhall ſuffer a recovery of lands ſettled on her by her huſband, or ſettled on her huſband and her by any of his anceſtors. And by ſtatute 14 Eliz. c. 8. no tenant for life, of any ſort, can ſuffer a recovery, ſo as to bind them in remainder or reverſion. For which reaſon, if there be tenant for life, with remainder in tail, and other remainders over, and the tenant for life is deſirous to ſuffer a valid recovery; either he, or the tenant to the *præcipe* by him made, muſt *vouch* the remainder-man in tail, otherwiſe the recovery is void: but if he does vouch ſuch remainder-man, and he appears and vouches the common vouchee, it is then good; for if a man be vouched and appears, and ſuffers the recovery to be had againſt the tenant to the *præcipe*, it is as effectual to bar the eſtate-tail as if he himſelf were the recoveree. Salk. 571.

In all recoveries it is neceſſary that the recoveree, or tenant to the *præcipe*, as he is uſually called, be actually ſeiſed of the freehold, elſe the recovery is void. (Pigott, 28.) For all actions to recover the ſeiſin of lands, muſt be brought againſt the actual tenant of the freehold, elſe the ſuit will loſe its effect; ſince the freehold cannot be recovered of him who has it not. And, though theſe recoveries are in themſelves fabulous and fictitious, yet it is neceſſary that there be *actores fabulæ*, properly qualified. But the nicety thought by ſome modern practitioners to be requiſite in conveying the legal freehold, in order

to

to make a good tenant to the *præcipe*, is removed by the provifions of the ftatute 14 Geo. II. c. 20. which enacts, with a retrofpect and conformity to the ancient rule of law, that, though the legal freehold be vefted in leffees, yet thofe who are entitled to the next freehold eftate in remainder or reverfion may make a good tenant to the *præcipe*;—that, though the deed or fine which creates fuch tenant be fubfequent to the judgment of recovery, yet, if it be in the fame term, the recovery fhall be valid in law; —and that, though the recovery itfelf do not appear to be entered, or be not regulaly entered, on record, yet the deed to make a tenant to the *præcipe*, and declare the ufes of the recovery, fhall after a poffeffion of twenty years be fufficient evidence, on behalf of a purchafor for valuable confideration, that fuch recovery was duly fuffered. And this may fuffice to give the ftudent a general idea of common recoveries, the laft fpecies of affurances by matter of record.

For an account of deeds to lead, or declare, the *ufes* of fines, and recoveries; fee Uses.

In fome manors, by fpecial cuftom, recoveries may be fuffered of copyhold (Moor, 637.); but as thefe differ in nothing material from recoveries of free land, excepting only that they are not fuffered in the king's courts, but in the court baron of the manor, we fhall refer this fubject to the article Surrender. In this place we fhall obferve, however, that a fine or recovery had of copyhold lands in the king's court may, if not duly reverfed, alter the tenure of the lands, and convert them into frank-fee, which is defined in the old book of tenures to be "land pleadable at the common law:" but upon an action on the cafe, in the nature of a writ of "deceit," brought by the lord in the king's court, fuch fine or recovery will be reverfed, the lord will recover his jurifdiction, and the lands will be reftored to their former ftate of copyhold. Blackft. Com. b. ii.

Clerk of Inrolments of Recoveries and Fines. See Clerk.

Recovery, *Fort*, in *Geography*, a fort of America, in the Indiana territory, fituated on a branch of the Wabafh river, about 23 miles from Greenville. It confifts of two block-houfes, and barracks with curtains, fufficient for 60 men.

RECOUPE, French; formed of *re*, and *couper*, *to cut again*, in *Law*, to rebate, or difcount.

Thus, if a man have ten pounds iffuing out of certain lands, and he diffeifes the tenant of the land; in an affife brought by the diffeifee, if he recover the land and damages, the diffeifor fhall recoupe the rent due in the damages.

Recoupe alfo denotes a quick, fharp reply, to a peremptory demand. See Repartee.

RECREANT, in our old *Law-Books*, implies cowardly, faint-hearted.

Hence *recreantife*. See Craven and Champion.

Recreant was fo reproachful a word, that Glanville would not defcribe it. *Recreantes equi* is ufed by Fleta, lib. ii. cap. 2. for dull, jaded horfes.

RECREATION Island, in *Geography*, a fertile ifland in the Southern Pacific ocean, difcovered by Roggewin in the year 1722. Some of the fhip's company obtained a quantity of antifcorbutic herbs; but upon venturing into the country, they were affaulted by the natives, who, by cafting ftones at them, killed fome, and wounded almoft all. Many of the iflanders were killed by the fire-arms in return. The foil produces fugar-canes, cocoa-nuts, pomegranates, Indian figs, &c. The inhabitants were well made, robuft, and very lively: their bodies were painted, and they were armed. S. lat. 16°. W. long. 148°.

RECREMENT, Recrementum, in *Medicine*, fome fuperfluous matter feparated from fome other that is ufeful.

In which fenfe, it amounts to much the fame with fæces, or excrement.

Recrements of vegetables are ufeful as manure.

Recrement is fometimes alfo ufed to denote fuch fecreted juices in the body, as are afterwards of ufe in the economy; as the lympha, gall, &c. which are thus called, in contradiftinction to excrements, which are expelled out of the body, as of no farther ufe.

RECRIMINATION, a pofterior accufation brought by the accufed againft his accufer, upon the fame fact.

When two parties have made their mutual complaint at the fame time; the bufinefs is, firft, to determine who fhall be the accufer, and who the accufed, *i.e.* on whom fhall fall the recrimination.

By the French laws, recrimination is of no force till the criminal hath been purged legally.

RECRUDESCENCE, Recrudescentia, in *Medicine*, is a relapfe, when a difeafe that has gone off returns again.

RECRUITS, in the *Military Art*, new men raifed to fupply the places of fuch as have loft their lives in the fervice, or are rendered unferviceable by age or wounds. See Listing.

Recruit-*Horfes*, are the horfes brought up for completing the regiments of horfe or dragoons every year.

RECTANGLE, in *Geometry*, called alfo *oblong*, and *long fquare*, a quadrilateral rectangular figure MLIK, (*Plate* XII. *Geometry*, *fig.* 3.) whofe oppofite fides, ML and IK, as well as MI and LK, are equal.

Or, a rectangle is a parallelogram, whofe fides are unequal, but its angles right.

To find the area of a rectangle, fee Parallelogram.

If from the fame point A, (*fig.* 4.) be drawn two lines, one of which, AD, is a tangent to a circle, the other a fecant AB; the fquare of the tangent AD will be equal to the rectangle under the fecant AB, and that part of it without the circle AC. If two or more fecants, A*a*, AB, &c. be drawn from the fame point A; the rectangles, under their wholes, and their parts without the circle, will be equal. If two chords interfect each other, the rectangles under their fegments will be equal. The rectangles under equal lines are equal. The fum of all the rectangles contained under a given line, and all the parts of another any how divided, is equal to the rectangle contained under the two whole lines. If from any point, within a rectangle, to the angles of a rectangle, four lines be drawn, the fums of the fquares of thofe drawn to the oppofite angles will be equal. The rectangles contained under the correfponding fides of equiangular triangles, taken alternately, are equal. The rectangle under the two fides of any triangle is equal to the rectangle under the perpendicular to its bafe, and the diameter of the circumfcribing circle. The fquare of a line bifecting any angle of a triangle, and terminating in the oppofite fide, together with the rectangle under the two fegments of that fide, is equal to the rectangle of the two fides, including the propofed angle. The rectangle of the two diagonals of any quadrilateral infcribed in a circle, is equal to the fum of the two rectangles contained under the oppofite fides.

Rectangles, *Similar*. See Similar.

Rectangle, in *Arithmetic*, is the fame with product or factum.

RECTANGLED, Right-angled, *Triangle*, is a triangle, one of whofe angles is right, or equal to 90°. See Triangle.

There can be but one right angle in a plain triangle; therefore a rectangled triangle cannot be equilateral.

RECTANGULAR, in *Geometry*, is applied to figures and solids which have one or more angles right.

Such are squares, rectangles, and rectangled triangles, among plain figures; cubes, parallelepipeds, &c. among solids.

Solids are also said to be rectangular with respect to their situation: thus, if a cone, cylinder, &c. be perpendicular to the plane of the horizon, it is called a rectangular or right cone, cylinder, &c.

The ancients used the phrase *rectangular section of a cone*, to denote a parabola; that conic section, before Apollonius, being only considered in a cone, whose section by the axis would be a triangle, right-angled at the vertex. See Conic *Sections*.

Hence it was that Archimedes entitled his book of the quadrature of the parabola, by the name of "Rectanguli Coni Sectio."

Rectangular *Barometer*. See Barometer.

Rectangular *Windmills*. See Windmills.

RECTIFICATION, compounded of *rectus*, *right*, *direct*, and *fio*, *I became*, the act of *rectifying*, *i.e.* of correcting, remedying, or redressing, some defect or error, in respect either of nature, art, or morality.

Rectification, in *Chemistry*, is the repeating of a distillation or sublimation several times, and generally with a less degree of heat than at first, in order to render the substance purer, finer, and freer from aqueous and earthy parts.

Rectification is a reiterated depuration of a distilled matter, *e. gr.* brandy, spirits, or oils, by distilling them over again, to render them more subtile, and exalt their virtues.

That the rectification of spirits may, in all cases, proceed with the greatest exactness, a due regard to it must be had even from the first fermenting the substance from which they are to be made, and continued through all the stages of distillation, the low wines, proof spirit, and alcohol. The management of the fermented liquor, to this purpose, is principally the letting it stand to subside after the fermentation is over, and the drawing it off clear and thin, not too rich for the still. The still is not to be overfilled with this. Great care must be taken to prevent its burning, and the faints that run last must be kept separate. not mixed with the rest of the liquor distilled, which is now called the low wines. In the rectifying of these into proof spirit, great caution must be used that the fire be kept regular, not raised by sudden spirts, which always throw up the oil in large quantities, which is to be left behind. In the succeeding rectification of the proof spirit into alcohol, the same cautious management of the fire is necessary; and, in both this and the last, the faints are not to be suffered to run in among the spirit, but to be saved separate. They may be all mixed together at last, and reduced to a spirit fit for burning in lamps; but the keeping out of the rectified liquor will keep away the coarsest and most stinking part of the oil of the ingredients.

By these easy means, without any additional trouble or charge, we might be furnished with a spirit greatly exceeding what we commonly meet with. And in general, the art and mystery of our sellers of the several sorts of English brandies, seem to consist in this prudent management, and in the adding a little of the *oleum vini*, or oil of wine-lees, to the spirits thus procured pure: this gives the flavour of foreign brandies, and is so extensive in its use, that half an ounce of it is sufficient for a hogshead of pure spirit.

Malt spirit is that which principally requires all this care in the rectification, because its oil is more nauseous and offensive than that of any other spirit; but all others will be greatly the better for being treated in the same manner, and it is indeed necessary that they should for some particular uses.

It is remarkable, that no one method of combinatory rectification, that is, of the rectification performed by means of salt, and other additions, is suited to all the several kinds of spirits; scarcely indeed will any one way serve for any two spirits: but this method, by simple and careful distillation, is equally suited to all. Molasses-spirit, cyder-spirit, wine-spirit, or brandy, rum, and arrack, are all improved by it; and all of them are then known to be perfectly rectified, when, in the state of alcohol, they not only prove totally inflammable in a little vessel floating upon cold waters, but when poured into the purest spring water they have not the least power of making any change in it, nor leave any marks of oiliness, or that unctuosity which, on the mixture of the less pure spirits, floats on the top, and in certain lights gives the rainbow colours. Shaw's Essay on Distillery. See Alcohol and Distillation.

Fixed salts are rectified by calcination, dissolution, or filtration.

Metals are rectified, *i. e. refined*, by the coppel; and reguluses by repeated fusions, &c.

In a word, all rectifications are founded upon the same principle; and consist in separating substances more volatile from substances less volatile; and the general method of effecting this is to apply only the degree of heat which is necessary to cause this separation.

Rectification *of vitriolic Acid*. See Concentration.

Rectification, in *Geometry*, is the finding of a right line equal to a proposed curve, or simply finding the length of a curve line; a problem which, even in the present advanced state of analysis, is attended in many cases with considerable difficulty; and was, *in all*, totally beyond the reach of the ancient geometers, who were not able to assign the length of any curve line whatever; though they could, in a few instances, determine the area of a curvilinear space. See Quadrature.

The first rectification of a curve line was effected by Mr. H. Neal, as we are informed by Dr. Wallis, at the conclusion of his Treatise on the Cissoid. This curve was the semicubical parabola, and Neal's rectification of it was published in July or August, 1657; and two years after, *viz.* in 1659, the same was done by Van Haureat in Holland. See Schooten's Commentary on Descartes' Geometry.

It is, however, to the doctrine of fluxions that we owe the complete rectification of curve lines, in finite terms, when they admit of it; and in others by means of infinite series, circular arcs, logarithms, &c.; of which method we shall give a general view in the present article.

Let AMO (*Plate* XIII. *Analysis*, *fig.* 10.) be a curve of any kind, whose ordinates are parallel to one another, and perpendicular to the axis AH; and let the fluxion of the abscis AP be denoted by Pp or MR, and Rm be taken to represent the corresponding fluxion of the ordinate PM, then will the tangent Mm be the line which the generating point of the curve would describe, if its motion were to become uniform at M; consequently this line will truly express the fluxion of the space AM. Hence putting AP $= x$, PM $= y$, and AM $= z$, we have $\dot{z} = Mm = \sqrt{(MR^2 + Rm^2)} = \sqrt{(\dot{x}^2 + \dot{y}^2)}$; from which, and the equation of the curve, the value of z may be determined. But if all the ordinates of the proposed curve ARM (*fig.*) be referred to a centre C; then, putting the tangent RP, intercepted by the perpendicular CP, $= t$, the arc BN, of a circle described about the centre C, $= x$, the radius

radius C N (or C B) $= a$, &c. (see QUADRATURE *of Curves, Case* 2.) we shall have $\dot{z} : \dot{y} :: y$ (C R) $: t$ (R P); and consequently, $\dot{z} = \frac{y\dot{y}}{t}$; whence the value of z will be found, if the relation of y and t is given.

I. To find the length of the semi-cubical parabola, of which the equation is $a x^2 = y^3$, or $x = \frac{y^{\frac{3}{2}}}{a^{\frac{1}{2}}}$.

Here $\dot{x} = \frac{3y^{\frac{1}{2}}\dot{y}}{2a^{\frac{1}{2}}}$, or $\dot{x}^2 = \frac{9y\dot{y}^2}{4a}$; substituting, therefore, this value of $\dot{x}^2$ in the general expression

$$\dot{z} = \surd(\dot{x}^2 + \dot{y}^2), \text{ we have}$$

$$\dot{z} = \surd\left(\frac{9y\dot{y}^2}{4a} + \dot{y}^2\right) = \frac{\dot{y}}{2a^{\frac{1}{2}}}\surd(9y + 4a);$$

the fluent of which is

$$z = \frac{1}{27a^{\frac{1}{2}}} \times (9y + 4a)^{\frac{3}{2}} + C, \text{ correction.}$$

Now when the arc $= 0$, then $y = 0$; therefore

$$\frac{4a^{\frac{3}{2}}}{27a^{\frac{1}{2}}} + C = 0, \text{ or } C = -\frac{4a^{\frac{3}{2}}}{27a^{\frac{1}{2}}};$$

whence the complete fluent is

$$z = \frac{(9y + 4a)^{\frac{3}{2}} - 4a^{\frac{3}{2}}}{27a^{\frac{1}{2}}},$$

which is the length of the curve, answering to any length of the ordinate y.

II. *To rectify the common parabola;* or to find the length of any parabolic arc A M (*fig.* 11.) Let the parameter $= a$, the abscis $=$ A P $= x$, &c. as above. From the well known property of this curve, $a x = y^2$; and $a\dot{x} = 2y\dot{y}$; consequently $\dot{x} = \frac{2y\dot{y}}{a}$, and $\dot{x}^2 = \frac{4y^2\dot{y}^2}{a^2}$, which substituted for $\dot{x}^2$ in the general expression for the length of the curve, makes $\dot{z} = \left(\frac{4y^2\dot{y}^2}{a^2} + \dot{y}^2\right)^{\frac{1}{2}} = \frac{\dot{y}}{a} \times (a^2 + 4y^2)^{\frac{1}{2}}$; which, thrown into an infinite series, becomes $= \frac{\dot{y}}{a} \times \left(a + \frac{2y^2}{a} - \frac{2y^4}{a^3} + \frac{4y^6}{a^5}, \text{ \&c.}\right)$ *i. e.* $\dot{z} = \dot{y} + \frac{2y^2\dot{y}}{a^2} - \frac{2y^4\dot{y}}{a^4} + \frac{4y^6\dot{y}}{a^6}$, &c.

The fluent of this series is $z = y + \frac{2y^5}{3a^2} - \frac{2y^5}{5a^4} + \frac{4y^7}{7a^6}$ —, &c. $=$ the length of the curve A M required.

Otherwise: the above $\dot{z} = \frac{\dot{y}}{a} \times (a^2 + 4y^2)^{\frac{1}{2}}$ is $= \frac{\dot{y}}{a} \times \frac{a^2 + 4y^2}{(a^2 + 4y^2)^{\frac{1}{2}}} = \frac{a^2y\dot{y} + 4y^3\dot{y}}{a \times (a^2y^2 + 4y^4)^{\frac{1}{2}}} = \frac{\frac{1}{2}a^2y\dot{y} + 4y^3\dot{y}}{a \times (a^2y^2 + 4y^4)^{\frac{1}{2}}} + \frac{\frac{1}{2}a^2\dot{y}}{a \times (a^2 + 4y^2)^{\frac{1}{2}}} = \frac{1}{a} \times (a^2y^2 + 4y^4)^{-\frac{1}{2}} \times (\frac{1}{2}a^2y\dot{y} + 4y^3\dot{y}) + \frac{1}{4}a \times \frac{\dot{y}}{(\frac{1}{4}a^2 + y^2)^{\frac{1}{2}}}$. But the fluent of the first of these two terms is $= \frac{1}{2a} \times (a^2y^2 + 4y^4)^{\frac{1}{2}} = \frac{y}{a} \times (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}}$; and the fluent of the last of the two terms is $= \frac{1}{4}a \times$ hyp. log. of $y + (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}}$; therefore $z = \frac{y}{a} \times (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}} + \frac{1}{4}a \times$ hyp. log. of $y + (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}}$. But when z and y vanish, or become equal 0, as they do at the vertex, this fluent becomes $= \frac{1}{4}a \times$ hyp. log. of $\frac{1}{2}a$; and, therefore, the said fluent being corrected, gives the true value of z, or the length of the curve A M $= \frac{y}{a} \times (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}} + \frac{1}{4}a \times$ hyp. log. of $y + (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}} - \frac{1}{4}a \times$ hyp. log. of $\frac{1}{2}a = \frac{y}{a} \times (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}} + \frac{1}{4}a \times$ hyp. log. of $\frac{y + (\frac{1}{4}a^2 + y^2)^{\frac{1}{2}}}{\frac{1}{2}a}$.

Hence, if A C and D C (*fig.* 12.) be the conjugate semiaxes of an equilateral hyperbola; and A C $= a$, M P $= 2y$, Q M $= x$, then will A P $= x - a$; and $x^2 - a^2 = 4y^2$; therefore $x^2 = 4y^2 + a^2$; consequently $x = \surd(4y^2 + a^2)$. If then $q m$ be supposed infinitely near Q M, we shall have Q $q = \dot{y}$, and therefore the element of the area C Q M A $= \dot{y} \times \surd(a^2 + 4y^2)$. Whence it appears, that the rectification of the parabola depends on the quadrature of the hyperbolic space C Q M A.

III. *To determine the length of an arc of the common hyperbola.* Let the semitransverse axis be represented by b, and the semiconjugate by c, and we shall have $\frac{b^2y^2}{c^2} = 2bx + x^2$, from the nature of the curve (see HYPERBOLA); and therefore $x = \frac{b\surd(c^2 + y^2)}{c} - b$: hence $\dot{x} = \frac{by\dot{y}}{c\surd(c^2 + y^2)}$, and $\dot{z} = \surd(\dot{y}^2 + \dot{x}^2) = \surd\left\{\dot{y}^2 + \frac{b^2\dot{y}^2y^2}{c^2 \times (c^2 + y^2)}\right\} = \dot{y}\surd\left(1 + \frac{b^2y^2}{c^4 + c^2y^2}\right)$; which, by converting $\frac{b^2y^2}{c^4 + c^2y^2}$ into an infinite series, becomes $\dot{y}\surd(1 + \frac{b^2y^2}{c^4} - \frac{b^2y^4}{c^6} + \frac{b^2y^6}{c^8} - \frac{b^2y^8}{c^{10}}$, &c.) But still we have the square root to extract: in order to which, let it be assumed $= 1 + Ay^2 + By^4 + Cy^6 + Dy^8$, &c. Then, by squaring, and transposing, there arises

$$\left.\begin{array}{r} 1 + 2Ay^2 + 2By^4 + 2Cy^6 + 2Dy^8, \text{ \&c.} \\ + A^2y^4 + 2ABy^6 + 2ACy^8, \text{ \&c.} \\ + B^2y^8, \text{ \&c.} \\ -1 - \frac{b^2}{c^4} \times y^2 + \frac{b^2}{c^6} \times y^4 - \frac{b^2}{c^8} \times y^6 + \frac{b^2}{c^{10}} \times y^8, \text{ \&c.} \end{array}\right\} = 0.$$

Hence $A = \frac{b^2}{2c^4}$; $B = -\frac{b^2}{2c^6} - \frac{1}{2}A^2 = -\frac{b^2}{2c^6} - \frac{b^4}{8c^8}$; $C = \frac{b^2}{2c^8} - AB = \frac{b^2}{2c^8} + \frac{b^4}{4c^{10}} + \frac{b^6}{16c^{12}}$, &c. &c. Therefore $\dot{z} = \dot{y}\surd(1 + \frac{b^2y^2}{c^4}$, &c.) $= \dot{y} \times (1 + Ay^2 + By^4$, &c.) $= \dot{y} + \frac{b^2}{2c^4} \times y^2\dot{y} - \left(\frac{b^2}{2c^6} + \frac{b^4}{8c^8}\right) \times y^4\dot{y} + \left(\frac{b^2}{2c^8} +\right.$

$\frac{b^4}{4c^{10}} + \frac{b^6}{16c^{12}}\Big) \times y^5\dot{y}$, &c. And consequently $z = y + \frac{b^2y^3}{6c^4} - \left(\frac{b^2}{c^4} + \frac{b^4}{4c^4}\right) \times \frac{y^5}{10c^4} + \left(\frac{b^2}{c^2} + \frac{b^4}{2c^4} + \frac{b^6}{8c^6}\right) \times \frac{y^7}{14c^6}$, &c.

By the very same way of proceeding, the arc of an ellipsis may be found, the equations of the two curves differing in nothing but their signs.

IV. *To rectify the spiral of Archimedes.* The value of t (A T, *fig.* 13.) being denoted by $\frac{by}{\sqrt{(b^2+y^2)}}$ (see TANGENT *of the Spiral*, &c.) we have $\dot{z}\left(= \frac{y\dot{y}}{t}\right) = \dot{y}\frac{\sqrt{(b^2+y^2)}}{b}$; which fluxion being the same as that expressing the arc of the common parabola (Prob. II.), by inserting in the expression $\dot{z} = \frac{\dot{y}}{a} \times (a^2 + 4y^2)^{\frac{1}{2}}$, b for $\frac{1}{2}$ a, its fluent will, therefore, be truly represented by the measure of the said arc, or by $\frac{\frac{1}{2}y\sqrt{(b^2+y^2)}}{b} + \frac{1}{2}b \times$ hyp. log. $\frac{y + \sqrt{(b^2+y^2)}}{b}$, the value there found, by making the proposed substitution.

V. *To rectify the involute of a circle,* whose nature is such, that the part P R (*fig.* 14.) of the tangent intercepted by the point of contact and the perpendicular C P, is every where equal to the radius C O of the generating circle. In this case $\dot{z}\left(= \frac{y\dot{y}}{t}\right) = \frac{y\dot{y}}{a}$, we obtain $z = \frac{y^2}{2a}$, which, corrected by making $y = a =$ A C, becomes $\frac{y^2 - a^2}{2a}\left(\frac{\text{C P}^2}{2\,\text{C A}}\right)$, the true measure of the required arc A R.

VI. *To find the length of a circular arc.*—This may be expressed either in terms of the sine, cosine, versed sine, or any other trigonometrical line, as follows. First,

Let the versed sine $= x$, the sine $= y$, radius $= r$, and arc $= z$, then, by the property of the circle, $y^2 = 2rx - x^2$

or, putting tangent $= t$ - - $y^2 = \frac{r^2t^2}{r^2+t^2}$

and secant $= s$, gives - - $y^2 = \frac{s^2-r^2}{s^2}r^2$

as are readily deduced from the known properties of the circle.

Now, by means of these values of y^2, or of $2rx - x^2$, and the general equation $\dot{z} = \sqrt{(\dot{x}^2 + \dot{y}^2)}$, we readily draw the following values of $\dot{z}$, *viz.*

$$\dot{z} = \begin{cases} \frac{r\dot{x}}{\sqrt{(2rx - x^2)}} = \frac{r\dot{y}}{\sqrt{(r^2-y^2)}} = \\ \frac{r^2\dot{t}}{r^2+t^2} = \frac{r^2\dot{s}}{\sqrt{(s^2-r^2)}} \end{cases}$$

the fluents of which can only be found in series, which are as follows; making radius $r = 1$, *viz.*

$$z = \left(1 + \frac{x}{2\cdot3} + \frac{3x^2}{2\cdot4\cdot5} + \frac{3\cdot5x^3}{2\cdot4\cdot6\cdot7} + \text{\&c.}\right) \times \sqrt{x}$$

$$z = \left(1 + \frac{y^2}{2\cdot3} + \frac{3y^4}{2\cdot4\cdot5} + \frac{3\cdot5y^6}{2\cdot4\cdot6\cdot7} + \text{\&c.}\right) \times y$$

$$z = \left(1 - \frac{t^2}{3} + \frac{t^4}{5} - \frac{t^6}{7} + \frac{t^8}{9} + \text{\&c.}\right) \times t$$

$$z = \left(\frac{s-r}{s} + \frac{s^3-r^4}{2\cdot3s^3} + \frac{3(s^5-r^3)}{2\cdot4\cdot5s^5} + \text{\&c.}\right) \times r$$

where r is retained in the latter for sake of analogy.

It is obvious, therefore, that the arc may be computed by any of these, in terms either of the sine or versed sine, tangent or secant, and consequently also in terms of the cosine, co-tangent, co-secant, &c.

Thus, in the first, taking $x = \frac{1}{2}$, which is the versed sine of 60°, we have

$$\text{arc } 60° = \left(1 + \frac{1}{2\cdot3} + \frac{3}{2^3\cdot3\cdot4\cdot5} + \frac{3\cdot5}{2^5\cdot4\cdot6\cdot7}\right)\sqrt{\tfrac{1}{2}}.$$

In the second, assuming $y = \frac{1}{2} =$ sin. 30°, we have

$$\text{arc } 30° = \left(1 + \frac{1}{2^3\cdot3} + \frac{3}{2^5\cdot4\cdot5} + \frac{3\cdot5}{2^7\cdot4\cdot6\cdot7}\right) \times \frac{1}{2}.$$

In the third, assuming $t = 1 =$ tang. 45°, we obtain

$$\text{arc } 45° = \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \text{\&c.}\right) . r$$

In the fourth, assuming $s = 2 =$ sec. 60°, we get

$$\text{arc } 60° = \left(\frac{2-1}{2} + \frac{2^3-1^3}{2^4\cdot3} + \frac{3(2^5-1^5)}{2^6\cdot4\cdot5} + \text{\&c.}\right) . r$$

Then multiplying the numbers obtained from these series by the number of times that the arc is contained in the whole circumference, will give the circumference required.

But no one of these series is sufficiently convergent for ascertaining the circumference of the circle to a great degree of accuracy, and therefore other methods have been contrived, in order to produce series better calculated for this purpose, of which that of Machin has been the most popular; though it does not appear that he employed it in his celebrated quadrature or rectification, in which he found the circumference to one hundred places of figures.

In order to render these series more converging, it is obvious that less arcs must be assumed, and the difficulty consists only in finding the tangents (for example, using that series) of a small arc, which may be expressed in numbers that are tolerably manageable in the general series.

For this purpose Machin, knowing the tangent of 45° to be 1, and that the tangent of an arc being known, any multiple of it is readily found, considered, that if there were assumed some small simple number for the tangent of an arc, and then the tangent of the double arc were continually taken, until a tangent be found nearly equal to 1, the tangent of 45°: by taking the tangent of this small difference between 45° and the multiple arc, there would be had two very small tangents, the one of the first arc, and the other of this difference. Then computing the arc to these tangents, whether the measure of them in degrees, &c. were known or not, the whole arc of 45° would become known; *viz.* by multiplying the first by the assumed multiple, and adding the last arc to the product, if the tangent of the multiple arc were less than 1, or the arc itself less than 45°; but subtracting it if greater.

Having

Having thus laid down his plan of operation, by a few trials he fell upon a number well suited to his purpose, *viz.* knowing the tangent of $\frac{1}{4}$ of 45°, or $11^\circ\ 15'$, to be very nearly $\frac{1}{5}$, radius being 1, he assumed for his first arc that whose tangent is $\frac{1}{5}$; then since $\tan.\ 2a = \frac{2\tan.\ a}{1 - \tan.^2 a}$, he had $\frac{5}{12}$ for the tangent of his double arc, and $\frac{120}{119}$ for the double of this, or of four times the first, which being a little greater than 45°, was well adapted to his views; for by a known trigonometrical property, $\tan.\ (a - 45) = \frac{\tan.\ a - 1}{\tan.\ a + 1}$; that is, the tangent of the small arc, which is equal to the excess of his multiple above 45°, was $\frac{\frac{120}{119} - 1}{\frac{120}{119} + 1} = \frac{1}{239}$. He had, therefore, two arcs to compute, the one having for its tangent $\frac{1}{5}$, and the other $\frac{1}{239}$; and then four times the first of these arcs minus the latter, would evidently give the exact arc of 45°, and both these numbers being such as to converge very well in the general series, the difficulty attending the usual approximation was avoided. Other approximations, however, have since been discovered, which, if not more rapid, their investigation is, at least, more simple, of which, perhaps, that of Euler's is the most deserving of notice. This celebrated geometer observes, that every arc whose tangent is commensurable with the radius, as, for instance, 45°, may be divided into two arcs, of which the tangents, though much smaller, are still commensurable with the radius; for since

$$\tan.\ (a + b) = \frac{\tan.\ a + \tan.\ b}{1 - \tan.\ a \tan.\ b},$$

we have also

$$\tan.\ a = \frac{\tan.\ (a + b) - \tan.\ b}{\tan.\ (a + b)\ .\ \tan.\ b + 1};$$

where it is obvious that if $\tan.\ (a + b)$ and b be rational, $\tan.\ a$ will also be rational; thus, if $\tan.\ (a + b) = \tan.\ 45^\circ = 1$, and $\tan.\ b = \frac{1}{2}$, we have $\tan.\ a = \frac{1}{3}$, and we shall evidently have a similar result, whatever rational fraction we assume for $\tan.\ b$.

We shall find, therefore, by the series which gives the arc in terms of the tangent, each of these arcs, the sum of which will evidently be the measure of the whole arc sought; whether the arcs themselves, which belong to these tangents, be rational or irrational, with respect to the whole arc of which they form the parts. These tangents, substituted in the general series above, give arc to tan. $\left(\frac{1}{2}\right) =$

$$\frac{1}{2} - \frac{1}{3\ .\ 2^3} + \frac{1}{5\ .\ 2^5} - \frac{1}{7\ .\ 2^7} + \frac{1}{9\ .\ 2^9} - \text{\&c.}$$

and arc to tan. $\left(\frac{1}{3}\right) =$

$$\frac{1}{3} - \frac{1}{3 \cdot 3^3} + \frac{1}{5 \cdot 3^5} - \frac{1}{7 \cdot 3^7} + \frac{1}{9 \cdot 3^9} - \text{\&c.}$$

In both which series, the terms diminish much more rapidly than in the original series, and may therefore be computed with tolerable ease.

But it is evident that we may proceed farther in this approximation, by dividing each of these into other two arcs, by which means the convergency will obviously be much more rapid; and though, generally speaking, for every subdivision we double the number of our series, yet the degree of convergency is so much the greater as amply to compensate for the additional number of series. Besides, we may always subdivide our greater arc, so that one of its subdivisions shall be the same as the smaller arc, in which case we do not increase the number of series. Thus; arc to tan. $\frac{1}{2}$ = arc to tan. $\frac{1}{3}$ + arc to tan. $\frac{1}{7}$; therefore arc to tan. $1 = 2$ arc to tan. $\frac{1}{3}$ + arc to tan. $\frac{1}{7}$. Again; arc to tan. $\frac{1}{3}$ = arc to tan. $\frac{1}{7}$ + arc to tan. $\frac{2}{11}$; therefore arc to tan. $1 = 3$ arc to tan. $\frac{1}{7}$ + 2 arc to tan. $\frac{2}{11}$, and so on to any extent required, which might in course be pursued so far as to render the operation as simple and as little laborious as can be expected in such kind of computations. Even with these already mentioned, the circumference of the circle might undoubtedly be computed to 200 places of decimals, with less labour than it cost Vieta to carry them to 10 places, or Romanus to 15.

The reader will observe, that this approximation differs from Machin's in nothing except the simplicity and generality of the investigation; for if we make the successive subdivision of the greater arc, so as always to include in it the smaller one, we shall find in our results the identical formula of Machin.

Let us repeat our former expression

$$\tan.\ a = \frac{\tan.\ (a + b) - \tan.\ b}{1 - \tan.\ a\ .\ \tan.\ b}.$$

Let $\tan.\ (a + b) = \frac{R}{T}$, $\tan.\ a = \frac{R'}{T'}$, $\tan.\ b = \frac{r}{t}$, and we shall have generally $\frac{R'}{T'} = \frac{Rt - Tr}{Rr + Tt}$.

Let now $\tan.\ (a + b) = 1$, answering to arc 45°, so that $R = 1$, and $T = 1$; assume also $r = 1$, then, by constantly substituting, in the general expression, the values found for R', R'', R''', &c. and T', T'', T''', &c. for R and T respectively, we shall have

$$\frac{R'}{T'} = \frac{t - 1}{t + 1}$$

$$\frac{R''}{T''} = \frac{t^2 - 2t - 1}{t^2 + 2t - 1}$$

$$\frac{R'''}{T'''} = \frac{t^3 - 3t^2 - 3t + 1}{t^3 + 3t^2 - 3t - 1}$$

$$\frac{R^{iv}}{T^{iv}} = \frac{t^4 - 4t^3 - 6t^2 + 4t + 1}{t^4 + 4t^3 - 6t^2 - 4t + 1}$$

$$\frac{R^{v}}{T^{v}} = \frac{t^5 - 5t^4 - 10t^3 + 10t^2 + 5t - 1}{t^5 + 5t^4 - 10t^3 - 10t^2 + 5t + 1}$$

$$\frac{R^{(n)}}{T^{(n)}} = \frac{t^n - nt^{n-1} - \frac{n(n-1)}{1 \cdot 2}t^{n-2} + \&c.}{t^n + nt^{n-1} - \frac{n(n-1)}{1 \cdot 2}t^{n-2} - \&c.}$$

So that, generally, arc to tan. $1 = n \times$ arc to tan. $\frac{1}{t}$ + arc to tan. $\frac{R^{(n)}}{T^{(n)}}$. If we take $n = 1$, and $t = 3$, we have arc tan. $1 =$ arc tan. $\frac{1}{3}$ + arc tan. $\frac{1}{2}$. If $n = 2$, and $t = 3$, we have arc tan. $1 = 2 \times$ arc tan. $\frac{1}{3}$ + arc tan. $\frac{1}{7}$. If $n = 4$, and $t = 5$, we have arc. tan. $1 = 4 \times$ arc tan. $\frac{1}{5}$ − arc tan. $\frac{1}{239}$; which is the formula of Machin; and by giving other values to n and t, a variety of other formulæ might be found, though it would, probably, be difficult to find one more convergent than the last. The reader will find more on this subject in vol. i. of Dr. Hutton's Tracts.

We shall conclude this article by giving the circumference of the circle to 155 places, as given by Zach, from a manuscript which he saw in the Ratcliff library at Oxford, distinguishing the periods of the several approximations of different authors mentioned in the preceding part of this article, and the article QUADRATURE.

The diameter of a circle being 1, the circumference will be

a	b c		d
3·14159,	26535,	89793,	23846,
		e	
26433,	83279,	50288,	41971,
69399,	37510,	58209,	74944,
		f	
59230,	78164,	06286,	20899,
			g
86280,	34825,	34211,	70679,
		*	
82148,	08651,	32823,	06647,
	h		
09384,	46095,	50582,	23172,
		i	
53594,	08128,	4802.	

a, Archimedes; b, Métius; c, Vieta; d, Adrianus Romanus; e, Van Ceulen; f, Abraham Sharp; g, Machin; h, Lagny; i, Oxford Manuscript.

* This figure is a 7 in Lagny's approximation, but Vega, in the revision of the computation, asserts that it ought to be an 8, as we have given it.

RECTIFIED SPIRITS, &c. are such as have undergone the operation of rectification, or have been distilled over and over, to separate from them any heterogeneous matter, which might have arisen with them in the former distillations.

Hence we say, spirit of wine twice rectified, thrice rectified, &c.

It is the rectification that makes the difference between brandy and rectified spirits of wine. See SPIRITS.

RECTIFIER, in *Navigation*, is an instrument used for determining the variation of the compass, in order to rectify the ship's course, &c.

It consists of two circles, either laid upon, or let into one another, and so fastened together in their centres, that they represent two compasses, the one fixed, the other moveable: each is divided into thirty-two points of the compass, and three hundred and sixty degrees, and numbered both ways, from the north and the south, ending at the east and west in ninety degrees.

The fixed compass represents the horizon, in which the north, and all the other points, are liable to variation.

In the centre of the moveable compass is fastened a silk thread, long enough to reach the outside of the fixed compass: but if the instrument be made of wood, an index is used instead of the thread.

RECTIFIER, in the *Distillery*, the person whose employment is to take the coarse malt-spirit of the malt-stiller, and re-distil it to a finer and better liquor. The art of the rectifier might be entirely set aside, if the malt-stiller could make his spirit perfect at a second operation; which seems very practicable, if the malt-stillers could be induced to forsake their old practice. The great things to be recommended for the improvement of their art, would be, first, the brewing in perfection; and secondly, the keeping of their wash after the manner of stale beer, till it has entirely lost its malt flavour, and acquired a pungent acid vinosity; and then, thirdly, leaving out the lees, to distil with a well-regulated fire. It is scarcely to be thought how pure a spirit is to be obtained from malt this way; but the great art would be, the finding of a method to make malt liquors artificially stale, bright, and flavourless, though otherwise vinous. Shaw's Lectures, p. 223.

RECTIFYING *of Curves*. See RECTIFICATION.

RECTIFYING *of the Globe* or *Sphere*, is a previous adjusting of the globe or sphere, to prepare it for the solution of problems. For the method of doing it, see *Use of the Celestial* GLOBE.

RECTILINEAR, RIGHT-LINED, in *Geometry*, is applied to figures whose perimeter consists of right lines.

RECTILINEAR *Angle*, *Maps*, and *Superficies*. See the substantives.

RECTITUDE, RECTITUDO, *Rectum*, in matters of philosophy, refers either to the act of judging, or of willing; and therefore, whatever comes under the denomination of rectitude is either what is true, or what is good: these being the objects about which the mind exercises its two faculties of judging and willing.

Rectitude of the mind, considered as it judges, *i. e.* rectitude of the faculty of judgment, consists in its agreement and conformity to the nature and reason of things, and in its determining and deciding about them according to what their constitutions, properties, uses, &c. really are.

Rectitude of the mind, considered as it wills, called also *moral rectitude*, or *uprightness*, consists in the choosing and pursuing of those things which the mind, upon due enquiry and attention, clearly perceives to be good; and avoiding those that are evil.

RECTITUDINES, in *Law*, rights, or legal dues, belonging either to God, or man. See RIGHT.

RECTO, a writ usually called a *writ of right*; of so high a nature, that whereas other writs in real action are only to recover the possession of the lands, &c. in question, lost by the plaintiff, or his ancestor; this aims to recover both the seisin thus lost, and the property of the thing: so that both rights are here blended together; that of *property*, and that of *possession*.

If a man lose his cause upon this writ, he is without all remedy.

There are two kinds of this writ: *breve magnum de recto*, or or *breve de recto patens*, a writ of right patent; and *recto clausum*, a writ of right close.

The first is so called, because sent open. It lies only for him that hath fee-simple in the lands sued for, against the tenant of the freehold at least.

Indeed, the writ of right patent is extended, in practice, beyond its original intention; for a writ of right of dower, which lies for the tenant in dower, is patent; and so in several other cases. Fitzherb.

The writ of right close, called also *breve parvum de recto*, is directed to the lord of ancient demesne, or the bailiff of the king's manors; and lies for those who hold lands and tenements by charter, in fee-simple, or in fee-tail, or for term of life, or in dower, if they be ejected out of such lands, or disseised. In such case a man, or his heirs, may sue out the writ of right close, directed to the lord of ancient demesne, commanding him to do him right in his court. This is called a writ *secundum consuetudinem manerii*. See Possession, Property, Title, and Writ.

Recto *de advocatione ecclesiæ*, a writ of right, lying where a man has right of advowson in fee to him, and his heirs; and, the incumbent dying, a stranger presents his clerk to the church; and he, not having brought his action of *quare impedit*, nor *darrein presentment*, within six months, has suffered the stranger to usurp upon him. See *Disturbance of* Patronage, Quare *impedit*, and Assisa *darrein presentment*.

Recto *de custodia terræ & hæredis*, a writ which lies for him whose tenant dying in his nonage, a stranger enters, and takes the body of the heir.

This writ as to lands holden *in capite*, or by knight's service, is become useless by the stat. 12 Car. II. but not where there is a guardian in socage, or appointed by the last will of the ancestor. See Guardian.

Recto *de dote*, a writ of right of dower, which lies for a woman that has received part of her dower, and proceeds to demand the remnant in the same town against the heir, or his guardian. This extends either to part or the whole, and is a more general remedy than that mentioned in the next article.

Recto *de dote unde nihil habet*, is a writ of right which lies in case where the husband, having divers lands and tenements, has assured no dower to his wife; and she is thereby driven to sue for her thirds against the heir, or his guardian. See Dower, and *Writ of* Entry.

Recto *quando* or *quia dominus remisit*, a writ of right, which lies in case where lands or tenements in the signory of any lord, are in demand by a writ of right.

If the lord hold no court, or, at the prayer of the demandant or tenant, send his writ to the king's court, to put the cause thither for that time; this writ issues for the other party, and has its name from the words comprised, which is the true occasion of it.

Recto *de rationabili parte*, a writ that lies between privies of blood, as brothers in gavel-kind, or sisters, or other coparceners, as nephews and nieces, and for land in fee-simple.

If a man lease his land for life, and afterwards die, leaving issue two daughters, and, after, the tenant for life likewise dies; the one sister entering on all the land, and so deforcing the other, the sister so deforced shall have this writ to recover her part.

Recto *sur disclaimer*, a writ which lies where the lord, in the court of common pleas, does avow upon his tenant, and the tenant disclaims to hold of him; upon which disclaimer the lord shall have this writ. This takes place when the tenant upon a writ of assise for rent, or on a replevin, disowns or disclaims his tenure; whereby the lord loses his verdict; in which case the lord may have this writ, grounded on this denial of tenure, and shall, upon proof of the tenure, recover back the land itself so holden, as a punishment to the tenant for such his false disclaimer. This piece of retaliating justice, whereby the tenant who endeavours to defraud his lord is himself deprived of the estate, as it evidently proceeds upon feodal principles, so it is expressly to be met with in the feodal constitutions: "vasallus, qui abnegavit feudum ejusve conditionem, exspoliabitur."

Recto *folio*. See Folio.

RECTOR of a parish, the parson, or he who has the charge or cure of a parish church. See Parson.

If the predial tythes of the parish be impropriated, or appropriated, *i. e.* either in lay hands, or in those of some ecclesiastical community, then, instead of *rector*, the parson is called *vicar*, (which see). In England are reckoned 3485 rectories.

The name rector denotes him governor or ruler, *quia tantum jus in ecclesia parochiali habet, quantum prælatus in ecclesia collegiata*.

Rector also denotes the chief elective officer in several foreign universities, particularly in that of Paris.

Rector is also used in several convents for the superior, or officer who governs the house.

The Jesuits used it for the superiors in such of their houses as were either seminaries, or colleges.

RECTORY, or Rectorate, *Rectoria*, a parish church, parsonage, or spiritual living, with all its rights, glebes, and tythes.

RECTRICES, in *Ornithology*, denote the strong feathers of the tails of birds.

RECTUM Intestinum, in *Anatomy*; or in English, simply the *rectum*; is the last portion of the large intestine, and of the whole alimentary canal. It begins at the left sacro-iliac symphysis, below the sigmoid flexure of the colon, and ends at the anus. See Intestine.

Rectum, *Abscesses in the Neighbourhood of*. See Fistula *in Ano*.

Rectum, *Concretions and extraneous Substances lodged in.* The concretions formed in the larger intestines, and especially in the rectum, by the accumulation and protracted lodgment of the feces, may become the cause of obstinate constipation, which can only be removed by their extraction. Sometimes these masses of indurated matter include no extraneous substance; in other instances, their nucleus is a biliary calculus; in a vast number of cases, they are merely composed of the feces in a dry hardened state. It is remarked that women, and persons of advanced age, are most subject to the constipation arising from the obstruction thus occasioned in the large intestines. Children and adults in the vigour of life are not, however, entirely exempt from the disorder, though they seldom have it, except when the formation of such concretions in the bowels has been brought on by swallowing a large quantity of hard indigestible bodies, like cherry and plum-stones. Lastly, excessively hardened masses of fecal matter have been noticed in patients who have for a long while been confined to bed in the recumbent posture by severe diseases.

Whatever may be the cause of the disorder, whether the defect itself consists in a mere accumulation of indurated feces, with which the rectum is distended, and behind which the excrement is detained; or whether the constipation is not complete, the concretion allowing the liquid part of the feces to pass out between it and the inside of the intestine; the existence of the hardened mass may be known by by the conſtipation which it produces; by the ſenſe of weight which the patient feels about the fundament; and alſo by the poſſibility of actually touching the indurated obſtructing body, when a finger is introduced up the rectum.

Oily emollient clyſters, and carminative draughts, will ſerve for expelling ſuch concretions as are not of too firm a conſiſtence; but the extraction of them is abſolutely neceſſary when they are particularly hard. The operation is to be done with a ſpoon, or ſuitable forceps, properly oiled; and, after the concretion has been removed, an emollient clyſter is to be adminiſtered, in order to allay any irritation which may have been cauſed by the introduction of the requiſite inſtruments. When the ſphincter ani contracts ſo forcibly, that the operation is attended with extreme pain and difficulty, we are adviſed by ſurgical writers to make a dilatation of the anus, by practiſing an inciſion at its poſterior angle. A wound made in this direction cannot do injury to any part of conſequence, whilſt there would be a riſk of wounding the urethra in the male, or the vagina in the female ſubject, if the cut were made at the anterior angle. An inciſion, carried laterally, would be apt to injure the pudic veſſels. A diviſion of the fibres of the ſphincter ani does not produce any material permanent weakneſs of its action, and a paralyſis of this muſcle, according to Richerand, can never proceed from ſuch a cauſe. Noſographie Chirurgicale, tom. iii. p. 414. edit. 2.

The hard concretions which lodge in the rectum cannot be reached with the finger when they are ſituated high, and, in this circumſtance, the ſurgeon muſt uſe a probe, or ſound, in order to aſſure himſelf poſitively of their preſence, their moveableneſs, and their ſize.

With regard to foreign bodies lodged in this inteſtine, ſome have been ſwallowed, and have paſſed through the whole extent of the alimentary canal; while others have been puſhed up the anus to a greater or leſſer height. The extraction of theſe laſt is generally attended with a great deal of difficulty, and even demands on the part of the operator more than ordinary ſagacity, in conſequence of the various ſhapes, the hardneſs, and the fragility of theſe different bodies. Glaſs phials, inſtrument caſes, ſhuttles, &c. have been introduced into the rectum by maniacs. One perſon of this deſcription put into his rectum a flintſtone, which did not admit either of being extracted, or broken, owing to its hardneſs, and ſlippery ſurface, and which in the end cauſed the patient to die in the greateſt agony, with ſwelling and gangrenous miſchief in the abdomen. Marchetti has recorded an inſtance, in which a pig's tail, hardened by cold, was forcibly thruſt up the rectum of a girl of the town. This extraneous body could not be withdrawn, as the ſhort briſtles, which all inclined outward, immediately came into contact with and pierced the inner part of the bowel. It remained in the part ſix days, and occaſioned a train of alarming ſymptoms, ſuch as fever, vomiting, ſwelling of the abdomen, and obſtinate conſtipation. Marchetti faſtened a ligature to the end of the foreign body, which protruded at the anus, and then paſſed the ligature through a long piece of reed, which he introduced up the rectum, in order that the foreign body might be drawn through this tube without the inteſtine being lacerated. The experiment was completely ſucceſsful. Obſ. Med. Chir. p. 126.

In another example a piece of wood, three inches long, and two in width, was introduced into the rectum. Colic, tenſion of the abdomen, fever, conſtipation, and difficulty of making water, came on, and laſted ſix days. The impoſſibility of removing the extraneous ſubſtance with a pair of forceps, led to the idea of uſing a borer, which, having been paſſed up the rectum under the guidance of the finger, was inſerted deeply enough into the piece of wood to draw it out. The extraction, however, could not be effected without a great deal of pain. See Mélanges de Chirurgie, par M. Saucerotte, p. 484. Mémoires de l'Academie de Chirurgie, tom. v. p. 605. Laſſus, Pathologie Chirurgicale, tom. ii. p. 569, edit. 2.

Rectum, *Congenital and Syphilitic Contractions of its inferior Portion.* A contraction of the lower end of the rectum is ſometimes an original malformation; but more frequently it ariſes from what has been conſidered by various ſurgical authors to be a venereal thickening of the parietes of this inteſtine. If this be really a ſyphilitic diſorder, a circumſtance which is to be doubted, it is certainly as grievous as any of the more common effects of the venereal diſeaſe. Excreſcences grow from the mucous membrane at the rectum, and diſcharge a purulent matter, which is continually oozing from the anus. When a finger is paſſed within this aperture, the irregularities occaſioned by the tumour may be plainly felt. Such writers as believe in the ſyphilitic nature of this complaint inform us, that the truth of this may be known by the antecedent and co-exiſtent ſymptoms of the venereal diſeaſe. They admit, however, that the diſorder almoſt always laſts after the cure of every other mark of ſyphilis, and they caution us not to perſiſt raſhly in adminiſtering mercury any longer for a diſeaſe which cannot be further benefited by it. Theſe circumſtances are quite ſufficient to prove that there is not much reaſon for the doctrine, that this ſort of contraction of the lower end of the rectum is venereal.

Such writers as conſider the complaint to be connected with ſyphilis, of courſe recommend the exhibition of mercury, and they further adviſe the frequent injection into the rectum of a weak ſolution of the oxymuriate of the ſame mineral. Tents, ſmeared with mercurial ointment, are alſo recommended to be paſſed into the bowel. The latter applications are ſtated to have the advantage; 1ſt, of oppoſing, by mechanical preſſure, the further increaſe of the excreſcences; 2dly, of dilating the contracted part; and, 3dly, of acting on the diſeaſe by their medicinal quality.

For our own part, we much doubt the reality of the venereal nature of the foregoing complaint. The language of the advocates for ſuch a doctrine muſt raiſe ſuſpicions, that they are influenced in their judgment more by prejudice than reaſon. "The venereal affection of the coats of the rectum (ſays one of theſe writers) almoſt always laſts after the total extinction of the ſyphilitic virus. Then, we ought to be content with the employment of dilating mechanical means, without perſiſting in the uſe of medicines, which would ſerve only to ruin the patient's conſtitution. An elaſtic gum cannula is to be preferred, and it ſhould be of a conical ſhape, in order that it may be gradually introduced further and further, in proportion as the dilatation of the bowel is effected." Richerand, Noſographie Chirurg. tom. iii. p. 418, edit. 2.

In caſes of congenital contraction of the rectum, the only plan which can be adopted, is that of making an inciſion through the poſterior part of the inteſtine.

Rectum, *Polypi of.* Sometimes, though not often, polypi grow from the mucous membrane of the rectum, and by their ſize obſtruct the paſſage of the feces. Their exiſtence is at firſt manifeſted by an uneaſy ſenſe of heavineſs, and afterwards they are protruded outwardly in the efforts which the patient makes at ſtool. The anus contracting after their expulſion, their roots become ſtrangulated, ſo that they cannot return, and exceſſive agony is produced. In

In this circumstance, the surgeon should take the opportunity of removing them with a knife, after having tied their root, or even without this precaution. The lining of the rectum, freed from the weight of the tumour, immediately retracts, and if the polypus should have received a supply of blood from a large vessel, hemorrhage may ensue. Such accident may be remedied by completely distending the wounded part of the rectum with a large piece of sponge, or with a compress of lint; but as it is easier to prevent the hæmorrhage altogether, than to stop it after it has occurred, we would advise surgeons, whenever the excrescence is of any size, always to tie its root before removing the rest of it with a cutting instrument.

Rectum, *Prolapsus of*. See Prolapsus *Ani*.

Rectum, *Scirrho-contracted*. Scirrhus of the rectum is not uncommon at an advanced period of life. Sometimes it extends over a considerable length of the gut, but generally it is more circumscribed. The coats of the bowel become much thicker and harder than in the natural state. The muscular coat is subdivided by membranous septa, and the internal coat is sometimes formed into hard irregular folds. The surface of the inner membrane is occasionally ulcerated, so as to form a cancerous disease. Every vestige of the natural structure is occasionally lost, and the gut is changed into a gristly substance. The cavity of the bowel is always rendered narrow at the scirrhous part, and is sometimes almost obliterated. When the passage through the gut is much obstructed, the bowel is always a good deal enlarged just above the stoppage, or stricture, from the accumulation of the feces there. As the disease advances, adhesions form between the rectum and adjacent parts, and ulcerations produce communications between them.

The disease is usually not much noticed till somewhat advanced, not being at first very painful. The patient only thinks that he is costive, and that he voids his stools with a little difficulty. In time, a good deal of pain is felt in the part affected, especially at stool, after which some relief is experienced. Pus and blood may sometimes be noticed with the excrement, particularly when the disease has advanced to the ulcerated state. The patient at length becomes sallow, the constitution suffers, and dissolution follows. Severe tenesmus attends the whole course of the disease.

Default has often seen the disease form a communication between the rectum and vagina, and the feces have passed through the latter part. In the latter stage of the affliction, the rectum, bladder, vagina, uterus, and adjacent parts, are all involved in one common ulceration.

When the disease has attained the ulcerated state, it is probably always incurable. Palliatives can now only be resorted to, such as anodyne and emollient glysters, the warm-bath, &c. with the exhibition of medicines like opium, cicuta, uva ursi, &c. Claudius applied his remedies to the inside of the bowel by means of tents, and did not employ the latter as a mode of curing the disease, when less advanced. Valsalva used to introduce a cannula pierced with numerous holes, when his patient got into the bath, so as to let the fluid enter the intestine. Numerous practitioners, among them Morgagni, made mercurials the base of their treatment, from a supposition that the complaint was of venereal origin.

When the disease is not attended with ulceration, the contraction and thickening of the gut may be diminished by introducing bougies, keeping them for a certain time, every day, so introduced, and increasing their size gradually. The pressure of these instruments seems to lessen the disease, and stop its progress; a proof that its nature differs from that of what is usually understood by scirrhus. Default used to employ long tents, made of lint, smeared with cerate, and passed into the bowel by means of a probe, with a forked end. This surgeon gradually increased the size of the tents, so as to continue the compression, to which he conceived all the good was owing. Their length was also augmented by degrees. Fresh ones were, at first, introduced twice every day. When any hardnesses were situated on the outside of the anus, Default cured them on the same principle, *viz.* by making pressure on them with compresses and a bandage. This eminent surgeon effected a cure of a scirrho-contracted rectum by this method. The woman was taught to pass occasionally the tents herself, so as to prevent a relapse. The disease is said to afflict women more frequently than men: from a comparative table kept at the Hôtel-Dieu, this has been the case there in the proportion of ten to one. See Œuvres Chirurgicales de Default, tom. ii. p. 422.

Rectum, *Hemorrhoidal Swellings of*. See Hemorrhoids.

Rectum, in *Law*. See Recto.

Rectum, in our old *Law Writers*, is also used for a trial or accusation.

Rectum, *Commune*, denotes a trial at law, or in the common course of law. *Stare ad rectum*, denotes to stand a trial. *Rectum rogare*, to petition the judge to do right.

RECTUS, in *Anatomy*, a name applied to several muscles, generally, but not invariably, distinguished by the straightness of their fibres, or of their general direction.

Rectus *abdominis*. See Obliquus.

Rectus *abducens*, or *externus*,
Rectus *adducens*, or *internus*,
Rectus *attollens*, or *superior*,
Rectus *deprimens*, or *inferior*, } muscles of the globe of the eye. See Eye.

Rectus *anterior cruris*, or *femoris*,
Rectus *extensor cruris*, or *femoris*, } synonyms of the Rectus *cruris*; which see.

Rectus *capitis anticus major et minor*. See Rectus *internus*.

Rectus *capitis internus major*, rectus anticus major, trachélo-sous-occipitien; a muscle of the head, flattened, broader and thicker above than below, occupying the anterior and lateral part of the neck, and reaching from the transverse process of the sixth cervical vertebra, to the inferior surface of the basilary process of the occiput. Its anterior surface is covered by the carotid artery, the internal jugular vein, the nerve of the eighth pair, the great sympathetic, and the pharynx. The longus colli, the rectus capitis internus minor, the articulations of the occiput and atlas, and of the latter bone, and the second vertebra, are covered by its posterior surface. The inner edge lies on the longus colli, and is connected to it by cellular substance: the outer is fixed to the front of the transverse processes of the sixth, fifth, fourth, and third cervical vertebræ, and is unattached above the latter. The lower end, very thin and pointed, is fixed to the transverse process of the sixth cervical vertebra: it ascends with a little obliquity from without inwards, increasing in breadth and thickness: it approaches the muscle of the opposite side, and is attached by its upper end to the basilary process of the occipital bone, in front of the foramen magnum. At the upper part of this muscle is a broad and thin aponeurosis, which descends on the anterior and inner surface: the attachments to the transverse processes are by small tendons terminating in muscular portions. The muscular fibres run obliquely between the last mentioned tendons and the aponeurosis.

This muscle bends the head forwards on the neck; and restores it after it has been carried backwards. The muscle of of one fide, acting fingly, inclines the head towards its own fide.

Rectus *capitis internus minor*, or rectus anticus minor, trachéli-fous-occipitien; a fmall mufcle of the head, lying under the laft, fhort, narrow, and flattened, and extending from the atlas to the occiput. It is covered in front by the rectus internus major, the internal carotid artery, and the great fympathetic nerve: behind it covers the capfule of the articulation between the atlas and occiput. The outer and inner edges prefent nothing remarkable. Its lower extremity is fixed to the anterior furface of the lateral portion of the atlas, and to the neighbouring part of its tranfverfe procefs. Thence it afcends, increafing fomewhat in fize, and inclined a little inwards, and is fixed to the under furface of the bafilary procefs of the occiput, behind and a little on the outfide of the rectus internus major, and to the cartilaginous mafs filling the fpace between the occipital and temporal bones. It has aponeurofes at its extremities, and very fhort mufcular fibres between thefe.

Its action on the head is exactly the fame with that of the rectus internus major.

Rectus *capitis lateralis*, le premier tranfverfaire anterieur Winflow, atloïdo-maftoïdien, petit droit lateral; a fmall mufcle of the head, fituated at the upper and lateral part of the neck, flattened and quadrilateral, reaching from the tranfverfe procefs of the atlas to the occiput. It is covered in front by the internal jugular vein; and it covers behind the vertebral artery. The two edges prefent nothing remarkable. Below it is fixed to the front of the upper furface of the tranfverfe procefs of the atlas: thence it afcends a little outwards, and is attached above to the rough impreffion behind the jugular foffa. It is mufcular, except juft at the attachments, which are tendinous. Its action, like that of the two laft mufcles, is to reftore the head, when it has been bent backwards; to bend it forwards; and, when one mufcle acts fingly, to incline it laterally.

Rectus *capitis pofticus major*, axoïdo-occipitien; a mufcle of the head, of a triangular flattened figure, placed at the upper and back part of the neck, and extending from the fpinous procefs of the fecond cervical vertebra to the occiput. Its pofterior furface is covered by the complexus, and above by the obliquus fuperior capitis; the anterior furface covers the pofterior arch of the atlas, the rectus pofticus minor, and the occiput. The inferior extremity, narrow, and almoft pointed, is attached to the fpinous procefs of the fecond cervical vertebra, thence it afcends, directed outwards, and a little backwards, and gradually increafing in breadth, to be inferted in the inferior furface of the occiput, at about an equal diftance from the great external tranfverfe ridge, and the foramen magnum, between the complexus, the obliquus fuperior, and the rectus pofticus minor. The extremities alone are tendinous; the reft being mufcular. It reftores the head, when it has been bent forwards; and carries it back on the vertebral column. When one mufcle acts fingly, it will have the power, from the oblique direction of its fibres, of rotating the head, fo as to turn the face towards its own fide.

Rectus *capitis pofticus minor*, atloïdo-occipitien; a fmall flattened mufcle with radiated fibres, and confequently a triangular figure, placed at the upper and back part of the neck, extending from the atlas to the occiput, and lying with its fellow in the interval between the two recti majores. Its pofterior furface is inclined downwards and covered by the complexus; the anterior furface correfponds to the occiput, and to the interval between it and the atlas. The lower extremity is the narroweft part, and is fixed to the rough impreffion in the middle of the pofterior furface of the pofterior arc of the atlas: it afcends parallel to the oppofite mufcle and directed backwards, and is fixed to the external furface of the occipital bone at a fhort diftance from the foramen magnum. It raifes the head when bent forwards; and extends it or carries it back on the neck.

Rectus *cruris*, rectus extenfor or anterior cruris, droit ou grêle anterieur, ileo-rotulien; a mufcle of the thigh, long and flat, broad in the middle, and narrow towards its extremities, occupying the middle and front part of the limb, and reaching from the anterior and inferior fpine of the ilium to the patella. It is covered in front by the iliacus internus, the fartorius, and the fafcia lata; behind it covers the orbicular ligament of the hip, the great extenfors of the knee, and the external or anterior circumflex veffels. The outer and inner margins of the mufcle are unattached in their upper three-fourths; they are confounded, in their lower fourth, with the extenfors of the knee.

The fuperior extremity of the rectus cruris prefents two tendons, one of which is ftraight, the other curved. The former is fixed to the anterior and inferior fpine of the os innominatum: the latter, curved from before backwards, and from above downwards, is fixed to the outer furface of the os innominatum for about an inch, immediately above the edge of the acetabulum. From this upper attachment the mufcle defcends vertically in front of the thigh, growing broader to the middle of the limb; it then becomes narrow towards the lower part, and is fixed to the bafis of the patella.

The rectus is tendinous at its extremities, and flefhy in the middle. The upper tendon has been already defcribed as divided into two portions; the anterior of thefe, attached to the anterior and inferior fpine of the os innominatum, is the thickeft and fhorteft, and has the fame direction as the mufcle; the other is longer and curved, and detaches fome fibres to ftrengthen the orbicular ligament of the hip. The two portions foon unite in a common tendon; this fpreads out into a broad aponeurofis, which defcends about four inches on the front of the mufcle, and then dips into its fubftance. The inferior tendon is broad and flat, and rifes from the bafis of the patella; its pofterior furface is united to the great extenfors of the knee, and the edges are ftrongly connected to the vaftus externus and internus. It is broad at the patella, grows a little narrower as it rifes, then fpreads out again, and forms a broad aponeurofis, covering the back of the mufcle above its middle. The fuperficial fibres of this tendon defcend over the front of the patella, to which they are ftrongly united, and are loft below in the tendon which unites this bone to the tibia. The mufcular fibres are placed very obliquely between the fuperior and inferior tendons: they cover the back of the firft up to the part where its two portions feparate; and they defcend on the front of the fecond to within two inches of the patella.

It extends the knee-joint, either by bringing the leg forwards upon the thigh, or the thigh upon the leg, according as the one or the other part is rendered a fixed point. If the knee be extended, or firmly retained in the bent pofition by its flexor mufcles, the rectus may bend the thigh upon the pelvis: when the leg and thigh are fixed, it can bend the pelvis forwards upon the latter, as in the attitude of ftooping to pick up any object from the ground. In the erect attitude it prevents the pelvis from inclining backwards; and reftores it when it has been carried in that direction.

Rectus *in curia*, in *Law*, one who ftands at the bar, and no man objects any thing againft him.

When

When a man hath reversed the outlawry, and can participate of the benefit of the law, he is said to be *rectus in curia*.

RECULVER, in *Geography*, a village and parish in the upper half-hundred of Blean-Gate, lathe of St. Augustine, and county of Kent, England, is situated at the distance of 10 miles N.E. by N. from Canterbury. It is noted in history as the scite of the Roman *Regulbium*, the station or castle which defended the northern entrance to the celebrated *Portus Rutupensis*. It is remarkable, that while the ocean has receded from the southern entrance, leaving Richborough (Rutupium) considerably inland, it has gradually advanced upon Reculver. This is proved on the authority of several ancient writers, particularly Leland, who states, that in his time it stood about half a mile from the shore, whereas, at present, the tide washes the walls of many of the village houses, and threatens to overwhelm the whole at no distant period. Regulbium was a station of much importance, as it not only commanded an extensive view of the open sea, but likewise of the mouths of the Thames and the Medway. It was therefore used as a watch-post to discover the approaches of an enemy; and also as a lighthouse to guide sailors. In its perfect state the station was of a square form, with the angles rounded off, and was environed by a ditch exterior to the walls, of which a considerable portion still remains. The extent of the inclosed area from east to west is about 190 yards, and from south to north about 198 yards. The ancient town was without the station, and is supposed to have stood towards the north, on that part of the coast long since swallowed up by the waves: "and from the present shore, as far as a place called Black Rock, seen at low water mark, where, according to tradition, a church once stood, there have been found great quantities of tiles, bricks, fragments of walls, tessellated pavements, and other marks of a ruinated town; and remains of the household furniture, dress and equipment of the horses belonging to its inhabitants, are continually met with among the sands; for after the fall of the cliffs, the earthen parts of them being washed away, these metalline substances remain behind." When a part of the cliff here fell down about the conclusion of the seventeenth century, a number of small vaults, arched over, and several cisterns, were discovered. The latter were all of the same figure, namely, square, and measured from ten to twelve feet in length each side, and the same in depth. They were constructed of posts, driven deep into the ground, with planks two inches thick fixed to them. Their use was evidently the reception and preservation of rain water, which the Romans thought more wholesome than spring water. Vast quantities of Roman coins have been discovered both in the fields and along the shore here; and Du Fresne has produced many, which, from the markings upon them, appear to have been struck at a mint in this place. British and Gaulish coins are likewise occasionally found here; also seals, keys, spoons, gold rings, bracelets, fibulæ, bullæ, belts, bridles, harness, beams of scales or stiliards, and many other articles of which the use has not yet been determined.

When Kent was subdued by the Saxons, Regulbium became a principal seat of the monarchs of that dynasty. It was then called *Raculf* and *Raculf-cester*; and hither king Ethelred retired with his court, after his conversion to Christianity by St. Augustine. In the next century it obtained the name of Raculf-minster, from a Benedictine abbey founded here by Bassa, a priest and nobleman, to whom lands were granted for that purpose by king Egbert, as an atonement for the murder of his two nephews. This abbey was dissolved previous to the Conquest, having probably been destroyed by the Danes. The town, however, continued in a flourishing condition for many years after that event, and had the privilege of a weekly market granted to it in 1313; but this right has been long discontinued. The church here is an ancient and spacious edifice, consisting of a nave, with two aisles, a chancel, and two lofty towers, surmounted by spires at the angles of the west front. The nave is separated from the aisles by five pointed arches, rising from short oblong piers; and from the chancel by three small semi-circular arches, springing from tall round columns, with very singular capitals. In this church kings Ethelbert I. and II. are said to have been buried; and a monument erected to the memory of the first is described by Weever in his "Funeral Monuments," though it has now disappeared. On the floor of the chancel are several brasses of great antiquity. (See RICHBOROUGH.) Beauties of England and Wales, vol. vii. by E. W. Brayley. History and Antiquities of Reculver and Herne, by W. Battely, D. D. 8vo.

RECUMPADO, in *Geography*, a town of Hindoostan, in the circar of Rajamundry; 23 miles N.W. of Rajamundry.

RECUPERATORES, among the Romans, were commissioners appointed to take cognizance of private matters in dispute, between the subjects of the state and foreigners, and to take care that the former had justice done them.

It came at last to be used for commissioners, to whom the prætor referred the determination of any affair between one subject and another.

RECURRENS, in *Anatomy*, a name under which the inferior laryngeal branch of the par vagum is often described, from the circumstance of its arising in the chest below the point of its distribution to the larynx, and then going back into the neck in a retrograde course. See NERVE.

RECURRING SERIES, is a series so constituted, that each succeeding term is connected with a certain number of the terms immediately preceding it, by a certain and invariable law; as the sums or differences of some multiples of those terms. Thus the series

$$\begin{array}{ccccccc} \alpha & \beta & \gamma & \delta & \varepsilon & \theta & \&c. \\ 1, & 3x, & 5x^2, & 7x^3, & 9x^4, & 11x^5, & \&c. \end{array}$$

is a recurring series; for these terms being respectively represented by $\alpha, \beta, \gamma, \delta$, &c. we have

$$\begin{aligned} \gamma &= 2x\beta - x^2\alpha \\ \delta &= 2x\gamma - x^2\beta \\ \varepsilon &= 2x\delta - x^2\gamma \\ \theta &= \&c. \qquad \&c. \end{aligned}$$

that is, each term is equal to $2x$ times that which precedes it, minus x^2 times the one preceding the last.

Or, generally, let

$$\begin{array}{ccccccc} \alpha & \beta & \gamma & \delta & \varepsilon & \theta & \&c. \\ a, & bx, & cx^2, & dx^3, & ex^4, & fx^5, & \&c. \end{array}$$

be any series whose terms are denoted as above, by $\alpha, \beta, \gamma, \delta$, &c. Also, let μ, ν, ξ, &c. represent the successive multipliers by which the terms are connected, so that

$$\begin{aligned} \alpha &= \alpha \\ \beta &= \beta \\ \gamma &= \mu x\beta + \nu x^2\alpha + \&c. \\ \delta &= \mu x\gamma + \nu x^2\beta + \&c. \\ \varepsilon &= \mu x\delta + \nu x^2\gamma + \&c. \\ \theta &= \&c. \qquad \&c. \end{aligned}$$

then this series is called a recurring series; and $\mu + \nu +$ &c. De Moivre calls the *scale of relation*, which is said to be of *one*, *two*, *three*, &c. terms, according to the number of

multipliers

multipliers by which it is connected. In the above we have used only two, μ and ν, whence $\mu + \nu$ is called the scale of relation, which is here of two terms; and 1 minus the scale of relation, as $1 - \mu - \nu$, is called by the same author the *differential scale*, which is always equal to the denominator of the fraction from which the series is produced.

If, in the above series, the terms had the relation

$$\begin{aligned}
\alpha &= \alpha \\
\beta &= \beta \\
\gamma &= \gamma \\
\delta &= \mu x \,.\, \gamma + \nu x^2 \,.\, \beta + \varrho x^3 \alpha \\
\varepsilon &= \mu x \,.\, \delta + \nu x^2 \,.\, \gamma + \varrho x^3 \beta \\
\theta &= \mu x \,.\, \varepsilon + \nu x^2 \,.\, \delta + \varrho x^3 \gamma \\
&\text{\&c.} \qquad \text{\&c.} \qquad \text{\&c.}
\end{aligned}$$

then the scale of relation would be $\mu + \nu + \varrho$, which is of three terms; and the differential scale, or the denominator of the fraction, is $1 - \mu - \nu - \varrho$.

The following problems are naturally connected with the doctrine of recurring series; *viz.*

1. Any recurring series being proposed, to find the scale of relation, or the law of the series, which is not always obvious on inspection.

2. To find the sum of an infinite recurring series, or the sum of any number of its terms (n).

3. To find a general expression for any indefinite term of such a series, as, for example, the nth term.

We shall consider each of these problems under their separate heads.

I. *To find the scale of relation in any proposed recurring series.*

Let $\alpha, \beta, \gamma, \delta, \varepsilon, \theta$, &c. be a recurring series, of which it is required to find the scale of relation

Assume
$$\begin{aligned}
\delta &= \mu' \gamma + \nu' \beta + \text{\&c.} \\
\varepsilon &= \mu' \delta + \nu' \gamma + \text{\&c.} \\
\theta &= \text{\&c.} \qquad \text{\&c.}
\end{aligned}$$

Where β, γ, δ, &c. are known, and μ, ν, &c. unknown quantities, whose numeral values are required, and which are readily found by the usual method of elimination. Thus in the above, using only μ and ν, we have

$$\mu' = \frac{\delta\gamma - \varepsilon\beta}{\gamma\gamma - \delta\beta}, \text{ and } \nu' = \frac{\delta\delta - \gamma\varepsilon}{\beta\delta - \gamma^2}.$$

These values of μ', and ν', will obviously contain in them the powers of the indeterminate quantity x, which being taken out, we shall have the required numeral values of μ and ν.

Let it be required to ascertain the scale of relation in the series

$$\begin{matrix} \alpha & \beta & \gamma & \delta & \varepsilon & \theta & \text{\&c.} \\ 1, & 3x, & 5x^2, & 7x^3, & 9x^4, & 11x^5, & \text{\&c.} \end{matrix}$$

Here, by substituting the proper values of β, γ, δ, &c. in the above equation, we have

$$\mu' = \frac{35x^5 - 27x^5}{26x^4 - 21x^4} = \frac{8x^5}{4x^4} = 2x$$

$$\nu' = \frac{49x^6 - 45x^6}{21x^4 - 25x^4} = \frac{4x^6}{-4x^4} = -1x^2$$

when $\mu = 2$, and $\nu = -1$.

The same method may obviously be employed in any other case; but in order to know whether or not we have assumed a scale of relation of a sufficient number of terms, we must repeat the same operation upon three other terms, of which one at least was not before employed; and if both give the same values, we may be assured of the truth of our results: or we may otherwise, instead of repeating the operation, examine the several terms, and see whether they agree with the law we have determined, and if not, we must increase the terms in our scale of relation; for it may be observed, that we can never fail of determining them in consequence of having assumed too many terms, as we shall, in that case, have one of our results zero.

Lagrange has formed a different rule for ascertaining whether a given series be recurring or not, which Mr. Bonnycastle has given at p. 323 of his Algebra; but as it does not seem adapted for detecting the law of formation, we shall not insert it.

II. *To find the sum of any recurring series, of which the scale of relation is known.*

$$\text{Let } \begin{cases} \alpha & \beta & \gamma & \delta & \varepsilon & \theta & \text{\&c.} \\ a, & bx, & cx^2, & dx^3, & ex^4, & fx^5, & \text{\&c.} \end{cases}$$

be a recurring series, of which the scale of relation is $\mu + \nu$, so that

$$\begin{aligned}
\alpha &= \alpha \\
\beta &= \beta \\
\gamma &= \mu x \,.\, \beta + \nu x^2 \alpha \\
\delta &= \mu x \,.\, \gamma + \nu x^2 \beta \\
\varepsilon &= \mu x \,.\, \delta + \nu x^2 \gamma \\
&\text{\&c.} \qquad \text{\&c.} \qquad \text{\&c.}
\end{aligned}$$

Here it is obvious, that the whole sum

$$S = \alpha + \beta + \gamma + \delta + \varepsilon + \text{\&c.}$$
$$S = \alpha + \beta + \mu x(\beta + \gamma + \delta +) + \nu x^2(\alpha + \beta + \gamma + \text{\&c.})$$
$$S = \alpha + \beta + \mu x(S - \alpha) + \nu x^2 \,.\, S$$

$$\text{whence } S = \frac{\alpha + \beta - \mu a x}{1 - \mu x - \nu x^2}$$

which is a general expression when the scale of relation is of two terms.

When the scale of relation is of three terms, so that

$$\begin{aligned}
\alpha &= \alpha \\
\beta &= \beta \\
\gamma &= \gamma \\
\delta &= \mu x \,.\, \gamma + \nu x^2 \,.\, \beta + \varrho x^3 \alpha \\
\varepsilon &= \mu x \,.\, \delta + \nu x^2 \,.\, \gamma + \varrho x^3 \beta \\
\theta &= \mu x \,.\, \varepsilon + \nu x^2 \,.\, \delta + \varrho x^3 \gamma \\
&\text{\&c.} \qquad \text{\&c.} \qquad \text{\&c.}
\end{aligned}$$

it is equally obvious that

$$S = \alpha + \beta + \gamma + \delta + \varepsilon + \theta + \text{\&c. or}$$

$$S = \begin{cases} \alpha + \beta + \gamma + \\ \mu x\ (\gamma + \delta + \varepsilon + \text{\&c.}) + \\ \nu x^2\ (\beta + \gamma + \delta + \text{\&c.}) + \\ \varrho x^3\ (\alpha + \beta + \gamma + \text{\&c.}), \text{ or} \end{cases}$$

$$S = \alpha + \beta + \gamma + \mu x(S - \alpha - \beta) + \nu x^2(S - \alpha)\ \varrho x^3 + S$$

whence we have

$$S = \frac{\alpha + \beta + \gamma - \mu x\ (\alpha + \beta) - \nu x^2 \,.\, \alpha}{1 - \mu x - \nu x^2 - \varrho x^3}$$

which is the general expression for the sum, when the scale of relation is of three terms.

In the same manner we have

$$S = \frac{\alpha + \beta + \gamma + \delta - \mu x(\alpha + \beta + \gamma) - \nu x^2(\alpha + \beta) - \varrho x^3 \,.\, \alpha}{1 - \mu x - \nu x^2 - \varrho x^3 - \sigma x^4}$$

for a scale of relation of four terms; and so on.

But as the terms $\alpha, \beta, \gamma, \delta$, &c. contain in them certain powers of x, we may reduce the above expressions to simpler forms

forms by fubftituting a for α, $b\,x$ for β, $c\,x^2$ for γ, &c. in which cafe the above become

$$S = \frac{a + (b - a\mu)\,x}{1 - \mu x - \nu x^2}$$

$$S = \frac{a + (b - a\mu)\,x + (c - b\mu - a\nu)\,x^2}{1 - \mu x - \nu x^2 - \varrho x^3}$$

$$S = \frac{a + (b - a\mu)\,x + (c - b\mu - a\nu)\,x^2 - (d - c\mu - b\nu - a\varrho)\,x^3}{1 - \mu x - \nu x^2 - \varrho x^3 - \sigma x^4}$$

which are the feveral expreffions for the fcales of relation of two, three, or four terms, and the law of formation is fufficiently obvious for any other fcale.

The fame law might have been otherwife obtained as follows. It is evident, from what is done above, that the fcale of relation fubtracted from unity is always equal to the denominator of the generating feries, and the fame may alfo be demonftrated on other principles. In order, therefore, to find the numerator, we might affume the propofed feries

$$a + b\,x + c\,x^2 + d\,x^3 + \text{ \&c.}$$
$$= \frac{a' + b'x + c'x^2 + d'x^3 + \text{ \&c.}}{1 - \mu x - \nu x^2 - \varrho x^3 - \text{ \&c.}}$$

then multiplying this denominator by the propofed feries, and equating the co-efficients of the products with thofe of the like powers of x in the numerator, we fhould find

$$\begin{aligned} a' &= a \\ b' &= b - a\mu \\ c' &= c - b\mu - a\nu \\ d' &= \text{\&c.} \qquad \text{\&c.} \end{aligned}$$

as in the preceding formulæ.

It is only neceffary to obferve, farther, that if the indices of x do not follow the law we have fuppofed, we muft make the neceffary correction in the general expreffion, and if the propofed feries have no power of x in it, as commonly happens, we muft, in the conclufion, make $x = +1$.

The above formulæ, it will be obferved, give the fum of the infinite feries. When only a certain number of terms are to be fummed, different formulæ are required, which we fhall inveftigate, after having fhewn how to obtain a general expreffion for the nth term of fuch recurring feries. We propofe, however, in the firft place, to illuftrate the above rules by one or two examples.

Exam. 1.—Required the fum of the infinite recurring feries $1 + 6x + 12x^2 + 48x^3 +$ &c. the fcale of relation being $1 + 6$.

Here $a = 1$, $b = 6$, $\mu = 1$, and $\nu = 6$, whence

$$\frac{a + (b - a\mu)\,x}{1 - \mu x - \nu x^2} = \frac{1 + 5x}{1 - x - 6x^2},$$

the fum required.

Exam. 2.—Required the fum of the infinite recurring feries

$$1 + 4x + 6x^2 + 11x^3 + 28x^4 + 63x^5, \text{ \&c.}$$

the fcale of relation being $2, -1, +3$.

Here $a = 1$, $b = 4$, $c = 6$; $\mu = 2$, $\nu = -1$, and $\varrho = 3$; whence

$$S = \frac{a + (b - a\mu)\,x + (c - b\mu - a\nu)}{1 - \mu x - \nu x^2 - \varrho x^3} =$$
$$\frac{1 + (4 - 2)\,x + (6 - 8 + 1)\,x^2}{1 - 2x + x^2 - 3x^3} =$$
$$\frac{(1 + x)^2 - 2x^2}{(1 - x)^2 - 3x^3},$$

as required

III.—*To find the general term of any propofed recurring feries.*

From the preceding part of this article it appears, that every recurring feries may be confidered as arifing from the developement or expanfion of fome rational fraction of the form

$$\frac{a + b\,x + c\,x^2 + d\,x^3 + \text{ \&c.}}{1 - \alpha x - \beta x^2 - \gamma x^3 - \delta x^4 - \text{ \&c.}}$$

Let us, therefore, fuppofe this fraction to be converted into the infinite recurring feries $A + B\,x + C\,x^2 + D\,x^3 + E\,x^4 +$ &c. of which we already know how to determine the co-efficients, and the law of their formation.

Now if this rational fraction be decompofed into its fimple fractions by the method explained under the article RATIONAL *Fractions*, and each of thefe fimple fractions be then converted into a recurring feries, it is evident that the fum of all thefe feries ought to be equal to the original feries

$$A + B\,x + C\,x^2 + D\,x^3 + E\,x^4 + \text{ \&c.}$$

Now each of thefe partial fractions being of the form $\frac{A'}{1 - r\,x}$, the feries thence arifing will have the form

$$A' + A'r\,x + A'r^2x^2 + A'r^3x^3 \;.\;.\;.\; A'r^n x^n$$

of which $A\,r^n x^n$ is the general term. Hence, the feveral feries arifing from the partial fractions may be fuppofed to be

$$\begin{aligned} &A' + A'\,r\,x + A'\,r^2\,x^2 + A'\,r^3\,x^3 \ldots A'\,r^n x^n \\ &A'' + A''\,r'\,x + A''\,r'^2\,x^2 + A''\,r'^3\,x^3 \ldots A''\,r'^n x^n \\ &A''' + A'''\,r''\,x + A'''\,r''^2\,x^2 + A'''\,r''^3\,x^3 \ldots A'''\,r''^n x^n \\ &A^{\text{iv}} + A^{\text{iv}}\,r'''\,x + A^{\text{iv}}\,r'''^2\,x^2 + A^{\text{iv}}\,r'''^3\,x^3 \ldots A^{\text{iv}}\,r'''^n x^n \end{aligned}$$

and fince the fum of thefe feries is equal to the original one propofed, we know that the co-efficients of the like powers of x are alfo equal, whence we have

$$\begin{aligned} A &= A' + A'' + A''' + A^{\text{iv}} + \text{ \&c.} \\ B &= A'r + A''r' + A'''r'' + A^{\text{iv}}r'' + \text{ \&c.} \end{aligned}$$

whence it appears that the co-efficient of any term x^n of the recurring feries is equal to the fum of the co-efficients of the fame power of x, which arife from expanding the feveral fimple fractions into which the given fraction is decompofed; and this co-efficient is always equal to the fum of each of the numerators of the feveral fimple fractions, multiplied into the nth power of the correfponding value of r in the denominator of the fame fraction, at leaft while the denominator contains no equal factor. But if, among the partial fractions, there is any one of the form $\frac{A'}{(1 - r\,x)^2}$, the general term of this will be $(n + 1)\,A\,r^n x^n$; of $\frac{A}{(1 - r\,x)^3}$, the general term is $\frac{(n+1)\,(n+2)}{1\,.\,2}\,A\,r^n x^n$; and univerfally $\frac{A}{(1 - r\,x)^k}$, the general term is

$$\frac{(n + 1)\,(n + 2)\,(n + 3)\;.\;.\;.\;(n + k - 1)}{1\,.\,2\,.\,3\;.\;.\;.\;(k - 1)}$$

we may, therefore, in all cafes wherein the generating fraction of the original feries admits of a rational decompofition, arrive very readily at the general term upon the principles above explained.

Thus,

Thus, as an example, let there be proposed the recurring series

$$1 + 4x + 14x^2 + 46x^3 + 146x^4 + \&c.$$

to find the general term, or the co-efficient of x^n.

The sum of this series is found by the preceding part of this article to be $\frac{1 - x}{1 - 5x + 6x^2}$.

This rational fraction is equal to $\frac{-1}{1 - 2x} + \frac{2}{1 - 3x}$. Now the general term of $\frac{1}{1 - 2x}$ is $- 2^n x^n$; and of $\frac{2}{1 - 3x}$ is $- 2 \cdot 3^n x^n$, as shewn above, therefore the general term of the proposed series will be $(2 \cdot 3^n - 2^n) x^n$.

It may be observed, however, that this method is in some cases very laborious, and not always practicable; it will, therefore, frequently be better to make use of the *multinomial theorem*, which may be done by putting the generating fraction under the form

$$(a + bx + cx^2 + \&c.)(1 - \alpha x - \beta x^2 - \gamma x^3 - \&c.)^{-1}$$

See *Multinomial* THEOREM.

IV.—*To find the sum of any number* (n) *terms of a recurring series.*

For this purpose it is only necessary to find the co-efficient of the $n + 1$th term of the series. Then, from the sum of the entire series subtract the sum of the series beyond the nth term, and the difference will obviously be the sum of the first n terms sought.

Let there be proposed as an example to find the sum of n terms of the series

$$1 + 2x + 3x^2 + 4x^3 + \ldots \ldots n x^{n-1}.$$

The infinite sum of this series is readily found $= \frac{1}{(1 - x)^2}$.

In the second case, *viz.* of the terms beyond $n x^{n-1}$, the series is

$$(n+1) x^n + (n + 2) x^{n+1} + (n + 3) x^{n+2}, \&c.;$$

and in the formula $s = \frac{\alpha + \beta - \alpha \mu x}{1 - \mu x - \nu x^2}$ we have only to substitute $\alpha = (n + 1) x^n$, and $\beta = (n + 2) x^{n+1}$, instead of $\alpha = 1$ and $\beta = 2x$, as in the former. Hence we have

$$s' = \frac{(n + 1) x^n + (n + 2) x^{n+1} - 2(n + 1) x^{n+1}}{1 - 2x + x^2}, \text{ or}$$

$$s' = \frac{(n + 1) x^n - n x^{n+1}}{(1 - x)^2};$$

and, therefore, $s - s'$, or the sum of the first n terms is equal to

$$\frac{1 - (n + 1) x^n + n x^{n+1}}{(1 - x)^2}.$$

2. Required the sum of n terms in the series

$$1 + 3x + 5x^2 + 7x^3 + \ldots \ldots (2n - 1) x^{n-1}.$$

Here, by trial, we find the scale of relation to be $\mu = + 2$, and $\nu = - 1$, as before, therefore the infinite sum is

$$s = \frac{\alpha + \beta - \alpha \mu x}{1 - \mu x - \nu x^2} = \frac{1 + 3x - 2x}{1 - 2x + x^2} = \frac{1 + x}{(1 - x)^2}.$$

After n terms, the series becomes

$$(2n + 1) x^n + (2n + 3) x^{n+1} + (2n + 5) x^{n+2} + \&c.$$

which therefore arises from the fraction

$$\frac{(2n + 1) x^n + (2n + 3) x^{n+1} - 2(2n + 1) x^{n+1}}{1 - 2x + x^2} =$$

$$\frac{(2n + 1) x^n - (2n - 1) x^{n+1}}{(1 - x)^2}$$

whence the sum of n terms is

$$\frac{1 + x - (2n + 1) x^n + (2n - 1) x^{n+1}}{(1 - x)^2}$$

3. Required the sum of n terms of the series

$$(n - 1) x + (n - 2) x^2 + (n - 3) x^3 + \&c.$$

Here again the scale of relation is $+ 2 - 1$, therefore the infinite sum is

$$\frac{(n - 1) x + (n - 2) x^2 - 2(n - 1) x^2}{(1 - x)^2} =$$

$$\frac{(n - 1) x - n x^2}{(1 - x)^2}$$

After n terms, it becomes $- x^{n+1} - 2 x^{n+2} -$ &c. the sum of which is found in the same manner to be $\frac{- x^{n+1}}{(1 - x)^2}$; therefore n terms of the proposed series is

$$\frac{(n - 1) x - n x^2 + x^{n+1}}{(1 - x)^2}$$

Hence, also, n terms of the series

$$\frac{(n - 1) x}{n} + \frac{(n - 2) x^2}{n} + \frac{(n - 3) x^3}{n} + \&c. \text{ is}$$

$$\frac{(n - 1) x - n x^2 + x^{n+1}}{n (1 - x)^2}$$

In a similar manner the sum of n terms of the series

$$1^2 + 2^2 x + 3^2 x^2 + 4^2 x^3 + \&c.$$

is found to be

$$\frac{1 + x - (n + 1)^2 x^n + (2n^2 + 2n - 1) x^{n+1} - n^2 x^{n+2}}{(1 - x)^3}$$

the scale of relation being $3 - 3, 1$.

In all the preceding examples we have determined the infinite sum of the series, as beginning at the first term, and at the $(n + 1)$th term, a more easy method is as follows, which is due to Simpson. Essays, p. 96.

Let $A + B + C + D + \ldots + K + L + M + N$ be any finite recurring series, of which each term depends upon the three which precede it, the scale of relation being p, q, r, so that

$$\begin{aligned} pA + qB + rC &= D \\ pB + qC + rD &= E \\ \&c. \quad \&c. \quad &\&c. \end{aligned}$$

or, which is the same,

$$\begin{aligned} pA + qB + rC - D &= 0 \\ pB + qC + rD - E &= 0 \\ pC + qD + rE - F &= 0 \\ \ldots \ldots \ldots \ldots \\ pK + qL + rM - N &= 0 \end{aligned}$$

whence,

whence, by addition

$$\left.\begin{array}{l} p(A + B + C + ..K) + q(B + C + D + L) + \\ r(C + B + D + ..M) - (D + E + F + N) \end{array}\right\} = 0$$

Or, reprefenting the whole fum by S,

$$\left.\begin{array}{l} p(S - L - M - N) + q(S - A - M - N + \\ r(S - A - B - N) - (S - A - B - C \end{array}\right\} = 0$$

which, by addition and divifion, gives

$$S = \frac{p(L + M + N) + q(A + M + N) + r(A + B + N) - (A + B + C)}{p + q + r - 1}$$

where the fum depends merely upon the three firft and the three laft terms of the feries; and a fimilar expreffion, it is obvious, may be obtained for any other fcale of relation.

It may not be amifs to obferve, that when the propofed feries is wholly numeral, (the fum of which, as we have before obferved, is to be found by making $x = 1$); both this formula and the preceding one fail, in the cafe in which the denominator of the fraction becomes zero, and we muft, therefore, in fuch cafes, have recourfe to other methods of fummation, as given under the article SERIES.

On this fubject the reader fhould confult De Moivre's Mifc. Analyt. and his Doctrine of Chances, and Euler's Analyfis Infinitorum, where he will find an explanation of its application to the approximation to the roots of equations. Colfon's Comment on Newton's Fluxions. Stirling's Methodus Differ. Cramer's Analyfis des Lignes Courbes. Bernoulli de Serieb. Inf. &c. See alfo a chapter on this fubject, in vol. ii. of Bonnycaftle's Algebra.

RECURVIROSTRA, the *Avocet*, in *Ornithology*, a genus of birds of the order Grallæ, of which the generic character is; bill depreffed, fubulate, recurved, pointed, flexible at the tip; the feet are palmate, four-toed, the hind toe not connected, very fhort, and placed high up; the noftrils are narrow, pervious; the tongue is fhort. There are only three

Species.

* AVOCETTA; Scooping Avocet; called alfo in different parts of this country, butter-flip, fcooper, yelper, crooked-bill, &c. This bird is variegated with white and black; the bill is three inches and a half long; irides hazel; crown black; a white fpot behind and beneath the eyes; reft of the head, neck, back, exterior part of the wings, leffer quill-feathers, tail, and under part of the body, white; inner fcapulars and greater quill-feathers without and at the tips black; legs blueifh, and very long; membrane connecting the toes indented. It refides in the temperate parts of Europe, weighing thirteen ounces; and meafuring, from the tip of the bill to the end of the tail, eighteen inches. It breeds in the fens of Lincolnfhire, and on Romney Marfh, in Kent. The female lays two white eggs, tinged with green, and marked with large black fpots. In winter thefe birds affemble in fmall flocks of fix or feven, and frequent the fhores, particularly the mouths of large rivers, in fearch of worms and marine infects, which they fcoop out of the mud or fand. They feem to be particularly fond of the cancer, pulex, or locufta. By means of their long legs, they run over fhores that are covered five or fix inches with water. In their movements they are lively, alert, volatile, and difficult to catch. When the female is frightened off her neft fhe counterfeits lamenefs; and when a flock is difturbed, they fly with their necks ftretched out, and their legs extended behind, over the head of the fpectator, making a fhrill noife, and uttering a yelping cry of twit, twit, all the time.

AMERICANA; American Avocet. The head and neck are reddifh; back black, beneath it is white. It inhabits North America and New Holland; is fourteen inches long. Bill black; front dufky-white; neck above white; primary and tertial wing-coverts black, the middle ones, and fome of the fecondary quill-feathers, white.

ALBA; White Avocet. This fpecies is white; the lower wing-coverts brownifh; bill orange; legs brown. Inhabits Hudfon's Bay; fourteen inches and a quarter long. Bill tipt with black; edge of the wings, greater quill-feathers, and tail, tinged with yellowifh.

RECUSANTS, in a general fenfe, perfons, whether Papifts or others, who refufe to go to church and to worfhip God after the manner of the church of England. Popifh recufants are Papifts, who fo refufe; and a popifh recufant convict is a Papift legally convicted of fuch offence. See PAPIST, PRÆMUNIRE, and TOLERATION.

RECUSATION, RECUSATIO, an act by which a judge is defired to refrain from judging fome certain caufe, on account of his relation to one of the parties; or of fome capital enmity, or the like.

By the French laws, kinfhip within the fourth degree is deemed a legal caufe of recufation; as alfo the judge's being godfather, &c. of one of the parties.

By the laws of England alfo, in the times of Bracton and Fleta, a judge might be refufed for good caufe; but now the law is otherwife, and it is held that judges or juftices cannot be challenged. Co. Litt. 254. See CHALLENGE.

RED, in *Phyfics*, one of the fimple or primary colours of natural bodies, or rather of the rays of light.

The red rays are thofe which are of all rays the leaft refrangible: hence, as fir Ifaac Newton fuppofes the different degrees of refrangibility to arife from the different magnitudes of the luminous particles of which the rays confift, the red rays, or red light, is concluded to be that which confifts of the largeft particles. See COLOUR, LIGHT, and RAY.

Authors diftinguifh three general kinds of red; one bordering on the blue, as colombine, or dove-colour, purple, and crimfon; another bordering on yellow, as flame-colour and orange; and between thefe extremes is a medium, partaking neither of the one nor the other, which is what we properly call *red*.

Acids generally turn black blue, and violet into red; and red into yellow, and yellow into a very pale yellow.

Alkalies change red into violet, or purple; and yellow into feuillemort, or dead leaf-colour.

Terreftrial and fulphureous matters become red by extreme heat; and fome, at length, black, as we fee in brick, red bole, red chalk, flate, &c. All thefe, when vitrified by a burning-glafs, become black.

Lobfters become red by a moderate fire; and by a violent one, black. Mercury and fulphur mixed and heated over a moderate fire make a beautiful red, called *artificial cinnabar*.

An acid fpirit, as lemon juice, being poured on a blue folution of turnfole, turns it into a beautiful red. Alkali reftores it again to its original blue. Filtrating of fome reddifh wines takes from them all their red colour.

M. De la Hire obferves, that a very luminous body viewed through a black one, always appears red; as when the fun is feen fhining through a black cloud. He adds, that fome people who fee all the other colours perfectly well, yet have no idea of red, and only fee it as black.

RED, in *Cofmetics*, a fucus or paint with which the ladies enliven their cheeks and lips.

There

There are two kinds of reds; the one in leaves, called Spanifh red; the other a liquor, which is an extract of a fcarlet dye.

Red, in *Dyeing*, is one of the five fimple or mother colours of the dyers.

Some reckon feven kinds, or cafts of red: *viz.* fcarlet-red, crimfon-red, madder-red, half-grain-red, half-crimfon-red, lively orange-red, and fcarlet of cochineal. But they may be all reduced to three, according to the three principal drugs which give the colours; which are kermes, cochineal, and madder.

The fine fcarlet, called *fcarlet of the Gobelins*, is given with agaric, bran-water, woad, and fcarlet grain, or kermes. Some dyers add cochineal, and others fenugreek; brightening it with bran-water, agaric, tartar, and turmeric. See Kermes and Scarlet.

Crimfon-red is dyed with bran-water, tartar, and meftique cochineal. See Crimson.

Madder-red is dyed with madder; to which fome add realgar, or red arfenic: others, common falt, or other falts, with wheat-flour; or agaric with fpirit of wine, with galls or turmeric. See Madder.

The half-grain is made with agaric and bran-water, half fcarlet grain, half madder, and fometimes turmeric.

The half-crimfon is made of half madder, half cochineal. As to the lively orange-red, the ftuff muft be firft put in yellow, then in a liquor made of goat's hair, (which has been boiled feveral times with madder,) diffolved over the fire with certain faline liquors, as urine, tartar, &c.

The fcarlet of cochineal, or Dutch fcarlet, as the French call it, is made with ftarch, tartar, and cochineal; after firft boiling it with alum, tartar, fal gemma, and aqua fortis in which pewter has been diffolved.

Befides thefe feven reds, which are good and allowed colours, there is alfo a Brafil red; which is difcouraged, as fading eafily.

Of the feven good reds, only four have particular cafts, or fhades; the madder-red, crimfon-red, lively orange-red, and fcarlet of cochineal.

The cafts or fhades of crimfon are flefh colour, peach colour, carnation rofe colour, and apple-tree flower colour. Thofe of madder are flefh colour, onion-peel colour, and flame colour. Thofe of orange are the fame with thofe of crimfon. Scarlet, befides the fhades of all the reft, has fome peculiar to itfelf, as cherry colour, fire colour, &c. See Dyeing.

Red, in the *Manufacture of Glafs*. See *Red* Glass.

To make a deep red in glafs, the following method is that moft practifed by the glafs-men. Take cryftal frit twenty pounds, broken pieces of white glafs one pound, calcined tin two pounds; mix thefe well together, and put them into a pot to melt and purify. When thefe are melted, take fteel calcined, fcales of iron from the fmith's anvil, both powdered very fine, of each an equal quantity; put leifurely an ounce of this mixed powder to the before mentioned metal; mix all well together, and let them ftand fix or eight hours in fufion to incorporate; take out a proof after this, and if there be too little of the powder, it will appear of a dufky yellow; then more of the powder muft be added, and then add three quarters of an ounce of calcined brafs, ground to a fine powder; mix them thoroughly together, and the mafs will be of a blood red; continue ftirring the whole together, and frequently taking out proofs of the colour, when it is right, work it immediately, otherwife it will lofe its colour and become black. The mouth of the pot muft in this procefs be left open, elfe the colour will be loft. Neri's Art. of Glafs, p. 100.

Red, in *Heraldry*. See Gules.

Red, in *Painting*. For painting in oil colours they ufe a red called *cinnabar*, or vermilion; and another called *lacca*. See each in its place.

In limning and frefco, for a violet red, inftead of lacca they ufe reddle, a natural earth found in England; for a brown red, they ufe burnt ochre, which is a native yellow earth, made red by calcination. It is chiefly brought from Oxfordfhire; and burnt by thofe who prepare it in large ovens. The marks of its goodnefs are brightnefs of colour, and a friable chalky texture, without manifefting any gritty roughnefs when rubbed betwixt the fingers.

The common Indian red, which is of a hue verging to the fcarlet, is much ufed, on account of its ftanding and warm though not bright colour, in finer as well as coarfer paintings in oil. It may be prepared by taking of the caput mortuum or ochre left in the iron pots after the diftillation of aqua fortis from nitre and vitriol, two parts; and of the caput mortuum or colcothar left in the long necks after the diftillation of oil of vitriol, one part; breaking the lumps found among them, and putting them into tubs with a good quantity of water: and having left them to ftand for a day or two, frequently ftirring them, then lading off as much water as can be obtained clear from them, and adding a frefh quantity; repeating the fame treatment till all the falts be wafhed out, and the water comes off nearly infipid. The red powder which remains muft then be wafhed over, and, being freed from the water, laid out to dry. When this is defigned for nicer purpofes, it fhould again be wafhed over in bafons.

The true Indian red is a native ochreous earth of a purple colour, brought from the ifland of Ormus, in the Perfian gulf; and called, among the authors on thefe fubjects, *terra Perfica*. At prefent it is very rarely to be found; but it is certainly very valuable (there being no other uncompounded purple colour in ufe with oil) as well for the force of its effect, as for the certainty of its ftanding. In its genuine ftate, it needs no other preparation than grinding or wafhing over. It may be eafily diftinguifhed from any fictitious kind, by its being more bright than any other ochre which can be made fo purple; and if it be rendered artificially purple by any addition, the fire will foon betray it; into which the genuine may be put without any hazard of change.

Venetian red is a native red ochre (fee Veneta *bolus*), not much different from the common Indian red, but fouler; and may be eafily prepared, by mixing common red ochre with the colcothar or caput mortuum taken out of the aqua fortis pots, and wafhed over. As it is generally ufed by the houfe painters in imitation of mahogany, it requires no other preparation than to be well ground with the oil with which it is ufed; but when it is ufed in miniature painting, it fhould be carefully wafhed over.

Red, *Blown*, in the *Porcelain Manufacture*, a name given to a peculiarly coloured china ware, of a fpangled red, or to the colour alone that fpangles it. It is an ornament eafily introduced into ufe in our own manufactories of porcelain ware, and is done in the following manner. The colour is to be prepared of common copperas, calcined to a red colour in a charcoal fire, in a crucible, with another luted on the top of it inverted, and with a hole in its bottom. The fignal of the calcination being finifhed, is, when the black clouds ceafe to come up through the hole, and a fine white thin vapour rifes in their place. The veffels are to be then fuffered to cool, and the red matter in them is to be reduced to a fine powder, while the veffels to be coloured with this are yet wet. The operator is to provide a glafs pipe, and covering one end of it with a piece of fine gauze, he is to dip this into the powder, and taking it carefully out, with what little is fticking to it, he is to blow againft the veffel at fome diftance from it: thus the fineft part of the powder only will reach the veffel, and will be laid on in form of glittering fpangles, very fmall, but all diftinct. This is fort of colouring much efteemed by the Chinefe themfelves, and they have a way of ufing the common blue in the fame manner; but few of the veffels thus painted come over to us.

Red *Clover*, in *Agriculture*, an ufeful artificial grafs for arable lands. It has this name in contradiftinction to the white and fome other forts. There were at firft many and very great prejudices againft and objections made to the introduction of this plant into cultivation by farmers, which were not furmounted without difficulty, and it prevailed for fome length of time in particular diftricts, as Staffordfhire and Worcefterfhire, before it was known in fome other counties, where it is now very predominant and beneficial, as Chefhire, Lancafhire, and many more.

In fome arable counties red clover is found to fail as a crop when long cultivated, dying away in the winter and fpring, which the farmers defignate by faying that the land is fick of it. This is a fevere inconvenience to them in many cafes; and renders fuch variations in the courfes of cropping neceffary, as may prevent the recurrence of it fo frequently as has hitherto been the cafe. It is very liable to fail in every part of the county of Effex, but of the caufe of which there are different opinions, fome thinking that the land becomes fick of the plant, while others do not afcribe it to any fatiety of this nature, but alter their modes of cropping that it may not take place fo often. About the Belcamps and Bofely this is very much the cafe, fome venturing it only once in feven years, and in that cafe it fucceeds well. In all the Tendring hundred it is found to decline little on the ftrong rich lands, but is felt on the lighter forts; on both the cropping is varied in regard to it. In the neighbourhood of Thorndon the lands are fick of it. And at Audley End the land is tired of it, but more in many cafes from want of fufficient feed than any thing elfe. In the vicinity of Hallingbury it is very liable to fail, if fown oftener than once in feven or nine years, though the fyftem thereabouts is crop and fallow.

In the county of Oxford fome fow red clover twice in ten years, the land being new to it; of courfe it never fails. On the gravelly loamy foils about Henly it dies from repetition, fo that it is alternately omitted in cropping, others being fubftituted, as white clover, trefoil, and peas. Nothing of this fort was known forty years ago, but now they fow it only once in two rounds. The loams and ftonebrafh lands around Wood Raton are not in general tired of this plant; fome however find it to fail on the latter fort of foil. About Great Tew, where the lands have been inclofed forty years, they are not yet tired of red clover. At Atterbury, where the lands have been inclofed more years, it does not now fucceed quite fo well as it did fifteen or twenty years ago. In thefe failures other crops are put in, as tares and early peas drilled.

Some fufpect fheep's dung to be deftructive to the red-clover plant, but there are no proofs of the fact.

The moft proper management of red clover as a preparation for wheat is a matter of great importance. Some think feeding it off wholly the beft practice; others mowing and feeding; and a few mowing altogether. The method of feeding off the crops altogether, when done in a clofe even manner, is probably the moft advantageous in this intention, though there may be fome immediate lofs and inconvenience; after which that of mowing the firft crop and feeding the fecond in a ufeful manner; the third mode, or that of mowing twice, is moft to be feared, but upon fome forts of land it may be done and anfwer well for wheat. Thefe methods are all practifed and have their advocates in different parts of Effex; and fome think that they get as good wheat after white as red clover, as well as that feeding the latter does no injury in this refpect.

The farmers in Oxfordfhire follow nearly the fame practices, and hold much the fame opinions in regard to the management of this crop as a preparation for wheat. And the cuftom of mowing and feeding off the firft year, is thought the beft practice in fome other counties.

But in the county of Lancafter, and fome others adjoining it, they know nothing of the land being ever *fick* or *tired* of this fort of crop, though they grow it in more frequent fucceffion and in a more full manner than perhaps any where elfe in the kingdom. Afk the farmers about this, from one end of the above county to the other, they are all of the fame opinion, and appear much furprifed at the queftion, not ever having any conception of fuch a circumftance. What can be the reafon that red clover has been as long and as frequently cultivated in thefe diftricts, as in thofe where it is fo liable to fail? Does it depend upon the difference in the nature or quality of the foils, or the management in regard to the quantity of feed and other matters? The circumftance is worthy of further and more clofe attention and inveftigation, in confequence of its great importance to the farmer.

There is one particular feature of management in the cultivation of red clover in the county of Oxford, which is that of hand-fowing over it from fourteen to fifteen bufhels of Newbury peat-afhes, that are brought into the Thames, by the Reading canal, on the acre, about the end of February or the beginning of the following month; which has an immediate effect upon it, feldom failing to produce a crop, except where it naturally declines. The expence is eftimated at about ten fhillings the acre. Thefe afhes do not, however, feem to be employed in this way to the red clover crop in the diftrict where they are found and prepared.

Seeded red clover undergoes two fucceffive threfhings, the firft, which only beats off the heads and chaffs containing the feed from the ftalks, is called *cobbing* in fome places; the parts thus feparated being denominated the red-clover *cobb*. The work is performed on a thick wooden plank frame for the purpofe, and requires much labour to feparate the feed, which, when done, is cleaned and paffed through different fieves, being ultimately divided into two forts, the primary and fecondary. The coft of thefe operations is very great, amounting to from four to fix fhillings the bufhel, and fometimes much more. It has been concluded by Mr. Middleton, that this plant grows a full crop in all the arable lands of this country, from the fands of Norfolk to the clays of Cleveland and Suffex. And that various foils that have been exhaufted by corn, and not much accuftomed to red clover, have been fo much reftored by it, as to produce a good crop of wheat; but that to do this every means fhould be ufed to fecure a full crop, as that is an excellent preparation for corn, and feldom fails of enfuring a confiderable produce, arifing from fhade, fmother, and putrefaction, the natural and conftant attendants of full-grown red clover. It is fuppofed advifeable, in fome cafes of poor land, to feed both crops off on the land by fheep and other animals, in fome way or other. And fometimes to mow the firft and feed the fecond, or the contrary. In every point of view this is an interefting plant to the farmer. See Clover.

Red *Gum*, an insect disease on wheat, by which the ears of the grain are deprived of their nutrition, and thereby prevented from perfecting themselves. It is described by Mr. Middleton to be a collection of insects, which are visible to the unassisted eye, and which, in the early part of their growth, are of a reddish colour, but become brown with age: the black spots on the straw, blades, and ears of the wheat, are supposed to be the excrement of the insects. The blighted ears are probably rendered so, by the insects piercing the necks of the straw immediately below them, and sucking the saccharine juice, otherwise destined for filling the corn. In those ears which have both perfect and imperfect grains, the insect has perhaps inserted its probe at the connection between the corn and the straw, and by drinking up the food of the grains severally, has starved many of them in such a manner as to cause their destruction and decay. The exact nature of the disease is not, however, yet well ascertained.

Red *Hay*, a term used to signify such as is mow-burnt, in opposition to such as is green from a moderate heat, and *vinny* hay, or such as is mouldy.

Red *Land*, a term used by husbandmen to express a sandy soil of a reddish hue, interspersed for the most part with pieces of sand-stone of the same colour, or somewhat deeper.

It may be noticed that there are several varieties of this soil: one of which is almost entirely made up of sand; another with an admixture of loam with the sand, the whole making a loose loamy earth; and a third full of fragments of a poor sandy iron ore, and often containing shining speculæ of selenite. See Soil.

In some of the more northern parts of the county of Oxford, there is a rich red sandy loam, upon a red grit-stone rock. In some places this land is of a more sandy quality than in others; and, in particular instances, a deep red loam, or red clay. The lands are mostly of an excellent quality, both for arable purposes and those of grass; but the sandy sorts are better than those of the clayey kinds, especially for the former use. The red soiled tracts in this district are considered as the boast and glory of the county, as they are deep, sound, friable, and yet capable of tenacity; being well suited to almost every sort of plant which can be trusted to them, in the way of cultivation. Soils of this nature prevail more or less in a vast number of counties throughout the kingdom, even from the more southern ones to those far advanced towards the north.

Red *Roan*, a term signifying the red tinge in ripening barley, and sometimes other sorts of grain.

Red *Row*, a provincial term, applied to the grains of barley, when in a ripening state, or streaked with red. The crop is then said to be in the red row.

Red *Antimony*, in *Mineralogy*, an ore of that mineral, of a cherry-red colour, containing, according to Klaproth,

67.5 antimony,
10.8 oxygen,
19.7 sulphur.

It occurs most frequently in minute diverging capillary crystals. It melts and evaporates before the blowpipe, yielding a sulphureous odour. See Antimony.

Red *Arsenic*. See Arsenic.

Red *Chalk*. See Reddle, and *Ores of* Iron.

Red *Cobalt*, called *cobalt crust*, and *cobalt bloom* or *ochre*, an ore of cobalt, of a peach blossom red colour. See Cobalt.

Red *Copper*, *Ruby copper*, an ore of copper, of a cochineal red colour, inclining to a lead-grey. It consists, according to Klaproth, of 91 parts copper and 9 of oxygen. See Copper.

Red *Hæmatite*, *Fer oligiste concreticnne* of Haüy, an ore of iron, found in kidney-shaped and globular balls. The structure is fibrous, and divergingly radiated, but arranged in concentric curves; the colour is a blueish-grey, intermixed with red. By friction, it acquires a high metallic lustre. It yields from 60 to 70 *per cent.* of pure iron. (See Iron.) An excellent ore of this kind is procured near Ulverstone, in the north of Lancashire, much valued, as producing an iron of a peculiarly ductile quality, suited for the purposes of the wire-drawers.

Red *Lead*. See Minium and Lead.

Red *Scaly Iron Ore*, *Fer oligiste luisant* of Haüy. It consists of scaly particles slightly cohering; it has an unctuous feel, and stains the fingers. It passes into micaceous iron ore.

Red *Schorl*. See *Ores of* Titanium.

Red, or *Ruby Silver Ore*, *Argent antimonié sulphuré* of Haüy. Werner divides this into two sub-species, dark red silver ore, and light red silver ore, distinguished from each other by their colour, and the situations in which they occur. The dark red ore is commonly accompanied by galena, antimonial sulphuret of silver, quartz, calcareous spar, and pyrites. The colour is between cochineal red and lead-grey. It occurs massive, disseminated, and crystallized in equiangular six-sided prisms, frequently variously truncated. The form of the primitive crystal is an obtuse rhomboid, whose plain angles are 104° 28′ and 75° 32′; the inclination of the faces 109° 28′ and 70° 32′. The external lustre is splendent, and in some specimens metallic; internally it is shining, and sometimes semi-metallic and metallic. The fracture is uneven, and in the crystallized varieties imperfectly small conchoidal. See *Ores of* Silver.

The massive varieties are opaque; the crystallized, semi-pellucid and pellucid. The colour of the streak is a cochineal red. This variety yields easily to the knife: before the blowpipe or charcoal it decrepitates, and melts with a slight effervescence, emitting a dense smoke, which colours the charcoal yellow, and leaves a globule of silver. The specific gravity is 5.563 to 5.608.

The light red silver ore is usually accompanied by native arsenic, white cobalt ore, orpiment, and sulphate of barytes. The colour passes from a carmine red to a medium between cochineal red and lead-grey. In most of its characters it agrees nearly with the dark red silver ore; but when fused, it yields an arsenical vapour. Hence some chemists have conjectured that this ore differs from the dark red ore, by the former containing antimony, and the latter arsenic. According to Klaproth, red silver ore contains nearly

60 of silver,
10.5 sulphur,

$$\text{Combined with 29.4 of antimonial kimes, or}\left\{\begin{array}{l}20.3 \text{ antimony,}\\ 3.2 \text{ oxygen,}\\ 5.9 \text{ sulphur.}\end{array}\right.$$

A variety of red silver ore, probably the light red ore of Werner, analysed by Proust, gave

74 sulphuret of silver,
25 sulphuret of arsenic.
.6 oxyd of iron.

Red silver ore may be distinguished from cinnabar and red copper ore, by its specific gravity, which is considerably less than the former, and greater than the latter; the specific gravity of red silver ore being 5.6 to 5.8.

of cinnabar	7 to 7.5.
red copper	3.9

Red *Vitriol*, a salt found at Neusohl, in Hungary, in the form

form of tranfparent cryftals of a pale rofe-red colour, and more or lefs tranfparent. It was difcovered by Klaproth to be a fulphate of cobalt. Its folution affords a pale blue precipitate, with carbonate of potafh, which tinges borax a pure blue colour.

Red *Charr*, in *Ichthyology*. See Charr.

Red *Eye*, *Erythrophthalmus*, the *cyprinus erythrophthalmus* of Linnæus, called by fome *rothauge*, or *rootang*, which, in the German language, fignifies the fame. It very much refembles the common river bream in fhape, but that it is fomewhat thicker. The fins are all red, and the whole body of the fifh is ftained with a very elegant red, but no part of it fo much as the iris of the eyes. When the fcales are off, the body is of a greenifh hue; and it has a yellow fpot under the tongue. It much refembles the river mullet in fome particulars, but it is of a more beautiful colour, and its eyes are more red. Its largeft fize feems a foot in length. It is a well-tafted fifh; and fpawns in April, under cover of the roots of trees. Ray.

This fifh is called *rudd* by fome Englifh authors; it is alfo called *rutilus latior*, *rubellio fluviatilis*, and *finfcale*. It is very common in many of the rivers of Germany and England, and is in feafon all the year, except in fpawning time, when the male is fubject to a great number of white fpots on its head, and is more rough than at any other feafon. Willughby. See Cyprinus *Erythrophthalmus*.

Red-*Breaft*, in *Ornithology*, a well-known bird, for the characters of which, fee Motacilla *Rubecula*.

The fong of this bird is remarkably fine and foft, and continues through the greateft part of the winter, fpring, and fummer. Many of the autumnal fongfters feem to be the young cock red-breafts of that year. Pennant.

Thompfon, in his Seafons, Winter, line 246, has admirably defcribed the annual vifits of this gueft: and the ancient ballad of " The Babes in the Wood," recording the affection of this bird for mankind, is univerfally known.

Red *Chatterer* of Latham, *Red-bird* from Surinam of Edwards, and *Ampelis carnifex* of Gmelin, a bird of red colours, with an ocular band, and the wing and tail-feathers black at their tips. It is found in New Spain, Guiana, and Surinam.

Red *Game*, an Englifh name of a bird, common in the mountainous parts of Yorkfhire, and fome other of our northern counties. See Gor-*cock*, Grouse, and Tetrao *Lagopus*.

Red-*Pole*, or *Linnet*. See Fringilla and Linnet.

Red-*Pole*, *Yellow*, or *Red-headed Warbler*. See Motacilla *Petechia*.

Red-*Shank*, the name of a water bird, called by authors *gallinula erythropus*, and *callidrys*; the *fcolopax calidris* of Linnæus. It is about the fize of the common plover. The back is of a greyifh or brownifh-green, ufually fpotted with black; its neck grey, and its throat variegated with black and white; the breaft is white, with a few loofe ftreaks of black; the wing-feathers are variegated with black, brown, and white; the bill is two fingers breadth long, flender, and fhaped like the beak of the woodcock; reddifh at the bafe, and blackifh lower down; its legs are of a fine beautiful red, and the hinder toe is very fhort and fmall. It breeds in the fens and marfhes; is found on moft of our fhores; conceals itfelf in winter in the gutters; and is generally found fingle, or at moft in pairs. When difturbed it flies round its neft, making a noife like a lapwing. It lays four eggs, of a whitifh colour tinged with olive, and marked with irregular fpots of black, chiefly on the thicker end. Ray and Pennant. See Scolopax.

Red-*Start*, the Englifh name of the *ruticilla*, or *motacilla phœnicurus* of Linnæus, a very beautiful bird. The bill and legs of the male are black; the forehead white; the crown of the head, hind part of the neck, and the back, are of a deep blue-grey; the cheeks and throat black; the breaft, rump, and fides, are red; the two middle feathers of the tail brown, the others red; the wings brown. In the female, the top of the head and back are of a deep afh colour; the rump and tail of a duller red than thofe of the male; the chin white; the lower fide of the neck cinereous; and the breaft of a paler red.

This bird appears among us only in the fpring and fummer, and is obferved to come over nearly at the fame time with the nightingale. It is fo fhy, that it will forfake its neft, formed with mofs on the outfide, and hair and feathers within, in hollow trees and the holes of buildings, if the eggs are only touched. It has a very fine foft note; and is remarkable for fhaking its tail, and moving it horizontally, as a dog does when fawning. Pennant.

Red-*Start*, *Greater*. See Lanius *Infauftus*. See alfo Turdus *Saxatilis*.

Red-*Start*, *Indian* or *Bengal*. See Lanius *Emeria*.

Red-*Start*, *Small American*. See Muscicapa *Ruticilla*.

Red-*Start*, *Grey*. See Motacilla *Gibraltarienfis* and *Erithacus*.

Red-*Stone Poll*. See Linnet.

Red-*Tail*. See Motacilla *Erithacus* and *Guianenfis*.

Red *Tanager*, and *Summer Red-bird*. See Tanagra.

Red-*Wing*, the name of a bird of the turdus, or thrufh kind, called alfo in fome places the *wind thrufh*, or *fwine pipe*; and by Linnæus and others the *turdus iliacus*, or *ilias*.

It is a little fmaller than the common thrufh, and is lefs fpotted. Its back, neck, and head, are of the fame colour with thofe of the common thrufh; but its fides under the wings, and the feathers which line the wings, are of an orange colour, or dufky red; its belly and breaft are whitifh, and its throat yellowifh, with brown fpots: the wings are of a fort of chefnut colour, a little variegated. It feeds on infects, as worms, and the like; and is a bird of paffage, coming to us in large flocks about the fame time with the fieldfare, and leaving us alfo when that bird does. When the red-wing appears on the coaft in autumn, it is certain the woodcocks are near. It is not well known where they breed, though fome have gueffed it to be in the mountains of Germany and Bohemia. They have a bitterifh tafte, and are lefs valued than the fieldfare. With us they have a difagreeable piping note; but in Sweden, during the fpring, they fing very finely, perching on the top of fome tree among the forefts of maples. They neft in hedges, and lay fix blueifh-green eggs fpotted with black. Ray and Pennant.

Red *Water*, a difeafe in fheep. It has been fuppofed by farmers to be caufed by taking too much watery food, fuch as turnips, clover, rape, eddifh, &c., but it is not peculiar to fheep feeding on turnips or rape, as has been believed by fome. Its removal has been attempted by the ufe of common falt, a tea-fpoonful of elixir of vitriol, and the frequent driving the animal about; and it is afferted, that the difeafe may be wholly prevented by having recourfe to the ufe of dry food, in the night time, while the fheep are feeding upon thefe juicy kinds of food. See Sheep.

In Suffex the fheep are fometimes affected with this complaint on their being firft turned into turnips, which is fuppofed to be caufed by their eating too large a portion of them in wet feafons. The difeafe is alfo believed to originate in the fheep being let out of the fold, when the ground is covered with hoar froſt; and often from feeding in the oat-erſhes about the beginning of the autumn, when the young oats are ſtrong. It is thought here to be readily obviated by allowing a ſmall quantity of hay ſo as to counteract the great waterineſs of the turnip; the quantity of half a pound or even leſs in the courſe of the day is believed to be quite enough for each ſheep in this intention. It is likewiſe ſuſpected, that clover, ſtubble, and folded land, are productive of it in wet weather or moiſt ſeaſons.

Red *Weed*, in *Botany*, a name given to a plant common in the Bermudas, and ſome other places; and called by our firſt travellers to that part of the world, the *Summer Iſland red weed*. Its berry is of a fine red colour, and affords a tincture little inferior to that of cochineal, and poſſeſſing all its virtues in medicine: the only misfortune of this, and ſome other very fine vegetable colours, is, that they fade ſoon. The juice of the fruit of the opuntia, or prickly pear, is as fine a dye as can be procured from the cochineal; but it will not ſtand; the inſect feeding on this, however, we find affords a colour of the ſame nature that will ſtand. The fruit of the red weed is in the ſame manner liable to be eaten by inſects as that of the prickly pear; and it is worthy a trial, whether the colour obtained at ſecond hand from thoſe inſects, will not ſtand as well as the cochineal does, and whether the inſects may not be propagated in a ſufficient abundance to ſerve the markets in the ſame manner. Phil. Tranſ. N° 40.

Red *Weed* is alſo a provincial term, ſignifying the round ſmooth-headed poppy, a pernicious weed in corn-fields. See Weeds.

Red *Worm*, in *Natural Hiſtory*, the name of an inſect very deſtructive to young corn crops. The following deſcription of this worm has been given by Mr. W. Baker: after obſerving, that he has often heard of the havoc which red worms make in young wheat, barley, and oats; and in ſome few writers upon huſbandry has read of them, but never ſaw them till May 1764; when, to his great mortification, in a few days they deſtroyed almoſt totally nine acres of his wheat, for he did not reap above half a barrel *per* acre; and that the ingenious M. de Chateauvieux ſpeaks of an inſect, which is certainly of the ſame kind, if it be not the very inſect which he has now under conſideration; and in noticing the loſs ſuſtained in wheat crops, ſays, they found in it many little white worms, which afterwards became of a cheſnut colour. They poſt themſelves between the blades, and eat the ſtems. They are uſually found between the firſt joint and the roots; every ſtalk which they attacked grew no more, but became yellow and withered. And the ſame misfortune happened to them in the year 1732. The inſects appeared about the middle of May, and made ſuch havoc, that the crops were almoſt deſtroyed; Stillingfleet, alſo, in the ſecond edition of his Miſcellaneous Tracts, ſpeaks of an inſect, which is probably the ſame as in Suffolk and in ſome parts of Norfolk, where the farmers find it their intereſt to encourage the breed of rooks, as the only means to free their grounds from the grub, from which the tree or blind-beetle comes, and which in its grub ſtate deſtroys the roots of corn and graſs to ſuch a degree, that he has ſeen a piece of paſture land where you might turn up the turf with your feet: he adds, that Mr. Matthews, a very obſerving and excellent farmer of Wargrove, in Berkſhire, told him, that the rooks one year, whilſt his men were hoeing a turnip field, ſat down in a part of it, where they were not at work, and that the crop was very fine in that part, whereas in the other part there were no turnips that year; though M. de Chateauvieux deſcribes this worm as being firſt white, and afterwards becoming of a cheſnut colour, he has carefully ſought them at different periods during the paſt year, but always found them of the ſame cheſnut colour, never varying in any particular except that of ſize, which he finds to be the caſe at all ſeaſons in which he has ſeen them; and he obſerves, that the inſect ſpoken of by Stillingfleet as a grub, which, he ſays, deſtroys corn and graſs, induces him to believe that it is the ſame inſect (though the report which he relates from Mr. Matthews ſeems to contradict it), becauſe he has obſerved that the red or cheſnut worm never appears voluntarily upon the ſurface; but when the earth is turned up, either with plough or ſpade, the rooks or crows are very bold in their approach to pick them up, a circumſtance which, he owns, has in ſome degree abated his enmity to theſe birds; he therefore never deſtroys or frightens them off his land whilſt he is ploughing it; but when he ſows, when the corn riſes, and when it is ripe, he deſtroys or baniſhes them as well as he can, becauſe the miſchief which they do at theſe times is intolerable; he has alſo obſerved his lucern to decay in its tops ſoon after it has been up; and upon examining the roots he has found the red worm which had eat them off; and that, in fact, this inſect ſeems to be every where in Ireland called the red worm, but by ſome of the Engliſh writers, who have ſpoken of an inſect which deſtroys the corn in the manner already mentioned, which he thinks undoubtedly the ſame, it is called a grub, by others the large maggot, and the rook worm, becauſe the rooks eat it.

Theſe worms are about half an inch long, and about one-tenth of an inch in diameter; they are jointed in their ſkins, and are of a very firm texture: they have many ſhort legs, two ſmall black ſpecks, which appear to be their eyes; and two ſmall points ſpringing from their heads, with which, he believes, they eat the corn, and which in that work, he apprehends, act like forceps: and all that he has ſeen of this ſpecies are of a bright cheſnut colour. For this reaſon, he ſhould conceive it would be more deſcriptive to call them the cheſnut-worms. When they are expoſed to the air, by turning up earth which is infeſted with them, they will very ſoon cover themſelves again in the ſoil, which they are very capable of doing by the ſtrength which their make gives them, although they appear to be a ſluggiſh inſect, and have not the advantage of a ſlimyneſs upon their ſkins, which the common large creeping worm has, which enables that inoffenſive worm to penetrate the earth, and get under timber and ſtones with eaſe. The red worm, immediately endeavouring to cover itſelf from the air, is certainly, he thinks, from natural inſtinct, as it will ſoon die when expoſed to the air, as will appear by the experiment, N° 10, mentioned below.

It is further ſtated, that theſe worms deſtroy wheat, barley, oats, and lucern, while in an infant ſtate, in the months of March, April, and May. Late ſown barley and oats they will deſtroy as late as June. He has not yet experienced that they deſtroy any other crops. The miſchief done by them is in dry weather. Rain ſufficient to penetrate the ground makes them deſiſt from deſtroying the corn; and he ſuppoſes every thing elſe which they at any time injure. They eat wheat off juſt above the crown of the roots; barley and oats in the ſame place, and alſo higher up, upon any part of the ſtem which is below the ſurface of the earth. And theſe worms ſeem to abound more in ground which is lightly tilled, than in ſuch as hath been well tilled; but in lay ground they ſeem to be more numerous than any where elſe: and the fields upon his farm in which he has found them, are wetter than other fields where they are not; whether that circumſtance contributes to their increaſe, he cannot ſay; but the following

lowing experiments prove that they will live longer in water than they can when expofed to the open air.

Experiments.

N° 1. He put ten red worms into a wine glafs with common falt in it. They were all dead in four hours.

N° 2. Into a glafs with brine in it he put ten red worms. They were all dead in fix hours.

N° 3. Into a glafs with lime in it, which had been flaked for a long time, and expofed to the weather, he put the like number. They were all dead in forty-four hours.

N° 4. Into a glafs with the above lime, and fome water in it, he put the like number. They were dead in twenty hours.

N° 5. Into a glafs with lime newly flaked, and when cold, he put the like number. They were dead in fourteen hours.

N° 6. Into lime water, made with cold water, he put the like number. They were dead in ten hours.

N° 7. Into a glafs with foot in it, he put the like number. They were dead in four hours.

N° 8. Into foot and water he put the like number. They were dead in four hours.

N° 9. Into pure water he put the like number. They were dead in fifty-two hours.

N° 10. Into a glafs, without any thing in it, he put the like number. They were dead in thirty-two hours.

It is ftated that by thefe experiments it is feen that all the articles ufed will kill this infect in a fhort time, particularly the falt and foot. He thought it neceffary to confider different articles, the better to fuit different parts of the kingdom.

Where lime can be conveniently had, and that it is ufed as manure, he is apt to believe, from the experiments, that no injury can be fuftained from thefe worms; but he is afraid a fmall quantity will not effectually deftroy them; befides, he fhould fear, if it were not put on before the fowing of the corn, that it might finge the blades of the corn; for, from thefe experiments, it appears that lime newly flaked is more fuddenly deftructive to them than old lime, and therefore it is to be preferred.

Where lime is ufed for no other purpofe than to deftroy this worm, he fhould conceive, that about eight barrels, regularly fown by hand on an acre of ground, might be fufficient: it muft be firft flaked and cold before a man can poffibly caft it upon the ground with his hand, lime being a very ftrong cauftic; and even when it is cold the man fhould have a thick glove upon his hand.

Where falt may be ufed to deftroy this worm, it muft always be fown upon the ground before the intended crop; for although corn will vegetate, and receive benefit from falt as a manure, when it is ufed antecedent to the fowing of the corn, yet if it be added after the corn is growing it will certainly deftroy it: therefore it fhould never be ufed for this purpofe, but before the corn is fown, or at leaft before it vegetates.

He conceives that where falt is ufed for this purpofe only, about four hundred and a half to an acre will anfwer the purpofe, which is a little more than one ounce to every fquare yard.

It is feen by the experiments, that foot kills this worm as foon as falt; and as in moft places it is to be had at a much lefs price than falt, he thinks there can be no doubt about preferring it; befides which, it may be fafely ufed after the corn is up.

He had fome fmall parcels of barley under experiments, which thefe worms began to deftroy; and in order to convey the foot as foon as poffible to the roots of the plants, he mixed a little of it in water, and poured it on the plants with a garden watering-pot: the confequence was that he did not lofe one plant afterwards.

It will hardly be imagined that he means that the fame method is to be purfued upon a whole farm: no; the method he would recommend to the practice of the farmer is this; to fpread, or caft by hand, as he fows his corn, about fix or eight barrels of foot on an acre, and let him be careful to choofe a calm day for the work, otherwife the wind will carry away a great part of it: and as what remains cannot be regularly difpofed, let him be careful to do it early enough in the fpring, that the rain may wafh in the foot and convey it to the roots of the plants before the worm begins the mifchief; if he does this, he is perfuaded his crop will be preferved.

It is found by the experiments, that thefe worms will live longer in water, by twenty hours, than when expofed to the open air; but at length, that is in fifty-two hours, they died in the water; perhaps this might be from the effect of drowning; but if fo, he might have expected they would have been totally deftroyed in his two fields in the winter of 1763 and 1764, by the immoderate rains which fell at that feafon for a long continuance, which often flooded the lands. But they furvived that winter, as appeared by the great lofs he afterwards fuftained by their deftroying his wheat; and therefore, whether water be an enemy to them or not, it feems not eafy to determine: but if thofe which died in the glafs of water were really drowned, he thinks we may conclude that water is neceffary to their exiftence in the earth, and probably aids them in getting their food from it: and what feems to confirm this notion is, that when the land is wet, they do not touch the corn, but as foon as ever the land is dry, they begin their mifchief. However, this fpeculation he muft fubmit to the confideration of perfons more capable of difcuffing it than he is.

It is feen by experiment N° 10, that they cannot live in the open air, which feems to prove, that, where they abound in land, the oftener it is ploughed, particularly in the fummer, when they cannot penetrate the ground fo eafily as when it is moift, they muft be, by fuch ploughing, greatly diminifhed: befides which, the frequent ploughing gives the crows more opportunities of picking them up, in which, as he has before faid, they are very watchful.

Frequent ploughing has been recommended by fome writers as the only means of deftroying this worm; and they have recommended the ploughs being ftuck with nails, urging, that by thofe nails the worms are cut to pieces; others have recommended walnut leaves being foaked in water, to fprinkle the land, and fteeping feed corn in various liquors, as infallible remedies; but fuch methods as thefe are founded upon miftaken principles; they only miflead the farmer, and muft difappoint him.

Worlidge recommends a ftrong ley made of fixed falts, but that would be impracticable. Mortimer recommends fea-water, which he believes would anfwer very well. He fays, he ufed foot once with fuccefs, but that it did not fucceed with him afterwards. Mr. Baker is perfuaded he did not ufe the foot early enough to have it wafhed into the ground by rain, or perhaps he ufed too fmall a quantity. He concludes by obferving, that he would not be thought to arrogate any merit to himfelf, on account of what he has here offered on this fubject, fince it appears that other perfons have ufed the articles which he has recommended, againft this common enemy; but many perfons have been difappointed in their expectations from thefe remedies,

remedies, which muſt have ariſen, he thinks, from their either having uſed too ſmall a quantity, or not having obſerved the neceſſary precautions; if thoſe which he has recommended ſhall be put in practice and found to anſwer, he ſhall think himſelf amply rewarded.

This worm undoubtedly does great injury to grain crops in many caſes, in particular ſoils and ſorts of land; but a great number of additional facts and experiments are wanting to fully prove its nature, and the ways in which its deſtructive effects on ſuch crops are produced, as well as the beſt, moſt ready, convenient, and effectual ways in which it can be deſtroyed. See Wire-*Worm*.

Red *Deer*, *fiſh*, *ſtar*, *ſtorax*, *tartar*. See the ſubſtantives.

Red *Ink*. See Ink and Printing.

Red *Notes*, in old *Muſic*, before the invention of printing, were uſed for diminution. In the MS. at Paris of the Latin and French poems of Gullaume Machau ſet to muſic, chiefly motets for a ſingle voice, ſome are written in black and red notes, with this inſtruction to the ſingers; "nigræ ſunt perfectæ, et rubræ imperfectæ;" an admonition worth remembering by thoſe who wiſh to decypher muſic of the fourteenth and fifteenth centuries, in which red notes frequently occur. It was an eaſy expedient of diminution till the invention of the preſs, when the uſe of different coloured inks on the ſame page occaſioned the trouble and expence of double printing. See Machau.

In the Pepyſian collection at Cambridge, there are examples of the uſe of red notes for diminution in fragments of muſic by Joſeph Gwinneth and Robert Davie, who flouriſhed in the time of Edward IV. Morley has given ſome examples of the uſe of red notes in his annotations.

Red *Bank*, in *Geography*, a fort of the United States, on the S.E. ſide of Delaware river, in the town of Woodbury, Glouceſter county, New Jerſey; ſeven miles S. of Philadelphia.

Red *Bay*, a bay on the N. coaſt of Spitzbergen. N. lat. 79° 44′. E. long. 10° 42′.—Alſo, a bay on the S.E. coaſt of Labrador. N. lat. 51° 50′. W. long. 56° 10′.—Alſo, a bay on the N. part of Buffaloe's bay, on the S. coaſt of Maſſachuſetts, in America.

Red *Crab Iſland*, a ſmall iſland in the Eaſt Indian ſea, near the coaſt of Arracan. N. lat. 21° 30′. E. long. 91° 50′.

Red *Deer Lake*, a lake of North America. N. lat. 55° 10′. W. long. 112°.

Red *Flaggy Bay*, a bay on the N. coaſt of the iſland of St. Chriſtopher, E. of Ragged Point.

Red *Haven*, a bay of Scotland, on the N. coaſt of the county of Banff; three miles E. of Cullen. N. lat. 57° 39′. W. long. 2° 38′.

Red *Head*, a cape of Scotland, on the E. coaſt of the county of Angus; ſix miles S. of Montroſe. N. lat. 56° 33′. W. long. 2° 26′.—Alſo, the N. point of the iſland of Eda. N. lat. 59° 6′. W. long. 2° 40′.

Red *Hills*, rocks in the German ſea, near the coaſt of Northumberland. N. lat. 55° 26′. W. long. 1° 17′.

Red *Hook*, a town of America, in the townſhip of Rhynebeck, and Dutcheſs county, New York, on the E. bank of Hudſon's river; 21 miles S. of Hudſon.

Red *Horſe*, *Vale of*, a diſtrict of England, in the county of Warwick, which owes its name to a horſe cut in a hill, the ſoil of which is reddiſh.

Red *Iſland*, an iſland near the E. coaſt of Labrador. N. lat. 43° 55′. W. long. 55° 50′.—Alſo, an iſland near the W. coaſt of Newfoundland. N. lat. 48° 35′. W. long. 59° 10′.

Red *Lake*, a comparatively ſmall lake of North America, at the head of a branch of the Bourbon river, ſometimes called "Red river;" its form is nearly round, and its extent is about 60 miles in circumference. It has on one ſide an iſland, cloſe by which a river enters. It lies almoſt S.E. both from lake Winnepeek, and from the lake of the Woods. N. lat. 51° 5′. W. long. 94° 10′.—Alſo, a lake of North America, in N. lat. 47° 40′. W. long. 95° 15′.

Red *Lick*, a ſalt ſpring of the ſtate of Kentucky; 32 miles E. of Stamford.

Red *Point*, a cape on the E. coaſt of New Holland. N. lat. 34° 29′. W. long. 208° 45′.

Red *River*, a river of Louiſiana, which riſes in about N. lat. 35°, and W. long. 96°, and runs into the Miſſiſippi, N. lat. 37° 15′. W. long. 91° 48′.—Alſo, a river of Upper Canada, which runs into lake Superior. N. lat. 47° 51′. W. long. 85° 48′.—Alſo, a river of Tenneſſee, which runs into Cumberland river, about two miles N.W. of Clarkſville. N. lat. 36° 18′. W. long. 87° 46′.—Alſo, a river of Kentucky, which runs into Kentucky river, about nine miles above Boonſborough, N. lat. 37° 45′. W. long. 84° 18′. It is 60 yards wide at the mouth.—Alſo, a river of North America, which riſes from Red lake, in N. lat. 47° 40′, and runs into Winnipeg lake.—Alſo, a river of Canada, which runs into the Utwas; 60 miles W. of Montreal. See alſo Natchitoches.

Red *Sea*, called by the ancients the "Arabian gulph," forms the grand natural diviſion between Aſia and Africa, and extends about 21° or 1470 Britiſh miles from the ſtraits of Babelmandeb to Suez; it terminates in two branches, the weſtern being extenſive, and the eaſtern aſcending a little beyond the parallel of mount Sinai.

This ſea is called, in the Old Teſtament, the ſea of Suph or Zuph, the ſea of weeds, on account of the great quantity of algæ and fuci, and perhaps the madrepores and coralline ſubſtances, anciently ſuppoſed to be of vegetable origin, found at its bottom, and near the ſhores. In ſcripture language it is alſo denominated "the tongue of the Egyptian ſea;" in the Greek and Latin geography, it was called the gulph of Heroopolis; and by the Arabian geographers, the weſtern arm of the ſea of Kolzum, (al Kolzum, with the article,) which ſeems to have ſome affinity with "Clyſma," another name by which this gulph was formerly known; Kolzum in Arabic, and Clyſma in Greek, ſignifying deſtruction, in reference, as it is ſuppoſed, to the deſtruction of Pharaoh's hoſt. Don John de Caſtro, viceroy of the Indies for the king of Portugal, conjectures that it was called the Red ſea from the great quantity of coral that is found in it. Pliny ſays that it obtained this name, in Greek "Erythrea," from a king called Erythros, who reigned in Arabia, and whoſe tomb was ſeen in the iſland Tyrine or Agyris. Several learned men believe, that this king Erythros is no other than Eſau, or Edom; Edom, in Hebrew, ſignifying red or ruddy, as Erythros does in Greek. But Calmet is of opinion, that Edom never dwelt, either on the ſhore of the Red ſea, or the Perſian gulph, which has been ſometimes alſo called the Red ſea. His habitation was eaſt of the land of Canaan, towards Bozra; and he inclines to believe, that the name of the Red ſea was not given to this gulph till after the Idumeans, deſcended from Edom, had ſpread themſelves from eaſt to weſt as far as the Red ſea. At that time it might receive the name of the ſea of Edom, which the Greeks rendered by the Red ſea, or "thalaſſa erythrea."

The famous miracle of the paſſage of the Red ſea by 600,000 Iſraelites, beſides old men, women, and children, recorded in the ſacred writings, is well known. Thoſe who have been deſirous of explaining this paſſage, without

out admitting the miraculous part of the hiſtory, have had recourſe to a variety of conjectures; both as to the place and the manner in which this paſſage was effected. As to the place of the paſſage, there has been a difference of opinion even among thoſe who have not heſitated to acknowledge that it was miraculous. Till of late years it has been generally believed, that the paſſage of the Iſraelites was at Baideah, or Bedea, which, according to Niebuhr, is about ſix German miles from Suez, and where the ſea, ſays Bruce, is ſomething leſs than four leagues broad, by 50 feet deep. In ſupport of this hypotheſis, Dr. Shaw has traced the march of the Iſraelites to their third encampment before Pihahhiroth. Whilſt they were removing from the edge of the wilderneſs of Etham towards this ſtation, they had left the open country and were marching through a narrow paſs, betwixt the mountains of Gewoubee and Attackah. In theſe circumſtances the Egyptians might well imagine, that they could have no poſſible way of eſcape, as the mountains of Gewoubee would obſtruct their progreſs towards the ſouth, and thoſe of Attackah would impede their advancing towards the land of the Philiſtines: the Red ſea lay before them to the eaſt; whilſt Pharaoh cloſed up the valley behind them, with his chariots and horſemen. This valley terminates at the ſea, in a ſmall bay, made by the eaſtern extremities of the mountains above-mentioned; and is called "Tiah Beni Iſrael," *i. e.* the road of the Iſraelites, from a tradition ſtill exiſting among the Arabs of their having paſſed through it; and it is alſo called "Baideah," from the *new* and unheard-of *miracle* that was wrought near it, by dividing the Red ſea, and deſtroying in it, Pharaoh, his chariots and his horſemen. The encampment of the Iſraelites, according to Dr. Shaw, was at this bay, before Pihahhiroth, betwixt Migdol and the ſea, over-againſt Baal-tzephon, Exod. xiv. 2. Baal-tzephon, as this learned geographer ſuggeſts, might have relation to the northern ſituation of the place itſelf, or to ſome watch-tower, or idol-temple that was erected upon it; or it may be taken for the extremity of the mountains of Suez, or Attackah, the moſt conſpicuous of theſe deſerts, as it overlooks a great part of the Lower Thebais, as well as the wilderneſs that reaches towards, or rather which makes part of, the land of the Philiſtines. Migdol might lie to the ſouth, as Baal-tzephon did to the north of Pihahhiroth. The marches of the Iſraelites, from the edge of the wilderneſs, being towards the ſea, *i. e.* towards the S.E., their encampment betwixt Migdol and the ſea, or before Migdol, could not well have any other ſituation. Pihahhiroth, or the mouth of Hhiroth, or a narrow gullet or defile, may denote the mouth, or the moſt advanced part of this valley towards the E., or towards the Red ſea. But as the Iſraelites were delivered at this place from their captivity and fear of the Egyptians (Exod. xiv. 13.) we may ſuppoſe that Hhiroth denotes the place where they gained their *liberty*, *horar* and *hhiroth* being words of the like import in the Chaldee. It may be further urged in favour of this explication, and alſo of the tradition ſtill preſerved, of the Iſraelites having paſſed through this valley, that the eaſtern extremity of the mountain, ſuppoſed to be Baal-tzephon, is called, even to this day, by the inhabitants of theſe deſerts, "Jibbel Attakah," or the mountain of deliverance; which appellation, together with thoſe of Baideah and Tiah Beni Iſrael, could never have been given or impoſed upon theſe inhabitants at firſt, or preſerved by them afterwards, without ſome faithful tradition, that ſuch places had been once the actual ſcene of theſe remarkable tranſactions. The ſea likewiſe of Kolzum, *i. e.* deſtruction, as the correſpondent part of the Red ſea is called in the Arabian geography, is a further confirmation of this tradition. Moreover, the Ichthyophagi, who lived in this very neighbourhood, are reported by Diodorus Siculus (l. iii.) to have preſerved the like traditionary account from their forefathers, of this miraculous diviſion of the Red ſea. There are likewiſe other circumſtances that tend to prove, that the Iſraelites took their departure from this valley, in their paſſage through the Red ſea; for an account of which we refer to Shaw's Travels, ch. v.

This hypotheſis, however, ſays Geddes, (Crit. Remarks on Exod. xiv.) has been fairly given up by our beſt modern critics; and the "Sinus Heroopolitanus," or gulph of Suez, pitched upon as the ſcene of action. The idea was firſt ſuggeſted by Le Clerc, and ſince adopted and defended by Michaelis, Niebuhr, and almoſt all the German commentators. But Mr. Bryant ſtill contends for Bedea (Baideah), and calls the arguments of Niebuhr "prejudice and miſconception." Dr. Geddes, whoſe ſentiments concerning Moſes and his whole hiſtory are ſingular, denies that there was any thing miraculous in the event; and ſtrenuouſly maintains, that Suez or its vicinity was the place of paſſage; for here, he ſays, at this day, are ſhallows fordable at low water, and which might, in former times, have been frequently dry. We all know what changes happen in the bed of ſeas as well as that of rivers, eſpecially where that bed is ſand, which is the caſe with that of the gulph of Suez. The occurrence is thus deſcribed by Dr. Geddes. When Moſes ſaw that the Egyptians had found out that the Iſraelites meant not to return, and were about to purſue him with a force which he could not reſiſt, he wiſely took the only courſe that was moſt likely to afford him an eſcape. Acquainted, as he muſt have been, during his long ſtay in Midian, with the nature of the Red ſea, and its ebbs and flows, he deemed it better to take his chance of paſſing over ſome ſhallow which he knew to be fordable at low water, than to expoſe himſelf to be overtaken in a deſert, where no ſtratagem could ſave him. If he got the ſtart of the Egyptians but for a ſingle day, he would have time to watch the tide, and begin his march as ſoon as the paſſage was fordable; and in the ſpace of a few hours might be ſafe on the other ſide. The width of the ſea at Suez is at preſent, according to Niebuhr's meaſurement, 757 double paces, or 3450 feet. It is common for the Arabs to paſs on foot over this paſſage, although not always without danger, as the ſea ſometimes flows back unexpectedly. At Suez, according to Niebuhr, it is low water, at the full of the moon, at half paſt ſix; but as the paſſage of the Iſraelites muſt have happened ſome days after the full of the moon, the ebb and flow muſt have been conſiderably later, and the former muſt have occurred in the night-time, during which the Iſraelites are ſaid to have paſſed. Michaelis was of opinion, that, as a ſtrong wind is ſaid to have accompanied this event, it might have cauſed a double ebb, as it ſometimes does on the coaſt of Holland and North Germany; but Niebuhr thinks that no ſuch thing is likely to happen in the Red ſea. Be this as it will, the wind might certainly have prolonged the ebb; and, if it happened at the time of the paſſage, might well be conſidered as a providential interference, and readily conſtrued into a miracle. Joſephus, in recording this tranſaction, puts a formal ſpeech into the mouth of Moſes to his terrified and diſcontented people, and a prayer to God before he ſtrikes the ſea with his rod; yet he tells us that all this he has related as he found it in the ſacred books. But he ſeems not ſure, whether to conſider it as a miracle or a natural effect. "Let no one," ſays he, "wonder at this account of a way of ſafety being opened to thoſe old-world innocent folks, even through the ſea, whether by the will of God or naturally; ſince, of later days, the Pamphylian ſea opened a way for Alexander's army, when God through him had decreed to overturn the Perfian empire." (Antiq. l. ii. c. 16. n. 5.) For this he appeals to all Alexander's hiftorians; and, indeed, both Appian and Arrian, who relate the event, feemed to have confidered it as a fort of divine interpofition; but honeft Strabo tells us, that Alexander only took the advantage of low water; and, trufting to his good fortune, paffed through the ftreight with his army; but not on dry land; for the water came up to the navel. (Strab. l. xiv.) The fame was the cafe with Scipio's foldiers, who furprifed New Carthage by taking the advantage of an ebb; although they waded fometimes up to the knee, at other times up to the navel, in water. (Liv. l. xxvi.) Here, fays Geddes, the fame two natural caufes, the tide and a ftrong wind, concurred to make a paffage through the water, as concurred at the paffage of the Red fea; and in both cafes they were converted into a miracle. Jofephus concludes his narrative with thefe words. "Of fuch things, let every one think as he pleafes;" and the author now cited adopts his language. It has been faid, and thus the priefts of Memphis explained the hiftory (fee Eufeb. Præp. l. iv. c. 17.), that Mofes taking advantage of the time of the ebb, led the Hebrews over in fafety; but the Egyptians, not knowing the nature of the fea, and eafily entering it juft before the return of the tide, were all fwallowed up and drowned.

In oppofition to all conjectures for explaining this hiftory, without having recourfe to miracle, we fhall content ourfelves with appealing to the hiftory itfelf, Exod. xiv. 16, 17, &c. from which it appears that the Hebrews traverfed the fea from fhore to fhore, on a large fpace of dry ground, which was left by the retiring waters; and that they were driven back to overwhelm the purfuing hoft of Pharaoh. See alfo Ifaiah, lxiii. 11, &c. Habbakuk, iii. 15. Wifdom of Sol. xix. 7, 8. x. 17, 18.

It is thought, fays Calmet, after Eufebius, that the place where the Hebrews paffed the Red fea, is two or three leagues below its northern point, at the place called Kolfum, or Clyfma. Niebuhr informs us that, every where on the coaft of Arabia, we meet with indications, that the waters are withdrawn; *e. gr.* Mufa, which ancient authors mention as a port of Arabia, is now at many leagues diftance from the fea; near Loheia, and Gidda, we fee great hills filled with the fame kind of fhells and corals, as are now found living in the fea; near Suez, are petrifications of all thefe things. From thefe and fimilar circumftances he infers, that fome thoufand years ago this Arabian gulf was much larger, and extended much farther north, efpecially that arm of it near Suez, for the fhore of this extremity of the gulf is very low. The breadth of the arm of the fea at Suez, he adds, is about 3450 or 3500 feet (in its prefent ftate). Although it would much fhorten the diftance of their way, no caravan now croffes this arm, nor could the Ifraelites have croffed it, without a miracle. The attempt muft have been much more difficult to the Ifraelites, fome thoufand years ago, the gulf being then probably larger, deeper, and longer toward the north, at the loweft time of the tide. Niebuhr croffed, when returning from mount Sinai, that arm of the fea, over to Kolfoum, upon his camel; and the Arabs, who accompanied him, were only immerfed to their thighs in water. The banks of the Red fea are pure fand from Suez to Girondel; but lower to the fouth are banks of coral. If the Ifraelites had croffed the fea upon fuch banks, they muft have been greatly incommoded by them.

The Red fea, notwithftanding the difficulty and danger, and alfo the tedioufnefs of its navigation, was, for many ages before the difcovery of the paffage by the Cape of Good Hope, the channel of communication between Egypt and other countries, bordering on the Mediterranean, and India. Accordingly, Dr. Robertfon obferves, in his "Hiftorical Difquifition concerning Ancient India," that navigation made its firft efforts in the Mediterranean and the Arabian gulf, and that in them the firft active operations of commerce were carried on. Nor are the accounts of the earlieft hiftorians in this refpect at all improbable, if we confider the pofition and form of thefe two great inland feas. They lay open the continents of Europe, Afia, and Africa, and fpreading to a great extent along the coafts of the moft fertile and moft early civilized countries in each, feem to have been deftined by nature to facilitate their communication with one another. We find, accordingly, that the firft voyages of the Egyptians and Phœnicians, the moft ancient navigators mentioned in hiftory, were made in the Mediterranean, and, moreover, by acquiring early poffeffion of ports on the Arabian gulf, they extended the fphere of their commerce, and are reprefented as the firft people of the weft who opened a communication by fea with India. Sefoftris, in the courfe of his reign (if we may give credit to fome hiftorians), was able to fit out a fleet of 400 fhips in the Arabian gulf, which conquered all the countries ftretching along the Erythrean fea to India. The Phœnicians, who, by their fituation on the Mediterranean, and the imperfect ftate of navigation, could not attempt to open a direct communication with India by fea, were prompted by the enterprifing fpirit of commerce to wreft from the Idumeans fome commodious harbours towards the bottom of the Arabian gulf. From thefe they held a regular intercourfe with India on the one hand, and with the eaftern and fouthern coafts of Africa on the other. The diftance, however, from the Arabian gulf to Tyre was fo confiderable, that it became neceffary for them to take poffeffion of Rhinocolura, the neareft port in the Mediterranean to the Arabian gulf. Thither all the commodities brought from India were conveyed over land by a route much fhorter, and more practicable, than that by which the productions of the Eaft were carried at a fubfequent period from the oppofite fhore of the Arabian gulf to the Nile. At Rhinocolura they were refhipped and tranfported by an eafy navigation to Tyre, and diftributed through the world. For an account of the trade which the Jews carried on by the Red fea, we refer to the articles Ophir and Tyre. For the manner in which the Egyptians carried on their trade with India by means of this gulf, fee Alexandria and Berenice.

All the commercial tranfactions of the ancients with the Eaft were confined to the ports on the Malabar coaft, or at the fartheft extended to the ifland of Ceylon. To thefe ftaples, the natives of all the different regions in the eaftern parts of Afia brought the commodities which were the growth of their feveral countries, or the product of their ingenuity, in their own veffels, and with them the fhips from Tyre and from Egypt completed their inveftments. While the operations of their Indian trade were carried on within a fphere fo circumfcribed, the conveyance of a cargo by the Arabian gulf, notwithftanding the expence of land-carriage, either from Elath to Rhinocolura, or acrofs the defart to the Nile, was fo fafe and commodious, that the merchants of Tyre and Alexandria had little reafon to be folicitous for the difcovery of any other. During the period in which this mode of carrying on commerce fubfifted, the price of goods imported from India into Europe was very much enhanced by the various operations to which the conveyance of them was fubject. In Ceylon, or the ports on the Malabar coaft to which they were brought from the various countries of Afia by the natives, they were put

put on board the ſhips which arrived from the Arabian gulf. At Berenice they were landed, and carried by camels 258 miles to the banks of the Nile. There they were again embarked, and conveyed down the river to Alexandria, whence they were diſpatched to different markets. But, after the paſſage to India by the Cape of Good Hope was diſcovered by Vaſco de Gama, at the cloſe of the fifteenth century, its various commodities were purchaſed at firſt hand in the countries of which they were the growth or manufacture; and as the carriage of mercantile goods by water is much leſs expenſive than by any other mode of conveyance, the Portugueſe, as ſoon as they could import the productions of India in ſufficient quantities to ſupply the demands of Europe, were able to afford them at ſuch a reduced price, that the competition of the Genoeſe and the Venetians, who had been actively engaged in this commerce, ceaſed almoſt entirely; and the full ſtream of commerce took its natural direction towards the cheapeſt market. The conſequence was, that early in the ſixteenth century, the ſubjects of the Portugueſe monarchs became poſſeſſed of a monopoly of the trade with India, founded upon the only equitable title, that of furniſhing its productions in greater abundance, and at a more moderate price. From the era of the diſcovery now mentioned, the Arabian gulf or Red ſea loſt its importance as a channel of communication between the weſtern and eaſtern parts of the globe; and from this time both its navigation, and the commerce connected with it, have been partial and reſtricted. An account of its principal ports will be found under their reſpective articles.

REDA, a town of Turkiſh Armenia, in the government of Erzerum; 36 miles N. of Iſpira.

REDANS, or REDANT See REDENS.

REDARIDES, in *Geography*, a town of France, in the department of the Mouths of the Rhone; 16 miles S.S.E. of Orangi.

RED-BOOK *of the Exchequer* (*liber rubeus ſcaccarii*) is an ancient record, in which are regiſtered the names of thoſe that held lands *per baroniam* in king Henry II's. time. It is a manuſcript volume of ſeveral miſcellaneous treatiſes, in the keeping of the king's remembrancer, in his office in the exchequer; and hath ſome things (as the number of the hides of land in many of our counties, &c.) relating to the times before the Conqueſt. There is likewiſe an exact collection of the eſcuages under king Henry I., Richard II., and king John; and the ceremonies uſed at the coronation of queen Eleanor, wife to king Henry III. &c.

REDDAT. *Precipe quod Reddat.* See PRECIPE.

REDDENDIS CHARTIS. See CHARTIS.

REDDENDUM, in *Law*, a clauſe in a leaſe, &c. by which a rent is reſerved to the leſſor; which anciently conſiſted of corn, fleſh, fiſh, and other victuals. 2 Rep. 71.

REDDIDIT SE, is where a man procures bail for himſelf to an action in any court at law; if the party bailed at any time before the return of the ſecond *ſcire facias* againſt the bail, renders himſelf in diſcharge of his bail, they are thereby diſcharged. 2 Lill. Abr. 430. See BAIL.

REDDITARIUM, an ancient law term for a tarrier, roll, or rental, in which the rents and ſervices of a manor are ſet down.

REDDITION, REDDITIO, a ſurrendering or reſtoring. In *Law*, it alſo denotes a judicial acknowledgment that a thing in queſtion belongs to the demandant, and not to the perſons ſo ſurrendering.

REDDITUS ASSISUS, a ſet or ſtanding rent. See ASSISUS.

REDDLE, *Red Ochre*, or *Red Chalk*, in *Mineralogy*, the red oxyd of iron intermixed with earthy matter. It is uſed for crayons, either in its natural ſtate, or pounded and waſhed, and afterwards mixed with gum, and caſt into moulds. The colour of reddle varies from a blood-red to a brown-red; its fracture is earthy; it is ſoft, friable, and ſtains the fingers. See *Ores of* IRON.

This is the common Engliſh name for the ſubſtance called in Latin *rubrica*, and uſed in painting, and for marking ſheep, &c. There are two kinds of it, a harder and a ſofter.

The firſt, or harder kind, is but little in uſe, except among the turners in wood, as it does not mark ſo eaſily, requiring to be firſt wetted, and then preſſed hard upon the ſubſtance to be marked. This is dug in Lincolnſhire, Hampſhire, and Suſſex; and is a hard and dry earth, of a ſomewhat pale red, like the common pale red bricks, and is of a very regular and cloſe texture, and always compoſed of a number of thin laminæ, lying cloſely and evenly on one another. It is of a rough uneven ſurface, adheres firmly to the tongue, is not eaſily broken between the fingers, and ſtains the hands a little; it is of a very aſtringent taſte, and melts pretty readily in the mouth. It is very readily diffuſible in water, mouldering to powder, ſoon after being thrown into it; and makes no efferveſcence with acids.

The ſecond, or ſofter kind, is very common, and put to a number of different uſes. It makes ſimply a very good pale red for the painters, and is very ſerviceable to them in their mixed colours. It is in conſtant uſe in many parts of the kingdom for the marking of ſheep; and when waſhed and ſeparated from its ſandy particles, is, by ſome of our modern druggiſts, ſold under the name of bole armenic.

It is found in many parts of the world: the beſt in England is that from ſeveral parts of Derbyſhire, from whence the colour-ſhops and druggiſts of London are ſupplied; many of the latter thinking this a ſhorter method than the common one of our bole armenic makers, of preparing it from a mixture of tobacco-pipe clay, and the red ochre called Spaniſh brown.

This ſoft, or common reddle, is a looſe ponderous earth, of a lax texture, and very friable; and of a pale, but tolerably bright red, of a ſomewhat ſmooth and gloſſy ſurface, ſoft to the touch, adhering firmly to the tongue, eaſily broken between the fingers, and ſtaining the hands. It is of a rough auſtere taſte, very readily breaks, and falls to powder in water, and makes no efferveſcence with aqua fortis. Hill.

Some call reddle, *lapis hæmatites;* but the real hæmatites is another thing.

REDEEMABLES, in *Law*, are lands, funds, &c. ſold with a reſervation of the equity of redemption.

Crown lands are redeemable for ever; others only for a certain time.

RE-DELIVERY, an yielding or delivery back of a thing: if a perſon has committed a robbery, and ſtolen the goods of another, he cannot afterwards purge the offence by any re-delivery. Co. Litt. 69. H. P. C. 72.

RE-DEMISE. See DEMISE.

REDEMPTION, REDEMPTIO, a faculty or right of re-entering upon lands, &c. that have been ſold, and aſſigned; upon reimburſing the purchaſe-money, with legal coſts.

Bargains in which the *faculty*, or, as ſome call it, the *equity of redemption*, is reſerved, are only a kind of pignorative contracts.

A certain time is limited, within which the faculty of redemption ſhall be exerciſed; and beyond which it ſhall not extend.

REDEMPTION, in *Theology*, denotes the recovery of mankind

kind from ſin and death, by the obedience and ſacrifice of Chriſt, who on this account is called the *Redeemer* of the world. See COVENANT.

REDEMPTIONS, *Redemptiones*, in our old *Law Writers*, denote grievous mulcts impoſed by way of commutation for the head or life of the delinquent.

REDEMPTION *of the National Debt*. See FUND.

REDEN, or REDZYN, in *Geography*, a town of Pruſſia, in the territory of Culm; 20 miles N.E. of Culm.

REDENS, REDANS, or *Redant*, in *Fortification*, a kind of work indented in form of the teeth of a ſaw, with ſaliant and re-entering angles; to the end that one part may flank or defend another.

It is alſo called *ſaw-work*, and *indented work*. The faces in this flank one another.

Redens are frequently uſed in the fortifying of walls, where it is not neceſſary to be at the expence of building baſtions; as when they ſtand on the ſide of a river, a marſh, the ſea, &c. But the fault of ſuch fortification is, that the beſiegers from one battery may ruin both the ſides of the tenaille or front of a place, and make an aſſault without fear of being enfiladed, ſince the defences are mined.

The parapet of the corridor alſo is frequently redented, or carried on by way of redens.

REDES, in *Geography*, a river of South America, which runs into the gulf of Darien, N. lat. 7° 37′. W. long. 76° 40′.

REDHIBITION, REDHIBITIO, in the *Civil Law*, an action allowed a buyer, by which to annul the ſale of ſome moveable, and oblige the buyer to take it back again, upon the buyer's finding it damaged, or that there was ſome perſonal cheat, &c.

The redhibition, or redhibitory action, has a place in ſeveral caſes, in the body of the civil law. If a horſe was ſold that had the glanders, were broken-winded, or foundered, it was a redhibitory caſe; and the ſeller might be obliged to take him again within nine days.

REDI, FRANCIS, in *Biography*, an Italian phyſician, was deſcended from a noble family, and born at Arezzo, in Tuſcany, in the year 1626. He commenced his ſtudies at Florence, and then removed to Piſa, for the proſecution of his philoſophical and medical purſuits, where he received the degree of doctor in both theſe ſciences. He had acquired great reputation both in ſcience and literature, and was induced to ſettle at Florence, where he at length gained the favour of the court, and was appointed firſt phyſician to Ferdinand II. duke of Tuſcany, and ſubſequently to Coſmo III. Theſe appointments and his conſtant profeſſional employment did not, however, prevent him from cultivating his favourite ſtudy of the belles lettres. He devoted much of his time to the language of his country, and contributed not a little to the perfection of the dictionary of the academy of La Cruſca, of which, and of ſeveral other learned bodies, he was a member. Totally free from preſumption, and attached to every cultivator of learning and ſcience, he was always ready to give his aſſiſtance to them in every way he could, and was univerſally eſteemed and beloved. He diſplayed both in his practice, and in the proſecution of his inquiries in natural hiſtory, a ſingular acuteneſs of obſervation, and a complete incredulity as to the marvellous, which was ſo prevalent in his time; and he cautioned his friends and pupils againſt the popular errors in this reſpect. Although he was afflicted with epileptic fits in his latter years, yet he appears neither to have abandoned his ſtudies, nor his profeſſional buſineſs, until his death, which took place in 1697, in his 71ſt year.

Redi was the author of ſeveral Italian poems, which are held in much eſtimation. His other works were all written in Italian, and his ſtyle was deemed ſo pure and elegant, that the authors of the dictionary of La Cruſca have often cited it as a ſtandard. Moſt of his writings on natural hiſtory have been tranſlated into Latin; eſpecially his "Experimenta circa Generationem Inſectorum, cum Figuris Æneis;" his "Obſervationes de Viperis;" his "Experimenta circa diverſas Res naturales, ſpeciatim illas quæ ex Indiis adferuntur;" and his "Obſervationes de Animalibus viventibus, quæ intra Animalia viventia reperiuntur." He alſo publiſhed a letter on the Uſe of Spectacles, and an Eſſay on Styptics. Eloy Dict. Hiſt. de la Med.

Redi, in the notes to his "Bacco in Torcano," a dithyrambic poem, publiſhed in 1685, has given many curious etymologies and explanations of the muſical terms uſed by the Italians in early times.

REDIGOODEM, in *Geography*, a town of Hindooſtan, in the circar of Ellore; 25 miles W. of Ellore.

REDIMICULUM, among the Romans, a girdle, which going about the neck, divided on the breaſt, and paſſing down each ſide, went round, and kept the robe tight to the body.

REDINKA, in *Geography*, a town of Portugal, in the province of Beira; 14 miles S. of Coimbra.

REDINTEGRATED MEDALS. See MEDAL.

REDINTEGRATION, REDINTEGRATIO, in the *Civil Law*, the act of reſtoring a perſon to the enjoyment of a thing, of which he had been illegally diſpoſſeſſed.

In France, where a perſon is deſpoiled of his property, he claims it again by redintegrand, or action of reſtitution. But the redintegrand muſt be demanded within a year and a day, otherwiſe it is precluded.

REDINTEGRATION, in *Chemiſtry*, the reſtoring of any mixed body, or matter, whoſe form has been deſtroyed by calcination, corroſion, ſublimation, or the like, to its former nature and conſtitution.

The redintegration of mercury is properly called *revivification*. Mr. Boyle has an expreſs treatiſe on the redintegration of ſaltpetre; where he ſhews, that after reducing it by fluxion into fixed nitre, which is next of kin to ſalt of tartar in all its properties, he could preſently redintegrate it, by pouring a ſufficient quantity of ſpirit of nitre on it; *i. e.* he could re-produce true cryſtals of the uſual form and virtue of ſaltpetre.

It is a ſtrong objection againſt the chemical principles, that we cannot redintegrate the body they were procured from, by re-mixing them.

This ſeems to argue, that the body did not properly conſiſt of ſuch elements, or that they were not originally contained in it, but were rather produced by the fire.

REDIPATAM, in *Geography*, a town of Hindooſtan, in Marawar; 18 miles N. of Ramadnaporum.

REDIRE *ad Pacem*, in *Law*, is applied to a perſon, whoſe outlawry is reverſed, and who is reſtored to the king's peace.

REDISSEISIN, a diſſeiſin made by him who once before was found and adjudged to have diſſeiſed the ſame man of his lands or tenements; for which there lies a ſpecial writ, called a *writ of rediſſeiſin*. See ASSISE *of Novel Diſſeiſin*, DISSEISIN, and POST-*Diſſeiſin*.

REDMANS, or RADMANS, in Doomſday and other ancient books, are probably the ſame with rod, or rad-knights; *viz.* men who, by the tenure or cuſtom of their lands, were to ride with, or for, the lord of the manor, about his buſineſs.

REDNITZ, in *Geography*, a river of Germany, formed by the union of the Upper and Unter Reſtat, about 5 miles S. of Roth, in Franconia. After receiving in its courſe ſeveral ſtreams, it diſcharges itſelf into the Maine, a little below Bamberg.

REDOLESCO, a town of Italy, in the department of the Mincio; 14 miles W.S.W. of Mantua.

REDON, a town of France, and principal place of a diſtrict, in the department of the Ille and Vilaine; 32 miles S.S.W. of Rennes. The place contains 3783, and the canton 11,620 inhabitants, on a territory of 187½ kiliometres, in 5 communes. N. lat. 47° 39′. W. long. 2°.

REDONDA, an iſland in the Weſt Indies, about 10 miles in circumference, without ports, rivers, or towns. N. lat. 16° 55′. W. long. 62° 20′.

REDONDELA, or Redondillo, a town of Spain, in the province of Galicia, near the weſt coaſt, defended by a ſtrong caſtle; 32 miles W.S.W. of Orenſa.

REDONDO, a rock, about three miles in circumference, between the iſlands of Montſerrat and Nevis, in the Weſt Indies. N. lat. 17° 6′. W. long 61° 35′.

Redondo *Novo*, a town of Benguela. S. lat. 11° 22′. E. long. 13° 45′.

Redondo, *O*, a town of Portugal, in Alentejo; 14 miles E.N.E. of Evora. N. lat. 38° 33′. W. long. 7° 22′.

REDONDOS, a town of Portugal, in the province of Beira; 17 miles S. of Coimbra.

REDOUBLE′, Fr., in *Muſic*, a doubled interval in the octave above a ſingle interval. The octave of the octave, with us, is called the 15th. See Interval.

REDOUBT, or Redoute, *Reductus*, in *Fortification*, a ſmall ſquare fort, without any defence but in front, uſed in trenches, lines of circumvallation, contravallation, and approach; as alſo for the lodging of corps de garde, and to defend paſſages. See Fort.

They are uſually figures of three, four, five, or ſix ſides, encompaſſed with a ditch, and a bank of earth, which conſiſts of two parts, called rampart and parapet.

In marſhy grounds, redoubts are often made of ſtone-work, for the ſecurity of the neighbourhood; their face conſiſts of from ten to fifteen fathoms; the ditch round them from eight to nine feet broad and deep; and their parapets, which are cut into embraſures and merlons, have the ſame thickneſs. See Reduct.

The inner ſides of ſquare redoubts are uſually between the limits of twelve and thirty-two yards; and when they are to be defended by muſketry, the number of men neceſſary to the defence may be thus determined: half the ſide ſquared gives the number of troops; and twice the ſquare root of a given number of men, ſhews the length in yards of the ſide of a ſquare redoubt proper to contain them.

To conſtruct a ſquare redoubt. — Mark out a ſquare, whoſe ſide is adapted to the number of troops allotted for the defence, as A B (*Plate* VII. *Fortification*, *fig.* 5.) for the inſide of the rampart. About this ſquare, at the diſtance of ten or twelve feet, deſcribe another ſquare, whoſe ſide, C D, is the inner boundary of the parapet; make a parapet of about nine or ten feet thick, whoſe outline is the line E F; leave a berm about three or four feet broad, whoſe ſide is G H; and dig a ditch about ſixteen feet wide, and about ſix or ſeven feet deep, which ſhould be rounded before the angles of the redoubt. Make the rampart from four feet to nine or ten feet high; let the parapet be ſix or ſeven feet higher, and let the foot-bank be four feet and a half lower than the crown of the parapet. On that ſide moſt ſecure from the enemy, make a bridge acroſs the ditch, and a paſſage through the rampart, about four or five feet broad when the defence is muſketry, about nine or ten feet broad when cannon are to be uſed; and ſhut up the paſſage by a ſtrong gate. If the redoubt is to be defended by cannon, both the rampart and parapet ſhould be at leaſt five or ſix feet thicker. In order to make the fire pretty nearly equal on all ſides, and ſufficient for defending the angles of the work, M. Clairac has contrived to cut the inſide of the parapet into notches, whoſe two ſides, of a yard each, are at right angles to one another, and make half-right angles with the ſides of the work; the manner of which, and its defence, are plainly ſhewn in the figure, where the lines with dots at the ends repreſent the fire three different ways from the ſame ſide.

For the method of conſtructing flanked redoubts, ſee Fort.

A *detached* redoubt is a kind of work reſembling a ravelin, with flanks, placed beyond the glacis; ſuch as B (*Plate* V. *Fortification*, *fig.* 6.) They are made in order to occupy ſome ſpot of ground which might be advantageous to the beſiegers; and likewiſe to oblige the enemy to open their trenches farther off than they would otherwiſe do. Their diſtance from the covert-way ought not to exceed a hundred and twenty toiſes, that they may be defended by muſket-ſhot from thence. The gorge, *a b*, is forty toiſes; the flanks, *a c*, *b f*, which are perpendicular to the gorge, ten; and the faces, *e d*, *f d*, thirty: the ditch before it is ſix toiſes, ending in ſlopes at both ends; the covert-way, four; the branches of the covert-way about forty-two toiſes long; the faces of the places of arms, *y*, *y*, which are perpendicular to the branches, ten; and the other, which is parallel to them, fourteen. The communication from the covert-way to the redoubt is five or ſix toiſes wide; and there is a traverſe made juſt at the entrance, and another in the middle when it is pretty long. The parapets of this communication terminate in a ſlope or glacis. Robertſon's Marine Fortif. p. 20, &c. Muller's Fort. p. 43, &c. See Arrow.

Redoubts are alſo ſmall works of the ſame form made in a ravelin.

Redoubt, *Caſtle* or *Donjon*. See Reduct.

Redoubts *en Cremaillere*, differ from other redoubts by having the inſide line of the parapet broken, ſo as to reſemble a pot-hook, or the teeth of a ſaw; by which a greater fire can be brought to bear upon the defile than if only a ſimple face was oppoſed to it, and conſequently the paſſage is rendered more difficult.

Redoutes *de Terre*, Fr. redoubts that are haſtily thrown up, and made with earth, for the purpoſe of ſecuring entrenchments, circumvallations, paſſages of rivers, &c.

Redoutes *de Maconnerie*, Fr. redoubts made of maſonwork; generally conſtructed in places where an enemy might derive advantage from eſtabliſhing himſelf; they are likewiſe built upon the ſaliant angles of the glacis.

Redoutes *Caſematées*, Fr. caſemated redoubts, or ſuch as are arched over and made bomb-proof. Thoſe conſtructed for the defence of Gibraltar, and for the ſecurity of Dover caſtle, are of this deſcription.

Redoutes *à Machicoulis*, Fr. are thoſe which are made of brick or ſtone-work ſeveral ſtories high. The higheſt ſtory juts out about one foot beyond the wall that ſurrounds or fronts the redoubt.

REDRESSING, the rectifying or ſetting any thing ſtraight again.

Trees and other plants have a natural faculty of redreſſing themſelves, when, by any external cauſe, they are forced out of the perpendicular.

In the moral ſenſe, to redreſs grievances, is to reform or remove them. The redreſs of injuries is the object with a view to which courts of juſtice are inſtituted in every civilized ſociety; in order to protect the weak from the inſults of the ſtronger, by expounding and enforcing thoſe laws, which define rights and prohibit wrongs. This remedy is, therefore.

therefore, to be fought for by application to thefe courts; that is, by civil fuit or action.

To redrefs a ftag, among hunters, is to put him off his changes.

REDRILL, *To*, in *Military Language*, is to put a foldier through the firft elements of military training. Every foldier, after his return from long abfence, muft be redrilled before he is permitted to act in the ranks of a company.

REDRUTH, in *Geography*, a confiderable market-town in the eaft divifion of the hundred of Penwith, and county of Cornwall, England, is fituated on the road from Launcefton to the Land's-End, at the diftance of 262 miles S.W. from London. It occupies the declivity of an eminence in the very centre of the mining diftrict, and derives its fupport entirely from the mines. Dr. Pryce fuppofes it to have been a town in Saxon times; but if fo, the records of its hiftory during that period have been entirely loft. It is firft mentioned in the year 1332, when William Baffet, the then proprietor of the manor, obtained for the inhabitants the privilege of fairs and markets. In 1502 a fimilar grant was made in favour of John Baffet, efq.; and in Oliver Cromwell's time, Mr. Buller of Morrall procured a charter for a market on Fridays, which was confirmed by king Charles II. At prefent there are two weekly markets, held on Wednefday and Friday; and three annual fairs, chiefly for cattle and ozier manufactures. The tolls of two of thefe fairs and the markets belong to the Buller family; and the other fair to lord de Dunftanville, the defcendant of the Baffets. The increafe of this town, fince the commencement of the copper mines in the laft century, has been as fix to one, as appears by the average of baptifms. According to the population return of 1801, it contained 664 houfes, and 4924 inhabitants; but in 1811 the houfes were returned as amounting to 879, and the inhabitants to 5903 in number.

Redruth confifts chiefly of one long ftreet. The church, the living of which is a rectory, was built, in 1770, by lord de Dunftanville, in the ftead of a more ancient one. This building is fituated about half a mile from the town. Here are the remains of a chapel of eafe, dedicated to St. Rumon, which has been unroofed for many years. In Redruth are meeting-houfes for Quakers and Anabaptifts, befides two for Methodifts in the town, and a third in the north part of the parifh. In 1803, a large fchool-houfe was built here by fubfcription, and a mafter placed in it by the fame means; but the fubfcription having been difcontinued, the fchool is now kept open by the mafter on his own account.

Among the numerous mines in Redruth and the contiguous parifhes of Gwennap, Kenwyn, and St. Agnes, thofe denominated the *Gwennap mines* are confidered to be the principal. Thefe lie to the fouth-eaft of Redruth, in a part of the county where the tin and copper lodes are peculiarly rich, and in fome places interfect each other. The country of the united mines Huel-Virgin, Poldice, and Huel-Unity, is fchiftus; that of Huel-Jewell, Huel-Gorland, and Trefavan, is granite; and it has been remarked, that the metallic veins moftly obey the courfe of the granite mountains, and run very nearly parallel with them. The united mines employ about 600 men, of whom 400 work under ground. The water is drawn off by four immenfe fteam-engines, one of the cylinders of which is nearly feven feet in diameter. The Huel-Virgin mine is 160 fathoms deep, and is extremely productive; but the Huel-Unity and Poldice mines are ftill more rich, and are wrought to fuch advantage, that the proprietors ufually fhare from 16,000*l.* to 20,000*l.* *per annum*. The depth of the Poldice mine is 170 fathoms; but at prefent it is not worked at a lower depth than 140. This is one of the oldeft mines in the county, and yields a yellowifh copper ore, a rofin tin, and a few ftones of galena. The Huel-Gorland mine is 120 fathoms below the furface, and is wrought at the expence of about 1000*l.* a month. The North Down mines, nine in number, occupy an extent of two miles in length, and one in breadth, and have their furplus water carried away by the fame long adit which runs through the Gwennap mines to the Carnon-Stream works.

Befides the mines, there are feveral other objects in the vicinity of Redruth not undeferving of notice. Portreath, about four miles to the north, is a fmall fea-port for the importation of coals and lime, and the exportation of copper ore to the works in Wales. It is defended by a fort, mounting four guns, and was erected by lord de Dunftanville in the year 1782, and is maintained at his expence. Tehidy park, the ancient feat of the Dunftanville family, adjoins Portreath on the fouth-weft. This manor is firft mentioned as being in their poffeffion as early as the year 1100, about thirty years before the marriage of Cecilia de Dunftanville with William Baffet, who carried the Dunftanville eftates to the Baffets. The prefent manor-houfe is of modern erection, confifting of a centre, and four detached pavilions at the angles, the whole conftructed chiefly of Cornifh free-ftone. The principal rooms are decorated with fome good portraits by Vandyke, Kneller, and fir Jofhua Reynolds; and alfo with a few pieces by Rubens, Carlo Dolci, Bononi de Ferrari, Rembrandt, Borgognone, and others of lefs note. The park and pleafure grounds attached to this manfion are very extenfive; containing about feven hundred acres, finely varied by wood and lawn, and appearing like a well-cultivated garden in the midft of a defert.

Weftward from Redruth, about a mile and a half, is Carn-breh hill, which Dr. Borlafe and others contend ought to be regarded as the grand centre of Druidical worfhip in this county, almoft every kind of monument commonly attributed to the Druids being found, as they allege, upon that eminence. How far this opinion is correct, we fhall not pretend to decide; but we may obferve, that feveral late writers maintain, that a part of the fuppofed monuments of religion, *viz.* the caves, are in fact the refult of natural convulfion. No doubt, however, fome of them are artificial, and probably belonged to the Druids; and what feems to corroborate this idea is, the circumftance of Redruth being a corruption for Dre-Druith, which fignifies the Druids' town. On the fummit of this hill is a circular fortification, called the Old Caftle, which appears to have been formerly furrounded by a ftrong wall; and about 300 yards to the eaftward, on a ledge of fuccumbent rocks, ftands Carn-breh caftle, part of which lays claim to a very high antiquity; but the remainder is of comparatively modern date. The rocks upon which this ftructure is erected not lying at all contiguous to each other, are connected by maffive circular arches thrown over the cavities.

On the fouth-weft fide of Carn-breh hill is Pendarves, the feat of John Stackhoufe, efq. It is a large handfome building, fituated on an eminence commanding extenfive views over the weftern parts of the county. In a field contiguous is a large cromlech, compofed of three upright ftones, and an impoft. Clowance, fituated about three miles further to the fouth-weft, has been for feveral centuries a feat of the family of St. Aubin. The houfe is deeply embofomed in wood; and contains, befides feveral pictures of curiofity and value, a large collection of rare and choice prints, accumulated in the portfolios of its prefent poffeffor. Lyfons's Magna Britannia, vol. iii. London, 1814, 4to.

Beauties

Bauties of England and Wales, vol. ii. by John Britton and E. W. Brayley.

REDSEAR. See Iron.

REDSTONE, in *Geography*, a town of Pennfylvania, on the Monongahela; 55 miles N.W. of Pittfburg.

REDUBBORS, thofe who buy ftolen clothes, &c. and, to the end they may not be known, turn them into fome other fafhion, &c. See Frippery, and Regrator.

REDUCE, in *Chemiftry*. See Reduct.

To Reduce *a Place*, in *Military Language*, is to oblige the governor to furrender it to the befiegers by capitulation.

To Reduce *the Circle*, is to reftore or bring back a battalion or company which has been formed in circle to its original pofition in line.

To Reduce *the Square*, is to reftore a battalion or battalions which have been formed in a hollow or oblong fquare to their natural fituation in line or column.

REDUCED Chart. See Chart.

To be Reduced, in *Military Language*, is to be taken off the eftablifhment, or ceafe to receive pay as foldiers. When a regiment is reduced, the officers are generally fent upon half pay. Sometimes, as at the clofe of a war, the corps are reduced, and the officers remain upon full pay. Hence are derived the expreffions *in* and *out* of the break. *In the break* denotes the liability of being reduced: *out of the break* fignifies the certainty of being kept upon the eftablifhment.

To be Reduced *to the Ranks*, is to be taken from a fuperior appointment in a regiment, and to be ordered to the duty of a common foldier. This fometimes happens by way of punifhment, when a ferjeant or corporal mifbehaves. A ferjeant, however, cannot, at prefent, be reduced, except by fentence of a regimental court-martial.

REDUCING Scale, is a thin broad piece of box, with feveral lines and fcales of equal parts upon it; for turning chains and links into acres and rods, by infpection.

It is ufed by furveyors to reduce maps and draughts from one dimenfion to another; it is fometimes alfo called a *furveying fcale*.

REDUCT, Reduit, or *Redoubt*, a military term, fignifying an advantageous piece of ground, intrenched and feparated from the reft of the place, camp, &c. for an army, garrifon, &c. to retire to, in cafe of a furprife. Reduits have been fometimes made for the purpofe of fecuring different pofts in a town independent of its citadel. They were propofed by the celebrated Vauban. See Donjon.

Reduct, in *Building*, a kind of recefs, or little place, taken out of a larger, to make it more uniform and regular; or for fome other convenience, as for a little cabinet afide of a chimney, for alcoves, &c.

Reduct, or *Redux*, among *Chemifts*, is a powder by which calcined metals and minerals are reduced again to their regulus, or pure fubftance.

REDUCTION, Reductio, in the *Schools*, a manner of bringing a term or propofition, which before was oppofite to fome other, to be equivalent to it.

Reduction is effected by the addition or retrenchment of a negative particle. Thus, to reduce this propofition, *no man is an animal*, to be equivalent to its oppofite, *every man is an animal*, I drop the negative, and fay, *man is an animal*. After the like manner might the term *every man* be reduced, by adding the negative and faying, *there is no man*.

Reduction *of Propofitions* is ufed in a more general fenfe, for any expreffion of one propofition, by another propofition equivalent to it.

To a reduction, therefore, there are two propofitions required, the *reduced*, and the *reducing*; which are confidered as the extremes of it, and to be connected in the reduction by means of the particle *that is*; which here has the effect of a copula.

As here, *only animals think; that is, animals think, and nothing befides animals thinks*. Where the propofition preceding the particle is reduced, and the fubject of the reduction; that following the particle reduces, and has the effect of the predicate of the reduction, and the particle *that is* acts as a copula, importing, not barely that the propofition is expreffed by another, but by another equivalent one, or, as it were, the fame.

Reduction *of Syllogifms*, is a regular changing or tranfforming of an imperfect fyllogifm into a perfect one. Or, it is a change of a fyllogifm in refpect of form, by which the neceffity of the illation, or inference, is made more evident.

Reduction obtains in fyllogifms of the fecond and third figure; as alfo in the indirect modes of the firft. By it thefe are all brought to the firft.

There are two kinds of this reduction; the one *direct*, or *oftenfive*, performed merely by a converfion of one or both the premifes, or by a tranfpofition of them; as when *cameftres* is reduced to *celarent*: the other *indirect*, called *per impoffibile*, or *ad abfurdum*; by which the perfon who denies the goodnefs and legitimacy of an imperfect fyllogifm, is reduced to affert or grant fomething abfurd and impoffible, or contradictory to fome other thing maintained by him.

Suppofe, *e. gr.* a perfon granting the premifes of the following fyllogifm, denies the conclufion: *All fraud is prohibited; but fome trading is not prohibited; therefore fome trading is not fraud.* We thus proceed againft him if the fyllogifm be not good, the antecedent is juft, but the confequent falfe; and, therefore, the contrary of the conclufion muft be true: now I take the contrary of the conclufion, which you thus give, *viz. all trading is fraud;* and of that, with the other premife of the former fyllogifm, *viz.* the major, which you likewife grant, make a new fyllogifm; thus, *All fraud is prohibited; all trading is fraud: therefore all trading is prohibited.* But this propofition, *all trading is prohibited*, and the other, *fome trading is prohibited*, which you granted me in the firft fyllogifm, are contradictories.

Reduction, in *Arithmetic*, is the converting of monies, weights, or meafures, into the fame value in other denominations; *e. gr.* pounds into fhillings and pence; or fhillings and pence into pounds.

The reductions of the principal monies, coins, weights, and meafures, ancient and modern, foreign and domeftic, are found under Coin, Weight, Measure, Pound, Foot, &c.

Reduction is of two kinds: 1. *Defcending*, when a quantity is to be brought from a higher denomination to a lower.

This is done by confidering how many of the next lefs denomination are contained in the next greater before, and by that number multiplying the greater.

Thus pounds are reduced into fhillings, by multiplying by 20; fhillings into pence, by multiplying by 12; and pence into farthings, by multiplying by 4.

Troy pounds are reduced into grains, by multiplying by 12, 20, and 24: and avoirdupois hundreds into ounces, by 4, 28, and 16.

2. *Afcending*, when a lower denomination is to be reduced to a higher.

In order to this, the bufinefs is to divide the leaft by fo many of its denomination as are contained in the next greater: thus, 24,720 pence, divided by 12, and the quotient by 20, gives 103 pounds.

If there remain any thing in each divifion, it is refpectively

ively either odd pence, or ſhillings: thus, 6713 pence reduced, give 27*l.* 19*s.* 5*d.* cut off the laſt, the reſt are the pounds required.

To expedite the practice, ſeveral compendious ways of reduction have been invented. See PRACTICE.

Thus, yards are turned into ells by ſubtracting a fifth; and into ells Flemiſh by adding a fifth. Ells Flemiſh are reduced into yards by ſubtracting a quarter. Ells Flemiſh reduced to ells Engliſh by multiplying by 6, and cutting off the right-hand figure.

Great pounds of ſilk of twenty-four ounces are reduced to pounds of fixteen ounces by adding one-half; and pounds of fixteen ounces into pounds of twenty-four by ſubtracting one-third.

REDUCTION *of Decimals.* See DECIMALS.

REDUCTION *of Fractions.* See FRACTIONS.

REDUCTION *of Ratios.* See RATIOS, *Reduction of.*

REDUCTION *of Surds.* See SURDS.

REDUCTION *of Equations.* Various algebraical operations are claſſed under this head by different authors; ſome conſidering it to be the ſame as is otherwiſe, and more properly, called the *ſolution* of equations, or the finding of their roots: ſome define it to be the taking away or exterminating all the unknown quantities except one, otherwiſe called *elimination:* others again, under this head, treat of what is more uſually termed the *transformation* of equations; and others again apply it to the depreſſing of an equation, or the reduction of it to another of lower dimenſions, which latter ſeems to us the only operation that can properly be treated of under the above deſignation. See RESOLUTION, and TRANSFORMATION.

There are but few caſes in which the reduction of an equation can be effected, *viz.* only when a known relation has place amongſt any of its roots, in which caſe the equation will admit of being reduced as many degrees lower, as there are independent conditions known to have place. So that if the relation be only between two roots, which is one condition, the equation may be reduced two degrees; if the relation extend to three roots, it may be reduced three degrees; and ſo on.

The conditions or relations more commonly conſidered, are thoſe in which the roots of an equation form an arithmetical or geometrical progreſſion, and when an equation has any number of equal roots. The two former relations ſeem rather objects of curioſity than utility, as it is not probable that an equation ſhould have ſuch relations obtain between its roots; but with regard to equal roots they may frequently ariſe in the ſolution of various problems. When any geometrical or phyſical problem is propoſed, the number of its poſſible ſolutions is generally limited, and therefore the ultimate reſult ariſing out of ſuch inveſtigation ought to be an equation, the number of whoſe roots agree with the limited number of ſolutions. But it may happen that the analyſt, by not purſuing the beſt mode of operation, is led to an equation of higher dimenſions than is requiſite, in which caſes, upon inveſtigation, it will always be found that his reſulting equation has ſome number of equal roots, which being taken away, will reduce the equation to one of lower dimenſions, which gives the proper number of ſolutions to the original problem. As to the caſes in which the roots of an equation form a geometrical progreſſion, they occur almoſt excluſively in the ſolution of binomial equations, having prime indices, a property which M. Gauſs has turned to a good account in the ſolution of theſe equations. See POLYGON, and RECIPROCAL *Equations.*

Nearly all other relations between the roots of equations are feigned for the purpoſes of framing queſtions, and exercising the ingenuity of authors and their ſtudents.

1. To aſcertain whether a propoſed equation has any equal roots.

Let $x^m + \alpha x^{m-1} + \beta x^{m-2} + \gamma x^{m-3} + \&c. = 0$, be any equation whoſe roots are a, b, c, d, &c. then from the known theory of equations we have

$$x^m + \alpha x^{m-1} + \beta x^{m-2} + \gamma x^{m-3} + \&c. =$$
$$(x-a)\ (x-b)\ (x-c)\ (x-d),\ \&c.$$

And it may be ſhewn alſo, that the equation $m x^{m-1} + (m-1)\alpha x^{m-2} + (m-2)\beta x^{m-3} + \&c. =$

$$\begin{aligned}&(x-a)\ (x-b)\ (x-c)\ \&c. +\\&(x-a)\ (x-b)\ (x-d)\ \&c. +\\&(x-a)\ (x-c)\ (x-d)\ \&c. +\\&(x-b)\ (x-c)\ (x-d)\ \&c.;\end{aligned}$$

that is, it is equal to the ſum of all the m equations that can be formed by the different combinations of the m firſt roots, taking $m-1$ at a time. (See Waring's Meditationes Algebraicæ, cap. 3.) Now if we ſuppoſe the firſt equation to have two equal roots, as, for example, $a = b$, the above products will become

$$x^m + \alpha x^{m-1} + \beta x^{m-2} + \gamma x^{m-3} + \&c. =$$
$$(x-a)\ (x-a)\ (x-c)\ (x-d)\ \&c. \text{ and}$$
$$m x^{m-1} + (m-1)\alpha x^{m-2} + (m-2)\beta x^{m-3} + \&c. =$$
$$\begin{aligned}&(x-a)\ (x-a)\ (x-c)\ \&c. +\\&(x-a)\ (x-a)\ (x-d)\ \&c. +\\&(x-a)\ (x-c)\ (x-d)\ \&c. +\\&(x-a)\ (x-c)\ (x-d)\ \&c.;\end{aligned}$$

where it is obvious that both the one and the other of theſe equations have the ſame factor, *viz.* $(x-a)$.

If the equation had three equal roots, it is equally obvious that both equations would have the common factor $(x-a)^2$; and generally, if the equation had p equal roots, they would both have the common factor $(x-a)^{p-1}$.

Therefore, when it is propoſed to find whether a given equation have equal roots, we muſt from the propoſed equation draw the *derived* equation as above, (which, it will be obſerved, is the ſame as would ariſe from taking the fluxion of the firſt, leaving out of courſe the $\dot{x}$'s,) and find by the uſual methods, whether theſe two functions have any common meaſure; which, if they have, will furniſh us with the equal root ſought; and conſequently the original equation may then be reduced by diviſion to another of two degrees lower dimenſion for two equal roots; of three degrees lower for three, and ſo on.

Exam. 1.—It is required to find the equal roots of the equation $x^3 - 48x - 128 = 0$.

Here the derived equation is $3x^2 - 48 = 0$, and the common meaſure of theſe two functions is $x + 4$; whence -4 and -4 are the equal roots; the third root being $+8$.

Exam. 2.—It is required to aſcertain whether the equation

$$x^4 + 3x^3 - 14x^2 - 12x + 40 = 0$$

have equal roots, and what they are.

Here the derived equation is

$$4x^3 + 9x^2 - 28x - 12 = 0;$$

and the common diviſor of the two is $x - 2$; whence $x = 2, 2$, which are two of the equal roots. Divide now the original equation by $x^2 - 4x + 4$, and we have

$$x^2 + 7x + 10 = 0,$$

whoſe

whoſe roots are -2, and -5; therefore, the four roots of the propoſed equation are $2, 2, -2, -5$.

If the roots of an equation be equal, but with contrary ſigns, the operation is more ſimple. For, in this caſe, we have only to change the ſigns of the roots in the propoſed equation, by changing the alternate ſigns of its co-efficient; and we ſhall thus have two equations, having neceſſarily a common quadratic factor of the form $x^2 - a^2$, which may be found, and the equation depreſſed as before.

Exam. 3.—Required the roots of the equation $x^4 + 3x^3 - 7x^2 - 27x - 18 = 0$, two of which are equal, but with contrary ſigns.

By changing the ſigns of the alternate terms, we have $x^4 - 3x^3 - 7x^2 + 27x - 18 = 0$, the common quadratic diviſor of which is $x^2 - 9 = 0$; whence the equal roots with contrary ſigns are $+3$, and -3. Now dividing the propoſed equation by $x^2 - 9$, we have $x^2 + 3x + 2 = 0$; whence $x = \frac{-3}{2} \pm \sqrt{\frac{1}{4}} = -2$, and -1, which are the other two roots.

On this ſubject the reader ſhould conſult Waring's Meditationes Algebraicæ, cap. 3. See alſo Bonnycaſtle's Algebra, vols. i. and ii.

REDUCTION *of Intereſt of the public Debt.* See FUND.

REDUCTION *of Curves.* See CURVE.

REDUCTION *of a Figure, Deſign,* or *Draught,* is the making a copy of it, either larger or ſmaller than the original, ſtill preſerving the form and proportion.

The great uſe of the proportional compaſſes is in the reduction of figures, &c. whence they are alſo called *compaſſes of reduction.*

There are various methods of reducing figures, &c.; the moſt eaſy is by means of the *pentagraph* (which ſee), or parallelogram: but this has its defects. The beſt and moſt uſual methods of reduction are as follow:

To reduce a figure, as A B C D E (*Plate* XII. *Geometry, fig.* 5.) *into a leſs compaſs.*—About the middle of the figure, as *z*, pitch on a point; and from this point draw lines to its ſeveral angles, A, B, C, &c. then drawing the line *a b* parallel to A B, *b c* parallel to B C, &c. you will have the figure *a b c d e* ſimilar to A B C D E.

If the figure *a b c d e* had been required to be enlarged, there needed nothing but to produce the lines from the point beyond the angles, as *z* D, *z* C, &c. and to draw lines, *viz.* D C, C B, &c. parallel to the ſides *d c*, *c b*, &c.

To reduce a figure by the angle of proportion.—Suppoſe the figure A B C D E (*fig.* 6.) required to be diminiſhed in the proportion of the line A B to *a b* (*fig.* 7.): draw the indefinite line G H (*fig.* 8.), and, from G to H, ſet off the line A B; on G deſcribe the arc H I; ſet off the line *a b* as a chord on H I, and draw G I. Then with the angle I G H you have all the meaſures of the figure to be drawn. Thus to lay down the point *c*, take the interval B C, and upon the point G deſcribe the arc K L; alſo on the point G deſcribe M N; and upon *a*, with the diſtance M N, deſcribe an arc cutting the preceding one in *c*, which will determine the ſide *b c*. And after the ſame manner are all the other ſides and angles to be deſcribed. The ſame proceſs will alſo ſerve to enlarge the figure.

To reduce a figure by a ſcale.—Meaſure all the ſides of the figure, *e. gr.* A B C D E, by a ſcale, and lay down the ſame meaſures reſpectively, from a ſmaller ſcale in the proportion required.

To reduce a map, deſign, or figure, by ſquares.—Divide the original into little ſquares, and divide a freſh paper of the dimenſions required, into the ſame number of ſquares; which are to be larger or leſs than the former, as the map is to be enlarged or diminiſhed.

This done, in every ſquare of the ſecond figure, draw what you find in its correſpondent one in the firſt.

REDUCTION *to the Ecliptic,* in *Aſtronomy,* is the difference between the argument of latitude, as N P (*Plate* XIX. *Aſtronomy, fig.* 10.) and an arc of the ecliptic N R, intercepted between the place of a planet and the node N.

To find the reduction.—The angle of inclination P N R, and the argument of latitude N P, being given, find, by the doctrine of ſpherics, the arc N R; ſubtract N R and N P from each other, the remainder is the reduction.

REDUCTION *into firſt Matter,* is a term which alchemiſts formerly uſed, when they found their ſubſtances putrefy, and grow black.

REDUCTION was more particularly uſed for the converſion of a dry matter into a liquid, particularly into water; which by the alchemiſts was held the principle of all things.

The reduction of metals into their firſt matter, or principles, according to theſe philoſophers, can only be effected by mercury; nothing elſe being able to looſen the fixed ſulphur of metallic bodies, which binds them together.

REDUCTION, in *Metallurgy,* is the decompoſition of a metallic oxyd, ſo as to leave the metal in a ſtate of greater or leſs purity, and exhibiting the luſtre which is ſo eminently characteriſtic of metallic bodies.

Reduction is, for the moſt part, effected by charcoal and a high temperature, either with or without the aſſiſtance of fluxes. For the various modes of reduction in actual practice, ſee the articles of the different metals.

REDUCTION, in *Surgery,* denotes an operation by which a diſlocated, luxated, or fractured bone is reſtored to its former place. Reduction, or *repoſition,* is always to be performed before any remedy be applied.

REDUIT, in *Military Affairs.* See REDUCT.

REDUNDANCY, or REDUNDANCE, a fault in diſcourſe, conſiſting in the uſe of a ſuperfluity of words.

Words perfectly ſynonimous are redundant, and ought to be retrenched. Redundancy neceſſarily makes the ſtyle weak and languid. See PLEONASM.

REDUNDANT HYPERBOLA, in *Geometry,* is a curve of the higher kind, thus called, becauſe it exceeds the conic ſection of that name in the number of its hyperbolic legs; being a triple hyperbola, with ſix hyperbolical legs.

REDUNDANT *Interval,* in *Muſic,* is uſed for an interval exceeding the truth by a comma.

Some apply redundant to an interval exceeding a diatonic interval by a ſemitone minor; but this is more uſually called a ſuperfluous interval. See INTERVAL and SECOND.

REDUPLICATION, in *Rhetoric,* a figure by which a verſe begins with the ſame word as the preceding one ends with. See ANADIPLOSIS.

REDUPLICATION, in *Logic,* is a kind of condition expreſſed in a propoſition, indicating or aſſigning the manner in which the predicate is attributed to the ſubject.

The uſual reduplicative words are *quatenus, as, ſo far as, conſidered as, inaſmuch as,* &c. Hence,

REDUPLICATIVE PROPOSITIONS, are ſuch in which the ſubject is repeated, with ſome circumſtances or condition. Thus, *Men, as men, are rational; kings, as kings, are ſubject to none but God.*

REDUTEA, in *Botany,* ſo called by the late M. Ventenat, in honour of his friend M. P. J. Redouté, one of the moſt accurate and intelligent botanical draughtſmen, and perhaps the fineſt botanical painter, ever known. He is the author of a ſplendid coloured work in folio, on the Liliaceous

liaceous tribe, including ſome other beautiful plants allied thereto, which has already extended to the ſeventh volume; and it is to his pencil that the perfection of moſt botanical works that have appeared in France, for near thirty years paſt, particularly the publications of L'Heritier and Ventenat, is owing.—Venten. Jard. de Cels, 11. Poiret in Lamarck Dict. v. 4. 87.—Claſs and order, *Monadelphia Polyandria*. Nat. Ord. *Columniferæ*, Linn. *Malvaceæ*, Juſſ.

Gen. Ch. *Cal.* Perianth inferior, double, permanent: the outer of many minute leaflets: inner much larger, of one leaf, in five very deep ſegments. *Cor.* Petals five, roundiſh kidney-ſhaped, imbricated obliquely, united at the baſe to each other, and to the column of the ſtamens. *Stam.* Filaments numerous, united below into a conical tube, ſubdivided and branched above; anthers kidney-ſhaped. *Piſt.* Germen ſuperior, ovate, ſimple; ſtyle thread-ſhaped, ſwelling upwards, about as long as the ſtamens; ſtigmas three, obtuſe. *Peric.* Capſule ovate, of three cells and three valves, the partitions from the middle of each valve. *Receptacles* of the ſeeds three, inſerted into the baſe of the capſule, alternate with the valves, and nearly equal to them in length, linear, bearing ſeeds on each edge. *Seeds* ſix or eight in each cell, obovate, minutely ſtalked, inſerted in two rows on the receptacle, each clothed with denſe wool.

Eſſ. Ch. Calyx double; the outer of many minute leaves; inner in five deep ſegments. Stigmas three. Capſule of three cells and three valves. Seeds enveloped in wool. Receptacles three, linear, unconnected with the valves.

Obſ. Ventenat conſiders the three diſtinct receptacles, as affording the moſt eſſential diſtinction, between this and every other malvaceous genus. The woolly ſeeds, moreover, diſtinguiſh it from all except *Goſſypium*, whoſe large three-leaved outer calyx is abundantly different from *Redutea*.

The only known ſpecies is

1. R. *heterophylla*. Various-leaved Redutea. Vent. Jard. de Cels, t. 11.—Diſcovered by Riedlé in the iſland of St. Thomas, and raiſed in M. Cels's garden at Paris. The plant is herbaceous and annual, and M. Ventenat ſeemed to think it might ſerve to decorate our flower-borders, like other annuals of very hot climates, in the open air, being, we preſume, raiſed on a hot-bed in the ſpring. Every part of the herbage is beſprinkled with ſmall, whitiſh, fringed ſcales, readily ſeen with a magnifying glaſs. The *root* is ſpindle-ſhaped, yellowiſh. *Stem* erect, twelve or fifteen inches high, about the ſize of a gooſe-quill, angular, pithy, branched, leafy, dark green, many-flowered. *Leaves* alternate, on longiſh ſtalks, ſpreading widely, ovate, undivided or three-lobed, entire, an inch or inch and half long; paler beneath. *Stipulas* minute, awl-ſhaped, deciduous. *Flowers* large, handſome, ſulphur-coloured, with a dark purple radiating ſpot at the baſe of each petal, ſolitary, erect, on long, ſimple, axillary ſtalks. Segments of the inner *calyx* nearly linear, half as long as the petals. *Style* hairy. *Capſule* the ſize of a filberd. Wool of the *ſeeds* of a dirty grey. —We have not heard of this plant in any Engliſh collection.

REDUVIA, in *Surgery*, a word uſed by ſome for a whitlow, and by others for a painful crack, or other diſorder about the nails, either of the fingers or toes.

REDUX, in *Chemiſtry*. See Reduct.

REDWAETH Bay, or *Traeth Coch*, in *Geography*, a bay on the N. coaſt of the iſland of Angleſey. N. lat. 53° 17'. W. long. 4° 25'.

REDWITZ, a town of Bavaria, in the biſhopric of Bamberg; 4 miles N.N.W. of Kunſtadt.

Redwitz, a town of Germany, in the principality of Culmbach; 4 miles N. of Bayreuth.

REDWOOD River, a river of America, which runs into the Wabaſh, N. lat. 40° 16'. W. long. 87° 5'.

REE, or Re, in *Commerce*. See Rees.

Ree, *Lough*, in *Geography*, an expanſion of the waters of the river Shannon, in Ireland, between the county of Roſcommon and the counties of Longford and Weſtmeath, reaching from Laneſborough nearly to Athlone, with ſeveral iſlands, and in ſome places three miles broad.

REED, in *Botany*. See Arundo.

The root of the *arundo donax* of Dioſcorides, attracts any matter lodged in wounds, if powdered and applied to them with wine; or if it is taken freſh and reduced to powder with an onion, or mixed with honey. (Oribas de Morb. Cur. lib. iii. cap. 32.) It alſo removes pains ariſing from diſlocation of limbs, and carries off pains in the hips. The green leaves cut and applied, are ſaid to cure the eryſipelas. Poor people boil the flowers in water or in beer, which they mix with honey, and drink, after being filtrated, to cure coughs, oppreſſions of the breaſt, and conſumptions. The ancients made flutes and other muſical inſtruments of the reed. James's Med. Dict.

Reed, *Barr*. See Sparganium.

Reed, *Indian flowering*. See Canna.

Reed *Mace*. See Typha.

Reed, in *Agriculture*, the name of an aquatic plant, infeſting boggy lowlands or meadows on the ſides of rivers.

The beſt method of deſtroying reeds, is by draining the land; for if the drains be cut deeper than their roots it will take away their nouriſhment, and, conſequently, deſtroy them. Aſhes, or ſoot, will likewiſe ſometimes kill them; and ſo will ploughing up the land, and laying it in high ridges. They always indicate a deep good moiſt ſoil, as a bad one will not nouriſh or ſupport them. There are many different ſorts of reeds, but thoſe of the more ſtrong and tall kinds are often of much uſe in thatching the different ſorts of farm buildings, where other better kinds of coverings are ſcarce, and theſe abundant. There is alſo a ſort of reed found in Huntingdonſhire, and ſome of the adjoining counties, that is very valuable for the purpoſe of laying plaſter floors with. In other ſituations, reeds of the other kinds may be met with, that may be found uſeful for different purpoſes either of the farmer or in the arts. In ſuch ſituations they may be cultivated with advantage as an article of profit: and it may often be more beneficial than to have them deſtroyed, eſpecially where they are of a valuable nature, and where the land is of too moiſt and boggy a quality to be ever fully reclaimed and brought into either the ſtate of good arable or meadow ground. Slips on the ſides of large rivers or brooks are likewiſe, frequently, the moſt advantageouſly, conveniently, and profitably kept under reed crops, as the overflow of the waters prevent their being uſefully managed in any other manner. There are other ſituations, as thoſe about the borders of large ponds, lakes, and other waters, where they may be preſerved with far greater propriety than having them deſtroyed, provided even that can be accompliſhed without difficulty, as not any thing more valuable can in general be raiſed in ſuch places. They are, however, by no means to be continued wherever any better crop will grow and ſucceed.

Reed is alſo a term applied to ſuch ſtraw of the wheat or rye kinds as has not been bruiſed by threſhing or in any other way.

Reed *Hedge*, in *Gardening*, that ſort of hedge fence which is formed from reeds. They are a ſort of temporary internal fences made with theſe dried materials which may be had cheap, and be expeditiouſly formed into hedges by the aſſiſt-

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ance of poſt and railing, being of great utility for occaſional uſe in gardens, to incloſe particular internal ſpaces of ground, ſo as to afford ſhelter to certain ſeedling plants, both in nurſeries and large kitchen gardens; and in ſome nurſeries, to form places of ſhelter for many ſorts of ſeedling trees and ſhrubs, &c., which being tender whilſt young, require the ſhelter of a fence in winter to break off ſevere or cutting blaſts two or three years, till they gradually gather ſtrength and a greater degree of hardineſs. They are alſo uſeful in training ſeveral ſorts of wall-fruit-trees againſt, to form them for rows, or what are called trained trees; admitting of planting trees againſt each ſide of them, ſix, eight, or ten feet aſunder. See NURSERY.

And in large open kitchen-gardens they are occaſionally made uſe of to incloſe the melonary, or place for raiſing early melons and cucumbers in, and often as croſs internal fences, under which to form warm borders for the purpoſe of raiſing various early crops of eſculents.

The proper ſort of reeds for theſe fences are the dried ſtems of the common marſh reed, which grows in great plenty by river ſides, and in lakes, and marſhy places, furniſhing a crop of ſtems annually fit to cut in autumn, when they ſhould be bound in bundles, and ſtacked up, or houſed, to remain for uſe.

Theſe fences are ſometimes erected in fixed ranges, and ſometimes formed into moveable pannels. In the firſt mode, ſome ſtout poſts ſhould be placed ſix or eight feet aſunder, and five or ſix high, and from poſt to poſt carry two or three ranges of flat thin railing, one range near the bottom, another near the top, and a third in the middle; againſt this railing, the reeds muſt be placed about two inches thick, having other railing fixed directly oppoſite; ſo that the reeds being all along between the double railing, the bottoms reſting either upon a plate of wood, or let into the ground, but the former is preferable; and as ſoon as one pannel is formed, the railing ſhould be nailed as cloſe as poſſible, driving ſome long ſpike-nails through each double railing, or binding them with ſtrong withy bands, or tar rope-yarn, but nailing is the beſt, in order to bring them as cloſe as may be, to ſecure the reeds firmly in the proper poſition; the top ſhould be cut even afterwards.

In the better method, a frame-work of railing ſhould be prepared as above, each pannel ſix or eight feet long, and the reeds fixed therein as before directed; then, where they are intended to be placed, poſts muſt be ranged ſix or eight feet diſtant to ſupport the different pannels. Or ſometimes the pannels may be placed inclining againſt the wall or other fence, in time of ſevere weather, when the borders are narrow. Theſe ſorts of fences are now however in much leſs uſe in gardening than formerly.

REED *Ronds*, in *Rural Economy*, a provincial word, ſignifying plots or beds of reed, or the ſwamps in which they grow.

REED, *Ezekiel's*. See EZEKIEL'S *Reed*.

REED, *Calamus*, likewiſe denotes a Jewiſh meaſure, otherwiſe called canna.

REED, in the *Manufactory of Tapeſtry*. See TAPESTRY.

REED *Sparrow*, in *Ornithology*. See EMBERIZA *Schoeniculus*.

REED *Point*, in *Geography*, a cape on the W. coaſt of the iſland of Antigua. N. lat. 17° 12′. W. long 61° 36′.

REEDHAM. See REEPHAM.

REEDS, in a *Fire-ſhip*, are made up in ſmall bundles of about twelve inches in circumference, cut even at both ends, and tied each with two bands. There are two kinds of them; the long, which are four feet; and the ſhort, which are two feet five inches in length. Some of them are ſingly dipped, *i. e.* at one end, the reſt are dipped at both ends, in a kettle of melted compoſition. After being immerſed about ſeven or eight inches in this preparation, and then drained, they are ſprinkled over with pulverized ſulphur upon a tanned hide. See FIRE-*ſhip*.

REEDSBOROUGH, in *Geography*. See READSBOROUGH.

REEDSTOWN. See STRONG.

REEDY CREEK, a river of New Jerſey, which runs into the Atlantic, N. lat. 39° 55′. W. long. 74° 16′.

REEDY *Iſland*, an iſland of America, in the Delaware river, 50 miles below Philadelphia, and 20 miles from Bombay Hook, about three miles long and not more than one-fourth of a mile wide. This iſland was formerly banked in, but is now under cultivation, and overflowed in high tides. It is the rendezvous of outward-bound ſhips in autumn and ſpring, waiting for a fair wind. Here is a ſecure harbour at Port Penn, where piers have been erected by the ſtate of Pennſylvania. On each ſide of the iſland is a channel; but veſſels, eſpecially of the larger kind, chooſe to keep the eaſtern ſide.

REEDY *River*. See SALUDA.

REEDY *River Shoal*, a poſt-town of America, in Greenfield county, South Carolina.

REEF (*reef*, Dutch), in *Navigation*, denotes a certain portion of a ſail, comprehended between the top or bottom, and a row of eyelet-holes parallel to it. The intention of the reef is to reduce the ſurface of the ſail in proportion to the increaſe of the wind; for which purpoſe there are ſeveral reefs parallel to each other in the ſuperior ſails, by which they may be ſtill farther diminiſhed, in order to correſpond with the ſeveral degrees of the gale. The top-ſails of ſhips are uſually furniſhed with four reefs, parallel to the yard; and there are always three or four reefs parallel to the foot of thoſe main-ſails and fore-ſails which are extended upon booms; a circumſtance common to many of the ſmall veſſels. Falconer.

A *bag-reef* is the fourth, or lower, reef of a top-ſail. A *balance-reef* croſſes boom-main-ſails diagonally, from the nock to the end of the upper reef-band on the after-larch. This is uſed to contract the ſails in a ſtorm.

REEF alſo denotes a chain of rocks, lying near the ſurface of the water.

REEF-*Band*, in *Sea Language*, a piece of canvas, ſewed acroſs the ſail, to ſtrengthen it in the place where the eyelet-holes of the reefs are formed.

REEF-*Hanks*, ſhort pieces of log-line or other ſmall line, faſtened at certain diſtances to form the reefs of boom-ſails.

REEF-*Tackle*, is a rope which paſſes from the deck to a block at the top-maſt head, and thence to another block at the topſail-yard-arm, where it communicates with another rope, called its *pendant*, that runs downwards through a hole in the yard, and is afterwards attached to a cringle, a little below the loweſt reef. It is uſed to pull the ſkirts of the reefs cloſe up to the extremities of the top-ſail yards, in order to lighten the ſail, the weight of which would otherwiſe render it very difficult to perform this operation. Falconer.

REEF *Iſland*, in *Geography*, a ſmall iſland in the Eaſt Indian ſea, about 50 miles from the W. coaſt of Sumatra. S. lat. 4°. E. long. 101° 3′.—Alſo, a ſmall iſland in the Eaſt Indian ſea, near the N. coaſt of the iſland of Celebes. N. lat. 0° 8′. E. long. 122° 48′.

REEFING, in *Sea Language*, the operation of reducing a ſail, by taking in one or more of the reefs, which is performed by lines, points, or knittles. The top-ſails are always

always, and the courfes generally, reefed with points, which are flat braided pieces of cordage, whofe lengths are nearly double the circumference of the yard. Thefe, being inferted in the eyelet-holes, are fixed in the fail by means of two knots in the middle, one of which is before, and the other behind the reef-band. In order to reef the top-fails with greater facility and expedition, they are lowered down, and made to fhiver in the wind, which confiderably relaxes their tenfion. The extremities of the reef are then drawn up to the yard-arms by an affembly of pullies communicating with the deck, termed the *reef-tackle*; and they are fecurely faftened to the yard-arms by fmall cords, called *earings*. The fpace of fail, comprehended in the reef, is then laid fmoothly over the yard, in feveral folds or doubles; and the whole is completed by tying the points above the yard, fo as to bind the reef clofe up to it. The courfes of large fhips are reefed either with points or fmall cords, which are thence called *reef-lines*. In the latter cafe, the line is paffed fpirally through the eyelet-holes of the reef, and over the head of the fail alternately, and afterwards ftrained as tight as poffible. It muft be obferved, however, that the reef-line is fometimes paffed round the yard, and fometimes only round the head of the fail; and each of thefe methods has its advocates. But if it fhould appear effential to prevent the friction by which a fail is galled between the line and the yard, and as the rope-bands are fufficient to fuftain the effort of the fail, it is better to pafs the line only round the fail, provided that the turns are inferted through the roband legs; a circumftance carefully practifed by every fkilful failor. The fame reafon may be alleged in favour of tying the points of the courfes in the fame manner; *i. e.* the after-end of the point fhould be thruft forward between the head of the fail and the yard; and the fore-end of the faid point fhould come aft over the head of the fail and alfo under the yard; and thus croffed over the head of the fail, the point fhould be extended, and the two ends brought over the yard; and tied on the upper fide of it as ftraight as poffible.

When a fail is reefed at the bottom, it is done by knittles, which, being thruft through the eyelet-holes of it, are tied firmly about the fpace of canvas of which the reef is compofed, and knotted on the lower fide of the bolt-rope. Thefe knittles are accordingly removed as foon as the reef is let out. Falconer.

REEK, in *Rural Economy*, a term provincially ufed for ftack. See STACK and RICK.

REEK-*Stavel*, a term applied to a frame of wood placed on ftone, on which the mow or ftack is raifed. It is fometimes written *Reek Staffold*.

REEL, in the *Manufactories*, a machine ferving for the office of reeling.

There are various kinds of reels; fome very fimple, others very complex. Of the former kinds, thofe moft in ufe are,

1. A little reel, held in the hand, confifting of three pieces of wood, the biggeft and longeft whereof (which does not exceed a foot and a half in length, and a quarter of an inch in diameter,) is traverfed by two other pieces difpofed different ways.

2. The common reel, or windlace, which turns upon a pivot, and has four flights, traverfed by long pins, or fticks, on which the fkain to be reeled is put; and which are drawn clofer or opened wider, according to the fkain.

Other reels ufed in particular arts, are explained under their particular articles; as the reel ufed in milling of filk, under the article MILLING; and that in the reeling or winding of filks, under the article of SILK, &c.

REELS, to reel ropes on from a fix-thread ratline to a two-inch rope, have four ribs fixed at each end in a flat circular piece of wood; and round the edges are blades, or handles, to turn them: one of the circular pieces is called the *head*, and is made to flide off for taking the coil away. They turn on an iron fpindle, and are from ten to thirty-fix inches long, and from twelve to eighteen inches diameter. The *Bench-reel* ufed by fail-makers is fimilar to a fpinning-wheel, and is ufed to expedite winding the twine from the fkains to the twine-reel. *Log-reels* have feveral ribs fixed in a circular piece of board at each end, and turn or run upon a fpindle, having a handle at one end. (See LOG.) *Twine-reels*, ufed by fail-makers, are fhort cylindrical pieces of wood, hollowed in the middle to receive the twine, with a hole through the middle for the fpindle. Thofe ufed by rope-makers have four oak bars, about eighteen inches long, framed together at the ends on a wooden fpindle; one of the bars flides, for the conveniency of taking off the twine. The *Yarn-reel* confifts of a circular board faftened horizontally on the middle of a piece of oak four inches fquare, and fixteen long, with a hole through its middle to receive a bolt, on which it turns as its axis, and is ufed to wind fpun-yarn off the coil. The *Hand-reel* is a narrow board, with three or four holes at each end, in which pegs are fixed for reeling marline and other lines.

REELFOOT, in *Geography*, a fmall navigable river of America, in Tenneffee, which difcharges itfelf into the river Miffifippi, about 35 miles S. of the Ohio. It is 30 yards wide feven miles from its mouth. One of its branches rifes on the borders of Kentucky.

REELING, in the *Manufactories*, the winding of thread, filk, cotton, or the like, into a fkain, or upon a bottom, to prevent its entangling.

It is alfo ufed for the charging or difcharging of bobbins, or quills, to ufe them in the manufacture of different ftuffs, as thread, filk, cotton, &c.

Reeling is performed different ways, and by different engines.

REEM, in *Zoology*. See RHINOCEROS *Unicornis*.

REEMING, a term ufed by caulkers for opening the feams of the planks with reeming-irons, that the oakum may be more readily admitted. To make any hole larger is alfo termed reeming.

REEMING-*Irons*, are the largeft irons ufed by caulkers in opening the feams.

REEMSTOWN, or REAMSTOWN, in *Geography*, a fmall poft-town of America, in Lancafter county, Pennfylvania, fituated on a ftream which runs into Calico creek, a water of Coneftoga, which falls into the Sufquehannah; 26 miles N.E. of Lancafter.

REEN, a river of Norway, in the province of Drontheim, which runs into the Glomme; 20 miles N. of Opfal.

REEN *Moffa*, a name ufed by fome for the mountain coralloides, or rein-deer mofs.

REENBERG, THEOCARUS, in *Biography*, a celebrated Danifh poet, was born at Viborg in 1656, where he was educated. In 1680 he fet out on his travels into foreign countries, after having undergone an examination by the theological faculty, and he returned to Denmark in 1682. In 1703 he was appointed fourth judge in Jutland. In 1730 he became counfellor of juftice, and he died in 1742. His poetical works were publifhed at Copenhagen in 1769, by his grandfon Tielmann, with a preface by Kofod Anker, and annotations by Luxdorph. Gen. Biog.

REENSKLOSSER, in *Geography*, a town of Norway; 12 miles N.N.W. of Drontheim.

RE-ENTERING Angle, in *Fortification*. See Angle, and Construction, *according to M. Vauban's first method*.

RE-ENTRY, in *Law*, the refuming or retaking that poffeffion which any one had lately forgone.

As, if I make a leafe of land or tenement, I do thereby forego the poffeffion: and if I condition with the leffee, that for non-payment of rent at the day, it fhall be lawful for me to re-enter; this is as much as if I conditioned to take again the lands, &c. into my own hands, and to recover the poffeffion by my own act, without the affiftance of judge or other procefs. But words in a deed give no re-entry, if a claufe of re-entry be not added. (Wood's Inft. 140.) All perfons who would re-enter on their tenants for non-payment of rent, are to make a demand of the rent; and, to prevent the re-entry, tenants are to tender their rent, &c. (1 Inft. 201.) If there is a leafe for years, rendering rent, with condition, that if the leffee affigns his term, the leffor may re-enter; and the leffee affigneth, and the leffor receiveth the rent of the affignee, not knowing or hearing of the affignment, he may re-enter, notwithftanding the acceptance of the rent. (3 Rep. 65. Cro. Eliz. 553.) See Rent. A feoffment may be made upon condition, that if the feoffor pay to the feoffee, &c. a certain fum of money at a day to come, then the feoffor to re-enter, &c. Litt. § 322. See Entry and Use.

REEPHAM, in *Geography*. See Repham.

REER County. See Rire.

REERSOE, in *Geography*, a fmall ifland of Denmark, in the Great Belt, near the coaft of Zealand. N. lat. 55° 32′. E. long. 11° 7′.

REES, Reis, or *Reas*, in *Commerce*, monies of account in Portugal, 1000 of which make a milreis or milree. In the notation of accounts, the milrees are feparated from the rees by a croffed cypher, called "Cifraon," and the milrees from the millions by a colon; thus Rs . 2 : 700 ⊕ 500, means 2700 mil. and 500 rees. The crufado of exchange, or old crufado, is 400 rees; the new crufado, 480 rees; the teftoon, 100; the vintin or vintem, 20 rees. Thus the milree is $2\frac{1}{2}$ old crufados, $2\frac{1}{12}$ new ditto, 10 teftoons, or 50 vintins. The gold pieces, coined before 1722, are now 20 *per cent.* higher than their original value; fo that the old dobras, coined at 20,000 rees, are worth 24,000; the lifbonnoines or moidores, coined at 4000 rees, are worth 4800; and the halves and quarters in proportion: but few of thefe coins are now in circulation. The gold coins, ftruck fince 1722, are the dobra of 12,800 rees; the meia dobra, Joanefe, or Portugal piece of 6400 rees; the half Joanefe, of 3200; the dezefeis teftoons, of 1600; the quatindo, of 1200; the oito teftoons, of 800; the old crufado, of 400, now very fcarce; and the new crufado, of 480 rees. The filver coins are new crufados, of 480 rees; halves, quarters, and eighths, or pieces of 240, 120, and 60 rees; teftoons of 100, and halves of 50; and vintins of 20 rees. There are alfo copper pieces of 10, 5, 3, and $1\frac{1}{2}$ rees. The pieces coined in Brazil, called patacas, of 600 and 640 rees, are current only in that country, and their intrinfic value is 10 *per cent.* lefs than that of the Portugal coins. There is, befides, a gold milree, ftruck for the Portuguefe poffeffions in Africa, and alfo a filver coin, of the value of 12 macutas, or 600 rees; the macuta being a money of account, worth 50 rees. The Spanifh patacas, or dollar, are reckoned at Lifbon at 830 rees, more or lefs.

Portuguefe gold coins are 22 carats (the mark fine being 24 carats), wrought gold is $20\frac{1}{2}$ carats, and gold duft from $21\frac{3}{4}$ to 22 carats fine. The finenefs of filver is expreffed in dinheiros and grains, the mark fine being 12 dinheiros, and the dinheiro fubdivided into 24 grains. Silver coins are 10 dinheiros 19 grains fine, and wrought filver $10\frac{1}{4}$ fine. The rate of coinage of gold and filver coins is as follows: 8 dobras of 12,800 rees, 16 Joanefes of 6400 rees, 32 half Joanefes of 3200 rees, 64 dezefeis teftoons, 128 oito teftoons, or 256 old crufados, are to weigh a Portuguefe mark of gold, 22 carats fine. Hence (the mark being $3542\frac{2}{5}$ Englifh grains) the dobra contains $442\frac{4}{5}$ grains; the piece of 6400 rees $221\frac{2}{5}$ grains of Englifh ftandard gold, and the other pieces in proportion. Thefe coins, moreover, are not, in general, exactly 22 carats fine; but there is a remedy which amounts from $\frac{1}{32}$ to $\frac{3}{32}$ of a carat; and the new crufados are found to be only $21\frac{27}{32}$ carats fine. The filver coin is 10 din. 19 gr. as above; and the mark is coined into $13\frac{1}{3}$ new crufados; hence the new crufado weighs $345\frac{3}{5}$ Portuguefe grains, or $265\frac{2}{3}$ Englifh grains; halves, quarters, and eighths, in proportion. It, therefore, contains $258\frac{1}{2}$ grains of Englifh ftandard filver. The gold piece of 6400 rees is worth 35*s.* 11*d.* fterling; and the old crufado, 2*s.* 3*d.*; and thus the milree, valued in gold, is worth $67\frac{1}{4}$*d.* fterling. The new filver crufado is worth about 2*s.* 9*d.* fterling; and, therefore, the milree, valued in filver, is worth $68\frac{3}{4}$*d.* fterling. Gold is to filver as 16 to 1.

At Bombay each quarter of a rupee is divided into 100 rees. See Rupee.

Rees, in *Geography*, a town of the duchy of Cleves; 8 miles E. of Cleves. N. lat. 51° 47′. E. long. 6° 20′.

Rees *ul Ain*, or *Refaina*, a town of Afiatic Turkey, in the province of Diarbekir; 80 miles S. of Diarbekir.

REETZ, a town of the New Mark of Brandenburg; 50 miles N.E. of Cuftrin. N. lat. 53° 18′. E. long. 15° 56′.

REEVE, in *Ornithology*, the name of a bird which is the female of the *avis pugnax*; the male of which, from the long feathers round his neck, is called the *ruff*. See Tringa *Pugnax*.

Reeve *of a Church*, is the guardian of it, or the churchwarden.

So *fhire-reef* is the fheriff, or guardian of a county; and *port-reeve*, the warden of a port or haven.

REEVE-LAND. See Reveland.

REEVING, in the *Sea Language*, is the putting a rope through any hole, as the channel of a block, &c. Hence, to pull a rope out of a block, is called *unreeving*.

RE-EXCHANGE, in *Commerce*, a fecond payment of the price of exchange, or rather the price of a new exchange, due upon a bill of exchange that comes to be protefted; and to be refunded the bearer, by the drawer or indorfer. See Exchange.

The occafion of re-exchage is, when the bearer of a bill of exchange, after protefting it, for want either of acceptance, or of payment, borrows money on his own promife, bond, or the like; or draws a bill of exchange in the place where the payment was to be made, on the perfon who furnifhed the firft for which he pays a fecond exchange; which, being added to the firft already paid, the drawer of the firft bill is anfwerable for two exchanges, properly called *exchange* and *re-exchange*.

The bearer of a protefted bill has a right to recover both the one and the other on the drawer. Yet the fimple proteftation which the bearer makes in the act of proteft, that he will take up a like fum at re-exchange, for want of his bill being accepted or paid, is not fufficient to entitle him to demand the reimburfement of his re-exchange, unlefs he make it appear, that he has actually taken up money in the place on which the bill was drawn.

Otherwife the re-exchange will only amount to the reftitution of the firft exchange, with intereft, the expences of protefting, and thofe of the journey, if there have been any.

If a bill of exchange, payable to the bearer or order, come to be protefted, the re-exchange is only due upon the drawer for the place where the remittance was made, not for thofe places where it may have been negociated; at leaft the drawer has a right to be refunded his re-exchange for thofe places by the indorfer.

Indeed, the re-exchange is due from the drawer upon all places where a power of negociation is given by the bill; and upon all others, if the power of negociating be indefinite.

Laftly, the intereft of the re-exchange, of the expences of the proteft, and the journey, are only due from the day of the demand.

It is fuppofed to be the Gibelins driven out of Italy by the faction of the Guelphs, and fheltered at Amfterdam, who firft eftablifhed the cuftom of re-exchange, on pretence of the interefts, damages, and expences they underwent, when the bills given them for the effects they had been obliged to abandon, were not accepted, but came to be protefted.

RE-EXTENT, in *Law*, a fecond extent made upon lands or tenements, on complaint that the former extent was partially made. See EXTENT.

REFAH, in *Geography*, a town of Egypt, on the coaft of the Mediterranean, anciently called "Raphia," (which fee); 18 miles N.E. of El Arifh.

REFECTION, REFECTIO, among *Monks* and *Ecclefiaftics*, a fpare meal or repaft, juft fufficing for the fupport of life.

REFECTION is alfo ufed, in *Ancient Authors*, for a duty or fervice incumbent on any perfon to provide meals for ecclefiaftics, or even for princes.

REFECTORY, or REFECTUARY, *Refectorium*, a fpacious hall in convents, and other communities, where the monks, nuns, &c. take their refections or meals in common.

The refectory of the Benedictines of St. George at Venice, defigned by Palladio, is one of the fineft in the world. Daviler.

REFERENCE, in *Writing, &c.* a mark relative to another fimilar one in the margin, or at the bottom of the page, where fomething, omitted in the text, is added; and which is to be inferted either in reading or copying. A copyift muft be very expert at taking references.

References are alfo ufed in books, where things being but imperfectly handled, the reader is directed to fome other part or place where they are more amply explained.

Dictionaries are full of references, denoted by *fee* or *vide*.

By means of thefe references the dictionary writer fettles a correfpondence between the feveral parts of his work, and may give his dictionary moft of the advantages of a continued treatife.

Indices or tables are only references to the feveral parts of the work where the feveral matters are handled.

REFERENCE, in *Law*, denotes the fending of any matter by the court of chancery to a mafter; and by the courts at law to a prothonotary, or fecondary, to examine and report to the court. (2 Lil. Abr. 432.) If a matter in difference be referred to the fecondary, and one of the parties will not attend at the time appointed, after notice given, to hear the bufinefs referred; the other party may proceed in the reference alone, and get the fecondary to make his report without hearing of the party not attending. (2 Lill. 342.) If a queftion of mere law arifes in the courfe of a caufe in chancery, as whether, by the words of a will, an eftate for life or in tail is created, or whether a future intereft devifed by a teftator fhall operate as a remainder on an executory devife; it is the practice of that court to refer it to the opinion of the judges of the court of king's bench, or common pleas, upon a cafe ftated for that purpofe, in which all the material facts are admitted, and the point of law is fubmitted to their decifion; who thereupon have it folemnly argued by counfel on both fides, and certify their opinion to the chancellor: and on fuch a certificate the decree is ufually founded. It feems that the mafter of the rolls, fitting for the chancellor, may make fuch reference; but not when fitting at the rolls. 2 Bro. C. C. 88.

The court of exchequer is both a court of law and of equity: therefore, if a queftion of mere law arifes in the courfe of the exercife of its equitable jurifdiction, the barons will decide upon it in that fuit, without referring it to another jurifdiction. Bl. Comm. iii.

REFERENDARY, REFERENDARIUS, in *Ancient Cuftoms*, an officer who exhibited the petitions of the people to the king, and acquainted the judges with his commands.

An officer of this kind, Spelman obferves, we had in England, in the time of the Saxons. The like office was afterwards difcharged by others, called mafters of requefts.

REFINING, in *Metallurgy* and *Affaying*. In the former it fignifies the means of obtaining metals from their ores, and from any other impurities, natural or artificial: for which fee the metals under their refpective heads. In the latter it is employed for afcertaining the quantity of the noble metals in the different alloys: for which fee CUPEL; where the methods of refining in the furnace ars fully treated. And for the humid procefs called *parting*, fee GOLD.

It may be proper here to obferve, that although the procefs of parting by nitric acid is ftill practifed, we are inclined to recommend the method propofed by Bergmann, which confifts in diffolving the alloy of gold and filver in nitro-muriatic acid. The filver falls to the bottom in the ftate of muriate of filver, and the gold is precipitated by the green fulphate of iron. The gold, by this means, is obtained perfectly pure, which is feldom the cafe in the procefs of parting. The trouble of tefting to know what filver to add to the alloy, to make the gold equal to one-fourth of the filver, will be faved, and, with heat, the nitro-muriatic acid diffolves the gold quite as foon as the filver is diffolved in the common method. The muriate of filver, which is eafily feparated by wafhing, may be readily reduced by heating it with foda in an iron crucible. The foda combines with the muriatic acid, and is fublimed in white fumes.

REFINING *of Sugar*. This operation is begun by feveral ftrong lixiviums or leys of lime-water and eggs, fhells and all, mixed and beaten together.

The firft refining is performed in the Caribbees, and other places, where the fugar-canes are cultivated; and only ferves to make the brown or coarfe fugars.

When thefe are imported into Europe, the fugar-bakers take them up, and refine them farther, by a fecond operation, or rather a repetition of the firft.

To render the fugar very fine, fit for confections, &c. they give it a third refining; in which they only ufe the whites of eggs and their fhells beaten together, and thrown into the melted fugar; which is called *clarifying the fugar*. See SUGAR.

REFINING *of Salt-petre*. The falt being put into an earthen or iron veffel, as much fpring-water is poured on it as fuffices to diffolve it. The veffel is then put over a gentle fire; and as foon as the water begins to boil, alum powder is thrown into it: the proportion is, one pound of alum to one hundred and twenty-eight pounds of falt-petre; and a little vinegar is added. As it boils, the fcum is to be taken off; and it is to be evaporated till a pellicle appears on it, and then fet to fhoot.

For

For the refining of other matters, as camphor, cinnabar, fulphur, falt, borax, &c. fee CAMPHOR, CINNABAR, SULPHUR, SALT, &c.

REFIRTH VOE, in *Geography*, a bay on the E. coaft of the ifland of Yell. N. lat. 60° 58′. W. long. 1° 25′.

REFITTING, in *Sea Language*, denotes the repairing of any damages which a fhip may have fuftained in her fails and rigging, by battle or tempeftuous weather.

REFLECTED RAY. See RAY.

REFLECTED *Vifion*. See REFLEX and VISION.

REFLECTING, or REFLECTIVE *Dial*, is a fort of dial, which fhews the hour by means of a thin piece of looking-glafs plate, duly placed to caft the fun's rays to the top of a ceiling, on which the hour-lines are drawn.

REFLECTING *Microfcope*. See MICROSCOPE.

REFLECTING *Level*. See LEVEL.

REFLECTING *Telefcope*. See TELESCOPE.

REFLECTION, or REFLEXION, in *Mechanics*, the return, or regreffive motion of a moveable, occafioned by the refiftance of a body, which hindered its purfuing its former direction.

It is controverted whether there be any moment's reft or interval between the incidence and the reflection. For the affirmative ftand the Peripatetics, and all who conceive the reflected motion to be different from the incident one of the fame body. The motion of incidence, according to thefe authors, is wholly loft, and deftroyed, by the refiftance of the obftacle ftruck againft; and the moveable is thus rendered abfolutely quiefcent in the point of contact, till a new motion of reflection is produced in it, from a contrary caufe.

The Cartefians affert the negative; abfolutely denying any reft at all between the incidence and reflection: urging, that if the motion were once deftroyed, though but for a moment, there would be nothing to excite it again; but the body would perfevere in that new ftate, as much as if it had been at reft a thoufand years.

Accordingly Rohault, and others, define reflection to be no other than a change of determination; or a continuation of the former motion in a new direction.

As, fay they, a pendulum, when arrived at its greateft fweep, does not ftop; fo a hard body, by ftriking on another hard one, does not reft, but purfues its motion the contrary way, according to the eftablifhed law of nature; and this from the immediate influence or impulfe of the caufe that firft moved it. But this doctrine is now generally fet afide.

Reflection is conceived, by the lateft and beft authors, as a motion peculiar to elaftic bodies, whereby, after ftriking on others which they cannot remove, they recede, or turn back by their elaftic power.

On this principle, it is afferted, that there may be, and is, a period of reft between the incidence and the reflection; fince the reflected motion is not a continuation of the other, but a new motion, arifing from a new caufe or principle, *viz*. the power of elafticity.

It is one of the great laws of reflection, that the angle a reflected body makes with the plane of a reflecting obftacle, is equal to that in which it ftruck on that obftacle. For the feveral laws of motion obferved in the reflections of bodies, fee PERCUSSION.

REFLECTION *of the rays of light*, in *Optics*, is a motion of the rays, by which, after impinging on the folid parts of bodies, or rather, after a very near approach to them, they recede, or are driven from them.

When rays of light arrive at a furface, which is the boundary of two mediums not homogeneous, they continue their progrefs without deviating from thofe planes in which their former paths lay, and which are perpendicular to the furface of the mediums, but they no longer retain the fame direction, a part of them, and fometimes nearly the whole, being reflected back from the furface, while the remaining part is tranfmitted and refracted, or bent. No inftance occurs of the abrupt change of the denfity of a medium, without a partial reflection of the light paffing either into the denfer, or into the rarer medium; and the more obliquely the light falls on the furface, the greater, in general, is the reflected portion. No body is fo black as to reflect no light at all, and to be perfectly invifible in a ftrong light; although at the furface feparating two very rare bodies, as two kinds of gas, the reflection is too faint to be perceptible; but in this cafe the feparation is feldom perfectly abrupt. The quantity of light reflected, when other circumftances are equal, appears to be always greateft when the difference of the optical or refractive denfity of the two fubftances is the greateft. Thus, the reflection from the common furface of glafs and water is much weaker than from a furface of glafs expofed to the air. Metals, in general, reflect a great proportion of the light falling on them; and even the reflection from the common furface of glafs and mercury appears to be but little weaker than the reflection from the furface of mercury immediately expofed to the air, fo that the optical denfity of the metals muft be exceedingly great. It appears, alfo, that a portion of the light falling on a reflecting furface, is always tranfmitted to a certain depth, notwithftanding the apparent opacity of any large maffes of the fubftance. Thus, if we cover a fmall hole of a window-fhutter with the thinneft leaf-gold, we fhall find that it tranfmits a greenifh light, which muft have paffed the reflecting furface, but which, if the gold had been but one ten-thoufandth of an inch in thicknefs, would have been wholly interrupted, and probably in the fame manner as by paffing through 700 feet of water. See LIGHT and REFRACTION.

The reflection of the rays of light from the furfaces of bodies, is the means by which bodies become vifible.

And the difpofition of bodies to reflect this or that kind of rays moft copioufly, is the caufe of their being of this or that colour.

The reflection of light from the furfaces of mirrors, makes the fubject of *catoptrics;* which fee. See alfo MIRROR.

The reflection of light, fir Ifaac Newton has fhewn, is not effected by the rays ftriking on the very parts of the bodies; but by fome power of the body equally diffufed throughout its whole furface, by which it acts upon the ray, attracting or impelling it without any immediate contact.

This power he fhews to be the fame, by which, in other circumftances, the rays are refracted; and by which they are at firft emitted from the lucid body. See REFRACTION.

The arguments he produces to prove this are as follow: 1. Becaufe the furfaces of polifhed glaffes, which to the eye appear fmooth, are yet, in reality, very rugged and uneven, (polifhing being nothing but the grating, fcratching, and breaking off the coarfer protuberances, by means of fand, glafs, putty, tripoli). If the rays of light, therefore, were reflected by ftriking on the folid parts of the glafs, the reflections would never be fo accurate as we find they are, but the rays would even be as much fcattered by the moft polifhed glafs, as by the rougheft. It remains, therefore, a problem how glafs, polifhed by fretting fubftances, can reflect light fo regularly as it does; which problem is fcarcely otherwife to be folved, than by faying, that the reflection of a ray is effected, not by a fingle point of the reflecting body, but by some power of the whole body, evenly diffused all over its surface, and by which it acts on a ray without immediate contact; for that the parts of bodies do act upon light at a distance, is already shewn under the articles INFLECTION and LIGHT.

2. If the colours, separated by a prism placed at the entrance of a beam of light into a darkened room, be successively cast on a second prism placed at a greater distance from the former, in such manner as that they all fall alike, or with an equal obliquity, upon it; the second prism may be so inclined to the incident rays, that those which are of a blue colour shall be all reflected by it; and yet those of a red colour pretty copiously transmitted. Now, if the reflection were caused by the parts of the air or glass, we would ask, why, at the same obliquity of incidence, the blue should wholly impinge on those parts so as to be all reflected; and yet, the red find pores enough to be, in a great measure, transmitted.

3. Where two glasses touch one another, there is no sensible reflection; and yet we see no reason why the rays should not impinge on the parts of the glass, as much when contiguous to other glass, as when contiguous to air.

4. When the top of a water bubble, by the continual subsiding and exhaling of the water, grows very thin, there is such a little, and almost insensible quantity of light reflected from it, that it appears intensely black; whereas round about that black spot, where the water is thicker, the reflection is so strong, as to make the water seem very white. Nor is it only at the least thickness of thin plates or bubbles, that there is no manifest reflection, but at many other thicknesses, gradually greater and greater. For, in one of our author's observations, the rays of the same colour were, by turns, transmitted at one thickness, and reflected at another thickness, for an intermediate number of successions: and yet, in the superficies of the thinned body, where it is of one thickness, there are as many other parts for rays to impinge on, as where it is of any other thickness.

5. If the red and blue rays, separated by a prism, fall successively on a thin plate of any pellucid matter, whose thickness increases in continual proportion, (such as a plate of air between two glasses, the one plane, and the other a little convex,) the same plate will, in the same part, reflect all the rays of one colour, and transmit all those of the other; but, in different parts, will reflect the rays of one and the same colour at one thickness, and transmit them at another; and thus alternately, and *in infinitum*. Now, it can never be imagined that at one place the rays, which, for instance, exhibit a blue colour, should happen to strike on the solid parts, and those which exhibit a red, to hit on the void parts of the body; and at another place, where the body is either a little thicker, or a little thinner, that, on the contrary, the blue should hit on the pores, and the red upon the solid parts.

6. In the passage of light out of glass into air, there is a reflection as strong as in its passage out of air into glass, or rather a little stronger, and by many degrees stronger than in its passage out of glass into water. Now, it seems improbable, that air should have more reflecting parts than water or glass: but if that should be supposed, yet it will avail nothing; for the reflection is as strong, or stronger, when the air is drawn from the glass by the air-pump, as when it is adjacent to it. If any should here object, on Descartes's hypothesis, that, though the air be drawn away, there is a subtle matter remaining to supply its place, which, being of a denser kind, is better fitted for the reflection of light than any other body; besides that we have elsewhere shewn such subtle matter to be fictitious, and that, supposing its existence, and its reflecting power, no light could ever have been propagated, but must have been all reflected back to the lucid body, immediately after it was first emitted, the following experiment does evidently convict it of falsity.

7. If light, in its passage out of glass into air, strike more obliquely than at an angle of forty or forty-one degrees, it is then wholly reflected: if less obliquely, it is in great measure transmitted. Now, it is not to be imagined, that light at one degree of obliquity should meet with pores enough in the air to transmit the greater part of it, and at another degree should meet with nothing but parts to reflect it wholly; especially considering, that, in its passage out of air into glass, how oblique soever be its incidence, it finds pores enough in the glass to transmit a great part of it. If any suppose, that it is not reflected by the air, but by the utmost superficial parts of the glass, there is still the same difficulty: besides, that such a supposition is unintelligible, and will also appear to be false, by applying water behind some part of the glass, instead of air; for so in a convenient obliquity of the rays, suppose of forty-five or forty-six degrees, at which they are all reflected, where the air is adjacent to the glass, they shall be in great measure transmitted where the water is adjacent to it; which argues, that their reflection or transmission depends on the constitution of the air and water behind the glass, and not on the striking of the rays upon the parts of the glass, the rays not being reflected until they have reached the last part of the surface, and have begun to go out. For if, in going out, they fall upon a surface of oil and water, they proceed, the attraction of the glass being balanced by an equal force the contrary way, and prevented from having its effect by the attraction of the liquor adhering to it: but if the rays, in passing out of this last surface, fall into a vacuum, which has no attraction, or into air, which has but little, not enough to counterbalance the effect of the glass in this case, the attraction of the glass draws them back, and reflects them.

This will appear still more evident by laying two glass prisms, or the object-glasses of two telescopes, the one plane, and the other a little convex, upon each other, so as they may neither touch, nor yet be too far apart; for that light which falls on the hinder surface of the first glass, where the glasses are not above $\frac{1}{1000000}$th part of an inch apart, will be transmitted through the surface, and through the air or vacuum between the glasses, and will pass into the second glass; but if the second glass be taken away, then the light passing out of the second surface of the first glass into the air or vacuum, will not proceed, but will return into the first glass, and be reflected.

Whence it follows, that the rays are drawn back again by some force in the first glass, there being nothing else to occasion their return. And hence too it follows, that the reflection is not effected by means of any subtle matter contiguous to the hinder surface, according to the principles of Descartes; since that matter ought to reflect them when the glasses were nearly contiguous, as well as when the second glass is quite removed.

Lastly, if it be asked, how some of the rays come to be reflected, and others transmitted; and why they are not all alike reflected, supposing the reflection owing to the action of the whole surface? the same great author shews, that there are, both in the rays of light, and in the bodies themselves, certain vibrations (or some such property) impressed on the rays, by the action either of the luminary that emits them, or of the bodies that reflect them; by means of which it happens that those rays, in that part of their vibration

which

which confpires with the motion of the parts of the body, enter the body, are refracted and tranfmitted; but thofe in a contrary part of their vibration are reflected.

Add, that every ray of light, in its paffage through any refracting furface, is put into a certain tranfient conftitution or ftate, which, in the progrefs of the ray, returns at equal intervals, and difpofes the ray, at each return, to be eafily tranfmitted through the next refracting furface; and between each return, to be eafily reflected by it.

Thefe alternate difpofitions, which fir Ifaac Newton calls *fits of eafy reflection*, and of *eafy tranfmiffion*, he accounts for by fuppofing, that they are occafioned by the vibrations of a fubtle fluid, in which the ray paffes, which happening to move fafter than the rays, when a ray is in that part of the vibration which confpires with its motion, it paffes through; but when in the contrary part of the vibration, it is beat back again: whence every ray is fucceffively difpofed to be eafily reflected, or eafily tranfmitted, by every vibration which overtakes it.

He alfo thought that thefe vibrations might be excited by the mutual action and re-action of light, of bodies and of this medium, at the inftant of reflection or refraction; fo that, in fact, he fuppofes two caufes of this difpofition to be reflected or tranfmitted, when rays of light arrive at any new furface. One of them is the regular vibration of the etherial medium, affecting them through the whole of their progrefs from the luminous body; and the other the tremulous motion, or irregular vibration of the fame medium at the furfaces of bodies, occafioned by the action and re-action between light and them: for this laft caufe can hardly be fuppofed to affect the whole etherial medium equally, and produce the regular returns of thefe fits in every ray.

M. Bofcovich fuppofes with Newton, that the fits of reflection or tranfmiffion affect the rays themfelves, in the whole of their paffage from the luminous body, but that they arife from an alteration in their form, by means of the elafticity of their component parts, having been originally driven from the luminous body by a force which acted more ftrongly on the hinder parts than on the reft of the mafs, and thereby put them into a vibratory motion. He alfo fuppofes, that the intervals of the fits of eafy reflection and tranfmiffion may be different in different rays, on the three following accounts. 1. The rays that are differently refrangible have different velocities, at leaft after refraction; fo that, though the fits fhould return at equal intervals, it will affect different rays in different parts of their progrefs. 2. The unequal action between the points that compofe the fame particle of light may make a difference in their ofcillations, at the time of changing their medium. And laftly, rays coming in different inclinations to the new furface, the internal motions of thefe points will be in different directions with refpect to the furface, and confequently the whole mafs of the medium will act upon all the points differently. Bofcov. Theoria, p. 232.

Upon the whole, fays Dr. Prieftley, is it not more probable that the rays of light are tranfmitted from the fun, with an uniform difpofition to be reflected or refracted, according to the circumftances of the bodies on which they impinge; and that the tranfmiffion of fome of the rays under the fame circumftances, apparently, with others that are reflected, is owing to the minute vibrations of the fmall parts of the furfaces of the mediums through which the rays pafs; vibrations that are independent of action and re-action between the bodies and the particles of light at the time of their impinging, though probably excited by the action of preceding rays. As to the tranfmiffion or reflection of certain kinds of light only, producing colours in thin plates, the caufe may be this; *viz.* that every particle of the medium has a great number of equal alternate intervals of attraction and repulfion, relatively to the particles of light; but that thefe intervals are of different magnitudes, according as the particles of light are of different colours. Now if the thicknefs of any tranfparent medium in which the particles of matter are uniformly placed is fuch, that the attracting intervals of the extreme particles, as well as the repelling intervals, coincide with one another, *i. e.* attracting with attracting, and repelling with repelling, in regard to any one kind of rays, *e. g.* the red; by the united force of thefe extremes, (all the intermediate particles of the medium mutually deftroying each other's effects,) thefe rays will be reflected. But where the plate is of an intermediate thicknefs between this and the next thicknefs, where the attracting intervals coincide, attracting with attracting, and repelling with repelling, the attracting intervals will coincide with the repelling ones, and the repelling ones with the attracting ones, and thefe mutually deftroying one another's effects, thefe rays will pafs on freely, and be tranfmitted. But as the intervals of attraction and repulfion are different for differently coloured rays, the thicknefs of the plates at which thefe coincidences will or will not happen, in the differently coloured rays, will be different. So that it appears probable, fays Dr. Prieftley, in conformity to a doctrine firft fuggefted to him by Mr. Michell, that the whole myftery of coloured plates depends upon the attractions and repulfions of the particles of the bodies that compofe them, affecting different rays in a different manner, according to their thicknefs. Hift. &c. of Light and Colours, p. 309, &c. See COLOURS *of thin Laminæ*, &c. and RINGS *of Colours*.

Sir Ifaac Newton concludes his account of the reflection of light with obferving, that if light be reflected not by impinging on the folid parts of bodies, but by fome other principle, it is probable that as many of its rays as impinge on the folid parts of bodies are not reflected, but ftifled and loft in the bodies. Otherwife, he fays, we muft fuppofe two kinds of reflection; for fhould all the rays be reflected which impinge on the internal parts of clear water or cryftal, thofe fubftances would rather have a cloudy colour than a clear tranfparency. To make bodies look black, it is neceffary that many rays be ftopped, retained, and loft in them; and it does not feem probable, that any rays can be ftopped and ftifled in them, which do not impinge on their parts: and hence, he fays, we may underftand, that bodies are much more rare and porous than is commonly believed. However, M. Bouguer difputes the fact of light being ftifled or loft by impinging on the folid parts of bodies. See ABSORBING.

For other facts and obfervations relating to the fubject of this article, fee LIGHT. See alfo RAYS *of Light*, and RAYS *of Heat*.

REFLECTION, in *Catoptrics*, is the return of a ray of light from the polifhed furface of a fpeculum or mirror, as driven thence by fome power refiding in it.

The ray, thus returned, is called a *reflex*, or *reflected ray*, or a *ray of reflection*; and the point of the fpeculum, whence the return commences, is called the *point of reflection*.

Thus the ray A B (*Plate* I. *Optics*, *fig.* 3.) proceeding from the radiant A, and ftriking on the point of the fpeculum B, being returned thence to C, B C reprefents the *reflected ray*, and B the *point of reflection*; in refpect of which A B reprefents the *incident ray*, or *ray of incidence*, and B the *point of incidence*.

Again, a line C G drawn from any point, as C, of the reflected

reflected ray B C, perpendicular to the speculum, is called the *cathetus of reflection*, or *cathetus of the eye*: as a line A F, drawn from the radiant perpendicular to the speculum, is called the *incidence*.

Of the two angles which the reflected ray B C makes with the mirror, the smallest, C B E, is called the *angle of reflection*: as of the two angles the incident ray makes with the speculum, the smallest, A B D, is called the *angle of incidence*.

If the mirror be either concave or convex, the smallest angles the ray makes with the tangent to the point of reflection and incidence, are the angles of reflection and incidence.

The angle C B H, which the reflected ray makes with a perpendicular to the point of reflection, is called the *inclination of the reflected ray*: as the angle A B H is called the *inclination of the incident ray*.

Reflection, *general laws of.*—I. *If a ray of light be reflected from a speculum of any form, the angle of incidence is ever equal to the angle of reflection.* This law obtains in percussions of all kinds of bodies; and consequently must do so in those of light. See *Laws of* Percussion; see also Angle.

It might therefore be here assumed as an axiom: but it is of that importance, and its demonstration so beautiful, that we cannot omit it. Suppose, then, D C (*Plate* XVII. *Optics, fig.* 14.) an incident ray, propagated from the radiant D: here, though the motion of the ray be simple, yet its determination in the line D C, being oblique with respect to the obstacle, is really compounded of two determinations; the one along D E, the other along D G.

The force along D C, therefore, is equal to the two forces along D G and D H. But the obstacle G F only opposes one of the determinations: *viz.* that along D G (for it cannot oppose a determination parallel to itself, as D E): therefore, only the force along D G will be lost by the stroke, that along D H or G C remaining entire. But a body perfectly elastic (such as we suppose the ray of light) will recover by its elasticity the force it lost by the shock.

The ray, therefore, will recover the force D G or C H: thus, retaining both its forces, and both its former determinations H C and C F, after percussion, it will be impelled along C F and C H by the same forces as before along D H and D G. By its compound motion, therefore, it will describe the right line C E, and that in the same time as D C; and H E and D H will be equal, as being described by the same force. Now, the two triangles D C H and C H E are equal, and consequently their similar angles are equal. Since then $HCA = HCF$; D C A, the angle of incidence, is equal to E C F, the angle of reflection. Q. E. D.

This law is confirmed in light by an easy experiment. For a ray of the sun falling on a mirror, in a dark room, through a little hole, you will have the pleasure to see it rebound, so as to make the angle of reflection equal to that of incidence. See Camera *Obscura*.

The same may be shewn various other ways: thus, *e. gr.* placing a semicircle F *i* G, (*Plate* I. *Optics, fig.* 3.) on a mirror D E, its centre on B, and its limb perpendicular to the speculum; and assuming equal arcs, F *a* and G *e*, place an object in A, and the eye in C: then will the object be seen by a ray reflected from the point B. And if B be covered, the object will cease to be seen.

For the conclusions drawn from this general doctrine of reflection, see *the doctrine of* Mirrors, &c.

II. *Each point of a speculum reflects rays falling on it, from each part of an object.* See *the doctrine of* Mirrors, &c.

III. *If the eye* C, *and the radiant point* A, *change places, the point will continue to radiate upon the eye, in the same course or path as before.*

For if the object be removed from A to C, it will still radiate on its former point of reflection, B; but there can be but one right line drawn between the two points G and D; and the rays are right lines. Therefore, that which was before the ray of reflection, will now be the ray of incidence; and since it will be reflected under the same angle as that under which it fell, that which was before the ray of incidence, will now be the ray of reflection. So that the object removed to C, will radiate on the eye placed in A, by the right lines C B and B A. Q. E. D.

Hence, an object is seen by the reflected ray A B, with the eye placed in A, the same as if the eye were in C, and the object in A.

The truth of this theorem is so easily confirmed by experiment, that some, with Euclid, assume it as a principle, and demonstrate the great law of reflection from it. Thus: suppose the angle of incidence a little greater than the angle of reflection, then will the angle A B F be greater than C B E. Wherefore, changing the places of the eye and the object, the angle C B E will become the angle of incidence; and therefore C B E greater than A B F by the supposition. So that the same angle A B F will be both greater and smaller than the other, C B E; which being absurd, A B F cannot be greater than C B E. The same absurdity will follow, if you suppose the angle of incidence less than the angle of reflection. Since then the angle of incidence can neither be greater nor less than that of reflection, it must be equal to it.

IV. *The plane of reflection, that is, the plane in which the incident and reflected rays, and also the angles of incidence and of reflection, are found, is perpendicular to the surface of the speculum; and in spherical specula, it passes through the centre.*

Hence the cathetus, both of incidence and reflection, is in the plane of reflection.

That the *plane of reflection is perpendicular to the speculum*, is assumed by Euclid, Alhazen, and others, as a principle, without any demonstration; as being evident from all observation and experiment.

V. *The image of an object seen in a mirror is in the cathetus of incidence.* This the ancients assumed as a principle; and hence, since the image is certainly in the reflected ray, they inferred, it must appear in the point of concourse of the reflected ray, with the cathetus of incidence; which indeed holds universally in plane and spherical mirrors, and usually also in concave ones, a few cases only excepted, as is shewn by Kepler.

For the particular laws of reflection, arising from the circumstances of the several kinds of specula, or mirrors, plane, concave, convex, &c. see them laid down under the article Mirror.

Reflection, *Caustic by.* See *Caustic* Curve.

Reflection *of Heat.* See Heat, and Rays *of Heat.*

Reflection *of Cold.* See Cold.

Reflection *of Sound.* See Sound.

Reflection *of the Moon*, is a term used by some authors for what we otherwise call her *variation*, being the third inequality in her motion, by which her true place out of the quadratures differs from her place twice equated. See Moon and Variation.

Reflection is also used, in the Copernican system, for the distance of the pole from the horizon of the disc; which

which is the fame thing as the fun's declination in the Ptolemaic fyftem.

Reflection is alfo ufed figuratively for an operation of the mind, by which, turning as it were back upon itfelf, it makes itfelf, and its own operation, its object; and confiders or contemplates the manner, order, and laws, which it obferves in perceiving, reafoning, willing, judging, doubting, believing, &c. and frames itfelf new ideas of the relations difcovered in them.

REFLECTOIRE Curve. See Curve *Reflectoire.*

REFLECTOR *for Light-houfes*, a combination of a number of fquare plane glafs mirrors, refembling thofe with which Archimedes is faid to have burnt the Roman fleet at the fiege of Syracufe. (See Burning-*Glafs.*) Each of thefe mirrors is about an inch fquare; and they are all arranged clofe to each other in the concave of a parabolic fegment formed of ftucco, which has been found to anfwer the purpofe beft. The idea of thus illuminating light-houfes, inftead of ufing coal-fires, in this country, without any previous knowledge of a fimilar method practifed in France, was firft fuggefted by Mr. Ezekiel Walker, of Lynn Regis, who made, and fixed up reflectors under his direction, in a light-houfe on the coaft of Norfolk, in the year 1779. Accordingly, in the year 1787, at the requeft of the truftees appointed by act of parliament for erecting four light-houfes in the northern parts of Great Britain, he inftructed Mr. Thomas Smith, tin-plate worker, of Edinburgh, to whom the original invention is erroneoufly afcribed in the fupplement to the Encyclopædia Britannica, in this mode of conftructing light-houfes. His parabolic moulds are from three to five or fix feet in diameter; and in the centre or apex of each is placed a long fhallow lamp of tin-plate, filled with whale-oil. In each lamp are fix cotton-wicks, almoft contiguous to one another, fo difpofed as to burn without trimming for fix hours. The light of thefe is reflected from each mirror fpread over the concave furface, and is thus multiplied, as it were, by the number of mirrors. The ftucco moulding is covered on the back with tin-plate, from which a tube, immediately over the lamp, proceeds to the roof of the light-room, and ferves as a funnel, through which the fmoke efcapes without fullying the faces of the mirrors. The light room is a cupola or lantern of from eight to twelve fides, compofed entirely of glafs, fixed in caft iron frames or fafhes, and roofed with copper. On circular branches paffing round the infide of this lantern, at about 18 inches from the glafs frames, are placed the reflectors with their lamps, fo as that the concave furfaces of two or three of the reflectors front every point of the compafs, and throw a blaze of light in all directions. In the roof, immediately over the centre of the room, is a hole, through which pafs all the funnels already mentioned, and which ferves likewife to admit frefh air to the lamps. This light-room is firmly fixed on the top of a round tower, fo as to be immoveable by the weather; and the number of the reflectors, and the height of the tower, are lefs or greater according as it is intended that the light fhould be feen at a lefs or a greater diftance. Experience, it is faid, has obviated feveral objections to which light-houfes of this kind were thought to be liable; and it has been found that light-houfes, with lamps and reflectors, are, in every point of view, preferable to thofe with fires burning in the air. They are fupported at a much lefs expence; their light is more brilliant, and feen at a greater diftance, whilft it can never be obfcured by fmoke, or beaten down, on the leefide, by a violent guft of wind; and they may be fo varioufly placed, that one light-houfe cannot be miftaken for another. Befides, the lamps do not need trimming fo often as open fires require fuel, and the man who attends them is never expofed either to cold or wet in the performance of his duty, fo that they are lefs likely to be neglected in ftormy weather than thofe with open fires.

It has been propofed to make the concave furface of the parabola one fpeculum of metal, inftead of covering it over with a number of plain glafs mirrors; or to diminifh the fize of each mirror, if it be thought beft to retain them inftead of introducing the fpeculum. To this propofed alteration it has been objected, that the brighteft metal does not reflect fuch a quantity of light as well foliated clear glafs; and by diminifhing the fize of the mirrors, the number of joinings would be increafed, in each of which fome light is loft, not merely in the feam, but from its being almoft impoffible to foliate glafs perfectly at its edge.

REFLEX, Reflect, in *Painting*, is underftood of thofe places in a picture which are fuppofed to be illuminated by a light reflected from fome other body reprefented in the fame piece.

Or, reflexes may be defined thofe places which, befide the general light that illumines the whole piece, receive fome particular light from their fituation with refpect to fome more illuminated polifhed body, that reflects part of the rays it receives upon them.

Reflexes are fcarcely fenfible, except in the fhadowed parts. The management of the reflexes requires great accuracy and fkill. All reflected light is fuppofed to carry with it part of the colour of the body which reflects it; fo that thofe places which receive this light, muft have their colour mixed or tinged with that colour. But the fame place may receive reflexes from different objects, differently coloured, and thofe again receive reflexes from others. The painter, therefore, muft have a view to every circumftance of the colour, light, and pofition of each figure; he muft confider what effect each has on others, and purfue nature through all the variety of mixtures. See Clair-obscure, and Light.

Reflex *Vifion*, or Reflected *vifion*, is that performed by means of rays reflected from the polifhed furfaces of objects to the eye.

Reflex vifion is the fubject of catoptrics. Under reflex vifion come all the phenomena of fpecula or mirrors of all kinds.

REFLEXIBILITY *of the Rays of Light*, is that property by which they are difpofed to be reflected. See Reflection.

Or, it is their difpofition to be turned back into the fame medium, from any other medium on whofe furface they fall; hence thofe rays are faid to be more or lefs reflexible, which are returned back more or lefs eafily under the fame incidence.

Thus, if light pafs out of glafs into air, and by being inclined more and more to the common furface of the glafs and air, begins at length to be totally reflected by that furface, thofe forts of rays which at like incidences are reflected moft copioufly, or the rays which, by being inclined, begin fooneft to be totally reflected, are the moft reflexible rays.

That rays of light are of different colours, and endued with different degrees of reflexibility, was firft difcovered by fir Ifaac Newton; and is fhewn by the following experiment. Applying a prifm D F E (*Plate* XVII. *Optics*, *fig.* 15.), whofe angles are each 45°, to the aperture C of a darkened room, in fuch manner as that the light is reflected from the bafe in G; the violet rays are feen firft reflected into H G; the other rays continuing ftill refracted in I K. After the violet the blue are all refracted, the green, &c. (See

(See Colour.) Hence it appears, that the differently coloured rays differ in degree of reflexibility.

From the other experiments it appears, that thofe rays which are moft reflexible, are alfo moft refrangible. See Refrangibility.

REFLEXION. See Reflection.

REFLEXITY, a term employed by Mr. Brougham to denote a property of light, which caufes the different rays to be acted upon by bodies, and to begin to be refracted, reflected, inflected, and deflected, at different diftances. This property obferves the fame law with the other optical properties of light; the red ray having moft reflexity, and the violet the leaft. (See Phil. Tranf. for 1797, p. 360.) Mr. Brougham has expreffed this property by the three words, "refrangity," "reflexity," and "flexity;" but the power being the fame, if fuch a property exift, different names feem to be unneceffary.

REFLUX *of the Sea*, the ebbing of the water; or its return from the fhore. It is thus called, as being the oppofite motion to the flood, or flux. See Tide.

REFORM, a re-eftablifhment, or revival of former neglected difcipline; or a correction of fome reigning abufes in it.

The term is much ufed in a monaftic fenfe, for the reducing an order or congregation of religious to the ancient feverity of the rule from which it had gradually fwerved; or even for the improving on the ancient rule and inftitution itfelf, and voluntarily making it more fevere.

In this fenfe the order of St. Bernard is faid to be only a reform of that of St. Benedict.

To Reform, in a *Military Senfe*, is, after fome evolution or manœuvre, to bring a line to its natural order, by aligning it on fome given point. See Battalion.

To Reform, is alfo to reduce a company, regiment, or other body of men, either by difbanding the whole, or only breaking a part, and retaining the reft; or fometimes by incorporating them with other regiments. Hence,

REFORMADO, or Reformed *officer*, one whofe troop or company is fuppreffed in a reform, whilft he is continued either in whole or half-pay, doing duty in the regiment. A reformed captain of foot follows the company, and affifts the ftanding officer as a fecond; but he ftill maintains his degree and precedence.

REFORMATION, Reformatio, the act of reforming, or correcting an error, or abufe, in religion, difcipline, or the like.

The reformation of religion, called, by way of eminence, *the Reformation*, was begun by the elector of Saxony, at the folicitation of Luther, about the beginning of the fixteenth century. See Luther and Lutheranism.

There were many circumftances which concurred at this time to bring about that happy reformation in religion, which refcued one part of Europe from the papal yoke, mitigated its rigour in the other, and produced a revolution in the fentiments of mankind, the greateft as well as the moft beneficial that has happened fince the publication of Chriftianity. How far the fale of indulgences, publifhed by Leo X., contributed to this event, we have already fhewn under the article Luther. We fhall here obferve, that the fame corruptions in the church of Rome which Luther condemned, had been attacked long before his appearance, and the fame opinions which he propagated had been publifhed in different places, and fupported by the fame arguments. Waldus in the 12th century, Wickliffe in the 14th, and Hufs in the 15th, had inveighed againft the errors of Popery with great boldnefs, and confuted them with more ingenuity and learning than could have been expected in thofe illiterate ages in which they flourifhed. But all thefe premature attempts towards a reformation proved abortive. Many powerful caufes contributed to facilitate Luther's progrefs, which either did not exift, or did not operate with full force in their days: the principal of thefe we fhall here enumerate. The long and fcandalous fchifm which divided the church, during the latter part of the 14th, and the beginning of the 15th centuries, had a great effect in diminifhing the veneration with which the world had been accuftomed to view the papal dignity. The proceedings of the councils of Conftance and Bafil fpread this difrefpect for the Romifh fee ftill wider, and by their bold exertion of authority in depofing and electing popes, taught the world that there was in the church a jurifdiction fuperior even to the papal power, which they had long believed to be fupreme. The wound given on that occafion to the papal authority was fcarcely healed, when the pontificates of Alexander VI. and Julius II. both able princes, but deteftable ecclefiaftics, raifed new fcandal in Chriftendom. Befides, many of the dignified clergy, fecular as well as regular, neglected the duties of their office, and indulged themfelves, without referve, in all the vices to which great wealth and idlenefs naturally give birth; and grofs ignorance and low debauchery rendered the inferior clergy as contemptible as the others were odious. So that we find, long before the 16th century, that many authors of reputation give fuch defcription of the diffolute morals of the clergy, as feems almoft incredible in the prefent age. The fcandal of thofe crimes, which very generally prevailed, was greatly increafed by the facility with which fuch as committed them obtained pardon. The exorbitant wealth of the church, the vaft perfonal immunities of ecclefiaftics, and their encroachments on the jurifdiction of the laity, and their various devices to fecure their ufurpations, created much diffatisfaction among the people, and difpofed them to pay particular attention to the invectives of Luther. Befides thefe caufes of his rapid progrefs, we may alfo reckon the invention of the art of printing, about half a century before his time, the revival of learning at the fame period, and the bold fpirit of inquiry which it excited in Europe; fo that many were prepared to embrace his doctrines, who did not really wifh fuccefs to his undertaking. In the writings of Reuchlin, Hutten, and the other revivers of learning in Germany, the corruptions of the church of Rome are cenfured with an acrimony of ftyle little inferior to that of Luther himfelf. The raillery and oblique cenfures of Erafmus in particular, upon the errors of the church, as well as upon the ignorance and vices of the clergy, prepared the way for Luther's invectives and more direct attacks. To all which we may add, that the theological doctrines of Popery were fo repugnant to the fpirit of Chriftianity, and fo deftitute of any foundation in reafon, in the word of God, or in the practice of the church, that this circumftance combined in favouring the progrefs of Luther's opinions, and in weakening the refiftance of his adverfaries.

The rife of the reformation in Switzerland was at leaft as early as in Germany; for Ulric Zuingle had, in the year 1516, begun to explain the fcriptures to the people, and to cenfure, though with great prudence and moderation, the errors of a corrupt church. He had very noble and extenfive ideas of a general reformation, at the time when Luther retained almoft the whole fyftem of Popery, indulgences excepted; and he had actually called in queftion the authority and fupremacy of the pope, before the name of Luther was known in that country. In the year 1524, Nuremberg, Francfort, Hamburgh, and feveral other cities in Germany, of the firft rank, openly embraced the reformed religion, and by the authority of their magiftrates abolifhed

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the mafs, and the other fuperftitious rites of Popery. The elector of Brandenburgh, Saxony, the marquis of the landgrave of Heffe, the dukes of Brunfwick and Lunenburgh, and prince of Anhalt, became avowed patrons of Luther's opinions, and countenanced the preaching of them among their fubjects. The reformers derived great advantage from the tranfactions of the diet at Nuremberg, which prefented to the pope a catalogue of a hundred grievances, which the empire imputed to the iniquitous dominion of the papal fee. The progrefs of the reformation in Germany was likewife promoted by the proceedings of the diet held at Spire in the years 1526 and 1529. See LUTHER and PROTESTANTS.

During thefe tranfactions in Germany, the dawn of truth arofe upon other nations. The light of the reformation fpread itfelf far and wide; and almoft all the European ftates welcomed its falutary beams, and exulted in the profpect of an approaching deliverance from the yoke of fuperftition and fpiritual defpotifm. Some of the moft confiderable provinces of Europe had already broke their chains, and openly withdrawn themfelves from the difcipline of Rome and the jurifdiction of its pontiff. The reformed religion was propagated in Sweden, foon after Luther's rupture with Rome, by Olaus Petri, one of his difciples, who was countenanced and encouraged by the valiant and public-fpirited prince Guftavus Vafa Ericfon, to whofe firmnefs and magnanimity it was owing, that from the year 1527 the papal empire in Sweden was entirely overturned, and Guftavus declared head of the church. The light of the reformation was alfo received in Denmark fo early as the year 1521, in confequence of the ardent defire difcovered by Chriftian or Chriftiern II., for purpofes of mere ambition, of having his difciples inftructed in the doctrines of Luther. His fucceffor Frederic, duke of Holftein and Silefia, contributed greatly to the progrefs of the reformation, by his fuccefsful attempts in favour of religious liberty, at the affembly of ftates that was held at Odenfee, in the year 1527, when he procured the publication of the famous edict which declared every fubject of Denmark free, either to adhere to the tenets of the church of Rome, or to embrace the doctrine of Luther; that no perfon fhould be molefted on account of his religion; that a royal protection fhould be granted to the Lutherans; and that ecclefiaftics of every order fhould be allowed to marry. But the honour of accomplifhing this glorious work was referved for Chriftiern III. a prince equally diftinguifhed by his piety and prudence. The religious doctrine, difcipline, and worfhip of this kingdom, were fettled according to a plan laid down by Bugenhagius. And the affembly of the ftates at Odenfee, in 1539, gave a folemn fanction to all thefe tranfactions, and thus the work of reformation was brought to perfection in Denmark.

In the fame year the reformation was eftablifhed in every part of Saxony. Upon the death of George, duke of Saxony, who was an inveterate enemy to the reformation, the fucceffion fell to his brother Henry, whofe attachment to the Proteftant religion furpaffed, if poffible, that of his predeceffor to Popery. Henry invited fome Proteftant divines, and among them Luther himfelf, to Leipfic; and by their advice and affiftance, he learned, in a few weeks, the whole fyftem of ancient rites, eftablifhing the full exercife of the Proteftant religion, with the univerfal applaufe of his fubjects, who had long wifhed for this change, which the obftinacy of their former duke had alone prevented. This revolution delivered the Proteftants from the danger to which they were expofed by having an inveterate enemy fettled in the middle of their territories; and their dominions now extended in a great and almoft unbroken line from the fhore of the Baltic to the banks of the Rhine

In France, the aufpicious patronage of Margaret, queen of Navarre, fifter to Francis I., encouraged feveral pious and learned men, whofe religious fentiments were the fame with her own, to propagate the principles of the reformation, and even to erect feveral Proteftant churches in that kingdom. It appears, that, fo early as the year 1523, there were many, and even perfons of rank, and fome of the epifcopal order, who had conceived the utmoft averfion both againft the doctrine and tyranny of Rome. But the wavering and inconfiftent conduct of Francis I. rendered the fituation of the Proteftants in this country always precarious, often diftreffed. Upon the whole, we may obferve, that, before the diet of Augfburg, the doctrine of Luther had made confiderable, though perhaps a fecret, progrefs in Spain, Hungary, Bohemia, Britain, Poland, and the Netherlands, and had, in all thefe countries, many friends, of whom feveral repaired to Wittemberg to improve their knowledge, and enlarge their views under fuch an eminent mafter. At this diet, held in 1530, the Augfburg or Auguftine confeffion was prefented to the emperor Charles V. and after many debates between the friends of liberty and the votaries of Rome, the latter prevailed; and the diet, in compliance with the opinion and remonftrances of Campeggio, the papal nuncio, iffued a decree, condemning moft of the peculiar tenets held by the Proteftants; forbidding any perfon to protect or tolerate thofe who taught them; enjoining a ftrict obfervance of the eftablifhed rites; and prohibiting any farther innovation, under fevere penalties. Thofe who refufed to obey this decree were declared incapable of acting as judges, or of appearing as parties in the imperial chamber, the fupreme court of judicature in the empire. The Proteftants, alarmed at the feverity of the decree, affembled at Smalcald, and concluded a league of mutual defence againft all aggreffors, by which they formed the Proteftant ftates of the empire into one regular body: and they refolved to apply to the kings of England, France, and Denmark, to implore them to affift and patronize this new confederacy. After various negociations between the emperor and the Proteftant princes, terms of pacification were agreed upon at Nuremberg, and ratified folemnly in the diet of Ratifbon, in the year 1532. In this treaty it was ftipulated, that univerfal peace be eftablifhed in Germany, until the meeting of a general council, the convocation of which, within fix months, the emperor fhall endeavour to procure; that no perfon be molefted on account of religion; that a ftop be put to all proceffes begun by the imperial chamber againft Proteftants; and the fentences already paffed to their detriment be declared void. On their part, the Proteftants engaged to affift the emperor with all their forces in refifting the invafion of the Turks. Thus the Proteftants, by their firmnefs, unanimity, and dexterity in availing themfelves of the emperor's fituation, obtained terms which amounted almoft to a toleration of their religion. But neither the emperor nor the pope were difpofed to abide by the unbiaffed fenfe of a general council, affembled, as the Proteftants wifhed, within the limit of the empire, but determined to decide their religious debates by the force of arms. After many evafions and delays, it was propofed, in the year 1545, to affemble a council at Trent, which was vigoroufly oppofed by the Proteftants. The emperor and the pope had mutually agreed to deftroy all who fhould dare to oppofe this council. The meeting of that affembly was to ferve as a fignal for their taking arms; and accordingly its deliberations were fcarcely begun, in the year 1546, when the Proteftants perceived undoubted marks of a formidable union to overwhelm and crufh them by one blow. The fathers, affembled in the council of Trent, promulgated

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their decrees; and the Proteftant princes in the diet of Ratifbon protefted againft their authority; and were, in confequence of this, profcribed by the emperor, who raifed an army to reduce them to obedience. Thus commenced the war of Smalcald, which was profecuted with various fuccefs on both fides, till, in the year 1552, Charles was furprifed at Infpruck by Maurice of Saxony, and was conftrained to conclude at Paffau the famous treaty of *pacification*, (which fee,) with the Proteftants, which is confidered by thofe of Germany as the bafis of their religious liberty; and to promife in fix months to affemble a diet, in which all the tumults and diffenfions, that had been occafioned by a variety of fentiments in religious matters, fhould be entirely removed. This diet, though not affembled at the ftipulated time, met, however, at Augfburg, in the year 1555, and terminated thofe deplorable fcenes of bloodfhed, defolation, and difcord, that had fo long afflicted both church and ftate by that *religious peace*, as it is commonly called, which fecured to the Proteftants the free exercife of their religion, and eftablifhed this ineftimable liberty upon the firmeft foundations. For, after various debates, the following memorable acts were paffed; that the Proteftants who followed the confeffion of Augfburg, fhould for the future be confidered as entirely exempted from the jurifdiction of the Roman pontiff, and from the authority and fuperintendance of the bifhops; that they were left at perfect liberty to enact laws for themfelves, relating to their religious fentiments, difcipline, and worfhip; that all the inhabitants of the German empire fhould be allowed to judge for themfelves in religious matters, and to join themfelves to that church whofe doctrine and worfhip they thought the pureft and moft confonant to the fpirit of Chriftianity; and that all thofe, who fhould injure or perfecute any perfon under religious pretexts, and on account of their opinions, fhould be declared, and proceeded againft, as public enemies of the empire, invaders of its liberty, and difturbers of its peace.

In the year 1533, Henry VIII. king of England, who, in the beginning of thefe troubles, had oppofed the doctrine and views of Luther with the utmoft vehemence, partly becaufe he had fpoken with contempt of Thomas Aquinas, the king's favourite author, having fued for a divorce from Catharine of Arragon, his brother's widow, at the court of Rome, for almoft fix years, during which period Clement VII. negociated, promifed, retracted, and concluded nothing, determined to apply to another tribunal for that decree which he had unfuccefsfully folicited at Rome. Cranmer, archbifhop of Canterbury, by a fentence founded on the authority of univerfities, doctors, and rabbies, who had been confulted with refpect to the point, annulled the king's marriage with Catharine; and Anne Boleyn, whofe charms had captivated the king, was acknowledged as queen of England. Clement, apprehenfive left England would revolt from the holy fee, determined to give Henry fuch fatisfaction as might ftill retain him within the bofom of the church. But the violence of the cardinals precipitated him, in 1534, to iffue a bull refcinding Cranmer's fentence, confirming Henry's marriage with Catharine, and declaring him excommunicated, if, within a time fpecified, he did not abandon the wife he had taken, and return to her whom he had deferted. Enraged at this unexpected decree, Henry kept no longer any meafures with the court of Rome; his fubjects feconded his refentment; an act of parliament was paffed, abolifhing the papal power and jurifdiction in England; by another the king was declared fupreme head of the church, and all the authority of which the popes were deprived was vefted in him; the *monafteries*, (which fee,) were fuppreffed, and their revenues applied to other purpofes.

The people had been gradually prepared for this great innovation. Each fucceeding feffion of parliament had made fome retrenchment from the power and profits of the Roman pontiff. Care had been taken, during fome years, to teach the nation that a general council was much fuperior to a pope. But now a bifhop preached every Sunday at Paul's Crofs, in order to inculcate the doctrine, that the pope was intitled to no authority at all beyond his own diocefe.

The laws paffed during this feffion (1534) fufficiently evince, that the king was determined not to furrender any part of his affumed prerogative. All payments made to the apoftolic chamber: all provifions, bulls, difpenfations, were abolifhed: monafteries were to be fubjected to the regulation and government of the king alone: the law for punifhing heretics was moderated: the ordinary was prohibited from imprifoning or trying any perfon upon fufpicion alone, without prefentment by ten lawful witneffes: and it was declared that to fpeak againft the pope's authority was no herefy: bifhops were to be appointed by a *congé d'elire* from the crown, or, in cafe of the dean and chapter's refufal, by letters patent; and no recourfe was to be had to Rome for palls, bulls, or provifions. Campeggio and Ghinucci, two Italians, were deprived of the bifhoprics of Salifbury and Worcefter, which they had hitherto enjoyed: the law which had been formerly made againft paying annats, or firft fruits, but which had been left in the king's power to fufpend or enforce, was finally eftablifhed: and a fubmiffion which was exacted two years before from the clergy, and which had been obtained with great difficulty, received this feffion the fanction of parliament. In this fubmiffion, the clergy acknowledged that convocations ought to be affembled by the king's authority only: they promifed to enact no new canons without his confent: and they agreed that he fhould appoint 32 commiffioners, in order to examine the old canons, and abrogate fuch as fhould be found prejudicial to his royal prerogative. An appeal was alfo allowed from the bifhop's court to the king in chancery. But the moft important act paffed this feffion, was that which regulated the fucceffion to the crown: the marriage of the king with Catharine was declared unlawful, void, and of no effect: the primate's fentence annulling it was ratified; and the marriage with queen Anne was eftablifhed and confirmed. The crown was appointed to defcend to the iffue of this marriage, and failing there, to the king's heirs for ever. An oath was likewife enjoined to be taken in favour of this order of fucceffion, under the penalty of imprifonment during the king's pleafure, and forfeiture of goods and chattels: and all flander againft the king, queen, or their iffue, was fubjected to the penalty of mifprifion of treafon. Thefe feveral acts, fo contemptuous towards the pope, and fo deftructive of his authority, were paffed at the very time that Clement pronounced his hafty fentence againft the king. The king found his ecclefiaftical fubjects as compliant as the laity. The convocation ordered that the act againft appeals to Rome, together with the king's appeal from the pope to a general council, fhould be affixed to all the doors of all the churches in the kingdom; and they voted that the bifhop of Rome had, by the laws of God, no more jurifdiction in England than any other foreign bifhop; and that the authority which he and his predeceffors had there exercifed, was only by ufurpation, and by the fufferance of Englifh princes. The bifhops went fo far in their complaifance, that they took out new commiffions from the crown, in which all their fpiritual and epifcopal authority was exprefsly affirmed to be derived ultimately from the civil magiftrate, and to be entirely dependent on his good pleafure.

Henry,

Henry, however, with the caprice peculiar to his character, continued to defend the doctrines of the Romish church as fiercely as he attacked their jurisdiction. He alternately persecuted the Protestants for rejecting the former, and the Catholics for acknowledging the latter.

Nothing more forwarded the first progress of the reformers, than the offer which they made, of submitting all religious doctrines to private judgment, and the summons given every one to examine the principles formerly imposed upon them. And what can be more just and reasonable? and yet the multitude, says Mr. Hume, were totally unqualified for this undertaking, though they were highly pleased with it. They fancied that they were exercising their judgment, while they opposed to the prejudices of ancient authority more powerful prejudices of another kind. The novelty itself of the doctrines; the pleasure of an imaginary triumph in dispute; the fervent zeal of the reformed preachers; their patience, and even alacrity, in suffering persecution, death, and torments; a disgust at the restraints of the old religion; an indignation against the tyranny and interested spirit of the ecclesiastics:—these motives, says the same historian, whilst, as some may imagine, he is depreciating the principles of the reformation, were prevalent with the people; and by such considerations were men so generally induced, during that age, to throw off the religion of their ancestors. In proportion, says the same author, as the practice of submitting religion to private judgment was acceptable to the people, it appeared, in some respects, dangerous to the rights of sovereigns, and seemed to destroy that implicit obedience on which the authority of the civil magistrate is chiefly founded. When some Englishmen, such were Tindal, Joye, Constantine, and others, retired to Antwerp, through fear of the exertion of the king's authority, they employed themselves in writing English books against the corruptions of the church of Rome; against images, relics, and pilgrims; and they excited the curiosity of men with regard to that question, which is the most important in theology, the terms of acceptance with the Supreme Being. These books, having been secretly conveyed to England, began to make converts every where; but it was a translation of the scriptures by Tindal that was esteemed the most dangerous to the established faith. Against Wolsey, a favourite minister of Henry VIII., it was one article of impeachment, that, by his connivance, he had encouraged the growth of heresy, and that he had protected and acquitted some notorious offenders. Wolsey was succeeded in the office of chancellor by sir Thomas More, who, irritated by polemics, became so superstitiously attached to the ancient faith, that few inquisitors have been guilty of greater violence in their prosecution of heresy. Several persons were not only brought into the courts for heretical offences, such as teaching their children the Lord's prayer in English, for reading the New Testament in that language, or for speaking against pilgrimages; and others were charged with the capital offences of harbouring persecuted preachers, neglecting the fasts of the church, and declaiming against the vices of the clergy. Some were tried, condemned, and committed to the flames. Notwithstanding the inconsistent conduct of Henry, his subjects having been encouraged, by his example, to break some of their fetters, were so impatient to shake off all that remained, that in the following reign, under his son Edward VI., with the general applause of the nation, a total separation was made from the church of Rome in articles of doctrine, as well as in matters of discipline and jurisdiction. (See Articles.) In 1553, his death retarded the progress of the reformation; and his sister Mary, who succeeded him, imposed a-new the arbitrary laws and tyrannical yoke of Rome upon the people of England. But the execution of a great number of persons, who were burnt for the Protestant faith in the five years of her persecuting and bloody reign, so alienated the people from Popery, that queen Elizabeth, her sister, found it no hard matter to deliver her subjects from the bondage of Rome, and to establish that form of religious doctrine and ecclesiastical government, which still subsists in England.

The seeds of the reformation were very early sown in Scotland, by several noblemen of that nation, who had resided in Germany during the religious disputes that divided the empire. The first and most eminent opposer of the Papal jurisdiction was John Knox, a disciple of Calvin, who set out from Geneva for Scotland in 1559, and in a little while prevailed with the greatest part of the Scotch nation entirely to abandon the superstitions of Rome, and to aim at nothing less than the total extirpation of Popery. In the following year, *viz.* 1560, the parliament ratified a confession of faith, agreeable to the new doctrines, and passing a statute against the mass, not only abolished it in all the churches, but enacted, that whoever, any where, either officiated in it, or was present at it, should be chastised, for the first offence, with confiscation of goods, and corporal punishment, at the discretion of the magistrate; for the second, with banishment; and for the third, with loss of life. A law was also voted for abolishing the Papal jurisdiction in Scotland; the Presbyterian form of discipline was settled, leaving only at first some shadow of authority to certain ecclesiastics, whom they called superintendants. From that period to the present times the form of doctrine, worship, and discipline, that had been established at Geneva by the ministry of Calvin, has been maintained in Scotland with invincible obstinacy and zeal; and every attempt to introduce, into that kingdom, the rites and government of the church of England, has proved impotent and unsuccessful. See Presbyterians.

The cause of the reformation in Ireland underwent the same vicissitudes that had attended it in England. When Henry VIII., after the abolition of the Papal authority, was declared supreme head of the church of England, George Brown, a native of England, and a monk of the Augustin order, whom that monarch had created, in the year 1535, archbishop of Dublin, began to act with the utmost vigour, in consequence of this change in the hierarchy. He purged the churches of his diocese from superstition in all its forms, pulled down images, destroyed relics, abolished absurd and idolatrous rites, and, by the influence as well as authority he had in Ireland, caused the king's supremacy to be acknowledged in that nation. Henry shewed soon after, that this supremacy was not a vain title; for he banished the monks out of that kingdom, confiscated their revenues, and destroyed their convents. In the reign of Edward VI. farther progress was made in the reformation, but the accession of Mary retarded it, in consequence of which Brown and other Protestant bishops were deprived of their dignities in the church. When Elizabeth ascended the throne, the Irish were again obliged to submit to the form of worship and discipline established in England.

The reformation had not been long established in Britain, when the Belgic provinces, united by a respectable confederacy which still subsists, withdrew from their spiritual allegiance to the Roman pontiff. The means which Philip II. king of Spain used to obstruct the reformation, promoted it: the nobility formed themselves into an association, in the year 1566, and roused the people; who, under the heroic conduct of William of Nassau, prince of Orange, seconded by the succours of England and France, delivered this state from

from the Spanish yoke: in consequence of which the reformed religion, as it was professed in Switzerland, was established in the United Provinces; and, at the same time, an universal toleration granted to those whose religious sentiments were of a different nature, whether they retained the faith of Rome, or embraced the reformation in another form, provided that they made no attempts against the authority of the government, or the tranquillity of the public.

Whilst Mr. Hume attributes the quick and surprising progress of the reformation in part to the late invention of printing, and revival of learning, he denies that reason had any considerable share in opening men's eyes with regard to the impostures of the Romish church; alleging that philosophy had made little progress, at least not till long after the period of the reformation, and that no instance occurs in which argument has ever been able to free the people from that enormous load of absurdity with which superstition has every where overwhelmed them: to which he adds, that the rapid advance of the Lutheran doctrine, and the violence with which it was embraced, prove sufficiently that it owed not its success to reason and reflection. The art of printing, and the revival of learning, he says, forwarded its progress in another manner. By means of that art, the books of Luther and his sectaries, full of vehemence, declamation, and a rude eloquence, were propagated more quickly, and in greater numbers. The minds of men, somewhat awakened from a profound sleep of so many centuries, were prepared for every novelty, and scrupled less to tread in any unusual path which was opened to them. And as copies of the scriptures, and other ancient monuments of the Christian faith, became more common, men perceived the innovations which were introduced after the first century; and though argument and reasoning could not give conviction, an historical fact, well supported, was able to make impression on their understandings. As the ecclesiastics would not agree to possess their privileges, though ancient and prior to almost every political establishment in Europe, as matters of civil right, which time might render valid, but appealed still to a divine right, they thus tempted men to look to their primitive charter, which, with little difficulty, they could perceive to be defective in truth and authenticity. Besides, Luther and his followers, not satisfied with opposing the pretended divinity of the Romish church, and displaying the temporal inconveniences of that establishment, proceeded to treat the religion of their ancestors as abominable, detestable, and damnable; foretold by sacred writ itself as the source of all wickedness and pollution. They denominated the pope antichrist, called his communion the scarlet whore, and gave to Rome the appellation of Babylon; expressions which, however applied, were to be found in scripture, and which were better calculated to operate on the multitude than the most solid arguments. Excited by contest and persecution on the one hand, by success and applause on the other, many of the reformers carried to the greatest extremities their opposition to the church of Rome; and in contradiction to the multiplied superstitions with which that communion was loaded, they adopted an enthusiastic strain of devotion, which admitted of no observances, rites, or ceremonies, but placed all merit in a mysterious species of faith, in inward vision, rapture, and ecstacy. The new sectaries, seized with this spirit, were indefatigable in the propagation of their doctrine, and set at defiance all the anathemas and punishments with which the Roman pontiff endeavoured to overwhelm them.

Thus, in terms which appear to us too disparaging, does our historian describe the origin and progress of the reformation; nor does he pay due respect to the principles on which it was founded, and to the character of the persons who were the principal agents in accomplishing it. We are ready to acknowledge, that the collateral circumstances above recited rendered its advances more rapid and more extensive; but we cannot allow that it did not owe much of its success to reason and reflection. But whatever may be our opinion of the primary causes that produced it, its influence on the minds and manners of mankind, on the state of society in general, and on the interests of liberty, religion, and virtue, has been eminently and extensively beneficial. Luther had no sooner began to attack the papal supremacy, than the charm, which had bound mankind for so many ages, was broken at once. The human mind, which had long continued as tame and passive, as if it had been taught to believe whatever was taught, and to bear whatever was imposed, roused of a sudden, and became inquisitive, mutinous, and disdainful of the yoke to which it had hitherto submitted. The reformation, wherever it was received, increased that bold and innovating spirit to which it owed its birth. Men who had the courage to overturn a system, supported by every thing which can command respect or reverence, were not to be overawed by any authority, how great or venerable soever. After having been accustomed to consider themselves as judges of the most important doctrines in religion, to examine these freely, and to reject, without scruple, what appeared to them erroneous, it was natural for them to turn the same daring and inquisitive eye to government, and to think of rectifying whatever disorders or imperfections were discovered there. As religious abuses had been reformed in several places, without the permission of the magistrate, it was an easy transition to attempt the redress of political grievances in the same manner. But though the spirit of innovation, that was excited and promoted by the reformation, might in some instances prove the occasion of turbulence and tumult, the good that eventually accrued from its operation far exceeded the partial and temporary evil that resulted from it. The prevalence of this spirit was so general, that it must have been excited by causes that were natural, and of powerful efficacy; and the consequences that flowed from them must have been as important and interesting as the causes that produced them. The kingdoms of Denmark, Sweden, England, and Scotland, and almost one half of Germany, threw off their allegiance to the pope, abolished his jurisdiction within their territories, and gave the sanction of law to modes of discipline and systems of doctrine, which were not only independent of his power, but hostile to it. Nor was this spirit of innovation confined to those countries which openly revolted from the pope; it spread through all Europe, and broke out in every part of it with various degrees of violence. It penetrated early into France, and made such rapid progress, that the number of converts to the opinions of the reformers was so great, their zeal so enterprising, and the abilities of their leaders so distinguished, that they soon ventured to contend for superiority with the established church, and were sometimes on the point of obtaining it. In all the provinces of Germany which continued to acknowledge the papal supremacy, as well as in the Low Countries, the Protestant doctrines were secretly taught, and had gained so many proselytes, that they were ripe for revolt, and were restrained merely by the dread of their rulers from imitating the example of their neighbours, and asserting their independence: hence in Spain and Italy, symptoms of the same disposition to shake off the yoke appeared. The pretensions of the pope to infallible knowledge and supreme power were treated by many persons of eminent learning and abilities with such scorn, or impugned

with

with ſuch vehemence, that the moſt vigilant attention of the civil magiſtrate, the higheſt ſtrains of pontifical authority, and all the rigour of the inquiſitorial juriſdiction, were requiſite to check or extinguiſh it. The defection of ſo many opulent and powerful kingdoms from the papal ſee was a fatal blow to its grandeur and power, and produced a very conſiderable diminution of its revenues. It likewiſe obliged the Roman pontiffs to adopt a different ſyſtem of conduct towards the nations which continued to recognize their juriſdiction, and to govern them by new maxims, and with a milder ſpirit. They became afraid of venturing upon any ſuch exertion of their authority as might alarm or exaſperate their ſubjects, and excite them to a new revolt. Hence it happens, that the popes, from the era of the reformation, have ruled rather by addreſs and management than by authority. They have been obliged not only to accommodate themſelves to the notions of their adherents, but to pay ſome regard to the prejudices of their enemies. In proceſs of time, and before the convulſions which have lately agitated Europe, they ſunk almoſt to a level with the other petty princes of Italy; and they hardly retain any ſhadow of the temporal power which they anciently poſſeſſed. Neverthelefs, whilſt the reformation has been fatal to the power of the popes, it has contributed to improve the church of Rome both in ſcience and in morals. Many motives have ariſen out of the reformation, and the exiſtence of two rival churches, which have ſerved to engage the Catholic clergy to apply themſelves to the ſtudy of uſeful ſcience, and to pay a ſtrict attention to the manners of their clergy. In thoſe countries where the members of the two churches have mingled freely with each other, or have carried on any conſiderable intercourſe, either commercial or literary, an extraordinary alteration in the ideas, as well as in the morals, of the Popiſh eccleſiaſtics is manifeſt. The beneficial influence of the reformation has not only been felt by the clergy, and the inferior members of the Roman Catholic church; but it has extended to the ſee of Rome, and to the ſovereign pontiffs themſelves, whoſe character, at a later period, has been very different from that of ſeveral of their predeceſſors. Many of them have been conſpicuous for the virtues becoming their high ſtation; and by their humanity, their love of literature, and their moderation, have made ſome atonement to mankind for the crimes of thoſe who in former times occupied their places. Thus the reformation has eminently contributed to increaſe purity of manners, to diffuſe ſcience, and to inſpire humanity. With the progreſs of the reformation we may alſo connect a variety of other important benefits, both to individuals and to ſociety; and as they pertain to the inveſtigation of truth and the improvement of ſcience, to the promotion of liberty both civil and religious, to the diffuſion of knowledge and virtue, and to the advancement of the beſt intereſts of mankind. But the details of the advantages reſulting from the reformation to nations and private perſons, to religion in general, and genuine Chriſtianity in particular, would far exceed the limits to which we are confined.

See, on the ſubject of this article, Robertſon's Hiſt. of Charles V. vol. ii. p. 113, &c. vol. iii. p. 44, &c. Moſheim's Eccl. Hiſt. Eng. ed. 8vo. vol. iii. Burnet's Hiſt. of the Reformation, paſſim. For a comprehenſive, and, upon the whole, a juſt ſketch of the prediſpoſing cauſes, and beneficial conſequences of the reformation, we refer the reader to a work which obtained the prize propoſed by the National Inſtitute of France, 15th of Germinal, in the year X. *viz.* "What has been the influence of the reformation by Luther on the political ſituation of the different ſtates of Europe, and on the progreſs of knowledge?" The work is entitled "An Eſſay on the Spirit and Influence of the Reformation by Luther," by C. Villers. We have two Engliſh tranſlations, one by B. Lambert, and the other by James Mill, 8vo. 1805.

Reformation, *Right of*, *Jus reformationis*, is a right which the princes of Germany claim to reform the church in their reſpective territories; as being inveſted with the ſpiritual as well as the temporal power.

The *jus reformationis* is annexed to the ſovereignty; by this they have the power of conſcience, the diſpoſition of eccleſiaſtical revenues, &c. as they enjoyed the ſame at the treaty of Munſter in 1624.

Reformation *of Images*, in *Optics*. See Anamorphosis.

REFORMED *Calendar* and *Church*. See the ſubſtantives.

Reformed *Officer*. See Reformado.

REFRACTED Angle, in *Optics*, the angle contained between the refracted ray and the perpendicular.

Refracted *Dials*, are ſuch as ſhew the hour by means of ſome refracting tranſparent fluid. See Dials, *Refracted*.

Refracted *Ray*, or *ray of refraction*. See Ray and Refraction.

Refracted *Viſion*. See Vision.

REFRACTING Telescope. See Telescope.

REFRACTION, Refractio, in *Mechanics*, the deviation of a moving body from its direct courſe, by reaſon of the different denſity of the medium it moves in; or a flexion and change of determination, occaſioned by a body's falling obliquely out of one medium into another of a different denſity.

Thus a ball A (*Plate* XXXVI. *Mechanics*, *fig.* 14.) moving in the air in the line A B, and falling obliquely on the ſurface of the water C D, does not proceed ſtraight to E, but deviates, or is inflected, to F. Again, if the ball, moving in water in the ſame line A B, ſhould fall obliquely on a ſurface of air C D; it will not proceed ſtraight to E, nor yet deflect to F, but to G. Now the deflection in each caſe is called the *refraction:* and the two caſes are diſtinguiſhed by means of the perpendicular M I; that B G being called *refraction towards the perpendicular*, or to the *axis of refraction;* and the other B F, *refraction from the perpendicular*, or *from the axis of refraction*.

Theſe refractions are ſuppoſed to ariſe hence, that the ball arriving at B, in the firſt caſe finds more reſiſtance or oppoſition on the one ſide O, *i. e.* from the ſide of the water, than it did from the ſide P, or that of the air; and in the latter more reſiſtance from the ſide P, which is now the ſide of the water, than the ſide O, which is that of the air.

The great law of refraction, then, which holds in all bodies, and all mediums, is that a body, paſſing obliquely out of a medium which reſiſts it more, is refracted towards the perpendicular; and in paſſing out of a medium which oppoſes it leſs into another which oppoſes it more, it is refracted from the perpendicular.

Hence the rays of light falling out of air into water are refracted towards the perpendicular; whereas a ball thrown into the water is refracted from it; becauſe water, which reſiſts the motion of light leſs than air, reſiſts that of the ball more; or, to ſpeak more juſtly, becauſe water, by its greater attraction, accelerates the motion of the rays of light more than air does; for that this is the true cauſe of refraction, at leaſt in light, ſhall be ſhewn under Refraction *of light*.

To have a body refracted, it is neceſſary that it ſhould fall obliquely on the ſecond medium. In perpendicular incidence there is no refraction.

Voſſius

Vossius indeed, and Snellius, imagined they had observed a perpendicular ray of light undergo a refraction; a perpendicular object appearing in the water nearer than in reality it was; but this was to attribute that to a refraction of the perpendicular rays, which was owing to the divergency of the oblique rays after refraction, from a nearer point.

Yet there is a manifest refraction even of perpendicular rays found in *Island* CRYSTAL, which see.

Rohault adds, that though an oblique incidence be necessary in all other mediums we know of, yet the oblique must not exceed a certain degree; if it do, the body will not penetrate the medium, but will be reflected instead of being refracted.

Thus cannon-balls, in sea-engagements, falling very obliquely on the surface of the water, are observed to mount aloft again, and frequently to sweep the men from off the opposite decks; and the like happens to the little stones with which children make their ducks and drakes.

The ancients confounded refraction with reflection, and it was sir Isaac Newton who first taught us the just difference between them. He shews likewise, that there is a good deal of analogy between them, and particularly in the case of light.

The laws of refraction of the rays of light in mediums differently terminated, *i. e.* whose surfaces are plain, concave, convex, &c. make the subject of *dioptrics*; which see.

By refraction it is, that convex glasses, or lenses, collect the rays, magnify objects, burn, &c. and hence the foundation of microscopes, telescopes, &c.

By refraction it is, that all remote objects are seen out of their real places; particularly, that the heavenly bodies are apparently higher than they are in reality, &c.

The refraction of the air has many times so uncertain an influence on the places of celestial objects, very remote from the zenith, that wherever refraction is concerned, the conclusions deduced from observations that are much affected by it, will always remain doubtful, and too precarious in many cases to be relied upon. See Dr. Bradley, in Phil. Transf. N° 485. See *Atmospherical* REFRACTION.

REFRACTION *of Light*, in *Optics*, is an inflection or deviation of the rays from their rectilinear course upon falling obliquely out of one medium into another, of a different density.

The term refraction is derived from the distortion which it occasions in the appearance of an object viewed in part only by refracted light; thus, an oar, partially immersed in water, appears to be bent, on account of the refraction of the light, by which its lower part is seen, in its passage out of the water into the air.

Although no sensible light can penetrate more than 700 feet deep into the sea, and a length of seven feet of water has been found to intercept one-half of the light which enters into it; yet in transparent substances (no medium being, strictly speaking, absolutely transparent) the greater part of the light penetrates to all distances with little interruption, and all rays, of the same kind, thus transmitted by the same surface, form with the perpendicular an angle of refraction, which is ultimately in a certain constant proportion to the angle of incidence; that is, for instance, one-half, three-fourths, or two-thirds, according to the nature of the surface. Thus, if the refractive properties of the substance were such, that an incident ray, making an angle of one degree with the perpendicular, would be so refracted as to make an angle of only half a degree with the same line, another ray, incident at an angle of two degrees, would be refracted, without sensible error, into an angle of one degree. But when the angles are larger, they vary from this ratio, their sines only preserving the proportion with accuracy: for example, if the angle of incidence at the supposed surface were increased to 90°, the angle of refraction would be 30° only, instead of 45°.

It does not appear that, before Descartes, any person attempted to explain the physical cause of the refraction, and also the reflection of light, which he undertook to do by the resolution of forces, on the principles of mechanics; in consequence of which he was obliged to suppose that light passes with more ease through a dense medium than a rare one: thus the ray A B (*Plate* XVIII. *Optics*, *fig.* 10.) falling obliquely on a denser medium at B, is supposed to be acted on by two forces, one of them impelling it in the direction A C, and the other in A D, which alone can be affected by the change of medium: and since, after the ray has entered the denser medium, it approaches the perpendicular B H, it is plain that this force must have received an increase, whilst the other continued the same; for if B E be taken equal to B D, or C A, the consequence of the angle I B H being less than A B C will be, that B H must be longer than B C or A D.

The first person who questioned the truth of this explanation of the cause of refraction was M. Fermat, who asserted, contrary to Descartes, that light suffers greater resistance in water than in air, and greater in glass than in water; and he maintained that the resistance of different mediums, with respect to light, is in proportion to their densities. M. Leibnitz adopted the same general idea; and they reasoned upon the subject in the following manner. Nature, they say, accomplishes her ends by the shortest methods; light, therefore, ought to pass from one point to another, either by the shortest road, or that in which the least time is required. But it is plain that the line in which light passes, when it falls obliquely upon a denser medium, is not the most direct or the shortest; so that it must be that in which the least time is spent. And, whereas it is demonstrable, that light falling obliquely upon a denser medium (in order to take up the least time possible, in passing from a point in one medium to a point in the other), must be refracted in such a manner, that the sines of the angles of incidence and refraction must be to one another, as the different facilities with which light is transmitted in those mediums; it follows that, since light approaches the perpendicular when it passes obliquely from air into water (so that the sine of the angle of refraction is less than that of the angle of incidence), the facility with which water suffers light to pass through it is less than that of the air; so that the light meets with greater resistance in water than in air. This method of arguing from final causes could not satisfy philosophers. Dr. Smith observes that it agrees only to the case of refraction at a plain surface; and that the hypothesis is altogether arbitrary. If he had endeavoured to accommodate his principle to concave and convex surfaces, as he had once proposed, he would soon have perceived its insufficiency. The easiest way for a ray to pass from a given point in any resisting medium into a vacuum, is in a perpendicular to the refracting surface, this being the shortest way, through any difficulty or resistance whatever; but this being reduced to nothing at the refracting surface, it may then take any other course in vacuo, without any farther difficulty; and, on the contrary, in returning back from the vacuum into the dense medium, it must take the shortest course through the same perpendicular as before. Thus, when the sun shines upon the atmosphere, all his rays should be refracted into lines tending to the centre of the earth, as being the shortest and easiest way through the atmosphere, and then we should see the sun exactly over our heads, in all places and at all times. Such is the strange conse-

consequence that follows from an hypothesis so arbitrary.

Dechales, in order to explain the law of refraction, supposes that every ray of light is composed of several smaller rays, which adhere to one another; and that they are refracted towards the perpendicular, in passing into a denser medium, because one part of the ray meets with more resistance than another part; so that the former traverses a smaller space than the latter; in consequence of which the ray must necessarily bend a little towards the perpendicular. This hypothesis was adopted by the famous Dr. Barrow, who, as some say, was the author of it. On this hypothesis, it is plain that mediums of a greater refractive power must give greater resistance to the passage of the rays of light than mediums of a less refractive power, which is contrary to fact.

The Bernouillis, both father and son, have attempted to explain the cause of refraction on mechanical principles; the former on the equilibrium of forces, and the latter on the same principles with the supposition of etherial vortices; but neither of these hypotheses have gained much credit. M. Mairan supposes a subtle fluid, filling the pores of all bodies, and extending, like an atmosphere, to a small distance beyond their surfaces; and then he supposes that the refraction of light is nothing more than a necessary and mechanical effect of the incidence of a small body in those circumstances. There is more, he says, of the refracting fluid in water than in air, less in water than in glass, and in general less in a dense medium than in one that is rarer. M. de Maupertuis supposes that the course which every ray takes, in passing from one medium into another, is that which requires the least quantity of action, which depends upon the velocity of the body, and the space it passes over; so that it is in proportion to the sum of the spaces, multiplied by the velocity with which bodies pass over them. From this principle he deduces the necessity of the sine of the angle of incidence being in a constant proportion to that of refraction: and also all the other laws relating to the propagation and reflection of light.

Dr. Smith (in his Optics, Remarks, p. 70.) observes, that all other theories for explaining the reflection and refractions of light, except sir Isaac Newton's, suppose that it strikes upon bodies, and is resisted by them, which has never been proved by any deduction from experience. On the contrary, it appears by various considerations, and might be shewn by Mr. Molyneux's and professor Bradley's observations on the parallax of the fixed stars, that their rays are not at all impelled by the rapid motion of the earth's atmosphere, nor by the object-glass of the telescope through which they pass. And by sir Isaac Newton's theory of refraction, which is grounded on experience only, it appears, that light is so far from being resisted and retarded by refraction into any dense medium, that it is swifter there than in vacuo, in the ratio of the sine of incidence in vacuo to the sine of refraction into the dense medium. From some cases of the production of colours, we are led to suppose, says Dr. Young (Lect. Phil. vol. i. p. 460.) that the velocity of light must be smaller in a denser than in a rarer medium; and supposing this fact to be established, the existence of such an attractive force as sir Isaac Newton suggests could no longer be allowed; nor, he says, could the system of the emanation of light, in opposition to that of the undulation of an etherial medium, be maintained by any one. Priestley's Hist. of Light, &c. p. 102, &c. p. 333, &c.

The refraction of light, sir Isaac Newton shews, is not performed by the very rays falling on the surface of bodies; but it is done without any contact, by the action of some power belonging to bodies, and extending to a certain distance without their surfaces; by which same power, acting in other circumstances, they are also emitted and reflected.

Admitting that certain powers of attraction and repulsion belong to bodies, and extend to a certain distance beyond their surfaces, and supposing also that light consists of particles emitted from luminous bodies, sir Isaac Newton demonstrates, in his "Principia," that the sine of the angle of incidence must be always to the sine of the angle of refraction in some certain ratio. For, as he proves geometrically, if two similar mediums be separated from each other by a space terminated on both sides by parallel planes, and a body, in its passage through that space, be attracted or impelled perpendicularly towards either of those mediums, and not agitated or hindered by any other force; and if the attraction be every where the same, at equal distances from either plane, taken towards the same hand of the plane, the sine of incidence upon either plane will be to the sine of emergence from the other plane in a given ratio.

In a corollary to this proposition he also shews, that if, instead of one parallel space, bodies be surrounded with several, or an infinite number of them, the attractive power of each of which differs from the next, increasing or decreasing, still, the ratio respecting any two contiguous ones being given, the ratio of the extremes will be given. He also demonstrates, that, if the cause of refraction be the attraction of the refracting medium, the velocity of light before its incidence will be to its velocity afterwards, as the sine of the angle of refraction is to the sine of the angle of incidence; so that light, in passing from a rarer medium into a denser, receives an increase of velocity. The same things being supposed, he shews, that if the velocity before incidence be greater than afterwards, so that the angle of emergence must always increase, in consequence of the repulsive power prevailing over the attractive one, the body will at length be reflected; and that, in this case, the angle of reflection must necessarily be equal to the angle of incidence.

That light does not consist of any mode of action upon a fluid medium, he concludes from having demonstrated that pressure cannot be propagated through a fluid in rectilinear directions, unless where the particles of the fluid lie in a right line, but must diverge into the unmoved spaces; and that every tremulous body, in an elastic medium, propagates the motion of the pulses on every side straight forwards. Admitting this, there is hardly any hypothesis that will agree with the phenomena of light, but that of particles emitted from the luminous body, affected by the attractions and repulsions of other bodies.

The same arguments by which we have proved, that *reflection* (which see) is performed without immediate contact, will go a great way towards demonstrating the same of refraction: to which may be added the following ones.

1. Because, if when light falls out of glass into air with the utmost obliquity it will be transmitted at, it be then made to fall a little more obliquely, it becomes wholly reflected: for the power of the glass, after it has refracted light emerging as obliquely as possible, supposing the rays to fall still more obliquely, will be too strong to let any of the rays pass; consequently, instead of being refracted, they will all be reflected.

2. Because in thin lamellæ, or plates of glass, light is reflected and transmitted several times alternately, as the thickness of the lamellæ increases in arithmetical progression; for here it depends on the thickness of the lamina which of the two the glass shall do, whether reflect it, or let it be transmitted.

3. Because, whereas the power of other bodies both to reflect and refract light are very nearly proportional to their densities;

denfities; yet unctuous and fulphureous bodies are found to reflect more ftrongly than according to their mere denfities; for as the rays act more ftrongly on thofe bodies to kindle them than on others, fo do they again, by their mutual attraction, act more ftrongly on the rays to refract them.

Laftly; Becaufe not only thofe rays tranfmitted through glafs are found to be refracted, but alfo thofe paffing in the air, or in a vacuum near its extremities, or even near the extremes of many opaque bodies, *e. gr.* the edge of a knife, undergo a fimilar inflection, from the attraction of the body. See Light, and alfo Inflection.

The manner in which refraction is performed by mere attraction, without contact, may be thus accounted for: fuppofe H I (*Plate* XVIII. *Optics, fig.* 11.) the boundary of two mediums, N and O; the firft the rarer, *e. gr.* air; the fecond the denfer, *e. gr.* glafs; the attractions of the mediums here will be as their denfities. Suppofe *p* S to be the diftance to which the attracting force of the denfer mediums exerts itfelf within the rarer. Let now a ray of light A *a* fall obliquely on the furface which feparates the mediums, or rather on the furface *p* S, where the action of the fecond and more refifting medium commences. All attraction being performed in lines perpendicular to the attractive body, as the ray arrives at *a*, it will begin to be turned out of its rectilinear courfe by a fuperior force, with which it is attracted by the medium O, more than by the medium N, *i. e.* by a force with which it is driven towards it in a direction perpendicular to its furface: hence the ray is bent out of its right line in every point of its paffage between *p* S and R T, within which diftance the attraction acts. Between thofe lines, therefore, it defcribes a curve *a* B *b*; but beyond R T, being out of the fphere of attraction of the medium N, it will proceed uniformly in a right line, according to the direction of the curve in the point *b*.

Again, fuppofe N the denfer and more refifting medium, O the rarer, and H I the boundary, as before; and let R T be the diftance to which the denfer medium exerts its attractive force within the rarer: even when the ray has paffed the point B, it will be within the fphere of fuperior attraction of the denfer medium; but that attraction acting in lines perpendicular to its furface, the ray will be continually drawn from its ftraight courfe B M perpendicularly towards H I: thus, having two forces or directions, it will have a compound motion, by which, inftead of B M, it will defcribe B *m*, which B *m* will in ftrictnefs be a curve.

Laftly, after it has arrived in *m*, being out of the influence of the medium N, it will perfift uniformly in a right line, in the direction in which the extreme of the curve leaves it.

Thus we fee how refraction is performed, both *towards the perpendicular*, and *from it*.

But note, the attraction of the denfer medium, *e. gr.* N, is continually diminifhing, as the ray proceeds from B, towards the limit of attraction R T; becaufe fewer and fewer parts ftill come to act; at I H, *e. gr.* all the parts between that and *p* S attract; but at R T, none but thofe in the line H I. Note, alfo, that the diftance between *p* S and R T being fmall, when we confider refractions, no notice is taken of the curve part of the ray, but we confider it as confifting of two ftraight lines, C B, A B, or *m* B, A B.

Sir Ifaac Newton, not content with afcribing the reflection, refraction, and inflection of light to powers of attraction and repulfion, extending beyond the furfaces of bodies and producing effect in the manner above explained, propofes a conjecture concerning the phyfical caufe of this attraction and repulfion; but his hypothefis is no lefs liable to difficulties and objections than the hypothefis of the mechanical production of the motion of light without attraction or repulfion. Does not the refraction of light, he fays, arife from the different denfity of an etherial medium in different places, the light always receding from the denfer parts of the medium? And is not the denfity of it greater in free and open fpaces void of air, and other grofs bodies, than within the pores of water, glafs, cryftal, gems, and other compact bodies? For when light paffes through glafs or cryftal, and falling very obliquely upon the farther furface, is all reflected, the total reflection ought to arife rather from the denfity and vigour of the medium without and beyond the glafs, than from the rarity and weaknefs of it.—Does not the etherial medium, in paffing out of water, glafs, cryftal, and other compact and denfe bodies, into empty fpaces, grow denfer and denfer by degrees, and by that means refract the rays of light, not in a point, but by bending them gradually in curve lines? And does not the gradual condenfation of this medium extend to fome diftance from the bodies, and thereby caufe the inflections of the rays of light, which pafs by the edges of the denfe bodies, at fome diftance from the bodies?

Refraction, in *Dioptrics*, is the inflection or bending of the rays of light, in paffing the furfaces of glaffes, lenfes, and other tranfparent bodies of different denfities.

Thus a ray, as A B (*Plate* XVIII. *Optics, fig.* 11.) falling obliquely from the radiant A, upon a point B, in a diaphanous furface, H I, rarer or denfer than the medium along which it was propagated from the radiant; has its direction there altered by the action of the new medium; and inftead of proceeding to M, it deviates, *e. gr.* to C.

This deviation is called the *refraction of the ray;* B C the *refracted ray,* or *line of refraction;* and B the *point of refraction.*

The line A B is called the *line of incidence*, or *ray of incidence;* and, in refpect of it, B is alfo called the *point of incidence.*

The plane in which both the incident and refracted rays are found, is called the *plane of refraction;* a right line B E, drawn in the refracting medium perpendicular to the refracting furface, in the point of refraction B, is called the *axis of refraction:* and a right line D B, drawn perpendicular to the refracting furface, in the point of incidence B, along the medium through which the ray fell, is called the *axis of incidence.*

The angle A B I, included between the incident ray and the refracting furface, is called the *angle of incidence;* and the angle A B D, included between the incident ray and the axis of incidence, is called the *angle of inclination.* The angle M B C, which the refracted ray makes with the incident, is called the *angle of refraction:* and the angle C B E, which the refracted ray makes with the axis of refraction, is called the *refracted angle.*

Refraction, *general laws of.* 1. *A ray of light in its paffage out of a rarer into a denfer medium,* e. gr. *out of air into glafs, is refracted towards the perpendicular,* i. e. *towards the axis of refraction.*

Hence, the refracted angle is lefs than the angle of inclination; and the angle of refraction lefs than that of incidence; as they would be equal were the ray to proceed ftraight from A to M. Hence, alfo, a ray perpendicular to the refracting furface, will pafs through without being refracted, as it cannot be refracted to the perpendicular. The phyfical caufe of which is, that the attraction of the denfer medium, which, in an incidence oblique to its furface acts perpendicularly to that furface, draws the ray out of its courfe: this attraction, we fay, in a perpendicular incidence, acts in the direction of the ray.

2. *The ratio of the fine of the angle of inclination, to the fine*

fine of the refracted angle, is fixed and conftant; viz. if the refraction be out of air into glafs, it is found greater than as 114 to 76, but lefs than 115 to 76; that is, nearly as 3 to 2.

This ratio, affigned by Huygens, agrees with another of fir Ifaac Newton, who makes the fine of the angle of inclination to the fine of the refracted angle, as 31 to 20; which is, likewife, nearly as 3 to 2. Indeed, there is fome difference in the quantity of refraction, in different kinds of glafs; but in phyfical matters, precifenefs is not neceffary. In rain-water, Defcartes found the ratio of the fine of the angle of inclination, to the fine of the refracted angle, as 250 to 187, that is nearly as 4 to 3; which agrees with fir Ifaac Newton's obfervation, who makes it as 529 to 396. In fpirit of wine, the fame great author makes the ratio as 100 to 73; which is not far from the fefquitertian ratio. In air he makes it as 3201 to 3200; and as to air, he fhews, that a ray of light, in traverfing quite through the atmofphere, is refracted the fame as it would be, were it to pafs with the fame obliquity out of a vacuum into air of equal denfity with that in the loweft part of the atmofphere.

See the following table, in which the proportion of the fines which meafure the refractions of feveral bodies; the denfities of the bodies, eftimated by their fpecific gravity; and their refractive power, in refpect of their denfities, are fet down in feparate columns.

The refracting bodies.	The proportion of the fines of incidence and refraction of yellow light.	The denfity and fpecific gravity of the body.	The refractive powerof thebody in refpect of its denfity.
A pfeudo-topaz, being a natural, pellucid, brittle, hairy ftone, of a yellow colour - -	23 to 14	4.27	3979
Air - - - -	3201 to 3200	0.0012	5208
Glafs of antimony -	17 to 9	5.28	4864
A felenites - -	61 to 41	2.252	5386
Glafs vulgar - -	31 to 20	2.58	5436
Cryftal of the rock -	25 to 16	2.65	5450
Ifland cryftal - -	5 to 3	2.72	6536
Sal gemmæ - -	17 to 11	2.143	6477
Alum - - -	35 to 24	1.714	6570
Borax - -	22 to 15	1.714	6716
Nitre - -	32 to 21	1.9	7079
Dantzick vitriol -	303 to 200	1.715	7551
Oil of vitriol - -	10 to 7	1.7	6124
Rain-water - -	529 to 396	1.	7845
Gum arabic - -	31 to 21	1.375	8574
Spirit of wine well rectified	100 to 73	0.866	10121
Camphor - -	3 to 2	0.996	12551
Olive oil - -	22 to 15	0.913	12607
Linfeed oil - -	40 to 27	0.932	12819
Spirit of turpentine -	25 to 17	0.874	13222
Amber - -	14 to 9	1.04	13654
A diamond - -	100 to 41	3.4	14556

Newton's Optics, edit. 3. p. 247.

M. Euler the younger, purfuing a fcheme fuggefted by his father for afcertaining the refractive powers of tranfparent liquors, made ufe of two Menifeus glaffes, which he put together when they were plunged in the fluid, the refractive power of which he wanted to determine: the edges of thefe glaffes being ground flat, they immediately cohered, fo that none of the fluid could efcape; and then they might both together be wiped, and ufed as one object-glafs in a long tube, which he could lengthen or fhorten at pleafure; and applying an eye-glafs to it, the whole obfervation he had to make was to meafure the exact length of his tube, when he could fee through it moft diftinctly a turret, which was at a confiderable diftance from him. Or, when the focal diftance was lefs than a foot, he only obferved, at what diftance from a wall the image of an oppofite window was the moft diftinct. Ac. Berlin. 1762, p. 302.

The refractive power of the fluids which he examined in this manner, he expreffed in the following tables.

A ray of light paffing from air into	The fine of the angle of incidence will be to that of refraction as ... To unity.
Diftilled water - - -	1.3358
Rain-water - - - - -	1.3358
Well-water - - - -	1.3366
French wine - - - - -	1.3453
French brandy - - -	1.3603
Ditto a ftronger kind - - -	1.3646
Rectified fpirit of wine - -	1.3685
Ditto more highly rectified - -	1.3706
The white of an egg - -	1.3685
Diftilled vinegar - - -	1.3442
A folution of gum arabic - -	1.3467
A folution of two fcruples of white fugar in an ounce of water - -	1.3457
A folution of two fcruples of rock-falt, in ditto - -	1.3477
A folution of two fcruples of falt of urine, in ditto - -	1.3400
Oil of Provence - - -	1.4651
Oil of turpentine - - -	1.4822

N. B. The rock-falt and the falt of urine were purified by a double cryftallization.

By a fecond pair of Menifcufes.	The fine of the angle of incidence will be to that of refraction as ... To unity.
Diftilled water - - -	1.3358
Rain-water - - -	1.3358
Well-water - - -	1.3362
French wine - - -	1.3458
French brandy - - -	1.3600
Ditto a ftronger kind - - -	1.3618
Spirit of wine rectified - -	1.3683
Ditto more highly rectified - -	1.3705
Tea - - - -	1.3376
Mineral alkali faturated (I fuppofe with water) - - -	1.3600
Spirit of nitre - - -	1.4025
A folution of two fcruples of Glauber's falt in an ounce of water -	1.3430
A folution of two fcruples of digeftive falt of Sylvius in ditto -	1.3454
A folution of two fcruples of fal ammoniac in ditto - -	1.3488
A folution of two fcruples of copperas in ditto - - -	1.3395
Oil of tartar per deliquium - -	1.3917
Oil of Provence - - -	1.4648
Oil of turpentine - - -	1.4822

The

The refractive power of fome other fluids found by the fecond pair of Menifcufes, 18th Auguft, 1761, Reaumur's thermometer being 31 *degrees above the freezing point.*

A ray of light paffing from air into	The fine of the angle of incidence will be to that of refraction as	
Well-water	1.3351	To unity.
Four different folutions of nitre, *viz.*		
Twelve grains of depurated nitre to an ounce of water	1.3380	
Twenty-four grains of depurated nitre to an ounce of water	1.3398	
Thirty-eight grains of depurated nitre to an ounce of water	1.3450	
Thirty-eight grains of depurated nitre to two ounces of water	1.3540	
Four different infufions		
of parfley	1.3355	
of nutfhells	1.3359	
of faffron	1.3363	
of fifh-fcales	1.3353	
of Zeltzer water	1.3353	
of Eger water	1.3358	
Anodyne liquor	1.3650	
Spirit of camphor	1.3757	
Spirit of Saxon fope	1.4088	

That the refractive power of thefe fluids, thus determined by M. Euler, may be more eafily compared with Mr. Haufkbee's and fir Ifaac Newton's experiments, he reduced the refult of their obfervations into the following tables, exactly fimilar to his own.

The refractive power of certain fluids found by Mr. Haukfbee, fee his Experiments, p. 292.

A ray of light paffing from air into	The fine of the angle of incidence will be to that of refraction as	
Water	1.3359	To unity.
Spirit of honey	1.3359	
Spirit of fal ammoniac	1.3377	
Oil of amber	1.3377	
Spirit of hartfhorn	1.3390	
Human urine	1.3419	
White of an egg	1.3511	
Jelly of hartfhorn	1.3541	
French brandy	1.3626	
Spirit of wine	1.3721	
Diftilled vinegar	1.3721	
Gum ammoniac	1.3723	
Aqua regia	1.3898	
Ditto from aqua fortis and fal ammoniac	1.3964	
Aqua fortis	1.4044	
Spirit of nitre	1.4076	
The cryftalline humour of an ox's eye	1.4635	
Butter of antimony	1.6831	
Oil of vitriol	1.4262	
Oil of wax	1.4524	
Oil of lavender	1.4960	
Oil of rofemary	1.4719	
Oil of origanum	1.4770	
Oil of ginger	1.4799	
Oil of oranges	1.4833	
Oil of turpentine	1.4833	
Oil of favine	1.4857	

	The fine of the angle of incidence will be to that of refraction as	
Oil of flowers of mufk	1.4878	To unity.
Oil of mint	1.4911	
Oil of amber	1.5010	
Oil of cummin	1.5088	
Oil of fennel	1.5114	
Oil of cloves	1.5136	
Oil of anife	1.5191	
Oil of cinnamon	1.5340	
Oil of faffafras	1.5443	

The refractive powers of fome tranfparent liquors according to the obfervations of fir Ifaac Newton. See Optics, p. 247.

A ray of light paffing from air into	The fine of the angle of incidence will be to that of refraction as	
A yellow pfeudo-topaz	1.6429	To unity.
Air	0.9997	
Glafs of antimony	1.8889	
A felenites	1.4878	
Glafs	1.5500	
Cryftal of the rock	1.5620	
Ifland cryftal	1.6665	
Sal gem	1.5455	
Alum	1.4577	
Borax	1.4667	
Nitre	1.5238	
Dantzick vitriol	1.5000	
Oil of vitriol	1.4285	
Rain-water	1.3358	
Gum arabic	1.4771	
Spirit of wine well rectified	1.3698	
Camphor	1.5000	
Olive oil	1.4666	
Linfeed oil	1.4814	
Spirit of turpentine	1.5625	
Amber	1.5556	
A diamond	2.4390	

See Prieftley's Hift. of Light, &c. p. 479, &c.

Whence the different refractive power in different fluids arifes, is not determined. Sir Ifaac Newton fhews, that in many bodies, *e. gr.* glafs cryftal, a felenites, pfeudo-topaz, &c. the refractive power is proportionable to their denfities; only in fulphureous bodies, as camphor, linfeed oil, olive, amber, fpirit of turpentine &c. the power is two or three times greater than in other bodies of equal denfity; yet even thefe have the refractive power with refpect to each other nearly as their denfities.

Water has a refractive power in a middle degree between thofe two kinds of fubftances, and is, probably, of a middle nature. Salts and vitriols have refractive powers in a middle degree between thofe of earthy fubftances and water, and accordingly are compofed of thofe two forts of fubftances. Spirit of wine has a refractive power in a middle degree between thofe of water and oily fubftances; and accordingly feems to be compofed of both, united by fermentation. It appears, therefore, that all bodies feem to have their refractive powers proportional to their denfities, or very nearly, excepting fo far as they partake of more or lefs fulphureous oily particles, and thereby have their refractive powers made greater or lefs. Whence it feems reafonable to attribute the refractive power of all bodies

bodies chiefly, if not wholly, to the fulphureous parts with which they abound.

From the obfervations of M. Euler it appears, that there is no fluid, and probably no tranfparent fubftance of any kind, the refractive power of which is lefs than that of rain-water, or diftilled water; and betwixt air and rain-water there is no fubftance that has an intermediate refractive power.

After rain-water immediately follows well-water; but there are probably as many varieties in its refractive power as there are different wells. We may, however, conclude, that the ratio of refraction from air into well-water is contained between the limits of 1.336 to 1, and 1.337 to 1.

Spirituous liquors have a greater refractive power in proportion to their ftrength: but the ratio of refraction from air into any fpirituous liquor is never lefs than 1.34, nor greater than 1.37.

There is, probably, no kind of falt, but what, being diffolved in water, increafes its refractive power.

The folutions of falt of urine and of vitriol have the leaft refractive powers, and thofe of rock-falt and fal ammoniac the greateft; but the ratio of refraction from air into any faline folution, preferving the proportion of one ounce of falt to twelve of water, will be contained between the limits of 1.34 to 1, and 1.35 to 1.

Diftilled vinegar, and the folution of gum arabic, have nearly the fame refractive power with common French wine; and the refractive power of white of egg is the fame as that of rectified fpirit of wine.

Mineral alkali faturated, feems to have the fame refractive power with very ftrong brandy.

Spirit of nitre and oil of tartar per deliquium have a medium refractive power between fpirituous liquors and oils.

The refractive powers of oils approach the neareft to that of glafs, efpecially oil of turpentine, which had the greateft refractive power of all the fluids on which he had made experiments.

Sir Ifaac Newton fufpected that different *degrees of heat* might have fome effect on the refractive power of bodies, but his method of determining the general refraction was not fufficiently accurate to afcertain this circumftance; but happily this method of M. Euler's proved to be well adapted to this purpofe.

From his experiments made for this purpofe, he infers, that the focal diftance of a fingle lens of glafs diminifhes with the heat communicated to it; and this diminution of the focal diftance is not owing to the increafe of bulk in the glafs by heat; for the effect of this change is both inconfiderable, and of a contrary nature. There can be no doubt, therefore, but that this alteration in the focal diftance is owing to a change in the refractive power of the glafs itfelf, which, as well as, probably, that of all other tranfparent fubftances, is increafed by heat, and diminifhed by cold.

It may feem furprifing that the focal diftance of a fingle lens fhould decreafe with heat, and yet that of the menifcufes filled with any fluid, fhould increafe with heat; but M. Euler obferves, that it by no means follows from hence, that thefe fluids are affected by heat in a manner different from glafs; and, after computing the effect of every circumftance of this complex experiment, of the two glaffes, and the fluid combined, he concludes, that heat increafes the refractive power of water, and of other fluids, as well as that of glafs.

He farther obferves, that as 66 degrees of heat diminifhed the focal diftance $\frac{1}{65}$th part, 33 degrees ought to have diminifhed it $\frac{1}{130}$th part; whereas the diminution in this cafe was $\frac{1}{97}$th. From hence, fays he, one may perhaps conclude, that when it is very cold, the fame change in the thermometer has a greater effect on the refractive power of the glafs than when it is very hot. But he acknowledges that experiments of this kind are not capable of fo much precifion as one could wifh, and that, perhaps in reality, the 66 degrees made a change of $\frac{1}{60}$th, and the 33 degrees of $\frac{1}{120}$th; but he imagined that a great number of experiments, made in different temperatures of the air, might decide the queftion, efpecially if object-glaffes of a very great focal diftance were made ufe of. Ac. Berl. 1762.

The duke de Chaulnes, not fatisfied with the methods ufed by Newton and others for determining the refractive power of glafs, propofed another mode of doing it, which is very ingenious, and, when well conducted, promifing fuccefs. He formed the glafs into plates, the furfaces of which were truly plane and parallel, and having placed fmall objects on each of them, he found, by means of a compound microfcope, to which he applied the moft exquifite micrometer, the different diftances at which they were diftinctly vifible, and compared them with the thicknefs of the glafs. This, he fays, gives the proportion of the fines of the angles of incidence and refraction in that kind of glafs directly. In this method he afcertained the mean refractive power of 15 kinds of glafs. Ac. Par. 1767. See Prieftley's Hift. of Light, &c. p. 483, &c.

Dr. W. H. Wollafton has propofed a new method of examining refractive as well as difperfive powers, by prifmatic reflection. This method was fuggefted by a confideration of fir Ifaac Newton's prifmatic eye-glafs, the principle of which depends on the reflection of light at the inner furface of a denfe refracting medium.

Since the range of inclination, within which total reflection takes place, depends not only on the denfity of the reflecting prifm, but alfo on the rarity of the medium adjacent to it, the extent of that range varies with the difference of the denfities of the two media. When, therefore, the refractive power of one medium is known, that of any rarer medium may be learned, by examining at what angle a ray of light will be reflected from it.

For inftance, when any object is laid under a prifm of flint-glafs, with air alone interpofed, the internal angle of incidence at which the vifual ray begins to be totally reflected, and at which the object ceafes to be feen by refraction, is about 39° 10′; but when the object has been dipped in water, and brought into contact with the glafs, it continues vifible, by means of the higher refractive power of the water, as far as $57\frac{1}{2}$° of incidence. When any kind of oil, or any refinous cement, is interpofed, this angle is ftill greater, according to the refractive power of the medium employed; and, by cements that refract more ftrongly than the glafs, the object may be feen through the prifm, at whatever angle of incidence it is viewed.

In examining the refractive powers of fluids, or of fufible fubftances, the requifite contact is eafily obtained; but, with folids, which can in few inftances be made to touch to any great extent, this cannot be effected without the interpofition of fome fluid, or cement, of higher refractive power than the medium under examination. Since the furfaces of a ftratum fo interpofed are parallel, it will not effect the total deviation of a ray paffing through it, and may therefore be employed without rifk of any error in confequence.

Thus, refin, or oil of faffafras, interpofed between plate-glafs and any other prifm, will not alter the refult.

If, on the fame prifm, a piece of felenite and another of plate-glafs be cemented near each other, their powers may

be

be compared with the same accuracy as if they were both in absolute contact with it.

For such a mere comparison of any two bodies, a common triangular prism is best adapted; but, for the purpose of actual measurement of refractive powers, Dr. Wollaston has preferred the use of a square prism, because, with a very simple apparatus, it shews the sine of refractive power sought, without the need of any calculation.

Let A (*Plate* XVIII. *Optics, fig.* 12.) be a square or rectangular prism, to which any substance is applied at *b*, and let any ray of light parallel to *cb* be refracted through the prism, in the direction *bde*.

Then, if *ef* and *ed* be taken proportional to the sines that represent the refractive powers of the prism and of air, *fg*, which is intercepted between *f* and the perpendicular *eg*, will be the corresponding sine to represent the refractive power of the medium *b*. For since *edg* (opposite to *ef*) is the angle of refraction, *efg* (opposite to *ed*) must be equal to the angle of incidence *bdh*; and *ef* : *fg* :: *bd* : *dh* :: sine of *cbi* : sine of *hbd*.

All, therefore, that is requisite for determining the refractive power of *b*, is to find the means of measuring the line *fg*. On this principle, the instrument in *fig.* 13 is constructed. On a board, *ab*, is fixed a piece of flat deal *cd*, to which, by a hinge at *d*, is jointed a second piece *de*, 10 inches long, carrying two plane sights at its extremities. At *e* is a second hinge, connecting *ef*, 15.83 inches long; and a third at the other extremity of *ef*, by which *fg* is connected with it. At *i* also is a hinge, uniting the radius *ig* to the middle of *ef*; and then, since *g* moves in a semicircle *egf*, a line joining *e* and *g* would be perpendicular to *fg*.

The piece *cd* has a cavity in the middle of it, so that, when any substance is applied to the middle of the prism P, it may continue to rest horizontally on its extremities. When *ed* has been so elevated, that the yellow rays in the fringe of colours (observable where perfect reflection terminates) are seen through the sights, the point *g*, by means of a vernier which it carries, shews by inspection the length of the sign of refraction sought.

The advantages which this method possesses above the usual mode of examining refractive powers, are greater than they may at first sight appear. The usual practice has been, to form two surfaces of the substance under examination, so inclined to each other that the deviation occasioned by them might be measured. The inclination of these surfaces to each other must also be known; and thence the refractive power might be computed. But, in the method here proposed, it is sufficient to have only one surface, and the result is obtained at once, without computation.

The facility of determining refractive powers is consequently such as to render this property of bodies a very convenient test in many philosophical inquiries.

The following table exhibits a series of substances, arranged according to their refractive powers.

Diamond	2.44
Plumbago	——
Native sulphur (double)	2.04
Glass, consisting of lead 6 and sand 1	1.987
Glass of antimony	1.98
Jargon	1.95
Spinelle ruby	1.812
Arsenic	1.811
Muriate of antimony, variable.	
White sapphire	1.768
Gum dragon	——
Iceland spar, strongest	1.657
Sulphate of barytes (double)	1.646
Balsam of Tolu	1.60
Guaiacum	1.596
Benzoin	——
Flint glass	1.586
Ditto	1.583
Horn	——
Phosphorus	1.579
Mica	——
Opium	——
Amber	1.547
Rock crystal (double)	1.547
Old plate-glass	1.545
Colophony	1.543
Box-wood	——
Bees-wax	1.542
Oil of sassafras	1.536
Red sealing-wax	——
Spermaceti, cold	——
Sugar, after fusion	——
Arseniate of potash	——
Mastic	——
Elemi	——
White wax (cold)	——
Oil of cloves	1.535
Copal	1.535
Anime	1.535
Radcliffe crown-glass	1.533
Pitch	——
Centre of crystalline of fish, and dry crystalline of an ox	1.530
Canada balsam	1.528
Crown glass, common	1.525
Selenite	1.525
Caoutchouc	1.524
Gum lac	——
Dutch plate-glass	1.517
Human cuticle	——
Gum arabic	1.514
Balsam of capivi	1.507
Oil of amber	1.505
English plate-glass	1.504
French plate-glass	1.500
Oil of nutmeg	1.497
Sulphate of potash	1.495
Tallow, cold	1.49
Iceland spar, weakest	1.488
Camphor	1.487
Linseed oil	1.485
Butter, cold	1.480
Essence of lemon	1.476
Oil of turpentine, common	1.476
Oil of turpentine, rectified	1.470
Oil of almonds	——
Oil of olives	1.469
Oil of peppermint	1.468
Oil of lavender	1.467
Tallow, melted	1.460
Alum	1.457
Spermaceti, melted	1.446
Crystalline lens of an ox	1.447
to	1.380
Computed average of ditto	1.430
Sulphuric acid	1.435
Fluor spar	1.433
Nitric acid (sp. gr. 1.48)	1.410

Alcohol

Alcohol - - -	1.37
White of an egg - - -	1.36
Æther - - - -	1.358
Vitreous humour of an eye - -	1.336
Water - - - -	1.336
Atmofpheric air (Hauksbee) - -	1.00032

See Phil. Tranf. vol. xcii. for 1802. art. 12. See Dispersion *of Light.*

From the law laid down in the beginning of this article, it follows, that one angle of inclination, and its correfponding refracted angle, being found by obfervation, the refracted angles, correfponding to the feveral other angles of inclination, are eafily computed. Now, Zahnius and Kircher have found, that if the angle of inclination be 70°, the refracted angle will be 38° 50′; on which principle Zahnius has conftructed a table of refractions out of air into glafs, for the feveral degrees of the angle of inclination; a fpecimen of which follows:

Angle of Inclination.	Refracted Angle.			Angle of Refraction.		
°	°	′	″	°	′	″
1	0	40	5	0	19	55
2	1	20	6	0	39	54
3	2	0	3	0	59	56
4	2	40	5	1	19	55
5	3	20	3	1	39	57
10	6	39	16	3	20	44
20	13	11	35	6	48	25
30	19	29	29	10	30	31
45	28	9	19	16	50	41
90	41	51	40	48	8	20

Hence it appears, that if the angle of inclination be lefs than 20°, the angle of refraction out of air into glafs is almoft one-third of the angle of inclination; and, therefore, a ray is refracted to the axis of refraction, by almoft a third part of the quantity of its angle of inclination. And on this principle it is that Kepler, and moft other dioptrical writers, demonftrate the refractions in glaffes; though in eftimating the law of thefe refractions, he followed the example of Alhazen and Vitellio, and fought to difcover it in the proportion of the angles, and not in that of the fines.

The true law of refraction was firft difcovered by Willebrord Snellius, profeffor of mathematics at Leyden; who found by experiment that the fecants of the complements, or co-fecants, of the angles of incidence and refraction, are always in the fame ratio. It is vulgarly attributed, however, to Defcartes; who having feen it in Snellius's MS., firft publifhed it in his Dioptrics, without naming Snellius; as we are informed by Huygens. The form in which Defcartes gives this law is different from that of Snellius, and in general more commodious; but it might have been eafily deduced from it. According to him, the fine of the angle of refraction always bears the fame proportion to the fine of the angle of incidence. Indeed, as the rays of light are not all of the fame degree of refrangibility, this conftant ratio muft be different in different kinds. The ratio, therefore, obferved by authors, is to be underftood of rays of the mean refrangibility, *i.e.* of green rays. The difference of refraction between the leaft and moft refrangible rays, that is, between violet and red rays, fir Ifaac Newton fhews is about the $27\frac{1}{2}$th part of the whole refraction of the mean refrangible; which difference he owns is fo fmall, that there feldom needs to be any regard paid to it.

3. *When a ray paffes out of a denfer into a rarer medium, e. gr. out of glafs into air, it is refracted from the perpendicular, or from the axis of refraction.* And hence the angle of refraction is greater than the angle of inclination.

Hence, alfo, if the angle of inclination be lefs than 30°, M B C (*Plate* XVIII. *Optics, fig.* 11.) is nearly equal to one-third of M B E; therefore M B C is one-half of C B E; confequently, if the refraction be out of glafs into air, and the angle of inclination lefs than 30°, the ray is refracted from the axis of refraction by almoft one-half part of the angle of inclination. And this is the other dioptrical principle ufed by moft authors after Kepler, to demonftrate the refraction of glaffes.

If the refraction be out of air into glafs, the ratio of the fine of inclination to the fine of the refracted angle is as 3 to 2, or, more accurately, as 17 to 11; if out of air into water, as 4 to 3: therefore, if the refraction be the contrary way, *viz.* out of glafs or water into air, the ratio of the fines, in the former cafe, will be as 2 to 3, or 11 to 17, and in the latter as 3 to 4.

Hence, if the refraction be from water or glafs into air, and the angle of incidence or inclination be greater than about $48\frac{1}{2}$° in water, or greater than about 40° in glafs, the ray will not be refracted into air, but will be reflected into a line, which makes the angle of reflection equal to the angle of incidence; becaufe the fines of $48\frac{1}{2}$° and 40° are to the radius as 3 to 4, and as 11 to 17 nearly, and therefore when the fine has a greater proportion to the radius than as above, the ray will not be refracted.

4. *A ray falling on a curve furface, whether concave or convex, is refracted after the fame manner as if it fell on a plane which is a tangent to the curve in the point of incidence.*

For the curve and plane furface touching it, have an infinitely fmall part common to them both (each being originally generated by the flux of a point). But a ray is refracted in fuch a little part; therefore it is the fame as if it were refracted in fuch a plane.

5. *If a right line* E F (*Plate* XVIII. *Optics, fig.* 14.) *cut a refracting furface,* G H, *at right angles; and if, from any point in the denfer medium, as* D, *be drawn* D C *parallel to the incident ray* A B: *this will meet the refracted ray in* C; *and will be to it as the fine of the refracted angle to the fine of the angle of inclination.*

For $o = x$; but if B C pafs out of a denfer medium into a rarer, $y > x$; and out of a rarer into a denfer, $y < x$; therefore, in the former cafe, $y > o$, in the latter $y < o$; confequently, in the former, $o + u < y + u$; in the latter $y + u < o + u$. But in the one cafe $o + u$, and in the other $y + u$, are equal to two right angles; therefore, $o + u$ in this, and $y + u$ in the other, are lefs than two right angles, and confequently D C will meet B C. But fince $o = x$, or the angle of inclination, and y is the refracted angle, it is evident that C B is to C D as the fine of the angle o to the fine of the angle y, or in the ratio of the fine of the angle of inclination to the fine of the refracted angle.

Hence, if B C pafs out of glafs into air, it is in a fubfefquialterate ratio to C D; if, on the other hand, it paffes out of air into glafs, it is in a fefquialterate ratio to C D.

Hence, alfo, if light pafs out of water into air, C B is in a fubfefquitertian ratio to C D; if out of air into water, in a fefquitertian. See *figs.* 14 and 15.

Refraction *in plane furfaces, laws of.* 1. If parallel rays be refracted out of one tranfparent medium into another of a dif-a different denfity, they will continue parallel after refraction. The phyfical reafon is, that, being parallel, their obliquity, or angle of incidence, is the fame; but, at equal obliquities, we have fhewn the refraction is equal; confequently the parallelifm, which they had before the refraction, will be retained after it.

But this may be alfo demonftrated geometrically: thus, if the rays be perpendicular to the refracting furface, they will pafs without any refraction; confequently being parallel before their paffage, they will be fo after it. If they fall obliquely, as A B and C D (*fig.* 16.), the angles of incidence o and u, and, confequently, alfo the angles of inclination x and y, will be equal. But the fines of the angles of inclination x and y have the fame ratio to the fines of the refracted angles m and n; therefore the refracted angles m and n, and alfo the angles s and r, are equal; confequently the refracted rays are parallel.

Hence a glafs, plane on both fide, being turned directly to the fun, the light paffing through it will be propagated after the fame manner as if the glafs were away; for the rays being perpendicular, will pafs without refraction. If the glafs be turned obliquely to the fun, the light, after refraction, will be of the fame intenfity as before, the intenfity depending on the fpiffitude or clofenefs of the rays, and on the angle with which they ftrike the object, or the eye; both which are here unvaried.

2. If two rays D C and C P (*fig.* 17.) proceeding from the fame radiant C, and falling on a plane furface of a different denfity, fo that the points of refraction D and P are equally diftant from the cathetus of incidence G K, the refracted rays D F and P Q have the fame virtual focus, or the fame point of difperfion G.

Hence, 1. Since, in rays very near each other, the diftance from the cathetus is the fame as to fenfe, very near rays will diverge from the fame point G, *i. e.* they will have the fame virtual focus G.

And hence, 2. When refracted rays, falling on the eye placed out of the cathetus of incidence, are either equally diftant from the cathetus, or very near each other, they will flow upon the eye, as if they came to it from the point G; confequently the point C will be feen by the refracted rays as in G.

3. If a ray C D fall obliquely out of a thinner into a denfer medium, having a plane furface, the diftance of the radiant point C K will have a lefs ratio to the diftance of the point of difperfion, or virtual focus, K G, than the fine of the refracted angle to the fine of the angle of inclination. But if the diftance of the point of refraction, from the cathetus of incidence K D, be lefs than the eleventh or nineteenth part of the diftance of the radiant point C K; and if in the former cafe the tenth, and in the latter the hundredth, part of it be fo fmall, that it cannot be affigned, or need not be minded, then will C K be to K G, as to fenfe, in the ratio of the fine of the refracted angle, to the fine of the angle of inclination.

Hence, 1. If the refraction be out of air into glafs, the diftance of the point of difperfion of rays near the cathetus is fefquialterate of the radiant point; of more remote rays greater than fefquialterate. But if the refraction be out of air into water, the diftance of the fame point will be fefquitertian, when the rays are near the cathetus; and when more remote, greater than fefquitertian.

Hence, 2. If the eye be placed in a denfe medium, objects in a rarer will appear more remote than they are; and the place of the image, in any given cafe, may be determined from the ratio of the refraction. *Thus, to fifhes fwimming under water, objects out of the water muft appear farther diftant than in reality they are.*

4. If a ray D G fall obliquely out of a denfer into a rarer medium A B, the diftance of the radiant point G K has a greater ratio to the diftance of the point of difperfion K C, than the fine of the refracted angle has to the fine of the angle of inclination. In the other cafe of the preceding theorem, K G will be to K C, as to fenfe, in the ratio of the fine of the refracted angle, to the fine of the angle of inclination.

Hence, 1. If the refraction be out of glafs into air, the diftance of the point of difperfion of the rays near the cathetus of incidence is fubfefquialterate of the diftance of the radiant point; that of the more remote rays is lefs than fubfefquialterate.

But, 2. If the refraction be out of water into air, the diftance of the point of difperfion of rays near the cathetus is fubfefquitertian; of thofe more remote, lefs than fubfefquitertian.

And, 3. The eye, therefore, being placed in a rarer medium, objects, placed in a denfer, appear nearer than they are; and the place of the image may be determined in any given cafe by the ratio of refraction. Hence, the bottom of a veffel full of water is raifed by refraction to a third part of its height, with refpect to an eye perpendicularly over the refracting furface; and hence *fifhes, and other bodies under water, appear nearer than they really are.*

5. If the eye be placed in a rarer medium, an object feen in a denfer medium, by a ray refracted in a plane furface, will appear larger than it really is. If the object be in a rarer, and the eye in a denfer medium, the object will appear lefs than it is. And, in each cafe, the apparent magnitude is to the real one in a ratio compounded of the diftance of the point to which the rays tend before refraction, from the refracting furface D E (*fig.* 18.) to the diftance of the eye G L from the fame, and of the diftance G M of the object A B from the eye, to its diftance F M from a point F, to which the rays tend before refraction.

Hence, 1. If the object A B be very remote, F M will be phyfically equal to G M; and, therefore, the real magnitude M B is to its apparent one M H, as G L to F L, or the diftance of the eye G from the refracting plane to the diftance of the point of convergence F from the fame plane.

Hence, 2. *Objects under water, to an eye in the air, appear larger than they are; and to fifhes under water, objects in the air appear lefs than they are.*

Refraction, *Laws of, in fpherical furfaces, both concave and convex.* 1. A ray of light D E (*fig.* 19.) parallel to the axis of a denfer fphere, after a fingle refraction in E, falls in with the axis in the point F, beyond the centre C.

For the femidiameter C E, drawn to the point of refraction E, is perpendicular to the furface K L, and is therefore the axis of refraction; but a ray out of a rarer into a denfer medium, we have fhewn, is refracted towards the perpendicular, or the axis of refraction; therefore the ray D E will converge to the axis of the fphere A F; and will, therefore, at length concur with it, and that beyond the centre C, in F; becaufe the angle of refraction F E H is lefs than the angle of inclination C E H.

2. If a ray D E fall on a fpherically convex furface of a denfer medium, parallel to its axis A F; the femidiameter C E will be to the refracted ray E F in the ratio of the fine of the angle of refraction, to the fine of the angle of inclination; but the diftance of the focus, or point of concurrence from the centre C F, is to the refracted ray F E, in the ratio

ratio of the fine of the refracted angle, to the fine of the angle of inclination.

3. If a ray D E fall on a denfer fpherical convex furface K L, parallel to the axis A F, the diftance of the focus from the refracting furface F B muft be to its diftance from the centre F C, in a ratio greater than that of the fine of the angle of inclination, to the fine of the refracted angle. But if the rays be very near the axis, and the angle of inclination B C E be only of a few degrees, the diftances of the focus from the furface, and the centre, F B and F C, will be nearly in the ratio of the fine of the angle of inclination, to the fine of the refracted angle.

Hence, 1. If the refraction be out of air into glafs; in the cafe of rays near the axis, B F : F C :: 3 : 2. And in the cafe of rays remote from the axis, B F : F C > 3 : 2. Confequently, in the former cafe, B C : B F :: 1 : 3; and in the latter, B C : B F < 1 : 3.

And, 2. If the refraction be out of air into water; in the former cafe, B F : F C :: 4 : 3; and in the latter, B F : F C > 4 : 3. Confequently, in the former, B C : B F :: 1 : 4; and in the latter, B C : B F < 1 : 4.

Hence, 3. Since the fun's rays are parallel as to fenfe, if they fall on the furface of a folid glafs fphere, or of a fphere full of water, they will not concur with the axis within the fphere; fo that Vitellio was miftaken, when he imagined, that the fun's rays, falling on the furface of a cryftalline fphere, were refracted to the centre.

4. If a ray D E (*fig.* 20.), parallel to the axis F A, fall out of a denfer into a rarer fpherical medium, after refraction, it will diverge from the axis; and the diftance of the point of difperfion, or the virtual focus from the centre of the fphere F C, will be to its femi-diameter C E in the ratio of the fine of the refracted angle, to the fine of the angle of refraction; but to the portion of the refracted ray drawn back, F E, it will be in the ratio of the fine of the refracted angle, to the fine of the angle of inclination.

5. If a ray E D fall parallel to the axis A F on the fpherically convex furface K L of a rarer medium, out of a denfer, the diftance of the point of difperfion from the centre F C, is to its diftance from the furface F B, in a ratio greater than that of the fine of the refracted angle to the fine of the angle of inclination. But if the rays D E be very near the axis F A, the ratio will be very nearly the fame with that of the fine of the refracted angle to the fine of the angle of inclination.

Hence, 1. If the refraction be out of glafs into air, in the cafe of rays near the axis, F C : F B :: 3 : 2. Confequently B C : F B :: 1 : 2. Therefore, in the cafe of rays more remote from the axis, F C : F B > 3 : 2.

2. If the refraction be out of water into air; in the former cafe F C : F B :: 4 : 3. Confequently, B C : F B :: 1 : 3; in the latter cafe therefore, F C : F B > 4 : 3.

3. Since then the point of difperfion F is more remote from the refracting furface K L, if the rays proceed out of water, than if they pafs out of glafs into air; parallel rays are lefs difperfed in the former cafe than in the latter.

6. If a ray H E (*fig.* 19.) fall parallel to the axis F A, out of a rarer, on the furface of a fpherically concave denfer medium; the refracted ray E N will be driven from the point of the axis F; fo that F E will be to F C in the ratio of the fine of the angle of inclination, to the fine of the refracted angle.

7. If a ray E H fall parallel to the axis F B on the concave furface K L of a fpherical denfer medium, from a rarer; the diftance of the point of difperfion from the refracting furface F B, is to its diftance from the centre F C, in a ratio greater than that of the fine of the angle of inclination, to the fine of the refracted angle. But if the rays be very near the axis, and the angle B C E be very fmall, B F will be to C F very nearly in the ratio of the fine of the angle of inclination, to the fine of the refracted angle.

Hence, 1. If the refraction be out of air into glafs; in the cafe of rays near the axis, F B : F C :: 3 : 2; in the cafe of rays more remote from the axis, F B : F C > 3 : 2; confequently, in the former, B C : F C :: 1 : 2. And hence, in the latter, B C : F C < 1 : 2.

Hence alfo, 2. If the refraction be out of air into water; in the cafe of rays near the axis, F B : F C :: 4 : 3. In the cafe of rays more remote from the axis, F B : F C > 4 : 3; confequently, in the firft cafe, B C : F C :: 1 : 3. And hence, in the latter, B C : F C > 1 : 3.

And hence, 3. Since the point of difperfion F is farther from the centre C, if the refraction be in water than in air; rays will be lefs difperfed in the latter cafe than in the former.

8. If the ray H E (*fig.* 20.) fall parallel to the axis A F, from a denfer upon the furface of a fpherical concave rarer medium, the refracted ray will concur with the axis A F, in the point F; fo that the diftance of the point of concourfe from the centre C F, may be to the refracted ray F E, in the ratio of the fine of the refracted angle, to the fine of the angle of inclination.

9. If a ray H E fall parallel to the axis A F on the concave furface of a rarer medium out of a denfer, the diftance of the focus from the centre F C will be to its diftance from the refracting furface F B in a greater proportion than the fine of the refracted angle, to the fine of the angle of inclination. But if the rays be very near the axis, F C will be to F B in the proportion of thefe fines.

Hence, 1. If the refraction be out of glafs into air; in the cafe of rays near the axis, F C : F B :: 3 : 2; in the cafe of rays more remote from the axis, F C : F B > 3 : 2. Whence, in the former cafe, B C : F B :: 1 : 2.

2. If the refraction be out of water into air; in the cafe of rays near the axis, F C : F B :: 4 : 3; in the cafe of rays more remote, F C : F B > 4 : 3. Whence, in the former cafe, B C : F B :: 1 : 3. For the demonftration of thefe feveral laws of refraction, we refer to Wolfius's Elem. Mathef. &c. tom. iii. p. 179, &c. See alfo Lens.

Refraction *in a glafs prifm.* If a ray of light D E (*fig.* 21.) fall obliquely out of air on a prifm A B C; being refracted towards the perpendicular, inftead of proceeding to F, it will decline to G, *i. e.* towards a line H I, drawn perpendicular to the furface A B in the point of refraction E. Again, fince the ray E G, paffing out of the glafs into air, falls obliquely on C B, it will be refracted to M, fo as to recede from the perpendicular N G O. *And hence arife the various phenomena of the prifm.* See Colour and Refrangibility.

Refraction *in a convex lens.* If parallel rays, A B, C D, and E F (*fig.* 22.) fall on the furface of a lens 2 B 3 K, the perpendicular ray A B will pafs unrefracted to K, where emerging into air perpendicular, as before, it will proceed ftraight to G. But the rays C D and E F, falling obliquely out of air into glafs, in D and F, will be refracted towards the axis of refraction (*i. e.* towards lines H I and L M, drawn perpendicular to the refracting furface in the points of refraction D and F) and decline to Q and P. Again, emerging obliquely out of the glafs into the furface of the air, they will be refracted from the perpendicular, and, therefore, D Q will not proceed to X, but to G; and F P, not to V, but to G; thus, likewife, might all the other rays, falling on the

the furface of the glafs, be fhewn to be refracted fo as to meet the reft about the point G. See Focus and Lens.

Hence the great property of convex glaffes; *viz. that they collect parallel rays, or make them converge into a point.*

Refraction *in a concave lens.* Parallel rays A B, C D, and EF (*fig.* 23.) falling on a concave lens G B H I M K, the ray A B, falling perpendicular on the glafs at B, will pafs unrefracted to M; where being ftill perpendicular, it will pafs into the air without refraction, to L. But the ray C D, falling obliquely on the furface of the glafs, will be refracted towards the perpendicular N D O, and proceed to Q; and the ray D Q, again falling obliquely out of the glafs upon the furface of air, will be refracted from the perpendicular R Q S, and proceed to V. After the fame manner might the ray E F be fhewn to be refracted to Y, and thence to Z.

Hence the great property of concave glaffes; *viz. that they difperfe parallel rays, or make them diverge.* See Lens and Mirror.

Refraction *in a plane glafs.* If parallel rays E F, G H, I L (*fig.* 24.) fall obliquely on a plane glafs A B C D, the obliquity being the fame in all, by reafon of their parallelifm, they will be all equally refracted towards the perpendicular; and accordingly, being ftill parallel at M, O, and Q, they will pafs out into the air equally refracted again from the perpendicular, and ftill parallel.

Thus will the rays E F, G H, and I L, at their entering the glafs, be inflected towards the right; and in their going out as much inflected to the left; fo that the firft refraction is here undone by the fecond: though not fo as that the object is feen in its true place. For the ray B Q, being produced back again, will not coincide with the ray L I, but will fall to the right of it; and this the more as the glafs is thicker; however, as to matter of colour, the fecond refraction does really undo the firft. See Colour.

Refraction *of Heat.* See Heat, Light, and Rays *of Heat.*

Refraction *in Iceland* or *Ifland cryftal.* See *Iceland* Crystal. Dr. Young, who maintains that radiant light confifts in undulations of the luminiferous ether, takes occafion to make fome remarks on fir Ifaac Newton's theory of the peculiar refraction in Iceland cryftal. Newton, he fays, has advanced the fingular refraction of the Iceland cryftal, as an argument that the particles of light muft be projected corpufcles; fince he thinks it probable that the different fides of thefe particles are differently attracted by the cryftal, and fince Huygens has confeffed his inability to account, in a fatisfactory manner, for all the phenomena. But contrarily to what might have been expected from Newton's ufual accuracy and candour, he has laid down a new law for the refraction, without giving a reafon for rejecting that of Huygens, which Mr. Haüy has found to be more accurate than Newton's; and, without attempting to deduce from his own fyftem any explanation of the more univerfal and ftriking effects of doubling fpars, he has omitted to obferve, that Huygens's moft elegant and ingenious theory perfectly accords with thefe general effects, in all particulars, and of courfe derives from them additional pretenfions to truth; this he omits, in order to point out a difficulty for which only a verbal folution can be found in his own theory, and which will probably long remain unexplained by any other.

Dr. Wollafton, in his paper on the oblique refraction of Iceland cryftal, confirms the experiments of Huygens on this fubftance, with additional evidence, deduced from the fuperiority of his mode of examining the powers of refraction. He obferves that Dr. Young has already applied the Huygenian theory with confiderable fuccefs to the explanation of feveral other optical phenomena, and that it appears to be ftrongly fupported by fuch a coincidence of the calculations deduced from it, with the refults of thefe experiments, as could have fcarcely happened to a falfe theory.

In ordinary cafes, the incipient undulations are of a fpherical form; but in the Iceland cryftal light appeared to Huygens to proceed as if the undulations were portions of an oblate fpheroid, of which the axis is parallel to the fhort diagonal of an equilateral piece of the cryftal, and its centre the point of incidence of its ray. From this fpheroidal form of the undulations, he deduces the obliquity of refraction; and lays down a law obfervable in all refractions, at any furface of the fpar, whether natural or artificial, which bears the clofeft analogy to that which obtains, univerfally, at other refractory furfaces; for as, in other cafes, the ratio is given between the fine of incidence and fine of refraction, (or ordinate of the *fpherical* undulation propagated,) fo in the Iceland cryftal, the ratio between the fine of incidence and ordinate of refraction (in any one fection of the *fpheroidical* undulation) in a given ratio, but different in different planes.

Dr. Wollafton obferves, that though we do not fully underftand the exiftence of a double refraction, and are utterly at a lofs to account for the phenomena occurring upon a fecond refraction, by another piece of the fpar, yet that the oblique refraction, when confidered alone, is nearly as well explained as any other optical phenomenon. Phil. Tranf. for 1801 and for 1802.

Refraction, *Particular laws of*, in different kinds of lenfes; fee Lens.

Refraction, *Atmofpherical*, is generally confidered under two diftinct heads; *viz.* aftronomical refraction, which is that relating to the refraction of the moon, ftars, and other celeftial bodies; and terreftrial refraction, or that which takes place in terreftrial obfervations.

It appears, from the article Refraction, that a ray of light is refracted in paffing obliquely out of one medium into another of different denfity; and as the atmofphere may be confidered as compofed of an infinitude of ftrata, whofe denfity increafe as they are pofited nearer the earth, the luminous rays which pafs through it are acted on as if they paffed fucceffively through media of increafing denfity, and are therefore inflected more and more towards the earth, as the denfity augments, that is, as they approach the eye of the obferver. In confequence of this it is, that rays from objects, whether celeftial or terreftrial, proceed in curves which are *concave* towards the earth; and fince the mind always refers the place of objects to the direction in which the rays reach the eye, that is, to the direction of the tangent to the curve at that point, it follows, that the apparent or obferved elevation of objects is always greater than the true one, at leaft with the exception of fome few remarkable anomalies which fometimes, in terreftrial obfervations, produce a contrary effect, and of which we have ftated a few particular inftances under the article Mirage, and on which fubject fome other curious facts are recorded in a memoir of profeffor Vince's, in the Phil. Tranf.; in Nicholfon's Philofophical Journal, 4to.; and more particularly by M. Monge, in vol. i. of the "Decade Egyptienne." Referring the reader therefore to thofe works, to which we ought alfo to add the memoir by M. Biot, in vol. x. of the National Inftitute, for an account and explanation of thofe phenomena, we fhall confine our prefent obfervations to thofe cafes only, in which an uniform law is fuppofed to have place, and which, as we have feen, has a conftant tendency to augment the obferved altitude of both terreftrial and celeftial objects.

objects. In order to submit the phenomena of refraction to strict mathematical investigation, it must be observed that, in consequence of the inconsiderable height of the atmosphere, and its spherical form, a luminous ray impinging upon it, even in the most unfavourable case, that is directly in the horizon, traverses only a small quantity of this medium; and in this space, if the atmosphere is calm, the density of the air at equal heights above the level of the sea is every where the same. Therefore, in supposing the earth spherical, a supposition which may be admitted, in the present case, without any sensible error, we may consider the atmosphere as composed of successive spherical concentric shells, or strata, of which the density diminishes from the surface of the earth upwards.

Let us conceive, now, a luminous ray, coming from a distance, to penetrate into one of the supposed spherical shells; then, if through the common centre of these shells, which is the same as the centre of the earth, we suppose a plane to pass in the direction of the luminous ray, the spherical beds of the atmosphere will be found divided into two equal portions, which acting equally upon the ray, can produce no deviation of it from that plane; whence it follows, that the effect of refraction is entirely produced in a vertical direction, and in such a manner as to augment the apparent altitudes of the heavenly bodies, and consequently to diminish their zenith distances.

But the intensity of these effects will not be the same at all heights, for we know that in all cases the quantity of refraction depends upon the obliquity of incidence, and therefore the refraction in the zenith is equal to zero, and increases from that point to the horizon, where it is the greatest.

If, now, we knew the law by which the density of the air is diminished in ascending from the earth, that is, if we knew the difference in the density of any two consecutive strata, it would be comparatively a direct and easy problem to find the whole amount of refraction for any given angle of observation; but unfortunately the uniformity of decrease in the density of the atmosphere, which, according to theory, is in geometrical progression, is so much interrupted by the multitude of causes which may tend to produce this effect, that it is found that the quantity of refraction computed on this principle, will by no means agree with that deduced from actual observation. It has been, however, demonstrated, that the quantity of refraction, in all cases exceeding 10 or 12 degrees of elevation, is not sensibly affected by any irregularity in the law of density, in the strata of which we have supposed the atmosphere to be composed, but that it depends simply upon its pressure and temperature at the time and place of observation, which are indicated at the time by the barometer and thermometer. It was formerly thought, also, that refraction was influenced by the degree of humidity and dryness of the air; but from a great variety of interesting and accurate experiments, carried on by M. M. Biot and Arrago, it appears indisputably established, that no sensible effect is thence produced. See a memoir on this subject by the former author, in vol. x. of the National Institute.

But before we proceed farther on this interesting subject, it will be proper to give a sketch of the several improvements which the theory has experienced in the hands of different celebrated astronomers; in doing which we shall avail ourselves of a memoir, published by Dr. T. S. Evans in the Philosophical Magazine, which contains a minute and circumstantial detail of many important particulars connected with this subject. There appears to be but little doubt that the astronomic refraction was known to the ancients, since it is expressly mentioned by Ptolemy, although not made use of in his calculations. He says, near the end of the 8th book of the Almagest, that in the rising and setting of the heavenly bodies, there are changes which depend upon the atmosphere, and he mentions it more at length in a work on optics, which, unfortunately, has not been handed down to us. Alhazen, an Arabian writer, who is generally supposed to have lived about the year 1100, and to have taken the greater part of his optics from the works of Ptolemy, speaks also decidedly of it, and shews the manner of convincing ourselves of it by experiment. "Take," says he, "an armillary, which turns round its poles, and measure the distance of a star from the pole of the world when it passes near the zenith in the meridian, and when it is rising or setting near the horizon, and you will find the distance from the pole less in the latter case." He then demonstrates that this must arise from refraction, but he does not state its quantity.

In the collection of observations made by Bernard Walter, and published by Willebrode Snell in 1618, it is stated, that the observations were so exact, that they pointed out to Walter the quantities by which the altitudes of the stars and planets were increased on account of the refraction.

Tycho Brahe, however, appears to be the first who asserted, with any degree of accuracy, that the refraction elevates the heavenly bodies rather more than half a degree when on the horizon. (See Progymn. p. 15.) But either his instruments or his observations were not sufficiently correct to determine it with certainty for all degrees from the zenith to the horizon; and, accordingly, where these failed, the rest were supplied by conjecture. He believed that the sun's refraction was 34′ in the horizon, and that it became insensible at 45° of altitude. For the stars, however, he assumed an entirely different quantity, *viz.* 30′ in the horizon; but this, according to him, terminated at only 20° of altitude.

The following is the manner in which it is related (Ency. Method.) that Tycho made this discovery. He had determined, with one or two instruments extremely well made, the latitude of the place by observations of Polaris above and below the pole. He determined it also by the sun's altitude in both solstices, and found it four minutes less in the latter. At first he doubted the goodness of his instruments, and therefore constructed, with the utmost care, as many as ten others, of different sizes and forms, but they all gave nearly the same results. He could, therefore, no longer attribute this difference in the two determinations of the latitude to any defect in the observations, but endeavoured, by an attentive consideration of the subject, to find out the cause of this singular phenomenon. At length he supposed it could only arise from the refraction which elevated the sun at the winter solstice, having then only 11° of elevation above the horizon. This result agreed very well with the principles of optics; but still Tycho Brahe could scarcely persuade himself that the refraction was sufficiently large to produce so great a difference. On this account, he made other instruments of ten feet diameter, whose axes corresponded exactly with the pole of the world, and with these he measured the declination of the stars out of the meridian. He then found, that even in summer the refraction, although insensible at the meridian altitude of the sun, was very considerable near the horizon, and amounted to half a degree in the horizon. See Progymn. p. 79—104. Street's Astr. Carol. p. 119.

Tycho

Tycho Brahe's table of refraction is as follows:

Alt.	Refraction.	Alt.	Refraction.
0°	30′ 0″	°	′ ″
1	21 30	11	5 00
2	15 30	12	4 30
3	12 30	13	4 00
4	11 00	14	3 30
5	10 00	15	3 00
6	9 00	16	2 30
7	8 15	17	2 00
8	6 45	18	1 15
9	6 00	19	0 30
10	5 30	20	0 00

In this ftate the refraction remained for many years. Even Riccioli, in 1665, fuppofed it nothing at about 26° of altitude; but he thought the moon had only 29′ of horizontal refraction in fummer, the fun 30′, and the ftars 30′ 37″. It was not till after the year 1672, that a tolerably near table of refraction made its appearance, when the elder Caffini took the fubject into confideration. (Mem. de l'Acad. tom. v. p. 81.) What led to this was the voyage of Richer to Cayenne in that year, upon the utility of which fome very excellent remarks were made by Caffini, fhewing how far obfervations made in a fituation fo near the equator tended to confirm or difprove certain theories derived from obfervations made in Europe. Several very ufeful deductions were drawn from a comparifon of thofe made both at Paris and Cayenne; among others, the refraction was fettled upon more accurate elements than heretofore, and a new table computed, for the firft time, of its quantity, for all degrees, up to the zenith; an abridgment of which is given below:

Alt.	Refraction.	Alt.	Refraction.
0°	32′ 20″	°	′ ″
1	27 56	30	1 42
2	21 04	40	1 10
3	16 06	45	0 59
4	12 48	50	0 50
5	10 32	60	0 34
10	5 28	70	0 21
15	3 36	80	0 10
20	2 39		

From the relation of his grandfon it appears, however, that Caffini had at one time computed three tables of refraction for all altitudes; one for winter, another for fummer, and a third for fpring and autumn; but feveral doubts having been fuggefted to him refpecting this arrangement, although in appearance conformable to nature, and principally the obfervations of Richer at Cayenne, where the refraction was found little different from that at Paris, he changed his opinion; and judging, that fince the great difference of heat of the torrid zone from that of the temperate zone, which we inhabit, does not caufe fenfible differences in the refraction; therefore the greateft heat or cold of our climate could not change it much; and he then fixed upon one table, which was that ufed by the aftronomers of the Royal Obfervatory of Paris up to the year 1745.

It was always thought, before the time of Caffini, that the refraction did not extend its influence higher than 45° of altitude: and he is generally confidered as the firft who proved that it reached all the way to the zenith. He alfo fuppofed that near the equator the horizontal refraction was lefs than in our climate by about one-third; that this difference decreafed as far up as 60°, after which it was the fame nearly for both climates.

From this difcovery it followed, as a natural confequence, that the refraction muft be greater near the pole than at Paris: and this was fhortly afterwards proved to the Academy by the publication of a work exprefsly on that fubject. (Refractio folis inoccidui, &c. Holmiæ, 4to. 1695.) The king of Sweden, being, in 1694, at Tornea, in Weft Bothnia, near the latitude of 65° 45′, and obferving that the fun did not fet there in the fummer folftice, fent the following year fome mathematicians to make more certain and exact obfervations of this curious phenomenon. They are contained in this book, and Meffrs. Caffini and De la Hire concluded from them, that in the latitude of 65° 45′ the horizontal refraction muft be 58′, or nearly double of that at Paris.

According to an obfervation made by fome Dutchmen who paffed the winter of 1596—7, in Nova Zembla, in latitude 76° north, the fun, which had entirely difappeared the 14th of November, began to rife again the 24th of January, *viz.* fix days fooner than was expected, according to aftronomical calculations. If fo, when the fun has been two or three months under the horizon, as the Dutchmen obferved in 1597, the cold becomes dreadful, and perhaps the refraction increafes prodigioufly. M. le Monnier affures us, that he found by the obfervations printed in 1599, that on the 24th and 27th of January 1597, there were more than $4\frac{1}{2}$ degrees of refraction: that he could neither explain thefe obfervations, reject them as doubtful, nor fuppofe any error, as was done by moft of the other aftronomers, Kepler, Caffini, Scoto, and, laftly, M. le Gentil, in his Voy. dans les Mers des Indes, tom. i. p. 395. tom. ii. p. 832, who maintained that there were errors in the obfervations, and accordingly read a memoir on the fubject. If it were not fo difficult a tafk to winter in thefe high latitudes, we might expect fuch obfervations as would remove all doubt on the fubject; and, perhaps, bring others to light of as great or greater importance.

The refraction of the north being fo confiderable, is very ufeful to the inhabitants, who are deprived of the fun's light during many months; as it makes the fun rife much earlier, and fet much later to them, than it otherwife would.

About the year 1725, Mr. Flamfteed, the Englifh aftronomer royal, publifhed his table computed from his own obfervations: and this was the one commonly ufed in England for many years afterwards.

Sir Ifaac Newton alfo conftructed one from theory, which was firft publifhed by Dr. Halley in the Philofophical Tranfactions, N° 368, for 1721. He made the horizontal refraction 33′ 45″; whereas Mr. Flamfteed's was only 33′ 0″.

But although the refraction might be determined within a few feconds at all altitudes by obfervation; yet, the law of its increafe from the zenith to the horizon was a fubject that occupied the principal mathematicians and aftronomers for more than a century. Newton having difcovered the general principles of attraction, found that the refraction was a confequence of this law of nature; and that it arofe from the attraction of the atmofphere on the particles of light. On this principle the curve which a ray of light defcribes might be determined; fince it is fucceffively attracted

tracted by different layers of the atmofphere, increafing in denfity as they approach the earth, and, confequently, bending the ray more and more from the right line which it defcribed in the vacuum previous to its reaching the atmofphere. There are many authors who have endeavoured to find from theory the curve defcribed by this ray in its courfe, by the affumption of various hypothefes; but perfection, and our attempts to arrive at it, as is well obferved by the elder Caffini in difcourfing on this fubject, are like the progrefs of certain curves and their afymptotes. The principal of thefe writers on the fubject are Bernouilli (Hydrodyn. 1738, p. 221.); Bofcovich (Oper. tom. ii.); Bouguer (Prix de 1729. Memoires, 1739, p. 407; 1749, p. 75.); Caffini (Epift. ad Montanari, 1665. Refrafflioni è Parallaffe, &c. 1671. Mem. for 1714, and his Aftr. vol. i. p. 11. Paris, 1740, in 2 vols. 4to.); Defcartes (Dioptrique, 4to. Paris, 1637); De la Grange (Nouveaux Mémoires de Berlin, vol. iii.); Euler (Mem. de Berlin, 1754, tom. x.); Gregory (Aftronomy, vol. i. p. 358. edit. of 1715, in 8vo.); Hodgfon (Mathematics, vol. i. p. 367. Fluxions, p. 133.); Huygens (Traité de la Lumiere, p. 44. Dioptrica, 4to. 1703); Kramp (Analyfe des Refract. Aftr. et Terres, 4to. Strafburg, 1799); Lambert (Les Proprietés Remarquables de la Route de la Lumiere. A la Haye, 1759. Another edition in German, 1773); La Place (Mécanique Célefte, vol. iv. p. 231.); Mayer (Tables, 1770); Newton (Principia, b. i. fect. 14.); Oriani (Ephem. de Milan. 1788); Thomas Simpfon (Mathematical Differtations, 1743); Brook Taylor (Methodus Incrementorum, 4to. Lond. 1715. Propof. 27. p. 108.); Heinfius (Differtatio de Computo refractionum Aftron. 4to. Leipfig, 1749); Tobias Mayer (De Refractionibus Aftronomicis, 4to. Altorf. 1781); La Hire (Mem. de l'Acad. pour 1702, p. 52.); d'Alembert (Opufcules Mathématiques, tom. viii. p. 297.)

It was conjectured by many of the early writers, that the refraction was fubject to variations depending upon the weather: but it then amounted to little more than a conjecture, on account of the indifferent manner in which aftronomic inftruments were divided. Picard found by meridian altitudes of the fun in 1669, that it was greater in winter than in fummer. He found alfo that it was lefs by day than by night. In the obfervations given at the end of his journey to Uraniburg, to fettle the latitude of that place, and its difference of longitude from Paris, for the purpofe of comparing the obfervations of Tycho Brahe with thofe made at the Royal Obfervatory of Paris, he found the horizontal refraction for the firft limb of the fun that made its appearance above the horizon there 33′ 2″, and for the fecond 32′ 37″. So that in the fmall interval of time that the fun was in rifing, the refraction was diminifhed 25 feconds by the warmth arifing from the fun's prefence.

A quadrant being alfo directed by him from the top of Mount Valerian towards the fummit of the church of Notre Dame at Paris, he found the depreffion 20′; but the fun had fcarcely rifen, when it was increafed to 22′; exhalations being raifed by the fun's prefence, and the medium between Paris and Mount Valerian become more equal; whereas, before the fun rofe, the air of Paris was more denfe than that of Mount Valerian.

The denfity of the atmofphere being the immediate caufe of the refraction, it was very natural to fuppofe that it muft decreafe as this denfity became lefs; whether by caufes which diminifhed its weight, or by the expanfion produced by heat: and, indeed, aftronomers were not long after this, before they difcovered that very fenfible differences were occafioned by thefe circumftances.

But all the honour of introducing corrections on account of the variation of denfity in the atmofphere, as indicated by the barometer and thermometer, is due to Meffrs. Lowthorpe and Haukfbee; the former of whom, in 1698, proved by a very fimple experiment, in the prefence of the Royal Society, that the refractive power of air is directly proportional to its denfity: and the latter, by repeating and extending the fame courfe of experiments in the year 1708, with the machinery pointed out by the former, found that the variations of refraction, depending on the barometer, are proportional to the alteration of height of the mercury in the tube: and by a feries of thefe experiments, he furnifhed us with a table of the corrections which it is neceffary to make on account of the changes of heat indicated by the thermometer. Thefe experiments, although not quite conclufive on the fubject, were yet made with as much accuracy and care as the nature of the machinery, and the ftate of experimental philofophy of that time, would admit. An example is alfo given, towards the end of his paper, on the mode of applying them to correct the refraction. By thefe, Haukfbee found that a volume of air expreffed by unity, when the thermometer was at 180° above zero, became, at 50° below, one-eighth more denfe: or, which is the fame thing, that the air loft one-eighth of its denfity, for an elevation of 180° of Fahrenheit's thermometer; which is exactly the difference of heat between melting ice and boiling water. But although this one-eighth, as will be fhewn hereafter, was too fmall; yet it laid the foundation for other experiments, fince made by feveral philofophers, by which the quantity of expanfion has been determined more accurately.

We have already fhewn that the refraction near the pole is greater than in our climate; the degree of cold being more intenfe. It was alfo found to be lefs in the torrid zone, where the heat is greater than in Europe. Bouguer made a variety of obfervations at Peru, the refult of which he has given us. In 1740, he came down into an ifland fituated in the river of Emeralds, called ifle of Inca, where he determined the refraction from 1° to 7° of altitude; and the table which he afterwards computed fhews the refraction to be about one-feventh lefs than in Europe. The horizontal refraction he found to be 27′: but at 6° of altitude it is 7′ 4″; and at 45°, it is 44″. Bouguer then gives a table for Quito, which is more elevated above the level of the fea. M. le Gentil found it greater at Pondicherry in India, although in the torrid zone.

The refraction diminifhes when we are elevated above the level of the fea. Bouguer obferved the quantity of it at Chimboraço, 2388 toifes above the level of the fea, and found it in the horizon only $19\frac{3}{4}$′. At the crofs of Pitchinca, 2044 toifes above the fea, he found it 20′ 48″; at Quito, 1479 toifes above the fea, 22′ 50″: but at the level of the fea 27′. Thefe obfervations, when joined with the theory, produced the following rule; *viz.* if we take the excefs of 5158 toifes above the elevation of the place, with regard to the level of the fea, the refraction will be as the fquare root of this excefs. Thus the fquare root of 5158 toifes is 27′, for the horizontal refraction, at the level of the fea, in the torrid zone: and the fquare root of the excefs of 5158 above the elevation of the place will be its horizontal refraction. The quantity 5158 is the height above which the refractive matter no longer produces any fenfible effect, at leaft in the torrid zone.

But although by this time confiderable attention had been paid to the fubject, yet great differences were to be found in the tables then moft in ufe. Thus at the altitude of 30°, according to Flamfteed, the refraction was 1′ 23″; Newton, 1′ 30″; Caffini, 1′ 42″; and de la Hire, 1′ 55″; leaving an uncertainty of more than half a minute: and it muft have been very mortifying to an obferver, after having taken the utmoft utmost pains to avoid errors of two or three feconds, to find his reduced obfervations liable to fo great an error, according to the choice of his table of refraction.

It is indeed rather extraordinary, that in a memoir publifhed by Caffini de Thury, among thofe of the Academy for 1745, he attempted to reconcile a number of obfervations with each other, by confidering the ftate of the thermometer only, without at all noticing that of the barometer; although at that time Haukfbee's experiments had been publifhed about 37 years.

He concludes his paper, as is very natural to fuppofe, without being able to make the obfervations agree: nor does it clearly appear that the French noticed the abovementioned experiments made by Haukfbee till about the year 1749. It is alfo worthy of remark, that although the neceffity of introducing corrections on account of the alterations of the barometer and thermometer were likewife fhewn to be abfolutely neceffary by Dr. Halley (Phil. Tranf. N° 364), and the circumftance mentioned, and in fome degree admitted by Le Monnier (Hift. Celeft.), yet it does not appear that he followed the advice of his illuftrious contemporary, but merely endeavoured, as Caffini did, to reconcile his obfervations with the ftate of the thermometer at the time of making thefe obfervations, without taking the barometer into account.

It would be endlefs to notice the different opinions refpecting both the terreftrial and the aftronomic refraction which are to be met with in the writings of various authors on the fubject: and it would be equally ufelefs to notice all the tables of its quantity given by them, fome of which differ very much from others. It will be fufficient to mention thofe only who made fome confiderable advances towards obtaining it with greater accuracy.

The next of thefe in order was La Caille (Mem. de l'Ac. de Sc. 1755, p. 547.), who in determining it certainly beftowed very great pains, by making and reducing an immenfe number of obfervations, and afterwards comparing them with others made at Greenwich by Dr. Bradley, at Gottingen by Mayer, at Bologna by Zanotti, and by La Lande, who was then at Berlin. From thefe it appeared that the refraction at 45° of altitude was $1' \, 6\frac{1}{2}''$; but this, as will hereafter be feen, was too great by fome feconds. In his paper on the fubject, which is divided into four parts, he proves, firft, that the mean refractions are very nearly the fame for the fame apparent altitudes throughout the whole extent of the temperate zone; fince thofe which were obferved at Paris did not exceed thofe obferved at the Cape of Good Hope but by $\frac{1}{40}$ at moft. In the fecond he determines the abfolute quantity of the mean refraction for the apparent height of the pole at Paris, and gives the refult of his obfervations with regard to the latitude of Paris and of the Cape of Good Hope. In the third he gives his table of mean refraction, and another of corrections depending upon the ftate of the barometer and thermometer; concluding with fome reflections on its conftruction and ufe. In the fourth he compares his new table with the moft celebrated of thofe that had before that time been in ufe among aftronomers; and he then fhews how it agrees with the obfervations of Bradley, Zanotti, and Mayer.

But by La Caille's memoir it appears, that previous to this time M. Mayer had formed and communicated to him a table of aftronomic refractions which he computed by means of an algebraic formula, the co-efficients of which he deduced from his own obfervations, and took into account the variations relative to thofe of the barometer and thermometer. He found the alteration of refraction for a depreffion of 15 lines in the barometer, the fame as for a rife of 10° in the thermometer, and the variation for each degree of the latter, according to his table, $\frac{1}{71}$ of the whole mean refraction, which he adapted for 28 inches of the barometer, and 0° of the thermometer. This proportion takes place down to 80° of zenith diftance. Mayer confidered alfo that the mean refraction is the fame for all parts of the earth; and that the only variation which takes place depends on the changes of the weight and temperature of the atmofphere.

La Caille, in comparing Mayer's table with obfervations, found that his correction for the thermometer was a little over-rated; and accordingly, for his new table, altered it to $\frac{1}{77}$ for each degree. And here it may be obferved that La Caille did not correct his altitudes above 36 at Paris, and 30° at the Cape; firft, becaufe he only noted the barometer and thermometer in the night, when he obferved ftars below 30° of altitude. Secondly, becaufe, that at 36° of altitude, where the mean refraction is about $1\frac{1}{2}$ minute, the variation which belongs to 10° of the thermometer only amounts to $3\frac{1}{2}$ feconds; a quantity about equal to the limits of the errors of obfervations made with an inftrument of fix feet.

The formula given by Euler (Mem. de l'Ac. de Berlin, 1754, p. 131.), appeared alfo about this time. It took into account the variation of the refraction depending upon the thermometer and barometer, but was certainly too complicated to be generally adopted. He fhews, however, that in very different hypothefes the refraction will be fufficiently exact, if taken in the inverfe ratio of the degrees of heat, when the ftar or planet is not too near the horizon, but the precife quantity of this ratio was unknown to him.

In this ftate the refraction ftood when Dr. Bradley took the fubject into confideration, and began to find its quantity from his own obfervations. The rule which he adopted, although a very elegant one, he neither lived to complete nor to prefent to the world; but it was publifhed after his death by Dr. Mafkelyne, (Pref. to 1ft vol. of Obf. 1765. Phil. Tranf. 1764 and 1787, p. 157. Req. Tables, &c.), and has commonly been ufed in England up to the prefent time. He found the mean refraction at 45° of altitude 57″, and, that at all other altitudes, it was equal to 57″ multiplied by the tangent of the zenith diftance, diminifhed by three times the refraction. Then fuppofing the mean ftate of the atmofphere to be at 29.6 inches of the barometer, and 50° of Fahrenheit's thermometer, he made the true or corrected refraction equal to $57'' \times t, (\text{Z. D.} - 3r) \times \frac{\text{barom.}}{29.6} \times \frac{400}{350 + \text{ther.}}$, where it is to be underftood that the mafs of air is fuppofed to increafe in bulk $\frac{1}{400}$ for each degree of Fahrenheit's fcale.

A variety of experiments has been made at various times to afcertain the increafe in bulk of a quantity of air reprefented by unity for a certain number of degrees of rife of the thermometer. The following is a lift of fome of them:

	for 1°
M. Bonne	1.00 25777
Bradley	1.00 25000
Dalton	1.00 20701
De Luc	1.00 20888
Fahrenheit	1.00 25777
Gay Luffac	1.00 20868
Groombridge	1.00 21000
Haukfbee	1.00 06933
La Caille	1.00 22222
Mayer	1.00 20444
Shuckburg	1.00 22222
Mean of all except Haukfbee's	1.00 22490

The

The refraction deduced from Bradley's very neat and fimple formula was, in a few years, adopted by nearly all the aftronomers of eminence throughout Europe. The extreme facility with which it might be computed, and the corrections applied, whether from the formula itfelf, or from tables ready calculated for that purpofe, was a powerful recommendation in its favour; but its near agreement with obfervation foon eftablifhed it.

We muft now, without entering farther into detail of minor improvements, proceed at once to the chapter given by La Place on this fubject, in his "Mecanique Celefte," vol. iv. p. 231, where he has drawn, from an inveftigation which we cannot undertake to exhibit in this place, the following general formula, for expreffing the refraction for all angles of elevation above 12 decimal, or 10.8 fexagefimal degrees, *viz.*

$$r = \frac{a p \,.\, \text{tan.}\, z}{0.76\,(1 + t \,.\, 0.00375)} - \frac{a p}{0.76} \,.\, 0.00125254\, \frac{\text{tan.}\, z}{\text{cof.}^2\, z}$$
$$+ \frac{\frac{1}{2} a^2\, \text{fin.}\, 1''\, p^2}{[0.76(1 + t \,.\, 0.00375)]^2} \times \frac{(1 + 2\, \text{cof.}^2\, z)\, \text{tan.}\, z}{\text{cof.}^2\, z};$$

where all the quantities are known except r and a; which latter reprefents a conftant co-efficient; *viz.* z is the obferved zenith diftance under the barometric preffure p, in metres, and t the temperature of the centigrade thermometer, r being the refraction: all, therefore, that is required for determining r, is the value of the unknown coefficient a; which is to be drawn from obfervations on the circumpolar ftars, in the following manner.

Let Z be the diftance of one of thefe ftars from the zenith, in its fuperior meridian paffage; Z′, this diftance at the inferior meridian paffage, obferved from the fame point of the terreftrial furface; r and r', the correfponding refractions. Now all the other quantities, except a, being known, we may, for the fake of fimplicity, put the above formula for both paffages under this form,

$$r = \mathrm{A}\,a + \mathrm{B}\,a^2,\quad r' = \mathrm{A}'a + \mathrm{B}'a^2;$$

where A, B, A′, B′, are all known quantities. Writing alfo Z, Z′, for the obferved zenith diftances, the true zenith diftance, D, corrected for refraction, will be

$$\mathrm{Z} + \mathrm{A}\,a + \mathrm{B}\,a^2, \text{ and } \mathrm{Z}' + \mathrm{A}'a + \mathrm{B}'a^2,$$

which are, therefore, now equal to each other; confequently, by addition, we have

$$\mathrm{Z} + \mathrm{Z}' + (\mathrm{A} + \mathrm{A}')\,a + (\mathrm{B} + \mathrm{B}')\,a^2 = 2\,\mathrm{D};$$

in which all the quantities are known, except a and D. But by repeating fimilar obfervations on fome other ftar, and denoting by Z″, Z‴, A″, A‴, B″, and B‴, the fimilar quantities before reprefented by Z, Z′, A, A′, &c. alfo a and D remaining the fame for all ftars obferved in the fame place, we fhall have thefe two equations:

$$\mathrm{Z} + \mathrm{Z}' + (\mathrm{A} + \mathrm{A}')\,a + (\mathrm{B} + \mathrm{B}')\,a^2 = 2\,\mathrm{D},$$
$$\mathrm{Z}'' + \mathrm{Z}''' + (\mathrm{A}'' + \mathrm{A}''')\,a + (\mathrm{B}'' + \mathrm{B}''')\,a^2 = 2\,\mathrm{D};$$

from which it is obvious, the conftant co-efficient a may be obtained by the ufual methods of elimination.

In the above operation, however, we have fuppofed the polar diftances of the fame ftar to be the fame for its fuperior and inferior paffage; whereas we know that, in confequence of the effect of preceffion, nutation, and aberration, this diftance is conftantly varying; and we ought, therefore, to introduce thefe variations into the above equation. But our object being merely to give a general view of the principles made ufe of for the determination of the co-efficient a, we have not thought it neceffary to enter fo ftrictly into the minutia of the computation. It appears from the above, that the conftant co-efficient a may be determined by means of four obfervations on two different circumpolar ftars; and confequently, that every fuch fet of obfervations ought to produce the fame refult, or the fame value of a. Confidering, however, the extreme accuracy required in fuch cafes, both in the inftruments and the application of them, fome little difagreement is to be expected; and indeed one is furprifed to fee it fo fmall, as it has been found to be in various obfervations undertaken for this purpofe, and the mean of which we have every reafon to confider as perfectly correct; and which is ftated by M. Biot, who has interefted himfelf very much on this fubject, at 187″.24 for the decimal divifion, or 60″.666 for the fexagefimal.

But now, in order to fimplify our firft formula, by taking $p = 0.76$ metres, and $t = 0$, this may be put under the form,

$$r = a\, \text{tan.}\, \mathrm{Z}\, \left(1 - \frac{0.00125254}{\text{cof.}^2\, z}\right) + \tfrac{1}{2} a^2\, \text{fin.}\, 1''\, \frac{1 + 2\, \text{cof.}^2\, z}{\text{cof.}^2\, z}$$
$$\text{tan.}\, \mathrm{Z};$$

in which, fubftituting for cof.$^2 z$, its value $\frac{1}{1 + \text{tan.}^2 z}$, and the proper numerical value of a, as above found, as alfo of fin. 1″, the whole is reduced to the following form, *viz.*

$$r = 0.99918761 \,.\, a\, \text{tan.}\, \mathrm{Z} - 0.001105823 \,.\, a\, \text{tan.}^3\, \mathrm{Z};$$

which latter form M. Biot has fhewn to be equivalent to

$$r = 187''.24 \,.\, \text{tan.}\, (\mathrm{Z} - 3.25\, r) \text{ for the decimal divifion;}$$
$$r = 60''.666 \,.\, \text{tan.}\, (\mathrm{Z} - 3.25\, r) \text{ for the fexagefimal divifion.}$$

But the reduction of it to this form would occupy more fpace than can be allowed for this article. This laft form is as fimple as can be defired, from which the following rule in words may be deduced, *viz.* *The refraction under the fame barometric preffure, and the fame degree of temperature, is proportional to the tangent of the apparent zenith diftance of the ftar, diminifhed by* $3\frac{1}{4}$ *times the refraction.*

It muft be remarked, however, that the formula $r = \mathrm{A}$ tan. $(\mathrm{Z} - 3.25\, r)$, though it exhibits the law of refraction in as fimple a form as can be defired, is not well adapted for calculation, in confequence of r entering on both fides of the equation; and aftronomers have, therefore, given different methods of rendering the above formula more commodious. In order to which, it is firft put under the form,

$$\text{tan.}\, n r = \text{tan.}^2\, n\, \mathrm{R}\, \text{tan.}\, (\mathrm{Z} - n r);$$

R reprefenting the refraction, anfwering to Z = 90°. Let us now add fucceffively to both fides of this equation, the quantities + tan. $n r$ tan.$^2 n$ R − tan. $n r$ tan.$^2 n$ R, and we fhall have,

$$\text{tan.}\, nr\,(1 + \text{tan.}^2 n\,\mathrm{R}) = \text{tan.}^2 n\,\mathrm{R}\,[\text{tan.}\,(\mathrm{Z} - nr) + \text{tan.}\, nr],$$
$$\text{tan.}\, nr\,(1 - \text{tan.}^2 n\,\mathrm{R}) = \text{tan.}^2 n\,\mathrm{R}\,[\text{tan.}\,(\mathrm{Z} - nr) - \text{tan.}\, nr].$$

Now, dividing thefe equations, member by member, $n r$ will be eliminated, and we obtain

$$\frac{1 + \text{tan.}^2 n\,\mathrm{R}}{1 - \text{tan.}^2 n\,\mathrm{R}} = \frac{\text{tan.}\,(\mathrm{Z} - n r) + \text{tan.}\, n r}{\text{tan.}\,(\mathrm{Z} - n r) - \text{tan.}\, n r},$$

$$\text{or } \frac{1}{\text{cof.}\, 2\, n\, \mathrm{R}} = \frac{\text{fin.}\, \mathrm{Z}}{\text{fin.}\, (\mathrm{Z} - 2\, n\, \mathrm{R})};$$

whence we draw

$$\text{fin.}\, (\mathrm{Z} - 2\, n r) = \text{cof.}\, 2\, n\, \mathrm{R} \,.\, \text{fin.}\, \mathrm{Z}.$$

Now

Now Z and n R being known, we may compute the fecond fide of this equation; whence the arc Z — $2nr$ is known, and confequently $2nr$; which, divided by $2n$, will give r, as required. But it may be found ftill more fimply by the formula,

$$\tan.\ ur = \tan.\ n\,R\ \tan.\ \tfrac{1}{2}\,n;$$

tan. n being found by means of the auxiliary equation,

$$\tan.\ u = \sin.^2\ n\,R\ .\ \tan.\ Z.$$

On the principle above explained, the following table of refractions has been computed, agreeing with the temperature of + 14° on the centigrade thermometer, and under a preffure of 0.76 metres of the barometer; which is the fame as 57°.2 Fahrenheit, and 29.922 Englifh inches. And for any other temperature and preffure, the correfponding corrections muft be made as indicated in Tables II. and III.; which tables are computed by means of the general formula given in the preceding part of this article.

We had intended to give here a fhort abftract of a very interefting paper on this fubject, publifhed by Mr. Groombridge, in the Philofophical Tranfactions for 1810; but having already exceeded our ufual limits, we can only refer the reader to the volume itfelf, where he will find feveral neat and ufeful formulæ.

Having thus given a fketch of the method of determining the quantity of aftronomical refraction for all angles of elevation, and under various degrees of temperature and barometric preffure, let us add a few words on the fubject of terreftrial or horizontal refraction; for the determination of which, the following method has been fuccefsfully practifed in the Englifh Trigonometrical Survey.

Let A, A′, (*Plate* XIX. *Aftronomy*, *fig.* 11.) be two elevated places on the furface of the earth; B D, the intercepted arc of the earth's furface; C, the centre of the earth; A H′, A′ H, the horizontal lines at A, A′, produced to meet the oppofite vertical lines C H′, C H. Let a, a', reprefent the apparent places of the objects A, A′; then is a' A A′ the refraction obferved at A, and a A′ A the refraction obferved at A′; and half the fum of thefe angles will be the horizontal refraction, if we affume it equal at each ftation.

Now an inftrument being placed at each of thefe ftations A, A′, the reciprocal obfervations are made at the fame inftant of time, which is determined by means of fignals or watches previoufly regulated for that purpofe; that is, the obferver at A takes the apparent depreffion of A′, at the fame moment that the other obferver takes the apparent depreffion of A. Then, in the quadrilateral A C A′ I, the two angles A, A′, are right angles, and confequently the angles I and C are together equal to two right angles; but the three angles of the triangle I A A′, are together equal to two right angles; and confequently the angles A and A′ are together equal to the angle C, which is meafured by the arc B D. If, therefore, the fum of the two depreffions H A′ a, H′ A a, be taken from the fum of the angles H A′ A, and H′ A A′, or, which is equivalent, from the angle C, (which is known, becaufe its meafure B D is known,) the remainder is the fum of the two refractions. Hence this rule, "take the fum of the two depreffions from the meafure of the intercepted terreftrial arc, half the remainder is the refraction." If, by reafon of the minutenefs of the contained arc B D, one of the objects, inftead of being depreffed below the tangent A H′, appears elevated, as fuppofe A to a'', then the fum of the angles a'' A A′, and a A′ A, will be greater than the fum I A A′ + I A′ A, or than C, by the angle of elevation a'' A A′; but if from the former fum there be taken the depreffion H A′ A, there will remain the fum of the two refractions, fo that in this cafe the rule becomes as follows: "Take the depreffion from the fum of the contained arc and elevation, and half the remainder is the refraction."

The quantity of this terreftrial refraction is eftimated by Dr. Mafkelyne at one-tenth of the diftance of the object obferved, expreffed in degrees of a great circle. Whence, if the diftance be 10,000 fathoms, its 10th part, 1000 fathoms, is the 60th part of a degree, or one minute, which, therefore, is the refraction in altitude of the object at that diftance. But Le Gendre is induced, by feveral experiments, to allow only one-fourteenth part of the diftance for the refraction in the altitude, fo that on the diftance of 10,000 fathoms, the 14th part of which is 714 fathoms, he allows only 44″ of terreftrial refraction, fo many being contained in 714 fathoms. (See his Memoir on the Trigonometrical Operations.) Again, Delambre makes the quantity of terreftrial refraction to be one-eleventh part of the arc of diftance. And the Englifh meafurers, from many very exact obfervations, determine the quantity of the medium refraction to be a twelfth part of the faid diftance. The mean of all thefe is about .085 of the intercepted arc, which is probably not very far from the truth: this quantity, however, it muft be obferved, is found to vary very confiderably with the different ftates of the weather and atmofphere, from one-feventh to one-eighteenth of the contained arc.

TABLE

TABLE I. Of Refraction.

Barometer 29.922 Inches = 0.76 Metre; Thermometer Centigrade, 14°; Fahrenheit's, 57°.2; Reaumur's, 11°.2.

Apparent altitude.	Refraction minus parallax of the ☉	Refraction of the stars.	Differences.	Apparent altitude.	Refract. minus parallax of the ☉	Refract. of the stars.	Differ.	Apparent altitude.	Refract. minus parallax of the ☉	Refract. of the stars.	Diff.	Apparent altitude.	Refract. minus parallax of the ☉	Refract. of the stars.	Diff.
° ′	′ ″	′ ″	″	° ′	′ ″	′ ″	″	°	′ ″	′ ″	″	°	′ ″	′ ″	″
0 0	33 7	33 16	110	6 0	8 13	8 22	11	21	2 20	2 28	7	56	0 34	0 39	1
10	31 17	31 25	103	10	8 2	8 11	11	22	2 13	2 21	7	57	0 33	0 37	1
20	29 33	29 42	96	20	7 51	7 59	11	23	2 6	2 14	6	58	0 31	0 36	1
30	27 57	28 6	88	30	7 40	7 48	11	24	2 0	2 8	5	59	0 30	0 35	1
40	26 29	26 38	82	40	7 29	7 38	10	25	1 55	2 3	6	60	0 29	0 33	1
50	25 7	25 15	76	50	7 19	7 28	10	26	1 49	1 57	5	61	0 28	0 32	1
1 0	23 50	23 59	70	7 0	7 9	7 18	9	27	1 44	1 52	4	62	0 26	0 31	1
10	22 40	22 49	65	10	7 0	7 9	9	28	1 40	1 48	4	63	0 25	0 29	1
20	21 35	21 44	61	20	6 51	7 0	9	29	1 36	1 43	4	64	0 24	0 28	1
30	20 34	20 43	56	30	6 43	6 51	8	30	1 32	1 39	4	65	0 23	0 27	1
40	19 38	19 47	53	40	6 35	6 44	8	31	1 28	1 35	4	66	0 22	0 26	1
50	18 45	18 54	48	50	6 27	6 36	7	32	1 24	1 32	3	67	0 21	0 24	1
2 0	17 57	18 6	45	8 0	6 20	6 28	7	33	1 21	1 28	3	68	0 20	0 23	1
10	17 12	17 20	43	10	6 13	6 21	7	34	1 18	1 25	3	69	0 19	0 22	1
20	16 29	16 38	39	20	6 5	6 14	7	35	1 15	1 22	3	70	0 18	0 21	1
30	15 50	15 59	37	30	5 58	6 7	6	36	1 12	1 19	3	71	0 17	0 20	1
40	15 13	15 22	35	40	5 52	6 1	6	37	1 9	1 16	3	72	0 16	0 19	1
50	14 39	14 47	32	50	5 46	5 54	6	38	1 6	1 13	2	73	0 15	0 18	1
3 0	14 6	14 15	30	9 0	5 39	5 48	6	39	1 4	1 11	2	74	0 14	0 17	1
10	13 36	13 45	29	10	5 33	5 42	6	40	1 2	1 8	2	75	0 13	0 15	1
20	13 7	13 16	27	20	5 28	5 36	6	41	0 59	1 6	2	76	0 12	0 14	1
30	12 41	12 49	25	30	5 22	5 31	5	42	0 57	1 4	2	77	0 11	0 13	1
40	12 15	12 24	24	40	5 17	5 25	5	43	0 55	1 2	2	78	0 10	0 12	1
50	11 51	12 0	22	50	5 12	5 20	5	44	0 53	0 59	2	79	0 10	0 11	1
4 0	11 29	11 38	22	10 0	5 6	5 15	28	45	0 51	0 57	2	80	0 9	0 10	1
10	11 7	11 16	20	11 0	4 39	4 47	23	46	0 49	0 55	1	81	0 8	0 9	1
20	10 47	10 56	19	12 0	4 15	4 24	20	47	0 48	0 54	2	82	0 7	0 8	1
30	10 28	10 37	18	13 0	3 55	4 4	18	48	0 46	0 52	2	83	0 6	0 7	1
40	10 10	10 19	17	14 0	3 38	3 46	15	49	0 44	0 50	1	84	0 5	0 6	1
50	9 53	10 2	16	15 0	3 23	3 31	14	50	0 43	0 48	2	85	0 4	0 5	1
5 0	9 37	9 45	15	16 0	3 9	3 18	12	51	0 41	0 46	1	86	0 3	0 4	1
10	9 21	9 30	15	17 0	2 57	3 6	11	52	0 39	0 45	1	87	0 3	0 3	1
20	9 6	9 15	14	18 0	2 47	2 55	10	53	0 38	0 43	1	88	0 2	0 2	1
30	8 52	9 1	14	19 0	2 37	2 45	9	54	0 37	0 42	2	89	0 1	0 1	1
40	8 38	8 47	13	20 0	2 28	2 36	8	55	0 35	0 40	1	90	0 0	0 0	
50	8 26	8 34	12	21 0	2 20	2 28		56	0 34	0 39					
6 0	8 13	8 22													

TABLE II. Of Corrections to the preceding Table of Refractions for different Degrees of Temperature. An Increase of Cold augments Refraction; therefore, the Correction is Additive for a Temperature less than 14° of the Centigrade, and Subtractive for those above it.

	Correction Additive.									Correction Subtractive.							
Centigrade Fahrenheit Reaumur	−2° 28.4 −1.6	0° 32 0°	+2° 35.6 +1.6	+4° 39.2 +3.2	+6° 42.8 +4.8	+8° 46.4 +6.4	+10° 50 +8	+12° 53.6 +9.6	+14° 57.2 +11.2	+16° 60.8 +12.8	+18° 64.4 +14.4	+20° 68 +16	+22° 71.6 +17.6	24° 75.2 +19.2	26° 78.8 +20.8	28° 82.4 22.4	30° 86 +24
Apparent Altitude.																	
°	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″
5	37	32	28	23	18	14	9	5	0	4	9	13	17	21	25	29	33
5½	35	30	26	21	17	13	8	4	0	4	8	12	16	20	23	27	31
6	32	28	24	20	16	12	8	4	0	4	7	11	14	18	22	25	28
7	28	24	21	17	14	10	7	3	0	3	6	10	13	16	19	22	25
8	25	22	18	15	12	9	6	3	0	3	6	9	11	14	17	21	22
9	22	19	16	14	11	8	5	3	0	3	5	8	10	13	15	17	20
10	20	17	15	12	16	7	5	3	0	2	5	7	9	11	14	16	18
12	17	15	12	10	8	6	4	2	0	2	4	6	8	10	11	13	15
14	14	13	11	9	7	5	4	2	0	2	3	5	7	8	10	11	13
16	13	11	9	8	6	5	3	2	0	1	3	4	6	7	9	10	11
18	11	10	8	7	5	4	3	1	0	1	3	4	5	6	8	9	10
20	10	9	7	6	5	4	2	1	0	1	2	3	5	6	7	8	9
25	8	7	6	5	4	3	2	1	0	1	2	3	4	5	5	6	7
30	6	6	5	4	3	2	2	1	0	1	2	2	3	4	4	5	6
40	4	4	3	3	2	2	1	1	0	1	1	2	2	3	3	3	4
50	3	3	2	2	2	1	1	0	0	0	1	1	1	2	2	2	3
60	2	2	2	1	1	1	1	0	0	0	1	1	1	1	1	2	2
70	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	1	1
80	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE III. Of Corrections to the Table of Refractions relative to the Weight of the Atmosphere. An Increase of Atmospheric Pressure augments Refraction; the Correction is Additive when the Barometer is more than 29.922 Inches, but Subtractive when less.

	Correction Additive.								Correction Subtractive.						
Metres. Inches.	0.795 31.301	0.790 31.104	0.785 30.907	0.780 30.710	0.775 30.159 30.513	0.770 30.080 30.316	0.765 30.119	0.760 29.922	0.755 29.725	0.750 29.528	0.745 29.331	0.740 29.134	0.735 28.937	0.730 28.740	0.725 28.543
Apparent Altitudes.															
°	″	″	″	″	″	″	″	″	″	″	″	″	″	″	″
5	27	23	19	16	12	8	4	0	4	8	12	16	20	24	27
5½	25	22	18	14	11	7	4	0	4	7	11	15	18	22	25
6	24	20	17	13	10	7	3	0	3	7	10	14	17	20	24
7	21	18	15	12	9	6	3	0	3	6	9	12	15	18	21
8	18	16	13	10	8	5	3	0	3	5	8	11	14	16	18
9	16	14	12	9	7	5	2	0	2	5	7	10	12	14	16
10	15	12	11	8	6	4	2	0	2	4	6	9	11	13	15
12	12	11	9	7	5	4	2	0	2	4	5	7	9	11	12
14	10	9	8	6	5	3	2	0	2	3	5	6	8	9	11
16	9	8	7	5	4	2	1	0	1	3	4	5	7	8	9
18	8	7	6	5	4	2	1	0	1	2	4	5	6	7	8
20	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7
25	6	5	4	3	3	2	1	0	1	2	2	3	4	5	6
30	5	4	3	3	2	1	1	0	1	1	2	3	3	4	5
40	3	3	2	2	1	1	1	0	0	1	1	2	2	3	3
50	2	2	2	1	1	1	0	0	0	1	1	1	2	2	2
60	2	1	1	1	1	1	0	0	0	0	1	1	1	1	2
70	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

To observe the Refraction of a Star, &c. 1. Observe the meridian altitude of a star near the zenith; whence the latitude of the place being known, the true declination of the star is easily had, the star being now void of any sensible refraction. 2. Observe the altitude of the same star in any other degree, and note the time by a pendulum. 3. For the given time of observation, from the declination of the star compute its true altitude.

This being thus found less than the altitude observed, subtract the one from the other; and the remainder is the refraction for that moment, in that degree.

Refraction *of Altitude*, is an arc of a vertical circle, by which the altitude of a star is increased by the refraction.

Refraction *of Declination*, is an arc of a circle of declination, by which the declination of a star is increased or diminished by the refraction.

Refraction *of Ascension and Descension*, is an arc of the equator, by which the ascension and descension of a star, whether right or oblique, is increased or diminished by means of the refraction.

Refraction *of Longitude*, is an arc of the ecliptic, by which the longitude of a star is increased or diminished by means of the refraction.

Refraction *of Latitude*, is an arc of a circle of latitude, by which the latitude of a star is increased or diminished by means of refraction.

Refraction, in *Commerce*, is a term sometimes used by merchants, where there has been an oversight in an account, to the prejudice of a person; who thereupon demands restitution of so much, added or omitted by mistake.

You must make me a refraction of five pounds forgot in your account. I will deduct or make you a refraction of 30*s*. charged inadvertently in my bill.

REFRACTORY, in *Chemistry*. See an explication of the term under Apyrous.

REFRAIN, Fr., in *Music*, the termination of every verse or stanza of a song, by the same words and the same melody. (See Burden.) The word, according to Menage (Dict. Etym.) is derived from the Spanish *refran*.

REFRAN, Span., a proverb; the burden of a song in that language, being usually sententious, and including some moral precept.

REFRANGIBLE, whatever is capable of being refracted. See Refrangibility.

REFRANGIBILITY *of Light*, the disposition of the rays to be refracted.

A greater or less refrangibility is a disposition to be more or less refracted, in passing at equal angles of incidence, into the same medium.

That the rays of light are differently refrangible, is the foundation of sir Isaac Newton's whole theory of light and colours. The truth of the principle, which was investigated and established by our great philosopher in the year 1616, will appear from the following experiments.

1. Let E G (*Plate* XIX. *Optics*, *fig.* 1.) represent the window-shutter of a dark room, and F a hole in it, through which the light is transmitted to the prism A B C, which refracts it towards P T, where it appears in an oblong form; its length being about five times greater than its breadth, and exhibiting the various colours of the rainbow. In *fig.* 2. *a g b* represents a second prism, which refracts the light back again to Q, where the image is round; whereas, without the interposition of this second prism, the light would have proceeded to P T, and, consequently, have been oblong, as before. In this experiment sir Isaac Newton took care that the plane *a g* was placed exactly parallel to B C, and also *b g* to A C, that the rays might be equally refracted, though in contrary ways, by both prisms. He also observed, that both prisms must be placed very near to one another; for if their distance be so great, that colours begin to appear in the light, before its incidence on the second prism, those colours will not be destroyed by the refraction of that prism.

2. Having placed one of two boards behind the prism at the window, so that the light might pass through a small hole made in it for the purpose, and fall on the other board at the distance of about twelve feet, a hole being made in it to admit the passage of the incident light, he then placed another prism behind the second board, so that the light which was transmitted through both the boards, might pass through that also, and be again refracted before it arrived at the wall. This being done, he took the first prism in his hand, and turned it about its axis so much, as to make the several parts of the image, cast on the second board, successively to pass through the hole in it, that he might observe to what places on the wall the second prism would refract them; and he saw, by the change of those places, that the light tending to that end of the image, towards which the refraction of the first prism was made, did, in the second prism, suffer a refraction considerably greater than the light which tended to the other end. The true cause, therefore, of the length of that image was discovered to be no other, than that light is not similar or homogeneal, but that it consists of rays, some of which are more refrangible than others; so that without any difference in their incidence on the same medium, some of them shall be more refracted than others; and therefore, that according to their particular degrees of refrangibility, they will be transmitted through the prism to different parts of the opposite wall.

To make this capital experiment, which sir Isaac Newton himself justly calls the *experimentum crucis*, let S F (*fig.* 3.) represent a ray of the sun, which, after passing through a hole in the window-shutter F, is received by the prism in A B C, close behind which is placed a board D E, with a hole in it at G, to admit any of the rays after they have been separated by the prism; then *d e* will represent the other board, placed at a considerable distance from the former, with a hole in it, *g*, to receive any part of the light transmitted through the other board. Behind this second board is placed another prism, *a b c*, through which different rays of light, falling upon it in the very same place, and with precisely the same angle of incidence, will be refracted higher or lower, on the opposite wall M N. This experiment was conducted with the utmost circumspection and accuracy; and it is observed, that neither the different magnitude of the hole in the window-shutter, nor the different thicknesses of the prism, at the place where the rays passed through it, nor the different inclinations of the prism to the horizon, nor the different matter of the prisms, made any sensible change in the length of the image.

3. In order farther to establish this famous hypothesis of the different refrangibility of the rays of light, he held a prism in a beam of the sun, which was transmitted into the room through a hole in the window-shutter, so that its axis might be perpendicular to that beam; and having turned the prism about its axis to make the image ascend and descend, and when it seemed to be stationary between these contrary motions, he fixed the prism so that the refractions of both sides might be equal to each other. In this situation he looked at the hole through the prism, and observed the length of its refracted image to be many times greater than its breadth: the most refracted part of it was violet, the least refracted red, the middle parts blue, green, and yellow, in order. The same thing happened when he removed the prism out

out of the ſun's light, and looked through it upon the hole ſhining by the light of the clouds beyond it.

4. Conſidering that if the image of the ſun ſhould be drawn into an oblong form, either by a dilatation of every ray, or by any other caſual inequality of the refractions, the ſame oblong image would, by a ſecond refraction, made ſideways, be drawn out as much in breadth, he placed a ſecond priſm immediately after the firſt, in an oblique poſition with reſpect to it, that it might again refract the light of the beam of the ſun's light, which came to it through the firſt priſm; ſo that in the firſt priſm, the beam would be refracted upwards, and in the ſecond ſideways. But he found that the breadth of the image was not increaſed by the refraction of the ſecond priſm, but only its upper part, which in the firſt priſm ſuffered the greateſt refraction, and appeared violet and blue, did again, in the ſecond priſm, ſuffer a greater refraction, than the lower part of it, which was red and yellow, and this without any dilatation of the breadth of the image. Thus let S (*fig.* 4.) repreſent the ſun, F the hole in the window, A B C the firſt priſm, and D H the ſecond. If Y repreſent the round image of the ſun, made by a direct beam of light, when the priſms are taken away, P T will be the oblong image of the ſun, made by the ſame beam paſſing through the firſt priſm only, and *p t* will be the image made by the croſs refractions of both priſms together. Sometimes he placed a third priſm after the ſecond, and ſometimes a fourth after the third; by all which the image might be often refracted ſideways, but the rays which were more refracted than the reſt in the firſt priſm, were alſo more refracted in all the others, and that without any dilatation of the image ſideways; and, therefore, thoſe rays, on account of their conſtancy of a greater refraction, he called the more refrangible ones. He obſerves, in order to render the meaning of this experiment more evident, that all the rays, which are equally refrangible, fall upon a circle anſwering to the ſun's diſc. Let, therefore, A G (*fig.* 5.) repreſent the circle which all the moſt refrangible rays, tranſmitted from the whole diſc of the ſun, would illuminate, and paint upon the oppoſite wall, if they were alone. Let E L be the circle which all the leaſt refrangible rays would, in like manner, illuminate, and paint, if they were alone, and let B H, C J, and D K, be the circles which ſo many intermediate kinds of rays would ſucceſſively paint upon the wall, if they were ſingly propagated from the ſun, the reſt being always intercepted, and conceive that there are other intermediate circles without number, which other innumerable intermediate kinds of rays would ſucceſſively paint upon the wall, if the ſun ſhould ſucceſſively emit every kind by itſelf. Now ſince the ſun emits rays of all theſe kinds at once, they muſt altogether illuminate and paint innumerable equal circles, of all which, being ranged according to their different degrees of refrangibility, the oblong image P T before deſcribed is compoſed.

Now if the ſun's circular image, Y, which is made by an unrefracted beam of light, was by any dilatation of the ſingle rays, or by any other irregularity in the refraction of the firſt priſm, converted into the oblong image P T, then ought every circle in the image to be in like manner drawn out into a ſimilar oblong figure, contrary to the reſult of this experiment.

He conſidered farther, that by the breadth of the hole through which the light enters into the dark chamber, there is a penumbra made in the circumference of the image Y, which is alſo viſible at the ſides of the oblong images P T and *p t*. He, therefore, placed at that hole a lens, or object-glaſs of a teleſcope, which might caſt the image of the ſun diſtinctly on Y, without any penumbra at all; and he found that the penumbra of the rectilinear ſides of the oblong images P T and *p t* was alſo thereby taken away, ſo that they were as diſtinctly defined as the circumference of the firſt image Y.

There are ſome other circumſtances attending this experiment, by which the concluſion drawn from it is made ſtill more plain and convincing.

Let the ſecond priſm, D H, (*fig.* 6.) be placed not immediately after the firſt, but at ſome diſtance from it, ſo that the light from the firſt priſm may fall upon it in the form of an oblong ſpectrum *q r*, parallel to this ſecond priſm, and may be refracted ſideways, to form the oblong image, *p t*, upon the wall, and it will be found that this image, *p t*, is inclined to the image P T, which the firſt priſm would have formed without the ſecond; the blue ends, P and *p*, being farther diſtant from one another than the red ones, T and *t*; and, conſequently, the rays which go to the blue end, *q*, of the image *q r*, and which, therefore, ſuffer the greateſt refraction in the firſt priſm, are again, in the ſecond priſm, more refracted than the reſt.

At two holes made near one another in his window-ſhutter, he placed two priſms, one at each, which might caſt upon the oppoſite wall two oblong coloured images of the ſun; and at a little diſtance from the wall he placed a long ſlender paper, with ſtraight and parallel edges; and he placed the priſms and papers, ſo that the red colour of one image, at T, (*fig.* 7.) might fall directly upon one half of the paper, and the violet colour, M, of the other image, upon the other half of the ſame paper. Then with a black cloth he covered the wall behind the paper, that no light might be reflected from it to diſturb the experiment; and viewing the paper through a third priſm, held parallel to it, he ſaw that half of it which was illuminated by the violet light to be divided from the other half, by a greater refraction, eſpecially when he retired to a conſiderable diſtance from the paper.

He farther cauſed the two images, P T and M N (*fig.* 8.) to coincide, in an inverted order of their colours, the red end of each falling on the violet end of the other; and then viewing them through a priſm D H, held parallel to their length, they no longer appeared coincident, as when they were viewed with the naked eye, but in the form of two diſtinct images, *p t* and *m n*, croſſing one another in the middle; which ſhews that the red of the one image, and the violet of the other, which were coincident at P N and M T, being parted from one another by a greater refraction of the violet to *p m*, than that of the red to *n* and *t*, differ in degree of refrangibility.

Having placed a priſm, whoſe two angles at its baſe were equal to one another, and half right ones, and the third a right one, in a beam of the ſun's light, admitted into the room as before, he turned it ſlowly about its axis, till all the light which went through one of its angles, and was refracted by it, began to be reflected by its baſe, (at which, till then, it went out of the glaſs,) and then he obſerved that thoſe rays which had ſuffered the greateſt refraction were ſooner reflected than the reſt. He imagined, therefore, that thoſe rays of the reflected light, which were moſt refrangible, did firſt of all, by a total reflection, become more copious in that light than the reſt; and that afterwards the reſt, alſo, by a total reflection, became as copious as theſe. To try this, he made the reflected light paſs through another priſm, and, being refracted by it, to fall afterwards upon a ſheet of white paper, at ſome diſtance behind it, and there to paint the uſual colours of the priſm. Then cauſing the firſt priſm to be turned about its axis, he obſerved, that when thoſe rays which, in this priſm, had ſuffered the greateſt

greateſt refraction, and were of a blue and violet colour, began to be wholly reflected, the blue and violet light on the paper, which received the rays from the ſecond priſm, was ſenſibly increaſed, above that of the red and yellow, which was leaſt refracted; and afterwards, when the reſt of the light, which was green, yellow, and red, began to be wholly reflected in the firſt priſm, the light of thoſe colours on the paper received as great an increaſe as the violet and blue had done before. From this it is manifeſt, that the beam reflected by the baſe of the priſm, being augmented firſt by the more refrangible rays, and afterwards by the leſs refrangible ones, is compounded of rays differently refrangible. This experiment is illuſtrated by *fig.* 9, in which A B C repreſents the firſt priſm, on the baſe of which the light falls, at M. When this priſm is turned about its axis, according to the order of the letters A B C, the more refrangible rays, M H, emerge more and more obliquely; and at length, after their moſt oblique emergence, are reflected towards N, and going on to *p*, increaſe the number of rays N *p*. By continuing the motion of the firſt priſm, the leſs refrangible rays, M G, are reflected to N, and increaſe the number of rays N *t*.

Since it appears from ſir Iſaac Newton's experiments, that different rays of light have different degrees of refrangibility, it neceſſarily follows that the rules laid down by preceding philoſophers, concerning the refractive power of water, glaſs, &c. muſt be limited to the middle kind of rays, as it may be ſuppoſed that Kepler, Snellius, and others would attend to them principally. Sir Iſaac, however, proves that the ſine of the incidence of every kind of light, conſidered apart, is to its ſine of refraction in a given ratio. This he deduces both by experiment, and alſo geometrically, from the ſuppoſition that bodies refract the light by acting upon its rays in lines perpendicular to their ſurfaces.

Upon the whole it appears, that the blue rays are more refracted than the red ones, and that there is, likewiſe, unequal refraction in the intermediate rays; and upon the whole it appears, that the ſun's rays have not all the ſame refrangibility, and, conſequently, are not of the ſame nature. It is alſo obſerved, that thoſe rays which are moſt refrangible are alſo moſt reflexible. See the proof of this under REFLEXIBILITY. Newton's Optics, p. 22, &c. ed. 3.

The difference between refrangibility and reflexibility was firſt diſcovered by ſir Iſaac Newton, in 1671-2, and communicated in a letter to the Royal Society, dated February 6, 1671-2, and publiſhed in the Philoſophical Tranſactions, N° 80, p. 3075, and from that time vindicated by him from the objections of ſeveral authors; particularly F. Pardies, M. Mariotte, Fr. Linus, or Lin, and other gentlemen at the Engliſh college at Liege; and at length it was more fully laid down, illuſtrated, and confirmed, by a great variety of experiments, in his excellent treatiſe of Optics.

But farther, as not only thoſe colours of light produced by refraction in a priſm, but alſo thoſe reflected from opaque bodies, have their different degrees of refrangibility and reflexibility; and as a white light ariſes from a mixture of the ſeveral coloured rays, the ſame great author concluded all homogeneous light to have its proper colour, correſponding to its degree of refrangibility, and not capable of being changed by any reflections, or any refractions; that the ſun's light is compoſed of all the primary colours; and that all compound colours ariſe from a mixture of the primary ones, &c.

The different degrees of refrangibility he conjectures to ariſe from the different magnitude of the particles of which the different rays conſiſt. Thus the moſt refrangible rays, *i. e.* the red ones, he ſuppoſes to conſiſt of the largeſt particles; the leaſt refrangible, *i. e.* the violet rays, of the ſmalleſt particles; and the intermediate rays, yellow, green, and blue, of particles of intermediate ſizes.

Having given a general view of the Newtonian theory of colours, as they depend upon the refraction of light, under the article COLOUR, we ſhall here add ſome farther particulars on this ſubject. From a review of that article, and of what has been above delivered, we may infer that, as the rays of light differ in refrangibility, they alſo differ in their diſpoſition to exhibit this or that particular colour; ſo that colours are not modifications of light, derived from refractions or reflections of natural bodies, but original and connate properties, which are different in different rays. Moreover, to the ſame degree of refrangibility always belongs the ſame colour, and to the ſame colour the ſame degree of refrangibility; nor are the ſame ſpecies of colour, and degree of refrangibility, that are proper to any particular kind of rays, ſuſceptible of change by refraction and by reflection of natural bodies, nor by any other cauſe which ſir Iſaac Newton could obſerve. Although a ſeeming tranſmutation of colours may be made by a mixture of different kinds of rays, yet, in ſuch mixtures, the component colours themſelves do not appear; but, by their mutually allaying each other, conſtitute a middle colour: and, therefore, if, by refraction, the different rays be ſeparated, colours will emerge different from that of the compoſition. Thus blue and yellow powders, finely mixed, appear green to the naked eye; and yet the colours of the component particles are not thereby really changed, but only blended: for when they are viewed with a microſcope, they ſtill appear blue and yellow. It appears that there are alſo two ſorts of colours: the one original and ſimple; the other compounded of theſe. The original and primary colours are red, orange, yellow, green, blue, indigo, and a violet purple, and an indefinite variety of intermediate gradations. The ſame colours in ſpecie with thoſe primary ones may be alſo produced by a compoſition: thus a mixture of yellow and blue makes green; of red and yellow, orange; and of orange and yellowiſh-green, yellow. In general, if any two colours are mixed, which, in the ſeries of thoſe that are produced by the priſm, are not too far diſtant from one another, they, by their mutual alloy, compoſe that colour which appears in the midway between them; but thoſe which are ſituated at too great diſtance have not this effect: *e. gr.* orange and indigo do not produce the intermediate green, nor ſcarlet and green the intermediate yellow.

The moſt wonderful compoſition is that of whiteneſs, which no one ſort of rays alone can exhibit, but which is always compounded; ſo that all the aforeſaid primary colours, mixed in a certain proportion, are neceſſary to form it. See COLOUR.

Having ſhewn, in the preceding part of this article, the extremes of the different degrees of refrangibility in the different kinds of light, we ſhall now proceed to give the reſult of Newton's inveſtigation, concerning the different degrees of refrangibility of all the different kinds of light, according to their ſeveral colours; particularizing this part of the ſubject with an explanation of the method which he made uſe of to define the boundaries of each colour, in the oblong image of the ſun above deſcribed. In that image, though there was a manifeſt difference of colour, not only between the two extremes, but alſo in the intermediate parts, yet the exact place at which any one colour ended, and another began, was far from being ſufficiently diſtinguiſhable.

guiſhable. The reaſon of this indiſtinctneſs is, that rays of every kind coming from all parts of the ſun's diſc, an entire image of the ſun is projected on the paper, conſiſting of a circle of each particular colour; and as the rays differ in kind by infiniteſimal degrees, from the extreme red to the extreme violet, there muſt, in fact, be thouſands of theſe circles in the ſame oblong image, the centres of which are infinitely near to one another; ſo that the light is intimately mixed, eſpecially in the middle of the image, where it is the brighteſt.

If theſe circles, as he obſerves, whilſt their centres keep their diſtances and poſitions, could be made leſs in diameter, their interfering one with another, and conſequently the mixture of heterogeneous rays, would be proportionably diminiſhed. Thus, in P T, (*fig.* 10.) the circles of which the ſolar image conſiſts, expand into one another; but in the ſame figure, *p t*, being compoſed of leſs circles, but having their centres at the ſame diſtance as the former, do not extend into one another, the mixture being diminiſhed in proportion to the diameters of the circles.

Now theſe circles would be diminiſhed, if, without the room, at a great diſtance from the priſm, towards the ſun, ſome opaque body was placed, having a round hole in the middle of it, to intercept all the ſun's light, excepting ſo much as, coming from the middle of its diſc, could paſs through that hole to the priſm; for ſo the ſeparate circles would no longer anſwer to the whole diſc of the ſun, but only to that part of it which can be ſeen from the priſm, through that hole. But that theſe circles may anſwer more diſtinctly to the hole, a lens is to be placed by the priſm, to caſt the image of the hole, that is, of each ſeparate circle, diſtinctly upon the paper; and if this be done, it will not be neceſſary to place that hole very far off, not even beyond the window. Inſtead, therefore, of that hole, he made uſe of the hole in his window-ſhutter, in the following manner.

At about 10 or 12 feet from the window, he placed a lens, by which the image of the hole might be diſtinctly caſt upon a ſheet of white paper, at the diſtance of 6, 8, 10, or 12 feet from the lens. Then, immediately after the lens, he placed a priſm, by which the refracted light might be thrown upwards, or ſideways; and he moved the paper that received it, either towards the priſm, or from it, till he found the exact diſtance at which the ſides of the image appeared moſt diſtinct. By this means the circular images of the hole were terminated moſt diſtinctly, without any penumbra, and therefore extended into one another the leaſt that they could; and conſequently the mixture of the heterogeneous rays was the leaſt of all. And by uſing a greater or leſs hole in the window-ſhutter, he made the circular images greater or leſs at pleaſure, and thereby the mixture of rays in the oblong image was as much or as little as he choſe. He ſometimes made the breadth of the image 40 times, and ſometimes 60 or 70 times leſs than its length. In this manner, he ſays, light is made ſufficiently ſimple, and homogeneal, for trying any of his experiments about ſimple light; for that the heterogeneous rays in this light are ſo few, as hardly to be perceived, excepting, perhaps, in the indigo and violet, which, being dark colours, do eaſily ſuffer a ſenſible allay by that little ſcattering light, which uſed to be refracted irregularly by the inequalities of the priſm. The whole proceſs of this experiment is ſo evident, by inſpection of *fig.* 11, that it needs no particular illuſtration.

Inſtead of a circular hole, our author recommends a hole ſhaped like a long parallelogram, with its length parallel to the priſm. For if this hole be an inch or two long, and but a 10th or 20th part of an inch broad, or narrower, the light of the image will be as ſimple as before, or more ſimple, and the image will become much broader, and therefore more fit for theſe experiments.

Or, inſtead of this hole, another may be formed of a triangle of equal ſides, whoſe baſe may be about the 10th part of an inch, and its height an inch or more. For, by this means, if the axis of the priſm be parallel to the perpendicular of the triangle, the image *p t* (*fig.* 12.) will now be formed of equicrural triangles, *a g*, *b k*, *c i*, *d k*, *e l*, *f m*, &c. and innumerable other intermediate ones, anſwering to the triangular hole in ſhape and bigneſs, and lying one after another in a continual ſeries, between two parallel lines, *a f*, *g m*. Theſe triangles are a little intermingled at their baſes, but not at their vertices; and therefore the light on the brighter ſide, *a f*, of the image, where the baſes of the triangles are, is a little compounded, but on the darker ſide, *g m*, it is altogether uncompounded; and in all places between the ſides, the compoſition is proportionable to the diſtances of the places from that obſcurer ſide *g m*; and having an image of ſuch a compoſition, we may try experiments either in its ſtronger and leſs ſimple light, near the ſide *a f*; or in its weaker and more ſimple light, near the other ſide *g m*, as ſhall ſeem moſt convenient.

In making theſe experiments, he adviſes, that the chamber be made very dark, that the lens be very good, being made of glaſs free from bubbles and veins, the ſides of the priſm truly plane, and its poliſh elaborate, with an angle of about 65 or 70 degrees; and the edges of the priſm and lens, as far as they make any irregular refraction, ſhould be covered with black paper glued on them. He alſo obſerves, that all the uſeleſs light ſhould be intercepted with black paper, or other black obſtacles. It being difficult to get glaſs priſms fit for theſe nice experiments, he ſometimes uſed priſmatic veſſels made with pieces of broken looking-glaſſes, and filled with rain-water; and to increaſe the refraction, he ſometimes ſtrongly impregnated the water with *ſaccharum ſaturni*.

When he had, by this means, got the ſides of the coloured image, as A F, G M, (*fig.* 13.) diſtinctly defined, he delineated on paper the outlines of it F A P G M T, and held the paper ſo that the image might fall on this figure, and coincide with it exactly; whilſt an aſſiſtant, whoſe eyes could diſtinguiſh colours better than his own, did, by right lines drawn croſs the image, mark the confines of each colour; and this operation being frequently repeated, both on the ſame and on different papers, he found that the obſervations agreed well enough with one another, and that the ſides, M G and F A, were by this means divided like a muſical chord; ſo that if G M were produced to X, making M X equal to G M, and if G X, *l* X, *i* X, *h* X, *e* X, *g* X, *a* X, M X, were in proportion to one another, as the numbers 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{9}{16}$, and $\frac{1}{2}$, and ſo repreſented the chords of the key, and of a tone, a third minor, a fourth, a fifth, a ſixth major, a ſeventh, and an eighth above that key. And the intervals M *a*, *a g*, *g e*, *e h*, *h i*, *i l*, and *l* G, were the ſpaces which the ſeveral colours, red, orange, yellow, green, blue, indigo, and violet, took up.

Now theſe intervals or ſpaces, ſubtending the differences of the refractions of the rays, going to the limit of thoſe colours, that is to the points M, *a*, *g*, *e*, *h*, *i*, *l*, G, may, without any ſenſible error, be accounted proportional to the differences of the ſines of refraction of thoſe rays, having one common ſine of incidence; and, therefore, ſince the common ſine of incidence of the moſt and leaſt refrangible rays, out of glaſs into air, was found in proportion to their ſines of refraction as 50 to 77 and 78; if the difference between

tween 77 and 78 be divided, as the line G M is divided by those intervals, there will be 77, $77\frac{1}{8}$, $77\frac{1}{5}$, $77\frac{1}{3}$, $77\frac{1}{2}$, $77\frac{2}{3}$, $77\frac{7}{9}$, 78, for the sines of refraction of those rays out of glass into air, their common sine of incidence being 50. So then the sines of the incidences of all the red-making rays out of glass into air were to the sines of their refractions not greater than 50 to 77, nor less than 50 to $77\frac{1}{8}$; but they varied from one another according to all their intermediate proportions, and so of the other colours.

Having demonstrated that the light of the sun consists of a certain proportion of differently coloured light, our author proves, by another series of experiments, what has been already demonstrated by a single one mentioned above, that when a beam of light has been divided into its component parts, if they be again mixed, they will produce white: or if any one of them be intercepted, the image will appear tinged, and in a different manner, according to the different colours that are thereby prevented from mixing with the rest: and to complete the whole, he observes, that intercepting all the colours that compose the white image except one, and thereby making it to exhibit the appearance of all the colours in order; yet, if he made this succession of all the colours very quick, the appearance was always white, though it was demonstrable that only one colour took place at any one time; and he justly observes, that if each of these colours in succession give the idea of whiteness, much more will they produce that effect, when they are so intimately mixed as they are in a natural sun-beam.

Not content with composing whiteness from the separately coloured rays of the sun, he attempted, and succeeded in his attempt, to do the same with natural coloured bodies, observing the same proportions of the respective colours that he had found in the solar image. The coloured powders which he made use of at first produced only a kind of grey; but this was in fact a dull white, or whiteness mixed with shade: for when he contrived to throw a very strong light upon it, it became intensely white, so that a friend of his, who happened to call upon him while he was busy about these curious experiments, and who knew nothing of what he had been doing, pronounced that the powders he had been mixing, when thus illuminated, made a better white than some very fine white paper, with which he was comparing it.

As the preceding proportion of all the prismatic colours makes a white, it is evident that when they are mixed in different proportions, or when only a few of them are used, they will make different colours; and our philosopher has given us the following ingenious method of knowing, in a mixture of primary colours, the quantity and quality of each being given, the colour of the compound. With the centre O, (*fig.* 14.) and the radius O D, describe a circle A D F, and divide the circumference into seven parts, proportional to the seven musical tones or intervals contained in an octave, that is in proportion to the numbers $\frac{1}{9}$, $\frac{1}{16}$, $\frac{1}{10}$, $\frac{1}{9}$, $\frac{1}{10}$, $\frac{1}{16}$, $\frac{1}{9}$. Let the first, D E, represent a red colour, the second, E F, orange, and so of the rest; and let all these colours be supposed to pass gradually into one another. Let p be the centre of gravity of the arc D E, and q, r, s, t, u, x, be the centres of gravity of the other arcs; and about those centres let circles, proportional to the number of rays of each colour in the given mixture, be described. Then find a common centre of gravity of all those circles; and if a line be drawn from the centre of the circle O, through this point, as suppose at z, the point Y, in which it terminates at the circumference, will shew the colour that arises from the mixture; and the line O Z will be proportioned to the fullness or intenseness of the colour, the centre O representing perfect white. But if only two of the primary colours, which in this circle are opposite to one another, be mixed in an equal proportion, the point Z will fall upon the centre O, and yet the colour compounded of those two will not be perfectly white, but some faint anonymous colour; for he could never, by mixing only two primary colours, produce a perfect white. Whether it might be the result of three taken at equal distances in the circumference he could not tell; but he did not much question, but that four or five of them would be sufficient. These, however, as he observes, are curiosities of little or no moment to the understanding of the phenomena of nature, since, in all natural whites, there is a mixture of all kinds of rays. Newton's Optics. Priestley's Hist. of Light and Colours.

For the method of correcting the effect of the different refrangibility of the rays of light in glasses, see ABERRATION and TELESCOPE; see also DISPERSION *of Light.*

REFRANGIBILITY *of Radiant Heat.* See RAYS *of Heat.* Radiant heat, as well as light, is not only refrangible, but it is also subject to the laws of the dispersion, arising from its different refrangibility. The prism refracts radiant heat, so as to separate that which is less efficacious from that which is more so. The whole quantity of radiant heat contained in a sun beam, if this different refrangibility did not exist, must inevitably fall uniformly on a space equal to the area of the prism; and if radiant heat were not refrangible at all, it would fall upon an equal space, in the place where the shadow of the prism, when covered, may be seen. But neither of these events taking place, it is evident that the radiant heat is subject to the laws of refraction, and also to those of the different refrangibility of light. Whence Dr. Herschel is led to surmise, that radiant heat consists of particles of light of a certain range of momenta, which range may extend a little farther, on each side of refrangibility, than that of light. (See RAYS *of Heat.*) Dr. Herschel having found that two degrees of heat were obtained from that part of the prismatic spectrum which contained the violet rays, while the full red colour, on the opposite side, gave no less than seven degrees, infers from these facts the different refrangibility of the rays which occasion heat, as clearly and certainly as it is concluded that the refrangibility of light is ascertained by the dispersion and variety of the colours. But he proceeds farther, and observes, that the rays of heat are of a much more extensive refrangibility than those of light. In order to make this appear, he delineates a spectrum of light, by assuming a line of a certain length; and, dividing it into seven parts, according to the dimensions assigned to the seven colours by sir Isaac Newton, in the fourth figure of the second part of his Optics, represents the illuminating power of which each colour is possessed, by an ordinate drawn to that line. And here, as the absolute length of the ordinates is arbitrary, provided they be proportional to each other, he assumes the length of that which is to express the maximum, equal to $\frac{27}{33}$ of the whole line.

Thus, let G Q (*fig.* 15.) represent the line that contains the arrangement of the colours, from the red to the violet. Then, erecting on the confines of the yellow and green the line L R $=\frac{27}{33}$ of G Q, it will represent the power of illumination of the rays in that place. For, by experiments already delivered, we have shewn that the maximum of illumination is in the brightest yellow or palest green rays. From the same experiments we collect, that the illuminations of yellow and green are equal to each other, and not much inferior to the maximum; this gives us the ordinates K and M. Then, by the rest of the same experiments, we obtain also the

the ordinates H, I, N, O, P, with fufficient accuracy for the purpofe here intended. All thefe being applied to the middle of the fpaces which belong to their refpective colours, we have the figure G R Q G, reprefenting what may be called the fpectrum of illumination.

We are now, in the fame manner, to find a figure to exprefs the heating power of the refracted prifmatic rays, or what may be called the fpectrum of heat. In order to determine the length of the bafe, Dr. Herfchel examined the extent of the invifible rays, and found, that at a diftance of two inches beyond vifible red, his thermometer, in a few minutes, acquired $1\frac{1}{4}$ degree of heat. The extent of the coloured fpectrum at that time, or the line which anfwered to G Q in his figure, meafured 2.997 inches. If two inches had been the whole of the extent of the invifible part, it might be ftated to be in proportion to the vifible one as 2 to 3; but we are to make fome allowance for a fmall fpace required beyond the laft ordinate, that the curve of the heating power drawn through it may reach the bafe; and indeed, at $2\frac{1}{2}$ inches beyond vifible red, Dr. Herfchel could ftill find $\frac{1}{2}$ degree of heat. It appears therefore fufficiently fafe, to admit the bafe of the fpectrum of heat A Q, to be to that of the fpectrum of light G Q, as $5\frac{1}{4}$ to 3; or, conforming to the Newtonian figure before mentioned, the bafe of which is 3.3 inches, as $57\frac{3}{4}$ to 33. Now, if we affume for the maximum of heat, an ordinate of an equal length with that which was fixed upon for the maximum of light, it will give us a method of comparing the two fpectra together. Accordingly, Dr. Herfchel has drawn the feveral ordinates B, C, D, E, F, G, H, I, K, L, M, N, O, P, of fuch lengths as, from experiments made on purpofe, it appeared they fhould be, in order to exprefs the heat indicated by the thermometer, when placed on the bafe, at the feveral ftations pointed out by the letters.

A mere infpection of the two figures, which have been drawn as lying upon one another, will enable us now to fee how very differently the prifm difperfes the heat-making rays, and thofe which occafion illumination, over the areas A S Q A, and G R Q G, of our two fpectra! Thefe rays neither agree in their mean refrangibility, nor in the fituation of their maxima. At R, where we have moft light, there is but little heat; and at S, where we have moft heat, we find no light at all!

REFRESHMENT, *Quarters of*. See QUARTERS.

REFRET, *Fr.* the burden of a fong. This word is only to be found in the fecond folio edition of Bailey's Dictionary, 1736. In no French dictionary is there authority for it. Cotgrave, Dict. du Vieux Langage; Trevoux, Dict. de l'Académie; and Gloffaries, have been confulted in vain.

REFRIGERANT, REFRIGERATIVE, in *Medicine*, or *cooling*; from *frigus*, *cold*, an appellation given to fuch remedies as were fuppofed to poffefs a power of cooling the internal parts. Hence all diluents, fuch as ptifan, gruel, and other thin drinks, vegetable and mineral acids, neutral falts, and other fubftances, which are deftitute of ftimulating qualities, and communicate a fenfation of coolnefs to the tongue and throat, have been confidered as refrigerant. As they have no actual power of generating cold in the animal body, the term is fomewhat incorrect; but as it expreffes the oppofite quality to that of ftimulating, which is ufed alfo as fynonimous with *heating*, it is ftill retained, and applied to diet, drink, and medicine of a non-ftimulant quality. In this fenfe, the term is nearly fynonimous with *fedative*.

Whatever, in fact, increafes the circulation, increafes the heat of the body, and *vice verfâ*; potentially, therefore, all fedative medicines may be faid to be refrigerant. The ufe of refrigerants will thence be inferred to be proper in all thofe cafes in which there is an over-excitement of the circulation, either locally or generally; fuch as local inflammations, febrile difeafes, hæmorrhages, and the like. In the cafe of external inflammations, indeed, actual refrigeration may be produced, by the application of cold fubftances, water or ice, or by the abftraction of heat by means of evaporation; both of which afford the means of directly diminifhing the activity of the veffels of the part. Thus, in burns and fcalds, the pain is inftantly relieved, and the inflammation effectually reduced, by the immerfion of the part in cold water, if fufficiently perfevered in. But in refpect to internal refrigerants, their operation is of a negative kind, and confifts rather in the removal of uneafy fenfations, and in the exclufion of ftimulant fubftances, than in the actual fuppreffion of increafed action. See SEDATIVE.

REFRIGERATION, denotes the act of cooling, or the abftraction of heat from various fubftances. This is effected in a variety of ways, and for various purpofes of domeftic ufe and of art; and the degree of cold that is produced is eftimated by an inftrument called the *thermometer*, which fee. Under this head it is needlefs to repeat the principles of refrigeration, and the different proceffes that are ufed for this purpofe, which are amply ftated and defcribed under the articles COLD, CONGELATION, COOLING, FREEZING, HEAT, ICE, ICE-*houfes*, &c.

REFRIGERATORY, REFRIGERATORIUM, in *Chemiftry*, a copper veffel filled with cold water, foldered round the capital of an alembic, to cool and condenfe the vapours raifed thither by the fire, and to convert them into a liquor, to be difcharged thence through the beak. See ALEMBIC.

The water in the refrigeratory is to be changed from time to time, as it begins to grow warm.

Sometimes they content themfelves with wrapping a wet cloth about the head of the alembic, inftead of a refrigeratory; but the more ufual method now is, to fupply the place of the refrigeratory by a worm, or fpiral pipe, running through a tub of cold water.

Diftillation chiefly confifts in evaporation and refrigeration. See DISTILLATION.

REFUGE, REFUGIUM, in our *Old Cuftoms*, a *fanctuary*, or *afylum*; which fee refpectively.

At Paris there is an hofpital called the *Refuge*, in which diffolute women are fhut up.

REFUGE, *Cities of*, in *Scripture Hiftory*, fix cities felected from the 48 appropriated to the refidence of the Levites, which were appointed for the protection of perfons from the rigour of the law, who were chargeable with involuntary homicide. Some have fuppofed that all the cities of the Levites were afyla; but it appears from Numb. xxxv. 6. that only fix of them were appointed to this ufe. Thefe afyla were intended not only for Jews, but for Gentiles, or for ftrangers who dwelt among them. (Numb. xxxv. 15.) They were not defigned as fanctuaries for wilful murderers and all forts of atrocious villains among the Jews, as they were among the Greeks and Romans, and as fuch places have fince been in Roman Catholic countries, but merely for fecuring thofe who had been guilty of involuntary homicide (Deut. xix. 4—10.) from the effects of private revenge, until they were cleared by a legal procefs. It is obfervable, that the Ifraelites are commanded to "prepare the way," that is, to make the road good, "that every flayer may flee thither," without impediment, and with all expedition. (Deut. xix. 3.) By having good roads to them, at leaft 32 cubits, or about 48 feet in breadth, and bridges wherever

wherever they were neceſſary, theſe cities were to be eaſy of acceſs; and at croſs roads poſts were erected with inſcriptions, directing the way to the "city of refuge." Upon this Hottinger remarks, that it was probably in alluſion to this cuſtom, that John the Baptiſt is deſcribed as "the voice of one crying in the wilderneſs, prepare ye the way of the Lord, make his paths ſtraight." (Luke, iii. 4—6.) He was the Meſſiah's forerunner, and in that character was to remove the obſtacles to men's flying to him as their aſylum, and obtaining σωτηριον τȣ θεȣ, the ſalvation of God. Every year, on the 15th of Adar, (February,) the magiſtrates were to inſpect the roads, and aſcertain their good condition. Theſe cities were to be ſupplied with water and proviſions; but they were not to be the reſidence of any artiſts who made weapons, by the uſe of which the relations of the deceaſed might gratify their revenge. It was neceſſary that thoſe who took refuge in theſe places ſhould underſtand ſome occupation, that might prevent their being chargeable, whilſt they were waiting for their trial. In order to excite and maintain the greater horror even of involuntary bloodſhed, the law puniſhed it by a kind of baniſhment, for the accuſed perſon was to remain in this city, without departing from it, till the death of the high-prieſt, but after the high prieſt's death, he might ſafely go wherever he pleaſed.

REFUGEES, French Proteſtants, who, by the revocation of the edict of Nantes, in 1685, have been conſtrained to quit their country, and retire for refuge into Holland, Germany, England, &c. to ſave themſelves from the neceſſity of abandoning their religion.

REFUGIO, El, in *Geography*, a harbour in one of the iſlands of Mayorga, where Maurelle was ſupplied with water in 1781, and which, he ſays, affords ſhelter from the moſt furious winds. S. lat. 18° 36′. E. long. 177° 32′.

REFVINGE, a town of Sweden, in the province of Halland; nine miles N.N.W. of Helmſtad.

REFUSAL, in *Law*, is where one hath by law a right and power of having or doing ſomething of advantage to him, and he declines it. An executor may refuſe an executorſhip: but the refuſal ought to be before the ordinary; if an executor be ſummoned to accept or refuſe the executorſhip, and he doth not appear upon the ſummons and prove the will, the court may grant adminiſtration, &c. which ſhall be good in law till ſuch executor hath proved the will; but no man can be compelled to take upon him the executorſhip, unleſs he hath intermeddled with the eſtate. (1 Leon. 154. Cro. Eliz. 858.) Where there are ſeveral executors, and they all refuſe, none of them ſhall adminiſter afterwards; but if there is a refuſal by one, and the other proves the will, the refuſing executor may adminiſter when he will, during the life of his co-executor. (1 Rep. 28.) If there is but one executor, and he adminiſters, he cannot refuſe afterwards, and if once he refuſe, he cannot adminiſter afterwards.

There is a refuſal of a clerk preſented to a church, for want of literature, &c. and if a biſhop once refuſes a clerk for inſufficiency, he cannot accept of him afterward, if a new clerk is preſented. (5 Rep. 58. Cro. Eliz. 27.) In action of trover and converſion, a demand of the goods, and refuſal to deliver them muſt be proved, &c. 10 Rep. 56.

REFUTATION, Refutatio, in *Rhetoric*, that part of the anſwer made to an opponent, which diſproves what had been advanced by him.

REGA, in *Geography*, a river of Pomerania, which riſes three miles N.W. of Dramburg, paſſes by Regenwalde, Plate, Grieffenberg, Treptow, &c., and then runs into the ſea, 12 miles S.W. of Colberg.

REGAH, a town of Egypt, on the left bank of the Nile; ſix miles N. of Atſieh.

REGAL, Regius, or *Regalis*, ſomething belonging to a king. Regal is of the ſame import with royal; the former being formed of the Latin *rex;* the other of the French *roy, king.*

Regal, Fr., a muſical term, which the Encyclopédie defines, "*firſt*, an ancient inſtrument compoſed of many ſticks of ſonorous wood of different lengths, forming a ſcale, played upon by an ivory ball faſtened to the end of a ſtick." This is exactly the deſcription of the ſticcado, ſaid to be invented by the brother of Bremner, the late muſicſeller in the Strand, who publiſhed a book of inſtructions for playing upon it.

"Regal is, *ſecondly*, a ſpinet organized, or rather a ſmall organ of two or three ſtops placed under a keyed inſtrument, very common in Spain and Italy. In France this kind of inſtrument is called a *poſitif*." Craing, an organbuilder in London about the middle of the laſt century, furniſhed organs of this kind to many harpſichords and ſpinets in a virginal form. Snetzler, when he firſt came hither from Straſburg, was employed by Shudi to organize his harpſichord.

But regal in all Roman Catholic countries is a portable organ uſed in proceſſions, carried by one perſon and played by another. We have ſeen that uſe made of this kind of organ at Naples. The pipes are of reeds, for the lightneſs of carriage.

In the liſt of Edward VI. and queen Elizabeth's muſical eſtabliſhments in the Sloane MSS. at the Britiſh Muſeum, among the inſtrument-makers, the regal-maker is allowed 20*l.* yearly. And in our own memory there was an office in the chapel royal under the title of "tuner of the regals;" but it was aboliſhed, and united to ſome more uſeful officer in the chapel.

In the ſupplement to the folio Encyclopédie, we are told that the regal is a portable organ, which has no pipes, or at moſt ſuch as are very ſhort, the tones being produced by reeds. This we believe to be the truth. The inſtrument is ſometimes ſo ſmall as to be ſet on a table.

Regal *Fiſh*. See Royal *Fiſh*.

Regal *Suit*. See Suit.

REGALE, in the French *Juriſprudence*, is a right belonging to the king over all benefices in that kingdom.

The regale conſiſts in enjoying the revenues of biſhoprics, during the vacancy of their ſees, and of preſenting to the benefices dependent on them, which become vacant during that time, and till ſuch a ſucceſſor have taken the oath of fidelity, and have procured letters patent, to ſecure him from the regale.

The enjoyment of the fruits of the ſee is called the *temporal* regale; that of preſenting the benefices, the *ſpiritual* regale.

Some refer the origin of the regale to the time of Clovis; and ſay, the clergy granted this privilege to the king upon his defeating the Viſigoths; others allege, that pope Hadrian I. gratified Charlemagne with it, in a council held at Rome. It is obſerved by others, that the regale was originally no more than a ward, or adminiſtration; and that the kings were only depoſitaries of the fruits of the vacant biſhoprics; and appointed œconomi to look to them during the vacancy.

It is added, that the kings of the firſt and ſecond race never enjoyed any ſuch privilege; and that it was only introduced in the twelfth century, in favour of inveſtitures.

Whatever was the origin of the regale, it occaſioned a very

very important and warm debate between Lewis XIV. and pope Innocent XI. which began about the year 1678, and was carried on with great animofity and contention for feveral years after. Lewis was defirous, that all the churches in his dominion fhould be fubject to the regale. Innocent pretended, on the contrary, that his claim could not be granted with fuch univerfality; nor would he confent to any augmentation of the prerogatives of this nature that had formerly been enjoyed by the kings of France. Lewis fummoned, for fettling this difpute, the famous affembly of thirty-five bifhops, and as many deputies of the fecond order, which met at Paris in the year 1682, and which extended the regale to all the churches in France, without exception. In this convocation the ancient doctrine of the Gallican church, that declares the power of the pope to be merely fpiritual, and alfo inferior to that of a general council, was drawn up in four propofitions, which were folemnly adopted by the whole affembly, and were propofed to the whole body of the clergy, and to all the univerfities through the kingdom, as a facred and inviolable rule of faith.

Regale, *Regalia*, a magnificent treat, or entertainment, given to ambaffadors, or other perfons of diftinction, to entertain or do them honour.

In Italy it is ufual at the arrival of any traveller of eminence, to fend him a regale, that is, a prefent of fruits, fweetmeats, &c. by way of refrefhment.

REGALIA, in *Law*, the royal rights or prerogatives of a king.

Thefe are reckoned by civilians to be fix. 1. Power of judicature. 2. Power of life and death. 3. Power of war and peace. 4. Mafterlefs goods, as waifs, eftrays, &c. 5. Affeffments. 6. Minting of money.

Regalia is alfo ufed for the feveral parts of the apparatus of a coronation: as the crown, the fceptre with the crofs, fceptre with the dove, St. Edward's ftaff, four feveral fwords, the globe, and the orb with the crofs, &c. ufed at the coronation of our kings.

Regalia *of the Church*, are thofe rights and privileges which cathedrals, &c. enjoy by grants, and other conceffions of kings.

Regalia is fometimes alfo ufed for the patrimony of a church; as, *regalia Sancti Petri*. And more particularly, for fuch lands and hereditaments as have been given by kings to the church.

"Cæpimus in manum noftram baroniam et regalia quæ archiepifcopus Eborum de nobis tenet." Pryn. Lib. Ang.

Thefe regalia, while in poffeffion of the church, were fubject to the fame fervices as all other temporal inheritances; and after the death of the bifhop they reverted to the king, till he invefted another with them; which, in the reigns of William the Conqueror, and fome of his immediate fucceffors, was frequently delayed, and as oft did the bifhops make complaint of it, as appears from Malmfbury, Neubrigenfis, &c.

This laft author fays, that great complaint was made againft Henry II. "Quod epifcopatus vacantes, et provenientia perciperet commoda, diu vacare voluit, et ecclefiafticis potius ufibus applicanda in fifcum redegit."

Regalia *Facere* is ufed for the bifhop's doing homage, or fealty, to the king, when he is invefted with the regalia. Thus Malmfbury, in Anfelm: "Regalia pro more illius temporis faciens principi vii. kalend. Octobris Cantuariæ affedit."

REGALITIES. See Royalties.

REGAN, in *Geography*, a town of Perfia, in the province of Kerman, and diftrict of Nurmanfheer, on the frontier of Kerman to the eaft, which diftrict is about 90 miles in length, and in breadth from 30 to 80. This diftrict is bounded on the N. and S. by a range of mountains, thofe to the S. being covered with fnow during the greater part of the year. The foil is fertile, the diftrict populous, and well watered by ftreams from the mountains, and the climate hot in the plain, but cold on the mountains. The Afghans were lately expelled from this diftrict by the Perfians, who invited different tribes of Balouches to occupy the deferted villages.

Regan is a neat little town, furrounded by a mud wall, within which the cattle of the inhabitants are driven every night for protection. The fort is quadrangular, the walls high and in good repair, and flanked with baftions; with one gate, conftantly guarded for preventing the entrance of ftrangers. The capital of Nurmanfheer is Krook, which is the refidence of the governor, and built in the fame ftyle as Regan, but larger, and furrounded by a deep ditch. Before the expulfion of the Afghans, a city, called Bumm, was confidered as the frontier town of Perfia in this quarter. This city is ftrongly fortified by a high mud wall, flanked with towers, furrounded by a deep and broad dry ditch, with one gate; and it has a bazar tolerably fupplied with dates, milk, and fruit. The ruins of Bumm teftify that it was formerly of much greater extent than it is at prefent. The fountains are faid to have thrown water to an amazing height, and the gardens, which appear to have been walled in, and adorned with elegant fummer-houfes, produce the moft delicious pomegranates. Kinneir's Geog. Memoir of the Perfian Empire, 1813.

REGARD *of the Foreft*, the overfight, or infpection, of it; or the office and province of the regarder; which is, to go through the whole foreft, and every bailiwick of it, before the holding of the feffions of the foreft, or juftice-feat, to fee and enquire of the trefpaffes in it, and for the furvey of dogs. A court for this purpofe is to be holden every third year. See Expeditation, and Forest.

"Ad vivendum, ad inquirendum, ad certificandum, &c." See Regarder.

Regard is alfo ufed for the extent of the regarder's charge, *i. e.* for the whole foreft; or all the ground that is parcel of it.

REGARDANT, in *Heraldry*, is underftood of a lion, or other beaft of prey, borne in a pofture of looking behind him, with his face towards his tail.

Others apply it to a beaft, which only fhews the head, and fome part of the neck, as moving from out of fome divifion of the coat into another. He bears azure, three bends, or, in a chief, argent, charged with a lion regardant, gules.

Regardant *Villain*, or *Regardant to the Manor*, denotes an ancient fervant or retainer to the lord; thus called, becaufe charged to do all bafe fervices within the manor, to fee the fame freed of all filthy and loathfome things that might annoy it, &c. Coke upon Littleton, fol. 120.

REGARDER *of a Foreft*, *Regardator Forefta*, an ancient officer of the king's foreft, whofe bufinefs was every year, upon oath, to make a regard, *i. e.* to take a view of the foreft limits; alfo to enquire of all offences and defaults committed by the forefters within the foreft, and of all the concealments of them; and whether all the other officers did execute their refpective duties or not.

Manwood refers this inftitution to king Henry II. but Spelman thinks the name, at leaft, was given fince; and that they were the fame with thofe officers called *cuftodes venationis*.

REGATTA

REGATTA is a name given at Venice to a kind of exhibition on the water, in which the gondoliers conteft for fuperiority in the art of rowing their gondolas.

A fplendid entertainment, under this appellation, was exhibited on the Thames in 1775.

REGAU, in *Geography*, a town of Auftria; 12 miles W. of Steyr.

REGE INCONSULTO, in *Law*, is a writ iffued from the king to the judges, not to proceed in a caufe which may prejudice the king, until he is advifed. A *rege inconfulto* may be awarded, not only for the party to the plea, but upon fuggeftion of a ftranger, on caufe fhewn that the king may be prejudiced by the proceeding, &c.

REGE *Querela Coram*. See QUERELA.

REGEL, or RIGEL, in *Aftronomy*, a fixed ftar of the firft magnitude, in Orion's left foot.

REGELSBRUN, in *Geography*, a town of Auftria; feven miles N. of Brugg.

REGEN, a river which rifes on the borders of Bohemia, and runs into the Danube, near Ratifbon.—Alfo, a town of Bavaria, on the above-named river; 40 miles E. of Ratifbon.

REGENERATED TARTAR. See TARTAR, *Regenerated.*

REGENERATION, in *Theology*, the act of being born again by a fpiritual birth, or becoming a child of God: or it is that change of heart and life experienced by a perfon, who forfakes a courfe of vice, and fincerely embraces a life of piety and virtue.

When an infidel is converted, baptifm is always adminiftered as a fign of regeneration.

The term is alfo ufed to fignify the change of ftate that takes place at the refurrection. Matt. xix. 28.

REGENSBERG, in *Geography*, a town of Switzerland, in the canton of Zurich, fituated on a mountain, and furrounded with walls in the year 1687; it is the principal place of a bailiwick formerly fubject to the dukes of Auftria; 6 miles E. of Baden.

REGENSBURG. See RATISBON.

REGENSTAUF, a town of Bavaria, in the principality of Neuburg; feven miles N. of Ratifbon.

REGENSTEIN, a town of Weftphalia, in the bifhopric of Halberftadt; feven miles W. of Quedlinburg.

REGENSTORF, or *Old Regenfberg*, a bailiwick of Switzerland, in the canton of Zurich, which derives its name from that of an ancient caftle, deftroyed in 1443.

REGENT, REGENS, a perfon who governs a kingdom during the minority or abfence or incapacity of a king.

In France, the queen-mother has the regency of the kingdom, under the title of *queen-regent*, while the king is a minor. Some have urged, that women, being incapable of fucceeding to that crown, were incapable of the regency; but cuftom has declared in their favour.

REGENT is alfo ufed for a profeffor of arts and fciences, who holds a clafs, or fet of pupils, in a college.

The foreign univerfities are generally compofed of doctors, profeffors, and regents. Regent and fcholar are relative terms. See TUTOR.

Regent is generally reftrained to the lower claffes, as regent of rhetoric, regent of logic, &c.; thofe of philofophy are rather called profeffors.

REGENWALDE, in *Geography*, a town of Hinder Pomerania, on the Rega; 30 miles N.N.E. of Stargard. N. lat. 53° 49'. E. long. 15° 24'.

REGERENDARIUS, among the Romans, an officer who fubfcribed and kept a regifter of all petitions prefented to the præfect. Pitifc. in voc.

REGESTOLA, in *Ornithology*, a name ufed by fome authors for the mattagefs, or larger butcher-bird, a very fmall hawk, not exceeding the fize of a common thrufh, but very fierce and voracious. See LANIUS *Excubitor.*

REGETZ, in *Geography*, a town of Hungary; 18 miles S. of Cafchau.

REGGE, a river of Holland, which rifes near Enfchede, and after paffing by Ghoer, Ryfen, &c. joins the Vecht near Ommens.

REGGIO, PIETRO, in *Biography*, a native of Genoa, who feems to have been the firft Italian who gave our country a tafte for the vocal refinements of his country. Before his arrival here, he had been in Spain, Germany, Sweden, and France. Befides refinements in florid fong, he was much admired for his exquifite manner of accompanying himfelf on the lute. His firft refidence in England was at Oxford, where he publifhed, in 1677, a fmall tract, entitled "A Treatife to fing well any fong whatever." In 1684 his book of fongs, in folio, the words chiefly from Cowley, appeared. We know not what were the tafte and expreffion which rendered his vocal powers fo captivating; but his airs are very dry and monotonous, and in as old an Italian tafte as thofe of Lulli.

REGGIO, in *Geography*, a city of Italy, capital of the department of the Croftolo, and formerly of the duchy of Modena, the fee of a bifhop, fuffragan of Bologna. It was founded by the Tufcans, and became a Roman colony under Lepidus the triumvir. It was deftroyed by Alaric, and rebuilt by Charlemagne. Its number of convents is 16, and of inhabitants about 18,000. The cathedral contains many capital pictures and fculptures. The inhabitants of this city were the firft of all the Italians, who in 1794 renounced their allegiance to their own fovereign, Hercules III., who fled to Venice, afterwards took up arms, and folicited the protection of Bonaparte. He took poffeffion of the city, proclaimed the liberty of the inhabitants, and inftituted a legiflative committee, who took the oath of allegiance to the French republic. Reggio is the native place of the poet Ariofto; 14 miles W.N.W. of Modena. N. lat. 44° 41'. E. long. 10° 38'.

REGGIO, a fea-port town of Naples, in Calabria Ultra, fituated on the ftraits of Meffina. The inhabitants carry on manufactures of ftockings, gloves, and waiftcoats of thread or filk. This place is the fee of an archbifhop, founded by the patriarch of Conftantinople, and contains two colleges and feven convents. The environs abound in oranges, citrons, mulberries, and grapes, with fome fugar-canes. This town was called by the Greeks *Rhegion*, derived according to Diodorus from the Greek word ῥήγνυμι, to break or tear, becaufe Sicily was torn from Italy, either by the fea or an earthquake. It is very ancient, founded as fome fay by Jocaftrus, fon of Æolus, king of Lipari, who entertained Ulyffes; or, according to others, by the Chalcidians, who came hither from Eubœa. The territory of the Rhegini was free and powerful, though fometimes governed by tyrants. In the Peloponnefian war they fuffered much from their neighbours the Epizephyrian Locri, and were diftracted by internal contentions. In the time of Dionyfius the elder they were very powerful and afferted their liberty, refufing an alliance with that tyrant, who demanded a daughter of the city. When Pyrrhus waged war againft the Romans, the latter fent a legion for the protection of Rhegium; but the foldiers murdered the citizens and feized on the city. After the war the infurgents were taken by the Romans, and put to death for their treachery and cruelty. St. Paul, on his journey to Rome, paffed through this city. In the year 1783 it was almoft totally deftroyed by by an earthquake; 10 miles S.E. of Meſſina. N. lat. 38° 6'. E. long. 16° 53'.

REGGIOLO, a town of Italy, in the department of the Mincio; ſix miles E. of Guaſtalla.

REGHABILLE, a town of Africa, in the country of Wangara, ſituated on a lake. N. lat. 12° 47'. E. long. 18° 19'.

REGIA AQUA. See AQUA.

REGIA *Via*. See VIA.

REGIA *Villa*. See VILLA.

REGICIDE, REGICIDA, *a king-killer*. The term is alſo uſed for the act itſelf of murdering a king; of *rex*, *king*, and *cædo*, *I ſlay*.

Regicide is chiefly uſed with us in ſpeaking of the perſons concerned in the trial, condemnation, and execution, of king Charles I.

REGIFUGE, REGIFUGIUM, a feaſt held in ancient Rome on the ſixth of the calends of March, *i. e.* on our 24th of February, in memory of the expulſion of their kings, particularly of Tarquin's flying out of Rome on that day. Some will have the feaſt to bear this name from the *rex ſacrorum*, *king of the ſacrifices*, flying out of the comitia, or place of aſſembly, as ſoon as the ſacrifice was over, in imitation of the flight of Tarquin the Proud.

Some critics and antiquaries will have Regifugium the ſame with Fugalia; others hold them to be different.

REGIMEN, in *Medicine*, from *rego*, *I rule* or *govern*, a rule or courſe of living, with regard to eating, drinking, clothing, and the like, accommodated to ſome diſeaſe, or particular courſe of medicine which the patient is under, or intended as a prevention of ſome threatening malady.

In many diſeaſes, eſpecially thoſe of the acute or febrile claſs, the regimen is often of equal, and ſometimes of more importance than medicine: and there can be no doubt that the humoral phyſicians, by the introduction of a *hot* regimen in the treatment of febrile complaints, contributed to render theſe diſeaſes more ſevere and fatal; and that the ſubſtitution of a cool regimen has of late years very materially diminiſhed the danger and mortality of theſe maladies. This change in medical practice has been, in fact, but a return to nature, and to Hippocrates, who taught this ſimple, but clear and rational principle, "contraria contrariis medentur;" remedies ſhould be of an oppoſite nature to diſeaſes: that is to ſay, if the body is morbidly hot, cold is the remedy; if it is cold, the application of heat is neceſſary; if there is over-diſtention, inflammation, or plethora, evacuation muſt be reſorted to: if depletion, we muſt ſupply nouriſhment: if there is thirſt, the remedy is the free uſe of drink, and ſo forth. The clear inſtincts of nature (where they can be diſtinguiſhed) are commonly infallible guides, as to the regimen to be purſued: but let not morbid habits and prejudices be miſtaken for them. Thus in *all fevers*, ſmall-pox, meaſles, ſcarlet-fever, catarrh, typhus, and the plague itſelf, the natural bias is for freſh air, coolneſs, light bed-clothes, clean linen, cold drink, light and merely liquid nouriſhment, in ſmall quantities, or abſolute abſtinence, quietneſs of mind and body, relief from noiſe, ſtrong light, and every ſpecies of excitement; and this is preciſely the regimen, which experience has proved to be moſt beneficial in ſuch diſeaſes. Under the influence of ſuch a regimen, where proper medicines are alſo employed, every ſymptom is rendered comparatively mild; the diſtreſs of the ſick is diminiſhed, by the ſoothing of every morbid ſenſation; and the derangements, which would otherwiſe enſue, or be aggravated, in the more vital organs, as in the brain, lungs, and alimentary canal, are frequently altogether prevented.

It is ſufficient to contraſt the effects of the hot regimen, in febrile diſeaſes, to be convinced of the truth of theſe obſervations. When a perſon afflicted with any ſpecies of fever, is confined in a cloſe and heated apartment, in which the free circulation of air is prevented by cloſed doors and windows, curtains, &c. and is kept at the ſame time under a load of bed-clothes, and ſupplied with hot drinks, or even cordials of vinous and fermented liquors, with the view of inducing perſpiration, the conſequences are as follow. The whole train of ſymptoms is aggravated. The heat of the patient is raiſed conſiderably above the natural ſtandard, notwithſtanding the profuſe perſpirations that are conſtantly bathing him; the pulſe is excited to the higheſt febrile ſtandard; the thirſt becomes inceſſant to ſupply the unnatural waſte of fluids; the mouth and lips become parched and furred; the head is in conſtant pain, with confuſion of ideas, preventing all ſound ſleep, and occaſioning diſtreſſing dreams, and at length delirium; the whole powers of the frame become proſtrate, with diſpoſition to fainting, on being moved, or on paſſing an evacuation by ſtool; and from this ſituation the recovery is extremely precarious. In caſes of contagious fever, ſuch as ſmall-pox, meaſles, ſcarlet-fever, &c., the eruption is always greatly multiplied by this hot regimen, and all the ſymptoms are changed to what has been called a putrid type; the tongue, teeth, and lips, become coated with a black, clammy, and immoveable fur; purple ſpots appear on the ſkin; and the whole diſeaſe aſſumes the character of malignancy. There is one diſeaſe, indeed, which is ſolely the reſult of this hot regimen, which has made a conſiderable figure in the writings of phyſicians, who never dreamt that it was of their own creation; we allude to the *miliary* fever. See MILIARIA.

The above may perhaps be conſidered as the extreme of the picture, which is ſcarcely ever to be ſeen in the preſent day. But the greateſt difficulty which a phyſician has even now to overcome, in the majority of caſes of feveriſh diſeaſes, is to counteract the tendency of nurſes and parents to the adoption of more or leſs of this pernicious ſyſtem. The ſalutary *chill* muſt be taken away from all liquids, whether uſed internally or externally; the cheering breeze is deemed a death-bringing *draught*; and though the patient may die from the ſeverity of a malignant fever, he muſt on no account run the ſlighteſt riſk of *catching cold*; that is to ſay, the poſſible occurrence of a ſlight ſore-throat, or a running at the noſe, is to be avoided religiouſly, at the expence of aggravating both the ſufferings and the danger, under a more formidable diſeaſe. The uſe of wine and cordials, in theſe diſeaſes, is now confined to the poor and ignorant, and it is to be hoped, that the other parts of the hot regimen will not long be reſorted to, at leaſt among the more intelligent claſſes of ſociety. See COLD *as a remedy*.

REGIMEN, in *Chemiſtry* and *Alchemy*, is the method of ordering and conducting any thing, that it may anſwer its intention.

Thus, regimen of fire is the method of making and ordering fire, and the degrees of it.

REGIMEN *of the Work*, that is, of the philoſopher's ſtone, called the *work of patience*, is the rule and conduct to be obſerved to obtain protection.

There are three things, they ſay, to be chiefly regarded in the regimen of the work. The firſt, to adminiſter a gentle eaſy heat at the beginning of the coction.

The ſecond, to continue this external heat according to the ſeaſon of the work, always obſerving four ſeaſons, as in the common and aſtronomical year; the beginning being the winter, the progreſs the ſpring, then ſummer, and laſtly autumn, which is the time of maturity and perfection of the ſtone;

ftone; in all which the heat is to be augmented in proportion to the augmentation obferved in nature.

It is to be added, that the work may not be begun in any feafon; but regard is to be had to the feafons of nature. left the winter of the work be found in the fummer of the year, &c. Which, however, is to be underftood of the day in which the mercury is put in the ovum philofophicum, not of that when it is begun to be fet at liberty from the prifons which nature had inclofed it in.

The third is, that in augmenting the fire, the augmentation be not of a whole degree at once, the fpirits being unable to bear fuch violence; but a degree is to be divided into four parts, and one part is to be taken at a time.

All the operations of the firft regimen are occult and invifible: in the fecond regimen comes putrefaction, which, they fay, is the firft fenfible change, fhewing itfelf by its black colour.

Regimen, or *Government*, in *Grammar*, is that part of fyntax or conftruction, which regulates the mutual dependency of words, and the alterations which one part of fpeech occafions in another, with regard to its mood, tenfe, or cafe, and thus it differs from concord, or the agreement which one word has with another, in gender, number, cafe, or perfon. See Concord.

The regimen, or government, is entirely arbitrary, and differs in all languages; one language forming its regimen by cafes, as the Latins and Greeks; others by particles in lieu of them, as the Englifh by *of*, *to*, &c. the French, Spaniards, and Italians, by *de*, *a*, *da*, &c.

There are, however, fome general maxims which hold good in all languages; as, 1. That there is no nominative cafe in any fentence but has a reference to fome verb, either expreffed or underftood. Sometimes, indeed, the infinitive mood, or part of a fentence, is put as the nominative cafe to the verb; as in Englifh, "to fee the fun is pleafant." Thefe fentences, or claufes, thus conftituting the fubject of an affirmation, may be termed "nominative cafes."

2. That there is no verb, except in the infinitive mood, or the participle, but has its nominative cafe, either expreffed or underftood. Indeed, in languages which have proper accufatives, as the Latin, before infinitives there is an accufative, not a nominative cafe; as *Scio Petrum effe doctum*. The nominative cafe is commonly placed before the verb; but fometimes it is put after the verb, if it is a fimple tenfe; and between the auxiliary and the verb, or participle, if a compound tenfe.

3. Two or more nouns, &c. in the fingular number, joined together by one or more copulative conjunctions, expreffed or underftood, muft have verbs, nouns, and pronouns, agreeing with them in the plural number. The conjunction disjunctive, however, has an effect contrary to that of the conjunction copulative; for as the verb, noun, or pronoun, is referred to the preceding terms, taken feparately, it muft be in the fingular.

4. A noun of multitude, or fignifying many, may have a verb or pronoun agreeing with it, either of the fingular or plural number; but not without regard to the import of the word, as conveying unity or plurality of idea. In the application of this rule, we ought to confider whether the term immediately fuggefts the idea of the number it reprefents, or whether it exhibits to the mind the idea of the whole as one thing. In the former cafe, the verb ought to be plural; in the latter, it ought to be fingular.

5. Pronouns muft always agree with their antecedents, and the nouns for which they ftand, in gender and number.

6. The relative is the nominative cafe to the verb, when no nominative comes between it and the verb; but when a nominative comes between the relative and the verb, the relative is governed by fome word in its own member of the fentence; *e. gr.* "he *who* preferves me, to *whom* I owe my being, *whofe* I am, and *whom* I ferve, is eternal."

7. When the relative is preceded by two nominatives of different perfons, the relative and verb may agree in perfon with either, according to the fenfe.

8. Every adjective, and every adjective pronoun, belongs to a fubftantive, expreffed or underftood. Adjective pronouns muft agree in number with their fubftantives; neverthelefs this rule admits of exceptions; *e. gr.* the word *means* in the fingular number, and the phrafes "by this means," "by that means," are ufed by our beft and moft correct writers, *viz.* Bacon, Tillotfon, Atterbury, Addifon, Steele, Pope, &c. Campbell, in his "Philofophy of Rhetoric," has this remark on the fubject before us: "No perfons of tafte will, I prefume, venture fo far to violate the prefent ufage, and confequently to fhock the ears of the generality of readers, as to fay 'by this *mean*,' 'by that *mean*.'" Lowth and Johnfon feem alfo to be againft the ufe of *means* in the fingular number. The diftributive adjective pronouns, *each*, *every*, *either*, agree with the nouns, pronouns, and verbs of the fingular number only. Adjectives are fometimes improperly applied as adverbs. An adjective pronoun, in the plural number, will fometimes properly affociate with a fingular noun. Although the adjective always relates to a fubftantive, it is, in many inftances, put as if it were abfolute, efpecially where the noun has been mentioned before, or is eafily underftood, though not expreffed. Subftantives are often ufed as adjectives: in this cafe, the word fo ufed is fometimes unconnected with the fubftantive to which it relates; fometimes connected with it by a hyphen; and fometimes joined to it, fo as to make the two words coalefce. Sometimes the adjective becomes a fubftantive, and has another adjective joined to it. When an adjective has a prepofition before it, the fubftantive being underftood, it takes the nature of an adverb, and is confidered as an adverb.

9. One fubftantive governs another, fignifying a different thing, in the poffeffive or genitive cafe; inafmuch as that cafe always expreffes the poffeffor, which muft be governed by the poffeffed: as, "my father's houfe," "virtue's reward," &c. When the annexed fubftantive fignifies the fame thing as the firft, and ferves merely to explain or defcribe it, there is no variation of cafe; as "George, king of Great Britain, elector of Hanover, &c." Nouns thus circumftanced are faid to be *in appofition* to each other: and nouns are not unfrequently fet in appofition to fentences, or claufes of fentences. This rule does not hold fo apparently in the modern as it does in the ancient languages; becaufe the particles *of*, *de*, &c. which are the proper figns of the genitive cafe, are frequently ufed as prepofitions. (See Genitive.) Subftantives govern pronouns as well as nouns in the poffeffive cafe; as "every tree is known by *its* fruit." Sometimes a fubftantive in the genitive or poffeffive cafe ftands alone, the latter one by which it is governed being underftood. The Englifh genitive has often an unpleafant found, fo that we make more ufe of the particle *of* to exprefs the fame relation: and in fome cafes, we ufe both the genitive termination and the prepofition *of*; as "it is a difcovery of fir Ifaac Newton's:" but when this double genitive, as fome grammarians call it, is not neceffary to diftinguifh the fenfe, and efpecially in a grave ftyle, it is generally omitted. Except to prevent ambiguity, it feems to be allowable only in cafes which fuppofe the exiftence of a plurality of fubjects of the fame kind, as "a fubject of the emperor's." But after all that can be faid for the double genitive, as it is termed,

termed, it is the opinion of some grammarians, that it would be better to avoid the use of it altogether, and to give the sentiment another form of expression.

10. Active verbs govern the objective (or accusative) case, as "Virtue rewards her followers." In English, the nominative case, denoting the subject, usually goes before the verb; and the objective case, denoting the object, follows the verb active; and it is this order that determines the case in *nouns;* as, "Alexander conquered the Persians:" but the *pronoun* having a proper form for each of those cases, is sometimes, when it is in the objective case, placed before the verb; and when it is in the nominative case, follows the object and verb; as "*whom* ye ignorantly worship, *him* declare I unto you." Verbs neuter do not act upon, or govern, nouns and pronouns. Part of a sentence, as well as a noun or pronoun, may be said to be in the objective case, or to be put objectively, governed by the active verb; and sentences or phrases under this circumstance may be termed "objective sentences or phrases." The verb *to be,* through all its variations, has the same case after it as that which next precedes it; so that this substantive verb has no government, or case, but serves, in all its forms, as a conductor to the two cases, insomuch that the two cases which, in the construction of the sentence, are the *next* before and after it, must always be alike. Passive verbs which signify *naming,* and others of a similar nature, have the same case before and after them; as "*he* was called *Cæsar.*" It is evident also, that certain other neuter verbs, besides the verb *to be,* require the same case, whether it be the nominative or the objective, before and after them; such verbs are, to become, to wander, to go, to return, to appear, to die, to live, to look, to grow, to seem, to roam, and several others. The auxiliary *let* governs the objective case; as "let *him* beware."

11. One verb governs another that follows it, or depends upon it, in the infinitive mood; as, "cease *to do* evil," "learn *to do* well;" and the preposition *to,* though generally used before the latter verb, is sometimes properly omitted; as "I heard him say it," instead of "*to* say it." This irregularity extends only to active or neuter verbs: for many other verbs, when made passive, require the preposition *to* before the following verb; as "He was seen *to go.*" The infinitive is frequently governed by adjectives, substantives, and participles; and this mood has much of the nature of a substantive, expressing the action itself which the verb signifies, as the participle has the nature of an adjective, so that the infinitive mood does the office of a substantive, in different cases, as in the nominative, "*to play* is pleasant," and in the objective, "boys love *to play.*" The infinitive mood is often made absolute, or used independently on the rest of the sentence, supplying the place of the conjunction *that* with the potential mood, as "to confess the truth, I was in fault." The preposition *to,* signifying *in order to,* was anciently preceded by *for,* as "what went ye out *for to see;*" but the word *for* before the infinitive, is now, in almost every case, obsolete.

12. In the use of words and phrases which, with respect to time, relate to each other, a due regard to that relation should be observed. Thus, instead of saying, "the Lord *hath given,* and the Lord *hath taken* away," we should say, "the Lord *gave,* and the Lord *hath taken* away." To preserve consistency in the time of verbs, and also of words and phrases, says Mr. L. Murray, in his excellent treatise on Grammar, we must recollect that, in the subjunctive mood, the present and the imperfect tenses often carry with them a future sense; and that the auxiliaries *should* and *would,* in the imperfect time, are used to express the present and future, as well as the past. With regard to verbs in the infinitive mood, says the same popular author, the practice of many writers, among whom are some of the most respectable, appears to be erroneous. They seem not to advert to the true principles which influence the different tenses of this mood. The following rules will, according to our author's judgment, be found perspicuous and accurate. "All verbs expressive of hope, desire, intention, or command, must invariably be followed by the present, and not the perfect of the infinitive." Instead of the phrase, "the last week I intended to *have written,*" though common, the infinitive being in the past time, as well as the verb which it follows, it ought to be, "the last week I intended *to write:*" for how long soever it now is since I thought of writing, "to write" was then present to me, and must still be considered as present, when I bring back that time, and the thoughts of it. Some writers on grammar, however, maintain that the former sentence is correct and grammatical, because, as they assert, it simply denotes the speaker's intention to be hereafter in possession of the finished action of writing; but this reasoning admits of the following answers, according to the statement of Mr. Murray. The phrase "to have written" is, in English grammars, the established past tense of the infinitive mood, and as incontrovertibly the past tense of the infinitive in English, as *scripsisse* is the past tense of the infinitive in Latin; nor can any writers be warranted in taking such liberties with the language, as to contradict its plainest rules, for the sake of supporting an hypothesis. Moreover, these writers might, on their own principles, and with equal propriety, contend, that the phrase "I intended *having written,*" is proper and grammatical; but by admitting such violations of established grammatical distinctions, confusion would be introduced, the language would be disorganized, and the most eccentric systems of grammar might be advanced, and plausibly supported. In short, says our author, the phrase "I intended to have written," appears to involve the following absurdity; "I intended to produce hereafter an action or event, which has been already completed." Some may hastily infer from the rule above stated, and from the near relation between the verbs *to desire,* and *to wish,* that the latter verb, like the former, must invariably be followed by the present of the infinitive. But when any one considers, that the act of *desiring* always refers to the future, and that the act of *wishing* refers sometimes to the past, as well as sometimes to the future, he will perceive the distinction between them, and that, consequently, the following modes of expression are strictly justifiable: "I wished *that I had written* sooner," "I wished *to have written* sooner;" and he will be perfectly satisfied, that the following phrases must be improper: "I desired that I had written sooner," "I desired to have written sooner." Mr. Murray, having considered and explained the special rule, respecting the government of verbs, expressive of hope, desire, intention, or command, proceeds to state and elucidate the general rule, on the subject of verbs in the infinitive mood. "This rule," he says, "is founded on the authority of Harris, Lowth, Campbell, Pickbourn, &c.; and we think, too, on the authority of reason and common sense. "When the action or event, signified by a verb in the infinitive mood, is *contemporary* or *future,* with respect to the verb to which it is chiefly related, the present of the infinitive is required; when it is *not* contemporary, *nor* future, the perfect of the infinitive is necessary." To comprehend and apply this rule, the student has only to consider, whether the infinitive verb refers to a time antecedent, contemporary, or future, with regard to the governing or related verb. When this simple point is ascertained, there will be no doubt in his mind, respecting the

form

form which the infinitive verb should have. A few examples may illustrate these positions. If I wish to signify, that I rejoiced at a particular time, in recollecting the sight of a friend, some time having intervened between the *seeing* and the *rejoicing*, I should express myself thus: "I rejoiced *to have seen* my friend." The *seeing*, in this case, was evidently antecedent to the *rejoicing*; and therefore the verb which expresses the former, must be in the perfect of the infinitive mood. The same meaning may be expressed in a different form: "I rejoiced *that I had seen* my friend;" or, "*in having seen* my friend:" and the student may, in general, try the propriety of a doubtful point of this nature, by converting the phrase into these two correspondent forms of expression. When it is convertible into both these equivalent phrases, its legitimacy must be admitted.—If, on the contrary, I wish to signify, that I rejoiced at the sight of my friend, that my joy and his presence were contemporary, I should say, "I rejoiced *to see* my friend;" or, in other words, "I rejoiced *in seeing* my friend." The correctness of this form of the infinitive may also, in most cases, be tried, by converting the phrase into other phrases of a similar import.

The subject may be still further illustrated, by additional examples. In the sentence which follows, the verb is with propriety put in the perfect tense of the infinitive mood: "It would have afforded me great pleasure, as often as I reflected upon it, *to have been* the messenger of such intelligence." As the message, in this instance, was antecedent to the pleasure, and not contemporary with it, the verb expressive of the message must denote that antecedence, by being in the perfect of the infinitive. If, on the contrary, the message and the pleasure were referred to as contemporary, the subsequent verb would, with equal propriety, have been put in the present of the infinitive: as, "it would have afforded me great pleasure, *to be* the messenger of such intelligence." In the former instance, the phrase in question is equivalent to these words; "*if I had been* the messenger;" in the latter instance, to this expression; "*being* the messenger."

To assert, as some writers do, that verbs in the infinitive mood have no tenses, no relative distinctions of present, past, and future, is inconsistent with just grammatical views of the subject. That these verbs associate with verbs in all the tenses, is no proof of their having no peculiar time of their own. Whatever period the governing verb assumes, whether present, past, or future, the governed verb in the infinitive always respects that period, and its time is calculated from it. Thus, the time of the infinitive may be before, after, or the same as, the time of the governing verb, according as the thing signified by the infinitive, is supposed to be before, after, or present with, the thing denoted by the governing verb. It is, therefore, with great propriety, that tenses are assigned to verbs of the infinitive mood. The point of time from which they are computed is of no consequence; since present, past, and future, are completely applicable to them.

It may not be improper to observe, that though it is often correct to use the perfect of the infinitive after the governing verb, yet there are particular cases, in which it would be better to give the expression a different form. Thus, instead of saying, "I wish to have written to him sooner," "I then wished to have written to him sooner," "He will one day wish to have written sooner;" it would be more perspicuous and forcible, as well as more agreeable to the practice of good writers, to say; "I wish that I had written to him sooner," "I then wished that I had written to him sooner," "He will one day wish that he had written sooner."

13. Participles have the same government as the verbs from which they are derived; as, "I am weary with *hearing him*," &c. It should be considered, however, that participles are sometimes governed by the article; for the present participle, with the definite article *the* before it, becomes a substantive, and must have the preposition *of* after it. This rule arises from the nature and idiom of our language, and from as plain a principle as any on which it is founded; namely, that a word which has the article before it, and the possessive preposition *of* after it, must be a noun; and, if a noun, it ought to follow the construction of a noun, and not to have the regimen of a verb. It is the participial termination of this sort of words that is apt to deceive us, and make us treat them as if they were of an amphibious species, partly nouns and partly verbs.

The same observations, which have been made respecting the effect of the article and participle, appear to be applicable to the pronoun and participle, when they are similarly associated. When a substantive is put absolutely, and does not agree with the following verb, it remains independent on the participle, and is called the "case absolute," or the "nominative absolute;" but when the substantive preceding the participle agrees with the subsequent verb, it loses its absoluteness, and is like every other nominative.

14. Adverbs, though they have no government of case, tense, &c. require an appropriate situation in the sentence, *viz.* for the most part, before adjectives, after verbs active or neuter, and frequently between the auxiliary and the verb.

15. Prepositions govern the objective case. Under this rule we may remark, that the prepositions *to* and *for* are often understood, chiefly before the pronouns, as "give *me* the book," for *to me*, &c. The preposition is often separated from the relative which it governs; as "whom will you give it to?" for "to whom will you give it?" Some writers separate the preposition from the noun or pronoun which it governs, in order to connect different prepositions with the same word; but this kind of construction is always inelegant, and should generally be avoided. Different relations, and different senses, must be expressed by different prepositions, though in conjunction with the same verb or adjective. Thus we say, "to converse *with* a person, *upon* a subject, *in* a house, &c." When prepositions are subjoined to nouns, they are generally the same that are subjoined to the verbs from which the nouns are derived. Many writers, as Dr. Priestley has observed, affect to subjoin to any word the preposition with which it is compounded, or the idea of which it implies, in order to point out the relation of the words, in a more distinct and definite manner, and to avoid the more indeterminate propositions *of* and *to*: but general practice, and the idiom of the English tongue, seem to oppose the innovation. Thus many writers say, "averse *from* a thing;" but others use "averse *to* it," which is more truly English: "Averse *to* any advice," Swift. "The words *averse* and *aversion*," says Dr. Campbell, "are more properly construed with *to* than with *from*. The examples in favour of the latter preposition are beyond comparison outnumbered by those in favour of the former. The argument from etymology is here of no value, being taken from the use of another language. If, by the same rule, we were to regulate all nouns and verbs of Latin original, our present syntax would be overturned. It is more conformable to English analogy with *to*; the words *dislike* and *hatred*, nearly synonimous, are thus construed."

16. Conjunctions connect the same moods and tenses of verbs,

verbs, and cases of nouns and pronouns, as "Candour is *to be approved and practised.*"

17. Some conjunctions require the indicative, some the subjunctive mood, after them. Those that are of a positive and absolute nature belong to the former class; *e. g.* "*As* virtue *advances, so* vice *recedes.*" When something contingent or doubtful is implied, the subjunctive ought to be used, as "*If I were* to write, he would not regard it." See Subjunctive.

18. When the qualities of different things are compared, the latter noun or pronoun is not governed by the conjunction *than* or *as*, but agrees with the verb, or is governed by the verb or the preposition, expressed or understood; as "Thou art wiser than I," that is, "than I am."

19. For the purpose of avoiding disagreeable repetitions, and of expressing our ideas in few words, an ellipsis, or omission of some words, is frequently admitted; *e. g.* instead of saying "He was a learned man, he was a wise man, and he was a good man," we say, availing ourselves of the ellipsis, "He was a learned, wise, and good man."

20. All the parts of a sentence should correspond to each other; so that a regular and dependent construction may, throughout, be carefully preserved. The following sentence is inaccurate; "He was more beloved, but not so much admired, as Cinthio," it should be, "He was more beloved than Cinthio, but not so much admired."

21. The regimen of verbs is frequently laid on different kinds of relations, according to custom or usage; which yet does not change the specific relation of each case, but only shews, that custom has made choice of this or that, according to fancy. Thus the Latins say, *juvare aliquem*, and *opitulari alicui, to help one.* So the French say, *servir quelqu'un*, and *servir à quelqu'un, to serve one.* Thus the English say, *fight one*, or *fight with one.* And thus, in Spanish, most of the verbs active govern indifferently either a dative or an accusative. Sometimes, also, the verb admits of several regimens; as *præstare aliquem*, or *alicui; eripere morti aliquem*, or *aliquem à morte.*

Indeed, the different regimen sometimes makes an alteration in the sense; in which, particular regard is to be had to the usage of the language. Thus, the Latin *cavere alicui* signifies *to watch*, or *be careful of the preservation of any one; cavere aliquem* signifies *to beware of him.*

There is one very common fault in regimen, which our accurate writers should be careful to avoid; *viz.* the using of two verbs that require different cases together, as only governing one case; as in this example; after *embracing and giving his blessing to his son;* where *embracing* requiring an accusative, and *giving* a dative case, the regimen or construction of the first verb with the noun is irregular; *embrace to a son.*

The same may be observed in nouns; as, *I conjured him by the memory and the friendship he bore my father;* where *memory* does not agree with *he bore.*

For an ample illustration of these rules by appropriate examples, and also of the exceptions which pertain to each respectively, we refer to Mr. Murray's English Grammar, vol. i. ch. 12. See Concord and Syntax.

Regimen, or *Construction, State of, Status regiminis*, a phrase used by Hebrew grammarians in contradistinction to the *absolute state*, or *status absolutus.* A noun in *statu absoluto* is that which does not govern either a genitive or any oblique case; and it is said to be *in regimine* or *in constructione*, when it does govern such case. Nouns of the former kind seldom undergo any change in the letters that form them, as מלכים צדקים, just kings, whereas the latter either lose one of their letters, or undergo a change of one into another; but these latter admit of excepted cases; *e. gr.* singular masculine nouns undergo no change *in regimine* מלך ארץ, king of the land, and plurals throw off the final letter, as מלכי ארץ, kings of the earth, for מלכים ארץ. This is also the case with participles, as פעל און, working iniquity, and פעלי און, workers of iniquity. Singular feminine nouns ending in ה change the ה *in regimine* into ת, as תורת יהוה, the law of the Lord; others, and especially plural nouns, undergo no change מלכת שמים, the kingdom of heaven. We shall here observe, that the change which takes place on account of the state of regimen is made in the governing noun, and not in that which is governed, contrary to the practice in other languages. For other particulars referring to regimen in Hebrew, as well as in Latin, Greek, and other learned languages, we refer to the article Syntax.

REGIMENT, derived from the Fr. *regir*, of *regere*, to govern, or from the Fr. *regime*, denoting system or administration, in *War*, a body consisting of several troops of horse, or companies of foot, commanded by a colonel, lieutenant-colonel, and major; or, as sir James Turner defines it, a certain number of companies joined in one body, under one head. A regiment of cavalry consists of one or more squadrons; and a regiment of infantry of one or more battalions.

The number of men in a regiment is as undetermined as that of the men in a troop, or company; in a squadron or battalion.

A battalion in each regiment of foot is divided into companies, but the number of companies is various; though, in England, our regiments are generally ten companies; two of which are called the flanks; one on the right, consisting of grenadiers, and another on the left, formed of light troops. The squadrons in cavalry, or in regiments of horse, are divided, sometimes into six, and sometimes into nine troops. Each regiment has a chaplain, quarter-master, adjutant, and surgeon. It has been suggested, that every regiment of foot should consist of 2400 men, making three battalions of 800 each.

Some German regiments consist of 2000 foot; and the regiment of Picardy in France consisted of 120 companies, or 6000 men.

The French have distinguished between the commanding officer of a regiment of cavalry, and the commanding officer of a regiment of infantry; the former having been called "maître de camp," and the latter "colonel," as with us. According to the present establishment of the French army, the term "regiment" is confined to the cavalry and artillery, and the name of half brigade is given to the infantry, so that "chêf de brigade," chief of brigade, corresponds with our colonel of a regiment of infantry. In the French cavalry the term colonel is still retained.

Some observe, that there were no regiments of horse before the year 1637. Till then the troops were loose and independent of each other, and not incorporated into a body or regiment.

Regiments, it is said, were first formed in France, under the reign of Charles IX. though F. Daniel refers them to the time of Henry II. and in England to the year 1660. Grose observes, that we may, without being very much mistaken, place the introduction of regiments and colonels about the reign of king Henry VIII.

We shall here annex a brief account of some of the principal regiments of the old corps. The first and second regiments of life-guards claim priority of notice. The life-guards

guards succeeded that body under the same denomination which was raised by Charles II., soon after the restoration, the privates of whom were taken from the cavalier gentlemen, who had adopted the profession of arms, and followed the fortunes of his father during the civil wars. As they were for the most part men of family, they possessed certain privileges, similar to those of the houshold troops in France, after whom they were modelled; and these privileges were continued long after the time when they ceased to be composed of the same class of men. It was, therefore, found necessary to reduce the privates, and to form a new corps, composed almost entirely of recruits under the old officers, and to place them nearly on the same footing with the rest of the cavalry; reserving for them, however, the advantages arising out of a higher pay, and an exemption from stoppages on the part of the privates, whose clothing is furnished by government. The life-guards claim the privilege, that their officers are not liable to be tried by any court-martial, unless the members are composed of their own regiment, or of officers of the other houshold troops. The first regiment of life-guards, consisting of very fine men, about 6 feet high at an average, was formed in 1788. The uniform is scarlet, faced with blue, and gold lace. The commissioned officers are a colonel, one lieutenant-colonel, one supernumerary lieutenant-colonel, two majors, five captains, six lieutenants, one adjutant and lieutenant, five cornets, one surgeon, and one veterinary surgeon. The non-commissioned officers consist of quarter-masters and corporals. The privates are about 260 in number. Their quarters are permanent at Knightsbridge barracks. The second regiment is on the same footing with the first, and of the same establishment. The average height of the men is 5 feet $11\frac{3}{4}$ inches; the horses are from 16 to 18 hands high, of a black colour, with long tails. In this regiment, as well as the other, there are five troops; each troop consisting of one captain, one lieutenant, one cornet, one quarter-master, three corporals, 49 privates, including a farrier, and one trumpeter. Each regiment has one kettle drummer. The officers usually ride bay-horses; the kettle drummers and trumpeters, grey. There are two "gold-sticks," one appertaining to each regiment: their duty is to attend alternately every month on his majesty. See *Life*-Guards.

A body of foot-guards was not regularly organized on the present plan till after the restoration. The regiment of general Monk, created duke of Albemarle, was, in compliment to him, retained on the establishment, when most of the other troops were disbanded. This regiment had been raised about ten years before the period alluded to, at Coldstream, in Scotland; and from this circumstance it assumed the name, which it has borne ever since. The year 1660 may thus be considered as the era of the formation of the foot-guards; and though other regiments were added, the Coldstream had the priority. The guards possess many peculiar honours and privileges: they have precedency of all others; their officers possess a higher rank in the army; and without expence to themselves, when on guard at St. James, they have a plentiful table kept for them by the public, and voted annually in the extraordinaries of the army. The king's person, the royal family, the Tower, and, in times of danger, the bank of England, are in a particular manner under their protection. Their uniforms are royal, with blue facings, and their pay superior to that of the marching regiments. See *Foot*-Guards.

The corps, denominated the royal regiment of horse-guards, blue, commonly called Oxford blues, derives its appellation from the noble family of Oxford, who was its first colonel in 1661. This regiment has distinguished itself on a variety of occasions. The following circumstances are peculiar to this corps. It is the only regiment, denominated "horse," at present on the British establishment. The promotions, that of colonel excepted, are restricted to the regiment. The quarter-masters' commissions are signed by the king, so that they are properly termed commission-officers; whereas in all the other cavalry, or dragoon regiments, quarter-masters are only warrant-officers. The average height of the men is 5 feet $10\frac{1}{2}$ inches. The uniform of the officers is blue, faced with scarlet, gold lace, and buff lining; of the privates, blue, with plain red lappets, very broad buff cross-belts, and gloves of the same colour. The troopers' horses are black, with long tails. The corps consists of nine troops; and to each troop belong four commissioned officers, five non-commissioned officers, and 54 private men: there are, besides, the colonel, one lieutenant-colonel, one major, an adjutant, a regimental surgeon and assistant, and a veterinary surgeon. See *Horse*-Guards.

The establishment of a royal regiment of artillery took place early in the last century; the first commission of colonel having been issued, as it is said, in the first year of the reign of George II. In a short time, the number of companies was augmented from four to eight. The uniform was blue, turned up with red; and waistcoats and breeches of the colour of the facings were then worn by the officers. The artillery take the right of foot on all parades, and likewise of dragoons, when dismounted. Each battalion consists of one colonel commandant, one ditto en-second, one first lieutenant-colonel, two second lieutenant-colonels, one major, ten captains, ten captain-lieutenants, thirty lieutenants, one adjutant, one quarter-master, one surgeon, and one assistant surgeon. The establishment of each company is 120 rank and file. The standard height of the men is 5 feet 9 inches, and upwards. The uniform of the officers is blue, faced with scarlet, gold epaulets, no lace, white waistcoat and breeches, boots, yellow breastplate on a white buff shoulder-belt. The uniform of the privates is blue, with red cuffs and collar, no facings, yellow lace, and buttons impressed with the ordnance arms. The serjeants wear frogged gold lace. The arms of the officers and serjeants are yellow-hilted swords; of the corporals, bombardiers, and privates, carbine and bayonet. The horse artillery have swords and pistols. The officers rise in a regular gradation by seniority. See Artillery.

The first or royal regiment of foot claims a high degree of antiquity. It is undoubtedly the oldest regiment in the service. It is said to have been the body-guard of the Scottish kings, whence it has derived its name of the royal Scots, and to have been put upon the English establishment in 1633. The first colonel was nominated during the reign of Charles I.; but on the fatal issue of the civil wars to that monarch, this corps seems to have been disbanded. At the restoration of Charles II., this regiment was re-established. It consists of two battalions, both commanded by the same colonel: in every other respect they are considered as separate corps. The uniform of the officers is scarlet, faced with blue, gold lace embroidered; that of the private soldiers red, faced with blue and white lace.

The second, or queen's royal regiment of foot, was raised in the year 1661. The regiment being royal, the facings for the whole are blue; the lace for the privates white, with a blue stripe.

The third regiment of foot, called the "Buffs," was put upon the regular establishment of the army in the year 1665. It was denominated the "Buffs," from being the first whose accoutrements were made of leather prepared from the buffalo, after the manner of shamois. The waistcoats, breeches, and

and facings of the coat, were afterwards directed to be made of a correſponding colour. When other regiments aſſumed this part of their appointment, the third acquired the name of the "Old Buffs." This regiment has the excluſive privilege of marching through the city of London by beat of drum. Its uniform is red, with buff facings; buff waiſtcoats and breeches. The 31ſt regiment, which has the ſame uniform, is commonly called the "Young Buffs."

The fourth, or king's own regiment of foot, was raiſed in the year 1680, by Thomas earl of Plymouth. This regiment was the firſt that joined king William, on his landing at Torbay; on which occaſion his majeſty honoured it with the title of the king's own regiment; and directed it to bear in its colours the lion of England, which ſtill continues the badge of the regiment, and is worn on the breaſtplate, buttons, cap, and pouch. The uniform of the regiment, at the beginning of the laſt century, was red, faced with blue velvet, and large velvet cuffs, richly embroidered with gold. The preſent uniform is red, with plain blue facings, ſilver buttons and epaulet, white waiſtcoat and breeches. On the epaulet, buttons, and breaſt-plate, are the crown and garter, and round the latter "The King's own Infantry." In the centre is the lion of England, and under it the number IV in ſmall Roman figures.

The fifth regiment of foot was raiſed by James II.; but it followed the fortunes of the prince of Orange. When the 4th, 5th, and 6th regiments were firſt raiſed, they were not placed upon the Britiſh eſtabliſhment, but ſent by James II. for the ſervice of the ſtates-general. On the abdication of that monarch, and the ſubſequent election of William, prince of Orange, they were numbered and taken into the line, according to the periods at which they landed from Holland. Thus the 4th, which had originally been raiſed after the 5th, arrived in England before it, and took precedence. The 6th, which had been levied before the 5th, returned at a later period than either, and was conſequently placed according to that date. The 5th regiment has been augmented to two battalions, by drafts from the militia; its uniform goſling green facings. The 24th, 54th, and 69th regiments are alſo faced with light green.

The ſixth regiment of foot derives its origin from the ſeven years' war, in the courſe of which the United Provinces of Holland threw off their ſubjection to Spain. Its regular eſtabliſhment did not take place until the year 1673; but it had previouſly ſerved under the three firſt princes of Orange. This was one of the three regiments intended, on their formation, to ſerve in Holland; and, therefore, it was paid by the Dutch republic. It came over to this country with king William, at the revolution in 1688, and was incorporated in our military eſtabliſhment, being numbered as the 6th in the Britiſh line. Its uniform is deep yellow facings, white lace, with yellow and red ſtripes. The 9th, 10th, 12th, 13th, 15th, 16th, 20th, 25th, 26th, 28th, 29th, 30th, 34th, 35th, 37th, 38th, 44th, 46th, 57th, 62d, and 67th regiments have alſo yellow facings and white lace; and are diſtinguiſhed from each other by the variations of the ſtripes, the tinge of the colour, &c.

The ſeventh regiment of foot, or "Royal Fuſileers," was raiſed, with nine others of infantry, and eight of cavalry, under James II., in the year 1685, three years before his abdication. As a fuſileer regiment, the men wear caps, ſimilar to thoſe of the grenadiers, but ſomewhat ſhorter. In all other reſpects they are dreſſed and appointed as the ſoldiers of other battalions. Three years after this, another regiment was raiſed, under the denomination of "Royal Welſh Fuſileers." This partiality for cap regiments is ſaid to have been cauſed by the celebrity of the Britiſh grenadiers, who were eaſily diſtinguiſhed by their caps. (By a regulation in 1800, all the regiments of the line, as well as the guards, are to wear a kind of caps.) The officers of theſe regiments never carried ſpontoons, as the others did, till the late change, but had fuſils, like the officers of the flank companies throughout the army. The other regiments of fuſileers have ſecond lieutenants, inſtead of enſigns. This regiment is peculiar in having none but firſt lieutenants, under the field-officers and captains. The uniform is royal blue facings, with white lace, and a blue ſtripe. The 8th, 18th, 21ſt, 23d, 42d, and 60th regiments have alſo blue or royal facings, but different lace.

The firſt, or king's regiment of dragoon-guards, was raiſed and entered on the eſtabliſhment on the 6th of June 1685. The eſtabliſhment of this regiment, called, during its ſervices in Germany in the courſe of the ſeven years' war, "Bland's dragoons," from the name of the officer who was then at the head of it, is ten troops, each conſiſting of one captain, one lieutenant, one cornet, one quarter-maſter, four ſerjeants, four corporals, one trumpeter, and ſeventy-one rank and file. The average height of the men is 5 feet 10 inches; of the horſes, 15 hands $1\frac{1}{2}$ inch. The uniform of the officers is ſcarlet and gold lace, blue cuffs and collar; no facings on the ordinary uniform. The uniform of the troopers, red jacket, faced half-lappel, blue, white lace, buttons marked K. D. G. The ſerjeants wear gold lace. The ſecond, or queen's dragoon-guards, is one of the eight cavalry regiments raiſed in 1685, the ſecond year after the acceſſion of king James II. to the throne. Five of theſe remain on the Engliſh eſtabliſhment, and three on the Iriſh: of the former five, three are diſtinguiſhed as "Dragoon-guards," the other two as "Dragoons;" the firſt of which is denominated "the king's own regiment." The uniform of the officers red, faced with black velvet and ſilver lace; and that of the troopers red jacket, black collar and cuffs, royal lace, white buttons, marked Q. D. G. The ſerjeants wear ſilver lace. The third, or prince of Wales's dragoon-guards, is the laſt of the three regiments diſtinguiſhed as dragoon-guards upon the Britiſh eſtabliſhment. The uniform is ſcarlet, faced with white, and yellow buttons. The fourth, or royal Iriſh regiment of dragoon-guards, was raiſed, with ſeven others of the cavalry, in the year 1685, ſoon after James II. aſcended the throne. It was originally called "the Prince of Wales's," or firſt regiment of horſe; and, with the other three of horſe upon the ſame eſtabliſhment, it was, in the year 1788, put upon a new one, and called "Dragoon-guards," numbering on to ſeven; ſo that the fourth of horſe, formerly ſo called, is now the ſeventh dragoon-guards. The uniform is royal, with ſilver lace. The fifth regiment of dragoon-guards, commonly called the "Green Horſe," was originally the ſecond of horſe, and raiſed in England in the reign of king James II., in the month of July 1685. It was at that time put upon the regular Britiſh eſtabliſhment. It went over with king William to Ireland in 1689, and remained more than 100 years upon the Iriſh eſtabliſhment. It is now on the Engliſh eſtabliſhment; and conſiſts of nine troops, of the ſame ſtrength with thoſe of the fourth regiment of dragoon-guards; each troop conſiſting of one quarter-maſter, four ſerjeants, four corporals, one trumpeter, and ſeventy-one privates. The uniform of the regiment is green facings with gold lace for the officers, and yellow for the private men. The height of theſe men is in general from 5 feet 8 inches to 6 feet. The firſt, or royal regiment of dragoons, was raiſed for the ſervice of Charles II. in 1683. Their badge is a horſe-ſhoe, incloſing 1ſt D., encircled with a wreath of laurels; the regiment conſiſts of nine troops, of the uſual number. The colour of the horſes is black. The ſecond,

second, or royal North British dragoons, called the "Scots Greys," were raised in Scotland during the reign of James II. The uniform is red, with gold lace, no facings, but blue collar and cuff. The horses are of an iron-grey colour, except those of the officers and trumpeters, which are of a light grey, approaching to white. The fifth, or royal Irish regiment of dragoons, was raised in or about the year 1688. In consequence of the good behaviour of this regiment at the battle of Hochstet, in August 1704, three additional troops were put upon the establishment, making its strength to consist of nine troops. Again this regiment, assisted by the Scots greys, distinguished itself at the battle of Ramillies in 1706; and both corps were distinguished from other cavalry regiments, by being permitted to wear grenadier caps. The permanency of the nine troops was secured by an order, dated in 1798. At this time there was an insurrection of the rebels in the disaffected parts of Ireland, and this regiment was ordered to resist and suppress it. In order to supply the loss it sustained in several conflicts with the rebels, its officers were instructed to receive eligible recruits. Many were enlisted, who, as the event afterwards proved, were rebel-partisans, who entered into a desperate plot for seizing the garrison at Lehaunstoun and massacring every officer and loyal soldier. The conspirators were seized, and suffered according to their deserts. The regiment, however, had the mortification to find it announced in the public papers, that several privates belonging to the fifth or royal Irish dragoons, had been found guilty by a general court-martial of joining the rebels. In consequence of this the regiment was, on the 10th of April following, disbanded by an order from his majesty, dated April 8th, 1799. See Grose's Mil. Ant. vol. ii. appendix.

REGIMENTAL *Court-martial.* See COURT-*Martial.*

REGIMENTAL *Staff.* See STAFF.

REGIMENTALS, the uniform clothing of the army, consisting of a hat, coat, waistcoat, breeches, shirts, stocks, shoes, stockings, spats, spatterdashes, &c.

REGINA, in *Geography*, a town of Naples, in Calabria Citra; 12 miles N. of Cosenza.

REGINA *Aurarum*, in *Ornithology*, a name given by Nieremberg to a bird called by the Mexicans *cozcacoauhtli*. It has obtained its name from its being able to fly against the strongest winds. It is of the bigness of an eagle, and its whole body is of a blackish purple, variegated with a brownish-yellow and deep black; its wings are variegated with black, yellow, and grey; its legs are red; its claws very strong and sharp; and its beak like that of a parrot; it has some rugose skin on the forehead, and about the beak; and its tail is black above, and grey underneath. It feeds on snakes, rats, and other vermin, but will also eat human dung; it flies very high; it is a native of Mexico, and breeds in spring; its feathers are said to be a remedy for many diseases; but the truth of this account is much to be doubted. Ray.

REGINA, *Salve.* See SALVE.

REGINELLI, NICOLA, in *Biography*, an Italian opera singer, renowned for his knowledge and the purity of his taste. He arrived in London in the autumn of 1746, an old but great singer, whose voice as well as person were in ruin. He first appeared on our stage in a pasticcio, called "Annibale in Capua." This performer was now turned of fifty; his voice a *soprano*, but cracked, and in total decay; his figure tall, raw-boned, and gawky; but there were fine remains of an excellent school in his taste and manner of singing; indeed, he had some refinements in his embellishments and expression, that cannot be described, and which we have not since heard in any other singer. In a *cantabile*, his taste, to those who had places near enough to hear his *rifiorimenti*, was exquisite; but the imperfections of his voice and figure disgusted those at a distance, to whose ears only the worst part of his performance arrived.

REGINO, a celebrated German ecclesiastical writer and chronicler, who flourished in the ninth and tenth centuries. He embraced the monastic life at the Benedictine abbey of Prum, in the diocese of Treves, and by his conduct gained such general respect among the fraternity, that in the year 892 he was made abbot, which office, however, from the jealousy of his rivals, he was obliged to resign in 899. After this he probably retired and spent the remainder of his days in the abbey of St. Maximin at Treves. He died about the year 908. He was author of "A Chronicon," extending from the birth of Christ to the year 907, which is said to be very useful in illustrating the history of his time, and particularly that of the Franks and Germans. This chronicon was published at Frankfort in 1583, with an appendix by another hand, continuing it from the year 907 to 972, and it is to be found in Pistorius's collection, entitled, "Scriptores de Rebus Germanicis." Regino was author likewise of "De Disciplinis Ecclesiasticis et Religione Christiana," in two books, of which the first contains those canons which relate to ecclesiastical persons, and the second, those which regard the laity. This work was undertaken by him about the year 906, at the desire of the archbishop of Treves, for the special benefit of his diocese. It was first published, with an appendix, by Joachim Hildebrand, at Helmstadt, in 1659, from a manuscript of Flacius Illyricus; and afterwards by M. Baluse, with additions, and a learned preface and notes, in 1671. Trithemius pronounces Regino to have been the best German writer of his age.

REGINO, in *Geography*, a town of Golo, or the island of Corsica, in the department of Calvi; the canton of which contains 3913 inhabitants.

REGIO ASSENSU, in *Law*, is a writ by which the king gives his royal assent to the election of a bishop.

REGIOMONTANUS, in *Biography*. See MULLER.

REGION, in *Anatomy*, denotes a division of the human body. Some anatomists have divided the body into three regions, or venters.

The upper region is that of the head, reaching as low as the first vertebra, and comprehending the animal organs, the brain, &c. See HEAD, &c.

The middle region is that of the thorax or breast, which Hippocrates calls the upper venter, and which reaches from the clavicles to the diaphragm: in this are contained the vital parts, as the heart, lungs, &c. See HEART, LUNGS, &c.

The third, or lower region, is the abdomen or belly, &c. containing the natural parts, destined for digestion, purgation, and generation. See ABDOMEN.

REGION, *epicolic*, *epigastric*, and *umbilical*. See the adjectives.

REGION, *Regio*, in *Geography*, a country, or particular division of the earth; or a tract of land inhabited by people of the same nation.

The modern astrologers divide the moon into several regions, or provinces, to each of which they give its proper name. See MOON.

REGION, in *Physiology*. Authors divide the atmosphere into three stages, called the *upper*, *middle*, and *lower* regions. See ATMOSPHERE.

The lowest region is that in which we breathe, and is bounded by the reflexion of the sun's rays, that is, by the height to which they rebound from the earth.

The middle region is that in which the clouds reside, where meteors are formed, &c. extending from the extremity of the loweft to the tops of the higheft mountains.

The upper region commences from the tops of the mountains, and reaches to the utmoft limits of the atmofphere. In this reigns a perpetual, equable calmnefs, clearnefs, and ferenity.

Region, *Elementary*. See Elementary.

Region, *Etherial*, is ufed for the whole extent of the univerfe, including the orb of the fixed ftars, &c.

Regions *of the Sea*. As fome naturalifts, in their defcriptions of the fubterraneous parts of the globe, diftinguifh the earth into three regions of different depths, in which different temperatures are obferved; fo in defcribing the fea, they allow it two regions; the one extending from the furface of the water, down fo low as the rays of the fun can pierce, and extend their influence; and the other, from the loweft bounds of that to the bottom. It is eafy to fee that thefe regions rather regard quality than fpace, and that their boundaries are far from being regular, or equal in all places, and at all times. The places expofed to the hotteft funfhine will have the largeft upper region; thofe where the fun has leaft power will have the fmalleft; and the fame part of the fea will have its upper region more or lefs deep, according to the feafon of the year. This upper region of the fea is always more or lefs hot; the lower region, except in fome few particular places, is every where cold; and the water, where the upper region is large, is always remarkably ftill and quiet in the lower. Boyle of Cofmical Qualities.

Region, *Subterranean*. The earth is not only divided on its furface into regions and countries, but philofophers, who have had occafion to difcourfe of its inner parts, have alfo divided them into three diftinct regions, according to their different depths from the furface. The temperature of the fubterranean parts of the globe is diftinguifhed according to the divifion of thefe regions, but is not fo regular and precife as fome have fuppofed. The firft region of the earth is very variable, both as to bounds and temperature. The fecond region feems for the moft part cold, in comparifon of the other two; but in feveral places, which, by reafon of their diftance from the furface of the earth, it would be natural to call the middle region, the temperature of the air is very different at the fame feafons of the year, which fhews that it depends on fomething more than bare depth from the furface. The third region of the earth is univerfally obferved to be warm, but by no means regularly or uniformly: the fame depth in fome places, giving only a moderate warmth, while in others it gives a very confiderable heat.

Borrichius tells us of a certain abbé, fond of chemiftry, and particularly curious in the matter of long digeftions by regular heat, who found a way of making a furnace perpetually warm, by piercing the earth to a certain depth, and ufing the heat of this third region of it. His method, we are told, was to bore a hole with a pike twenty feet deep, and pour into it ten or twelve pounds of quickfilver; this made its way into the ftrata, and through them in a body into the chambers of heat in this third region, where the heat, having a vent upwards, made by this opening, never failed to afcend in a perpetual and regular ftream, and gave that regular and digefting heat that no artificial fire could equal. But this is an alchemical ftory. Boyle of Cofmical Qualities. Borrich. de Ortu Chem.

Region, in ancient Rome, a part or divifion of the city. Romulus divided his little city into three tribes, and Servius Tullius added a fourth; which divifion continued till Auguftus's time, who firft divided the city into fourteen regions, over each of which he fettled two furveyors, called *curatores viarum*, who were made annually, and took their divifions by lot. Thefe fourteen regions contained 424 ftreets, 31 of which were called great or royal ftreets, which begun at the gilt pillar that ftood at the entry into the open place in the middle of the city.

The extent of thefe divifions varied greatly, fome being from 12,000 or 13,000 to 33,000 feet and upwards in circumference. Authors, however, are not agreed as to the exact limits of each.

According to Kennet, who formed his divifion on the authority of the accurate Panvinius, the different regions were as follow: The *firft* region, called "Porta Capena," contained 9 ftreets, 3 luci, or confecrated groves, 4 temples, 6 ædes, or facred buildings, 6 public baths, 4 arches, 14 granaries, 12 mills for grinding corn, and 121 domi, or great houfes. The whole compafs of this region, or ward, was 13,223 feet. The *fecond* region, denominated "Cœlimontium," included 12 ftreets, 2 luci, 5 temples, the public baths of the city, 80 private baths, the great fhambles, 23 granaries, 23 mills, and 133 great houfes. Its compafs was 13,200 feet. The *third* region, or Ifis and Serapis, contained 8 ftreets, 2 temples, the amphitheatre of Vefpafian, the baths of Titus, Trajan, and Philip, 19, or, as fome fay, 29 granaries, 23 mills, 160 great houfes. Its compafs was 12,450 feet. The *fourth* region, Via Sacra, or Templum Pacis, comprehended 8 ftreets, 10 temples, the coloffus of the fun, 120 feet high, the arches of Titus, Severus, and Conftantine, 75 private baths, 18 granaries, 24 mills, and 138 great houfes. Its compafs, according to fome, was only 8000, but, according to others, 14,000 feet. The *fifth* region, or Efquilina, included 15 ftreets, 8 luci, 6 temples, 5 ædes, 75 public baths, 18 granaries, 22 mills, and 180 great houfes. Its compafs was 15,950 feet. The *fixth* region, Acta Semita, contained 12 or 13 ftreets, 15 temples, 2 porticos, 2 circi, 2 fora, 75 private baths, 19 granaries, 23 mills, 155 great houfes. Its compafs was 15,600 feet. The *feventh* region, Via lata, included 40 ftreets, 4 temples, 75 private baths, 3 arches, 17 mills, 25 granaries, and 120 great houfes. Its compafs was 23,700 feet. The *eighth* region, Forum Romanum, included 12 ftreets, 21 temples, 66 private baths, 10 ædes, 9 porticos, 4 arches, 7 fora, 4 curiæ, 7 bafilicæ, 6 columns, 18 granaries, 30 mills, and 150 great houfes. Its compafs was 14,876 feet. The *ninth* region, Circus Flamininus, comprehended 20 ftreets, 8 temples, 20 ædes, 12 porticos, 2 circi, 4 theatres, 3 bafilicæ, 2 curiæ, 5 baths, 2 arches, 2 columns, 32 mills, 32 granaries, and 189 great houfes. Its compafs was 30,560 feet. The *tenth* region, Palatium, contained 7 ftreets, 10 temples, 9 ædes, 1 theatre, 4 curiæ, 15 private baths, 12 mills, 16 granaries, and 109 great houfes. Its compafs was 11,600 feet. The *eleventh* region, Circus Maximus, included 8 ftreets, 22 ædes, 15 private baths, 16 granaries, 12 mills, and 189 great houfes. Its compafs was 11,600 feet. The *twelfth* region, Pifcina Publica, contained 12 ftreets, 2 ædes, 68 private baths, 28 granaries, 25 mills, and 128 great houfes. Its compafs was 12,000 feet. The *thirteenth* region, or Aventinus, included 17 ftreets, 6 luci, 6 temples, 74 private baths, 36 granaries, 30 mills, and 155 great houfes. Its compafs was 16,300 feet. The *fourteenth* region, Tranftiberina, contained 23 ftreets, 6 ædes, 136 private baths, 20 granaries, 32 mills, and 150 great houfes. Its compafs was 33,409 feet.

REGIONARY, Regionarius, in *Ecclefiaftical Hiftory*, a title given, from the fifth century, to perfons who had the charge and adminiftration of the church affairs within a certain diftrict or region.

At Rome there were anciently feven regionary deacons, who

who prefided over a kind of hofpitals, and looked to the diftribution of alms.

There were alfo regionary fubdeacons, and regionary notaries, as alfo regionary bifhops, &c.

A regionary bifhop was properly a miffionary invefted with an epifcopal character, but without being attached to any particular fee, that he might be at liberty to go to preach, and perform other functions of his miniftry, whitherfoever the Spirit of God and the wants of the people fhould call him.

REGIS, Peter-Sylvan, in *Biography*, a celebrated French philofopher, was born at Salvetat de Blanquefort, in the Agenois, in the year 1632. After having been inftructed in claffical learning and the belles lettres, by the Jefuits, at Cahors, he entered himfelf a ftudent of divinity at the univerfity of that city, intending to qualify himfelf for the clerical profeffion. This, however, he abandoned, in order to devote himfelf to the ftudy of the Cartefian philofophy, which at that time was taught with great fuccefs by Rohault. With this view he went to Touloufe in 1605, and read a courfe of lectures upon the principles of Defcartes, and was attended by perfons of all ranks and characters, who inlifted themfelves in the number of his difciples. Among thefe were to be found the magiftrates, clergy, and even the women of Touloufe, who affected to be the zealous converts to the new philofophy, in oppofition to the old. To exprefs their gratitude to the man who had been the inftrument of diffufing this light over their city, the inhabitants granted him a penfion; a circumftance which, it has been obferved, correfponded more with the fpirit and ufages of ancient Greece, than of modern times. In 1680 he came to Paris, confidering that as the moft proper fcene for the exhibition of his talents. Here he was extremely popular, and the friends to the Ariftotelian fyftem began to be alarmed at his fuccefs, and complained againft him to the archbifhop of Paris, who prohibited him from continuing his lectures, and they were accordingly fufpended. But after a fhort time, the prelate withdrew his interdict, and Regis devoted the remainder of his life to the propagation of the Cartefian philofophy, as well by his writings as his lectures. In 1699 he was admitted a member of the Academy of Sciences, but his infirmities prevented him from attending its meetings. He died in the year 1707, at the age of 75, highly efteemed by perfons of the firft diftinction for talents and rank. He was author of a great number of works, of which the following may be mentioned: "A Syftem of Philofophy, containing Logic, Metaphyfics, and Morals;" "An Anfwer to the Book of M. Huet, entitled 'Cenfura Philofophiæ Cartefianæ,'" which is mentioned by Bayle as a model for every writer on the fame fide of the queftion; "An Anfwer to the Critical Reflections of Du Hamel on the Syftem of Philofophy."

Regis, in *Geography*, a town of Saxony, in the bifhopric of Nuremburg; 14 miles S. of Leipfic.

Regis, *St.*, a village of Upper Canada, on the St. Lawrence, half a mile N. from the N. line of the United States. It is feated on a beautiful elevated plain, in the angle between the mouth of St. Regis river and the St. Lawrence. It confifts of about 80 houfes of hewn logs, inhabited by about 100 Indian families, of the Caghnowaya tribe, who have lived here more than half a century. They are peaceable, honeft, and induftrious. Their diverfions are footraces, playing at ball, and dancing. They are Roman Catholics, and have a handfome ftone church, with a fpire, and generally a minifter. Thefe Indians have 30,000 acres of land referved to them S. of the village. They keep a great number of horfes and cattle, and raife plenty of corn on the fertile iflands in St. Lawrence. From St. Regis there is a good road to Plattfburg, on Champlain; the diftance being 72 miles.—Alfo, a river of Canada, which rifes from lakes near Racket river, and enters the St. Lawrence at the village above-mentioned.

Regis *Pondus*. See Pondus.

Regis *Villa*. See Villa.

REGISTAN, or *Sandy Defert of Agimere*, in *Geography*, a fandy defert, forming the weftern boundary of Hindooftan, between the country of Agimere and the Indus. The northern extreme of this defert bounds the dominions of the Seiks on the fouth.

REGISTER, Registrum, a public book ferving to enter and record memoirs, acts, and minutes, to be had recourfe to occafionally, for the juftifying of matters of fact.

Menage derives the word, by corruption, from *regeftum*, a book containing extracts of feveral books, &c. collected together: "Dicitur regeftum quafi iterum geftum." Others derive it from the old French *gifter*, *to lie down in a bed*, &c.

The law of Scotland is rendered very eafy and regular, by means of the great number of regifters, for recording the conveyances of lands, &c. of private perfons. Of thefe there are two kinds: the one general, fixed at Edinburgh, under the direction of the lord regifter, who, before the Union, was the fifth officer of the ftate, and, befides the regiftry, was clerk of the parliament, treafury, exchequer, and feffion.

The other is particularly kept in the feveral fhires, ftewarties, and regalities. The clerks of it are obliged to tranfmit the regifters of their refpective courts to the general regifter; and the notaries their protocols: and here they are fo difpofed, that, on demand, the lieges can have a view of any writs which the law requires to be regiftered, or which parties, for their fecurity, have thought fit to record.

The regifters were firft fet on foot by act of parliament, under king James VI., to the unfpeakable advantage of the fubject.

No man can have a right to any eftate, but it muft be regiftered within forty days of his becoming feifed of it, otherwife it is null; and by this means all fecret conveyances are cut off.

By a law in 1704, it was enacted, that a memorial of all deeds and conveyances, and of all wills and devifes in writing, by which any honours, manors, &c. in the Weft Riding of Yorkfhire, might be any way affected in law or equity, may, at the election of the party or parties concerned, be regiftered: and that, after fuch regifter, every fubfequent deed or conveyance of the faid honours, manors, &c. fo regiftered, or any part of it, fhall be adjudged fraudulent and void, unlefs a memorial of it fhall be alfo regiftered: and the like of wills, &c. But this act did not extend to copyhold eftates, nor to leafes at rack-rent, nor to any leafe not exceeding twenty-one years.

In the year 1708, a fimilar ftatute was paffed for the regiftering of deeds, conveyances, wills, devifes, mortgages, &c. in the Eaft Riding of Yorkfhire: and all the provifions and claufes in this act were hereby extended to the honours, manors, lands, and tenements, in the Weft Riding of the fame county.

In 1709, a law was made for the public regiftering of deeds, conveyances, wills, &c. in the county of Middlefex; which may be done for the fee of one fhilling: and every deed or conveyance, which fhall hereafter be executed, fhall be adjudged fraudulent and void, againft any fubfequent purchafer or mortgagee for valuable confideration, unlefs fuch memorial of it be regiftered according to the direction of of this act, before the registering of the memorial of the deed or conveyance, under which such subsequent purchaser or mortgagee shall claim; and the like as to memorials of wills not registered.

In 1735, a similar register of mortgages, &c. was legally enacted for the North Riding of the county of York; whence York and Middlesex are register counties. (2 & 3 Ann. cap. 4. 6 Ann. cap. 35. 7 Ann. cap. 20. 8 Geo. II. cap. 6.) These statutes do not extend to copyhold estates, leases at a rack-rent, or to any leases not exceeding 21 years, where the possession goes with the lease; nor to any chambers in the inns of court.

Many have wished that the same regulation was extended to all the counties of England and Wales; but judge Blackstone observes, that, however plausible these provisions may appear in theory, it hath been doubted, by very competent judges, whether more disputes have not arisen in those counties, by the inattention and omission of parties, than prevented by the use of registers.

Register, more correctly *Registrer*, *Registrarius*, is also used for the clerk, or keeper of a register, or registry.

Of these we have several, denominated from the registers they keep; as register of the high court of delegates, registers of the arches court of Canterbury, register of the court of admiralty, register of the prerogative court, registers of the province of Canterbury, register of the archdeaconry of Middlesex, &c. register of the faculty office, and register of the garter, who is always dean of Windsor, and deputy registers.

There are also, in the court of chancery, the principal register, the lord chancellor's registers, the registers of the master of the rolls, entering registers, and register of the affidavits.

The appellation of register or registrarius is also given to a notary. See Notary, and Notary, *Public*.

Register, *City*. See Town-*Clerk*.

Register of a parish church, is a book in which the yearly baptisms, marriages, and burials, of each parish, are orderly registered. See Marriage.

This practice was laudably instituted by that great but unfortunate person Thomas Cromwell, earl of Essex, anno 1538, while he was vicar-general to king Henry VIII.; and it was continued in the reigns of king Edward VI. and of queen Elizabeth.

These parish registers are to be kept in a coffer, provided by the churchwardens, with three locks and keys, one of which is to remain with the minister, and the other two with the churchwardens severally, so that neither the minister without the two churchwardens, nor the churchwardens without the minister, shall at any time take that book out of the said coffer. These parish registers are to be subscribed by the minister and churchwardens; and the names of the persons shall be transmitted yearly to the bishop; and it has been enforced by canon 70, and by statute, &c.

By 26 Geo. II. c. 33. to make a false entry in a marriage register, to alter it when made, to forge or counterfeit such entry or a marriage licence, or aid and abet such forgery, to utter the same as true knowing it to be counterfeit, or to destroy or procure the destruction of any register, in order to vacate any marriage, or subject any person to the penalties of this act; all these offences, knowingly and wilfully committed, subject the party to the guilt of felony, without benefit of clergy.

By the 30 C. II. c. 5. for burying in woollen, it is enacted, that the minister of every parish shall keep a register in a book to be provided at the charge of the parish, and make a true entry of all burials within his parish, and of all affidavits of persons being buried in woollen brought unto him according to the said act; and where no such affidavit shall be brought to him within the time therein limited, he shall enter a memorial thereof in the said registry, against the name of the party interred, and of the time when he notified the same to the churchwardens or overseers of the poor according to the said act.

An approved register of births, consisting of certificates signed by two persons who were present at the said births, and entered in a book signed by the register or secretary, is kept with great accuracy, and authenticated by a committee, for the benefit of Protestant dissenters and others. This book is deposited and carefully preserved at Dr. Williams's library, Red-cross Street, Cripplegate, to which any person may have free access at the stated hours, under the direction of the secretary of the said library, whose attention to his office entitles him to public respect.

Register is also a title of a book, containing the forms of most of the writs, original and judicial, used in common law. This is called the *register of writs*, or *registrum omnium brevium*. This register, Coke on Littleton observes, is one of the most ancient books of the common law. And judge Blackstone observes concerning it, that it is the most ancient and highly venerable collection of legal forms, upon which Fitzherbert's Natura Brevium is a comment, and in which every man, who is injured, will be sure to find a method of relief, exactly adapted to his own case, described in the compass of a few lines, and yet without the omission of any material circumstance.

Register, in *Antiquity*, a book or table at Athens, belonging to each particular φρατρία, or ward, in which all fathers were obliged to enrol their sons, making oath, at the same time, that every son, so registered, was either born to them in lawful wedlock, or lawfully adopted. The adopted sons were registered in the festival Thargelia; the natural, upon the third day of the festival Apaturia.

At what age children were thus registered is not agreed. Some are of opinion, that at every return of the Apaturia it was customary to register all the children that had been born that year. Others affirm, that they were commonly three or four years old before they were registered.

There were two other seasons when young Athenians were enrolled in a public register: one, when they arrived at the age of eighteen years, and were admitted into the number of the ἔφηβοι, and was performed on the third day of the festival Apaturia; and the other, before the festival Panathenæa, when those who were twenty years old were entered in a register, called ληξιαρχικὸν γραμματεῖον, in which the names of all persons of that borough, who were of age to succeed in the λῆξις, or inheritance of their fathers, were entered. This was termed *to be registered among the men*: and the persons, thus enrolled, became their own masters, and free from the government of their guardians. Potter's Arch. Græc. vol. i. p. 48.

Registers *of Estates*, the accounts of particular things which belong to them, as those of rentals, valuations of fields, names, admeasurements, different portions of land, cottages, and other buildings distinct from the farms, and any other separate parts. In these registers the valuations are to be inserted in columns, as they arise from surveys or other ways, and afford the means of fixing the real values in re-letting the lands or for other purposes.

Also, a general register of the *timber trees* which are growing on the several divisions of the estates, should always be kept; in which the number contained in each separate wood, grove, hedge-row, or any other part, must be entered,

tered, with their kinds, and the admeafurement of each, for the ufe of the proprietor and wood managers.

A great many other forts of particulars regarding the eftates may likewife be ufefully and conveniently put down in thefe regifters.

Register *of Seamen.* See Manning *the Fleet.*

Register *Ships*, or *Ships of Regifter*, in *Commerce*, were veffels to which the king of Spain, or the council of the Indies, granted permiffion to go and traffic in the ports of Spanifh America.

They were thus called, becaufe the fhips were to be regiftered before they fet fail from Cadiz, which was the place where they ufually loaded for Bueuos Ayres.

Thefe veffels, by the tenor of the cedula or permit, were not to exceed three hundred tons; but there fubfifted that good underftanding between the merchants and the council of the Indies, that fhips of five or fix hundred tons frequently paffed unnoted.

Thefe regifter fhips, which were firft introduced in order to furnifh America with a regular and timely fupply, and thus to prevent a contraband trade with the Englifh, French, and Dutch iflands, were fitted out, during the intervals between the ftated feafons, when the galleons and flota failed, by merchants in Seville or Cadiz, upon obtaining a licence from the council of the Indies, for which they paid a very high premium, and were deftined for thofe ports where any extraordinary demand was forefeen or expected. In proportion as experience manifefted the advantages of carrying on trade in this mode, the number of regifter fhips increafed, and at length, in the year 1748, the galleons, after having been employed upwards of two centuries, were finally laid afide. From that period there has been no intercourfe with Chili and Peru, but by fingle fhips difpatched from time to time, as occafion requires, and when the merchants expect a market will open. Thefe fail round Cape Horn, and convey directly to the ports in the South fea the productions and manufactures of Europe, for which the people fettled in thofe countries were formerly obliged to repair to Porto Bello or Panama.

But as all the regifter fhips deftined for the South feas were obliged to take their departure from Cadiz, and were under a neceffity of returning thither, this branch of the American commerce, even in its new and improved form, continued fubject to the reftraints of a fpecies of monopoly, and felt its pernicious effects.

The intercourfe between Spain and her colonies has in later times been much improved and facilitated. In the year 1764, Charles III. appointed packet-boats to be difpatched on the firft day of each month from Corunna to the Havanna or Porto Rico. From thence letters are conveyed in fmaller veffels to Vera Cruz and Porto Bello, and tranfmitted by poft through the kingdom of Tierra Firmé, Granada, Peru, and New Spain. Packet-boats alfo fail with the fame regularity, once in two months, to Rio de la Plata, for the accommodation of the provinces to the eaft of the Andes.

With this new arrangement for facilitating intercourfe a fcheme of extending commerce has been more immediately connected. Each of the packet-boats, which are veffels of fome confiderable burden, is allowed to take in a loading of fuch commodities as are the product of Spain, and moft in demand in the ports whither they are bound. In return for thefe, they may bring home to Corunna an equal quantity of American productions. This regulation may be confidered as the firft relaxation of thofe rigid laws, which confined the trade with the new world to a fingle port, and the firft attempt to admit the reft of the kingdom to fome fhare in it. This meafure of relaxation was foon followed by another more decifive. In the year 1765, Charles III. laid open the trade to the windward iflands, Cuba, Hifpaniola, Porto Rico, Margarita, and Trinidad, to his fubjects in every province of Spain. This ample privilege was foon after extended to Louifiana, and to the provinces of Yucatan and Campeachy. As foon as this general liberty was permitted, it produced the moft beneficial effects: and it has been computed, that fuch a number of fhips was foon employed in the free trade, that the tonnage of them far exceeded that of the galleons and flota, at the moft flourifhing era of their commerce. This arrangement extended its good effects through every province of the kingdom; and by opening a new market for their various productions and manufactures, encouraged and added avidity to the induftry of the farmer and artificer. Spain has alfo permitted a free trade between the colonies themfelves. In the year 1774 Charles III. publifhed an edict, granting to Peru, New Spain, Guatimala, and Granada, the privilege of a free trade with each other. See Robertfon's Hift. of America, vol. iii.

Register, among *Letter Founders*, is one of the inner parts of the mould in which the printing types are caft. Its ufe is to direct the joining of them juftly together again, after opening them to take out the new-caft letter.

Register, in *Printing*, the difpofing of the forms of the prefs, fo as that the lines and pages printed on one fide of the fheet meet exactly againft thofe on the other; which is done by means of two points in the greater or outward tympan.

Register, in *Organ-building*, is another word for a ftop in that inftrument; but is in fact only a lath pierced with holes, correfponding with thofe in the found-board, which by drawing out the ftops opens the holes, and putting them in fhuts them. By thefe fliders each ftop fpeaks or is filent. Regifter is figuratively ufed by muficians in fpeaking of a voice, in which real and falfet notes are not well united. Mr. Braham's *high* notes, for example, are faid to be of a different regifter from the *low*.

Registers, in *Chemiftry*, are holes, or chinks, with ftopples to them, contrived in the fides of furnaces, to regulate the fire; *i. e.* to make the heat immediately more intenfe, or remifs, by opening them to let in the air, or keeping them clofe to exclude it. See Fire-*places* and Furnace.

REGISTRY, Registrum, comprehends the office, books, and rolls, in which the proceedings of chancery, or any fpiritual court, are regiftered or recorded.

REGISTRY *of Shipping*, in *Commerce*. The regiftering of fhips appears to have been firft introduced into this country by the Navigation *Act*, 12 Car. II. c. 18. § 10. By this ftatute, however, foreign fhips only, "Britifh owned," were required to be regiftered. By ftat. 7 & 8 W. III. c. 22. § 17, Britifh or plantation built fhips, Britifh owned, if intended to be employed in the plantation trade, and alfo all "prize fhips," were required to be regiftered; and in confequence of a regulation at the admiralty, fhips for which Mediterranean paffes were wanted, were alfo to be regiftered. The provifions in the acts requiring regiftry are founded upon the wifeft policy, and are not lefs calculated to prevent the commiffion of private fraud upon individuals, than to advance the public policy of the ftate. By ftat. 26 Geo. III. c. 60. (lord Hawkefbury's act), no fhip or veffel foreign built (except fuch as have been condemned as lawful prize in any court of admiralty), nor any fhips or veffels built or rebuilt upon any foreign made keel or bottom, although owned by Britifh fubjects, and navigated according

according to law, ſhall be entitled to the privileges of a Britiſh built ſhip, or of a ſhip owned by Britiſh ſubjects; and all the privileges and advantages allowed ſhall be confined to ſuch ſhips only as are wholly of the built of Great Britain or Ireland, Guernſey, Jerſey, and the Iſle of Man, or ſome of the plantations in Aſia, Africa, or America, now belonging, or which may hereafter belong to his majeſty, except ſuch foreign built veſſels as before the 1ſt of May 1786 did truly and wholly belong to Britiſh ſubjects, navigated according to law, and duly regiſtered, which ſhall continue to enjoy the privileges to which ſuch ſhip or veſſel is by law entitled; nor ſhall this act prevent any ſuch veſſel which may have been begun to be repaired or rebuilt before the 1ſt of May 1786 from being regiſtered, provided it ſhall appear upon oath, to the ſatisfaction of the commiſſioners of the cuſtoms, that ſuch veſſel was ſtranded by the act of Providence, and was at the time of being ſo ſtranded the ſole property of ſome foreigner, or a droit of the admiralty; and if it ſhall appear that ſuch veſſel, from the damage received, was rendered unfit to proceed to ſea without undergoing a thorough repair in this kingdom, and that ſhe was neceſſarily ſold for the benefit of the foreign owners, or under an order or commiſſion from the court of admiralty, and that ſhe was fairly and openly purchaſed by a Britiſh ſubject, and being the ſole and entire property of ſuch Britiſh ſubject, that ſhe had been ſo much repaired, that two-thirds of her at leaſt are of Britiſh built, ſhe may be regiſtered. ſ. 1.

No veſſel ſhall be deemed Britiſh built, or enjoy the privileges belonging to Britiſh built veſſels, which ſhall be rebuilt or repaired in any foreign port, if ſuch repairs ſhall exceed 15*s.* for every ton, unleſs ſuch repairs ſhall be rendered neceſſary by extraordinary damage, and abſolutely neceſſary to enable her to perform the voyage, and to return in ſafety to ſome place or port within his majeſty's dominions; and before ſuch veſſel ſhall be ſo repaired, the maſter ſhall report her ſtate and condition upon oath to the Britiſh conſul or other chief officer at the port where ſuch repairs may be neceſſary, and cauſe the ſame to be ſurveyed by two perſons to be approved of by ſuch conſul or chief Britiſh officer, and ſhall deliver to ſuch conſul or officer, in writing, the particulars of the damage ſuſtained, and verify upon oath the particulars and amount of the repairs, and that the ſame were become neceſſary in conſequence of damage ſuſtained during her voyage, to enable the ſame veſſel to proſecute her intended voyage, and to return to ſome port within his majeſty's dominions, which muſt be certified under the hand and ſeal of the chief conſul or other officer; or if no ſuch conſul, &c. ſhall be there reſident, the ſurvey ſhall be made by two perſons to be approved of by two known Britiſh merchants reſiding at or near ſuch port. And the maſter of ſuch ſhip ſhall produce to ſuch merchants vouchers of the particulars and amount of the repairs, and their certificate ſhall be of the ſame effect as that of the Britiſh conſul or chief officer. And the maſters of veſſels repaired in any foreign port ſhall make oath before the collector and comptroller, or other principal officer of the cuſtoms in the firſt port of arrival (if required ſo to do), deſcribing the nature and amount of ſuch repairs; and if ſuch expence ſhall exceed 15*s.* *per* ton, and the maſter or commander of ſuch ſhip ſhall neglect or refuſe to deliver to ſuch collector or comptroller, or other principal officer of the cuſtoms, the certificate by this act required to be produced, ſuch veſſels ſhall to all intents and purpoſes be deemed foreign built. ſ. 2.

Ships above 15 tons Britiſh owned ſhall be regiſtered in the manner hereinafter mentioned, and the perſons claiming property therein ſhall cauſe the ſame to be regiſtered, and obtain a certificate of ſuch regiſtry from the collector or comptroller of the cuſtoms of Great Britain, or the Iſle of Man, or from the governor, lieutenant-governor, or commander-in-chief and principal officer of the cuſtoms reſident in the iſlands of Guernſey or Jerſey, or in any of the ſaid colonies, plantations, or iſlands reſpectively.

By § 4, no regiſtry is to be made except in the port to which the veſſel belongs.

The port to which any ſhip or veſſel ſhall hereafter be deemed to belong, ſhall be the port from or to which the ſame ſhall uſually trade, or being a new ſhip, ſhall intend ſo to trade, and at or near which the huſband or acting owners uſually reſide.

No American veſſel ſhall be entitled to be regiſtered, or to any of the privileges of a Britiſh built ſhip or veſſel, unleſs ſuch ſhip ſhall have been taken and condemned as lawful prize, or having been ſtranded, ſhall have been built or rebuilt, and regiſtered in the manner before practiſed and allowed. ſ. 7.

No regiſtry ſhall be made or certificate granted until oath be taken and ſubſcribed before the perſons herein before authoriſed to make ſuch regiſtry and grant ſuch certificate, by the owner of ſuch ſhip or veſſel, if the ſame belong to one perſon only; or, in caſe there ſhall be two joint-owners, then by both of them, if both be reſident within 20 miles of the port where ſuch regiſtry required, or by one of ſuch owners, if one or both be reſident at a greater diſtance; or if the number of ſuch owners ſhall exceed two, then by the greater number of them, if the greater number ſhall be reſident within 20 miles of ſuch port, not exceeding three of ſuch owners, or by one of ſuch owners, if all ſhall be reſident at a greater diſtance. ſ. 9 and 10.

In caſe the owners ſhall amount to three or more, and three of ſuch owners ſhall not perſonally attend to take and ſubſcribe the oath directed, then ſuch owner or owners as ſhall attend and take and ſubſcribe the oath, ſhall further make oath that the part-owner or part-owners abſent, is or are not reſident within 20 miles, and hath or have not, to his or their knowledge or belief, wilfully abſented himſelf or themſelves to avoid taking the ſaid oath, or is or are prevented by illneſs. ſ. 11.

By way of identifying the veſſel to which a certificate of regiſtry is alleged to be granted, the ſurveying officer ſhall go on board ſuch ſhip or veſſel as is to be regiſtered, and ſtrictly admeaſure the ſame in the preſence of the maſter, or any other perſon appointed for that purpoſe on the part of the owners, or by the ſaid maſter, and ſhall deliver a true account in writing of all ſuch particulars of the built, deſcription, and admeaſurement of ſuch ſhip or veſſel as are ſpecified in the certificate, to the perſon authoriſed to make ſuch regiſtry; and the ſaid maſter or ſuch perſon as ſhall attend on the part of the owners, is to ſign his name to the certificate of ſuch ſurveying officer, provided ſuch maſter or other perſon ſhall conſent and agree to the ſeveral particulars ſet forth in the ſaid certificate. ſ. 12.

Surveying officers making or granting falſe certificates to forfeit 100*l.*, and be for ever incapable of holding any office under his majeſty. ſ. 13.

The tonnage of any veſſel when afloat is to be aſcertained by the following method, *viz.* drop a plumb line over the ſtern of the ſhip, and meaſure the diſtance between ſuch line and the after part of the ſtern poſt at the load water mark; then meaſure from the top of the ſaid plumb line, in a parallel direction with the water, to a perpendicular point immediately over the load water mark, at the fore part of the main ſtem; ſubtracting the above diſtance from ſuch admeaſure-admeafurement, the remainder will be the fhip's extreme length, from which are to be deducted three inches for every foot of the load draught of water for the rake abaft, and alfo three-fifths of the fhip's breadth for the rake forward; the remainder fhall be efteemed the juft length of the keel to find the tonnage; and the breadth fhall be taken from outfide to outfide of the plank in the broadeft part of the fhip, either above or below the main-wales, exclufive of all manner of fheathing or doubling, that may be wrought upon the fide of the fhip; then multiplying the length of the keel for tonnage by the breadth fo taken, and that product by half the breadth, and dividing by 94, the quotient fhall be deemed the true contents of the tonnage. Nothing in this act to be conftrued to alter the manner of admeafuring the tonnage of any fhip which has heretofore been practifed for the purpofe of afcertaining the light duties, or any other duties or impofts payable according to the tonnage of any veffel. f. 14.

At the time of obtaining the certificate of regiftry, bonds fhall be given to his majefty by the mafter, and fuch of the owners who fhall attend, in the following penalties:

If a decked veffel, or from 15 to 50 tons, 100*l.*; 50 to 100 tons, 300*l.*; 100 to 200 tons, 500*l.*; 200 to 300 tons, 800*l.*; 300 and upwards, 1000*l.*

The condition of every bond given upon regiftry fhall be, that fuch certificate fhall not be fold, lent, or otherwife difpofed of to any perfon or perfons whomfoever, and that the fame fhall be folely ufed for the fervice of the fhip or veffel for which it was granted; and that in cafe fuch veffel fhall be taken by the enemy, burned or broken up, or otherwife prevented from returning to the port to which fhe belongs, the certificate, if preferved, fhall be delivered up within one month after the arrival of the mafter in any port or place in his majefty's dominions, to the collector or comptroller of fome port in Great Britain, or the Ifle of Man, or of the Britifh plantations, or to the governor, lieutenant-governor, or commander-in-chief for the time being, of the iflands of Guernfey or Jerfey; and that if any foreigner, or any perfon or perfons for his ufe and benefit, fhall purchafe, or otherwife become entitled to the whole or any part or fhare of, or any intereft in fuch veffel, and the fame fhall be within the limits of any port in Great Britain, Guernfey, Jerfey, Man, or the Britifh colonies, plantations, iflands, or territories aforefaid, then in fuch cafe the certificate of regiftry fhall, *within feven days after fuch purchafe or transfer of property* in fuch fhip or veffel, be delivered up to the perfon or perfons authorifed by this act to make regiftry and grant certificates thereof at fuch port and place refpectively; and if fuch fhip or veffel fhall be in any foreign port when fuch purchafe or transfer fhall take place, then that the fame fhall be delivered up to the Britifh conful or other chief Britifh officer refident at or neareft to fuch foreign port; or if fuch veffel fhall be at fea, at the time of fuch transfer of intereft and property, then the faid certificate of regiftry fhall be delivered up to the Britifh conful or other chief Britifh officer at the foreign port or place in or at which the mafter or other perfon having or taking the command of fuch fhip or veffel fhall firft arrive after fuch purchafe or transfer of property at fea, immediately after his arrival at fuch foreign port; but if fuch mafter abovementioned in the cafe above-mentioned fhall not arrive at a foreign port, but fhall arrive at fome port of Great Britain, Guernfey, Jerfey, Man, or his majefty's faid colonies, plantations, iflands, or territories, then the faid certificate fhall be delivered up in manner above-mentioned, within 14 days after the arrival of fuch fhip or veffel, or of the perfon who had the command thereof, in any port of Guernfey, Jerfey, Man, or any of his majefty's faid colonies, plantations, iflands, or territories. And if any pafs, called a Mediterranean pafs, fhall have been obtained and procured by any fuch fhip or veffel, then and in fuch cafe the fame fhall be delivered up at the fame time, and in like manner with the certificate of regiftry, to the perfons herein before authorized to receive fuch certificate of regiftry: and fuch certificates fo delivered up, fhall be tranfmitted forthwith to the commiffioners of the cuftoms in England and Scotland refpectively; and fuch Mediterranean paffes fhall alfo be tranfmitted to the admiralty of Great Britain, by the perfon or perfons authorized to receive fuch certificate and paffes, that the fame may be cancelled. f. 15.

In cafe of any alteration of property in the fame port by the fale of any fhare or fhares in any fhip or veffel after regiftering thereof, fuch fale or transfer of property fhall always be acknowledged by indorfement in the certificate of regiftry, before two witneffes, in order to prove that the entire property in fuch fhip is vefted in fome of the fubjects of Great Britain. In cafe any difpute fhould arife concerning the fame, the above indorfement to be figned by the perfon transferring the property in fuch fhip or veffel, or by fome perfon legally authorifed for that purpofe. 7 & 8 W. III. c. 22. f. 21. 34 Geo. III. c. 68. f. 15, and by ftat. 26 Geo. III. c. 60. f. 16.

In addition to the above indorfement there fhall alfo be indorfed on the certificate of regiftry, before two witneffes, the town, place, or parifh, where all perfons to whom the property in any fhip or veffel fhall be transferred fhall refide; or if fuch perfons ufually refide abroad, but in fome Britifh factory, then the name of fuch factory of which fuch perfons are members; or if fuch perfons refide in any foreign town or city, the name of fuch foreign town or city, and alfo the names of the houfe or copartnerfhip in Great Britain or Ireland for or with whom fuch are agents or partners; and the perfon to whom the property of fuch fhip or veffel fhall be fo transferred, or his agent, fhall deliver a copy of fuch indorfement to the perfon authorifed to make the regiftry, who is to caufe an entry to be indorfed on the oath or affidavit upon which the original certificate of regiftry of fuch fhip or veffel was obtained; and alfo to make a memorandum in the book of regifters, and forthwith give notice to the commiffioners of the cuftoms in England or Scotland, under whom they refpectively act.

The certificate of regiftry of fuch veffel fhall be recited in words at length in the bill or inftrument of fale thereof, otherwife fuch bill of fale fhall be utterly void. f. 17.

As often as the mafter or commander of any regiftered veffel fhall be changed, the mafter or owner thereof fhall deliver to the perfon authorifed to make fuch regiftry at the port where fuch change fhall take place, the certificate of regiftry belonging to fuch fhip or veffel, who fhall indorfe and fubfcribe a memorandum of fuch change, and fhall give notice to the proper officer of the port where fuch fhip or veffel was laft regiftered; who fhall likewife make a memorandum of the fame in the regifter book, and give notice to the commiffioners of the cuftoms in England and Scotland. f. 18.

No owner of any fhip or veffel fhall be permitted to give any other name thereto than that by which fhe was firft regiftered. And all owners of regiftered veffels fhall, within one month from the regiftry, paint in white or yellow letters, of a length not lefs than four inches, upon a black ground, on fome confpicuous part of the ftern (provided there fhall be fufficient fpace, but if not, then in letters as large as fuch fpace will admit), the name by which fuch fhip or veffel fhall have been regiftered, and the port to which

which ſhe belongs, and ſo keep and preſerve the ſame. And if ſuch owner, or maſter or commander of ſuch ſhip or veſſel ſhall wilfully alter, eraſe, or conceal, or permit the ſame to be done, unleſs in the caſe of ſquare rigged veſſels in time of war, or ſhall in any written or printed paper deſcribe ſuch ſhip by any other name than that by which ſhe was firſt regiſtered, or ſhall verbally deſcribe ſuch ſhip or veſſel by any other name to any officer of the revenue in the due execution of his duty, ſuch owner or commander thereof ſhall forfeit the ſum of 100*l*. ſ. 19.

By ſtat. 26 Geo. III. c. 60, all perſons who ſhall apply for a certificate of regiſtry in Great Britain, Guernſey, Jerſey, or the Iſle of Man, for any ſhip which ſhall be built, or whoſe building ſhall be completed after the 1ſt of Auguſt 1786, ſhall produce to the perſon authoriſed to grant ſuch certificate a true account under the hand of the builder of the ſame, of the proper denomination, the time when, and the place where ſuch ſhip or veſſel was built, and an exact account of the tonnage, together with the name of the firſt purchaſer; and alſo make oath before the perſon authoriſed to grant ſuch certificate, that the ſhip or veſſel for which ſuch certificate is required is the ſame with that ſo deſcribed by the builder. And every perſon applying for a like certificate in any of his majeſty's colonies, plantations, or territories, ſhall, before ſuch certificate is granted, produce the like account, under the builder's hand, and take the like oath as is required to be produced and taken by perſons applying in Great Britain. ſ. 20, 21.

If any certificate of regiſtry ſhall have been loſt, a regiſter and certificate *de novo*, in the form herein directed, ſhall be granted for ſuch veſſel, according to 15 Geo. II. c. 31; but in all ſuch caſes ſuch ſecurity ſhall be given as is directed in this act, and in lieu of the oath preſcribed by 15 Geo. II. the like oath ſhall be taken and ſubſcribed as hereinbefore directed, by the owner or owners of ſuch ſhips and veſſels as are required to be regiſtered by this act. ſ. 22, 23.

If any ſhip or veſſel ſhall, after regiſtry, be altered, either in form or burthen, or in any manner whatſoever, ſuch ſhip or veſſel ſhall be regiſtered *de novo* as ſoon as ſhe returns to her port, or to any other port in which ſhe may be regiſtered by virtue of this act; on failure whereof ſuch ſhip or veſſel ſhall be conſidered as a foreign veſſel. ſ. 24.

The owners of all ſuch ſhips as ſhall be condemned as lawful prize, ſhall, upon regiſtry thereof, before any certificate of regiſtry ſhall be obtained, produce to the proper officer of the cuſtoms a certificate of the condemnation of ſuch veſſel, and alſo a true account in writing of all the particulars contained in the certificate herein-before ſet forth, to be made and ſubſcribed by one or more ſkilful perſons to be appointed by the court to ſurvey ſuch ſhip or veſſel; and ſhall alſo make oath before the ſaid officer, that ſuch ſhip or veſſel is the ſame ſhip or veſſel mentioned in the certificate. ſ. 25.

No ſhip condemned as prize ſhall be regiſtered in the iſlands of Guernſey, Jerſey, or the Iſle of Man, although belonging to his majeſty's ſubjects reſident in thoſe iſlands; but the ſame ſhall be regiſtered either at Southampton, Weymouth, Exeter, Plymouth, Falmouth, Liverpool, or Whitehaven, by the collector and comptroller at ſuch port reſpectively. 26 G. III. c. 60. ſ. 26.

In all caſes where any ſhip or veſſel taken and condemned in any of his majeſty's colonies, plantations, or iſlands aforeſaid, ſhall be regiſtered, and obtain a certificate, an exact account ſhall be ſubjoined thereto of the ſum for which ſuch ſhip or veſſel ſhall have been ſold, verified upon the oath of the perſon applying for ſuch certificate of regiſtry. ſ. 27.

All certificates, hereafter to be granted in purſuance of this act, ſhall diſtinguiſh whether ſuch ſhips or veſſels be of the built of Great Britain, Guernſey, Jerſey, or the Iſle of Man, or of the colonies, plantations, iſlands, or territories aforeſaid, or of any foreign country; and ſhall, if Britiſh built, be entitled "Certificate of Britiſh plantation regiſtry," and if foreign built, ſhall be entitled "Certificate of foreign ſhip's regiſtry for the European trade, Britiſh property," as the caſe may be. ſ. 28.

No ſhip or veſſel, directed by this act to be regiſtered, ſhall be permitted, after the firſt arrival at the port to which ſhe belongs, at the expiration of the notice by this act directed, to clear outwards for foreign parts, or coaſtwiſe, or to proceed to ſea for the purpoſe of fiſhing on the coaſts, or for any other purpoſe, as a Britiſh ſhip or veſſel, unleſs the owners thereof ſhall have obtained a certificate; and in caſe ſuch ſhip or veſſel depart from ſuch port without being regiſtered, and without having obtained a certificate, every ſuch ſhip or veſſel, with all her guns, furniture, ammunition, tackle, and apparel, ſhall be ſubject to forfeiture. ſ. 32.

If, after the expiration of the before-mentioned notice, any ſhip or veſſel (being ſquare rigged) ſhall be found in any port within 20 leagues by water from the port to which ſhe belongs, or if any veſſel, not ſquare rigged, be found within any port other than that to which ſhe belongs, without having a certificate of regiſtry hereinbefore directed, it ſhall be lawful for the principal officer of ſuch port, and he is hereby required to detain ſuch until the maſter or commander ſhall, if ſuch ſhip or veſſel be under 50 tons, give ſecurity by bond in 50*l*. in manner hereinafter directed; and if the ſame ſhall exceed 50 and not exceed 100 tons, ſhall give ſecurity by bond in 100*l*.; and if the ſame ſhall exceed 100 tons, then until the maſter or commander ſhall with one ſecurity give bond in 200*l*., with condition that ſuch maſter or commander ſhall forthwith repair with her to the port to which ſhe belongs, and there cauſe her to be regiſtered, procure a certificate, and deliver to ſuch officer ſuch certificate within the time limited in the condition of ſuch bond; which time is to be fixed according to the diſtance of the veſſel from the port to which ſhe belongs, and the nature of the voyage in which ſhe may be engaged; and on failure of producing ſuch certificate, ſuch bond ſhall be forfeited; but if the certificate be produced within the time ſo limited, ſuch bond ſhall be void. And in caſe any ſquare rigged veſſel ſhall be found in port, after the expiration of the aforeſaid notice, more than 20 leagues diſtant by water from the port to which ſhe belongs, or that the water at the entrance of the port to which ſhe belongs ſhall be ſo ſhallow as not to admit her entrance, the maſter or commander ſhall, within 48 hours after his arrival at ſuch port, make known his arrival to the collector and comptroller of the cuſtoms, or other principal officer of ſuch port; and ſhall require ſuch collector and comptroller to cauſe his ſhip or veſſel to be ſurveyed by the proper officer, who ſhall accordingly make a perfect ſurvey, and certify the ſeveral particulars thereof; and ſuch collector and comptroller ſhall immediately tranſmit the ſaid certificate of ſurvey to the perſon authorized to regiſter ſhips and veſſels at the port to which ſuch veſſel belongs, who ſhall regiſter ſuch veſſel, and grant certificate of regiſtry; and it ſhall be lawful for the collector and comptroller, or other principal officer of the cuſtoms, in the port where ſuch ſhip or veſſel ſhall be ſo found, to detain her until a perfect and accurate ſurvey, in the manner hereinbefore directed, can be made.

The remaining ſections of this act relate to penalties upon the

the mifconduct of officers, forging or altering certificates of regiftry, mode of recovering penalties, &c.

By 27 G. III. c. 19. f. 4, no oath taken for the fole purpofe of acquiring the rights of a citizen or burgher in any foreign city or town in Europe, to be enjoyed during the time that fuch perfon taking fuch oath fhall refide in fuch city or town, and for a limited time after fuch refidence fhall have expired, fhall be deemed an oath of allegiance to a foreign ftate, nor inconfiftent with the form of the oath upon regiftry prefcribed by 7 & 8 W. III.

Ships belonging to the Eaft India company, or any other body corporate, are to be regiftered upon the oath fubfcribed by the fecretary of the faid company or other body corporate, or by any other officer properly authorized. f. 7.

No veffel whatfoever, not exceeding the burthen of 30 tons, and not having a whole or fixed deck, and being employed folely in the Newfoundland fifhery, or on the banks or fhores of the provinces of Quebec, Nova Scotia, or New Brunfwick, adjacent to the gulf of St. Lawrence, and to the north of cape Canfo, or of the iflands within the fame, or in trading coaftwife within the faid limits, fhall be fubject to be regiftered in purfuance of the faid act. f. 8.

Ships built in Newfoundland, and thofe parts of the provinces of Quebec, Nova Scotia, and New Brunfwick, adjacent to the gulf of St. Lawrence, and to the north of cape Canfo, or in the iflands within the faid limits, on account of owners refiding in his majefty's European dominions, fhall be regiftered in the above places, upon the hufbands or principal agents of the faid fhips taking the oath required; and fuch certificates fhall be of the fame effect as if granted upon the oath of the owners, until fuch time as they fhall arrive in port in any of his majefty's European dominions, where they may be refpectively regiftered upon the oath of the refpective owners, but no longer. And whenever fuch fhip fhall arrive at any fuch port in his majefty's European dominions, the certificates of regiftry, granted in purfuance of this act, fhall be null and void, and fhall be delivered up to be cancelled; and fuch fhips are hereby required to be refpectively regiftered *de novo* conformably to the requifitions of the preceding act. f. 9.

By 27 G. III. c. 19. f. 13, all fhips not regiftered according to the directions and regulations of the faid act, although fuch fhips may be owned by his majefty's fubjects, fhall be held and deemed as alien fhips, and fhall in all cafes be liable to fuch and the fame penalties and forfeitures as alien fhips are by law liable to in fimilar cafes.

By 34 G. III. c. 42, foreign fhips and veffels heretofore owned by fubjects of the late French king, which in confequence of any capitulation may be put under his majefty's protection at the time of, or in confequence of the furrender of any foreign colony, may be regiftered as fhips condemned as lawful prize, and fhall become entitled to the privileges of Britifh fhips, under the regulations and reftrictions hereafter mentioned. Provided always, that no fhip fhall be fo regiftered but upon producing a certificate under the hand and feal of the perfon who commanded in chief, by fea or land, at the time when fuch foreign colony was furrendered (or in cafe of the death or departure of any fuch officer before fuch certificate fhall have been fo given, then upon a like certificate under the hand and feal of the perfon who fhall command in chief, by fea or land, at fuch colony), teftifying that fuch fhip or veffel was put under the protection of his majefty at the faid time; and upon oath, hereinafter directed, being taken and fubfcribed before the perfon authorifed to make fuch regiftry, by the owner of fuch fhip, if fhe belong to one perfon only; or in cafe there fhall be two joint owners, then by both of fuch joint owners, if both be refident within 20 miles of the place where fuch regiftry is required, or by one of fuch owners, if one or both of them fhall be refident at a greater diftance; or if the number of fuch owners fhall exceed two, then by the greater part of them, if the greater number of them fhall be refident within 20 miles, not in any cafe exceeding three of fuch owners, or by one of fuch owners, if all fhall be refident at a greater diftance. Provided that fuch regiftry fhall, for the ifland of St. Domingo, be made at the port of Kingfton in the ifland of Jamaica, and for any of the French Leeward iflands, in the port of Rofeau in the ifland of Dominica; and the faid ports of Kingfton and Rofeau fhall refpectively, for the purpofe of fuch regiftry, be deemed to be the port to which fuch fhip belongs. f. 1.

His majefty, by the advice of his privy council, may at any time, on the arrival of any fuch fhip in Great Britain, upon application made to him, authorife any fuch fhip (without payment of any duty whatever for the faid fhip, or the fails and other neceffary tackle, apparel, and furniture thereof) to be regiftered, as in the cafe of a prize-fhip, in any port of Great Britain. f. 4.

No perfon heretofore a fubject of the late French king, being a white perfon, a mulatto, or free negro, fhall be employed to navigate any veffel bound from fuch foreign colony, to any part of his majefty's dominions, or be conveyed as a paffenger on board thereof, unlefs fuch perfon fhall produce a certificate under the hand and feal of the perfon who commands in chief in fuch foreign colony, or at the place therein whence fuch fhip fhall fail, teftifying that fuch perfon has taken the oath of fidelity and allegiance to his majefty; and no negro-flave belonging to any perfon whatfoever, heretofore a fubject of the late French king, fhall be fo conveyed or employed, but upon a certificate under the hand and feal of his mafter (which mafter fhall have taken the oath of fidelity and allegiance as aforefaid), certifying the good character of fuch negro-flave, and teftifying that his conduct has been fuch that he may be fafely admitted into the ports of his majefty's dominions; which certificate fhall be indorfed by the perfon who commands in chief his majefty's troops or veffels at the place from whence fuch fhip fhall fail, fignifying that he has no reafon to doubt of the truth thereof; upon pain that the mafter or commander of fuch fhip fhall forfeit 50*l.* for every perfon refpectively employed or conveyed in fuch fhip without having fuch certificate. f. 5.

By 34 G. III. c. 68, no goods, wares, or merchandizes whatever fhall, from the expiration of fix months after the conclufion of the prefent war, be imported into, or exported from, any port or place in Great Britain, or Guernfey, Jerfey, Alderney, Sark, or Man, to any other port or place of the fame, on board any fhip or veffel which, by law, is or fhall be required to be regiftered as a Britifh fhip or veffel, unlefs fuch fhip or veffel fhall be navigated by a mafter and three-fourths at leaft of the mariners Britifh fubjects. Nor, from the expiration of fix months from the conclufion of the prefent war, fhall any fhip or veffel, which by law is or fhall be required to be regiftered as a Britifh fhip or veffel, be navigated but by a mafter and three-fourths of the mariners at leaft Britifh fubjects, except as hereinafter provided. f. 1, 2, 3.

No goods, wares, or merchandizes whatever fhall be carried from any port in Great Britain, or Guernfey, Jerfey, Alderney, Sark, or Man, to any other port or place of the fame, nor fhall any fhip be permitted to fail in ballaft from or to any of the aforefaid ports, nor be employed in fifhing on the faid coafts, unlefs fuch fhip fhall be wholly and folely manned with and navigated by a mafter and mariners all Britifh fubjects. The commiffioners of the cuftoms may, however, by licence under their hands, authorife any fuch fhip or veffel employed in fifhing on the coaft of Great Britain, or of the iflands of Guernfey, Jerfey, Alderney, Sark, or Man, to have on board any foreign mariners for the purpofe of inftructing the Britifh mariners thereof in the art of fifhing; fuch foreign mariners not exceeding one-fourth of the number of mariners on board fuch veffel, except in cafes of ficknefs, death, defertion, or capture. f. 5.

By ftat. 34 G. III. c. 68, no perfon fhall hereafter be deemed to be qualified to be the mafter of a Britifh fhip, or to be a Britifh failor, feaman, or mariner, except the natural-born fubjects of his majefty, or perfons naturalized by any act of parliament, or made denizens by letters of denization; or except perfons who have become his majefty's fubjects by virtue of conqueft or ceffion of fome newly acquired country, and who fhall have taken the oath of allegiance to his majefty, or the oath of fidelity required by the treaty of capitulation, by which fuch newly acquired country came into his majefty's poffeffion, except as is hereinafter provided. f. 6.

But every foreign feaman ferving on board any of his majefty's fhips in time of war, for the fpace of three years, who fhall alfo take the oath of allegiance, fhall be entitled to be employed as a mafter of a Britifh fhip or veffel, or as a Britifh mariner on board any Britifh fhip, upon delivering certificates from the captains under whom he ferved, of the time he fhall have ferved, and of his faithful fervice and good behaviour, and a certificate of his having taken the oath of allegiance. f. 7.

No perfon who has taken an oath of allegiance to any foreign ftate fhall be deemed qualified to be the mafter of a Britifh fhip or veffel, or a Britifh failor, unlefs fuch perfon fhall have taken fuch oath of allegiance before he became fo qualified; and any perfon who fhall, after having become difqualified by taking fuch oath of allegiance, take the charge or command of any Britifh fhip or veffel, fhall for every fuch offence forfeit one hundred pounds; and if fuch perfon fhall engage to ferve as a Britifh feaman or mariner on board any fuch fhip, he fhall forfeit ten pounds, unlefs the owners fhall fhew that fuch difqualifications were unknown to them or their agents at the time of engaging fuch mafter or failor to ferve on board fuch fhip or veffel. Except in the navigation on the feas of America and the Weft Indies, any negroes belonging to his majefty's fubjects, and in the feas to the eaftward of the Cape of Good Hope, Lafcars and other natives of any of the countries to the eaftward of the Cape of Good Hope, may be employed as Britifh failors, feamen, or mariners, in manner heretofore practifed. Provided neverthelefs, that no negro belonging to any perfon who has become a fubject of his majefty, in manner before defcribed, in any of the iflands or colonies late under the dominion of the French, fhall be entitled to be employed in manner before mentioned as a Britifh failor, feaman, or mariner, unlefs all the conditions required by the 34th G. III. c. 42, fhall have been complied with during the continuance of the faid act.

By the 13th G. II. c. 3, his majefty in time of war may permit merchant fhips to be navigated by foreigners, provided one-fourth of the crew be Britifh fubjects.

If any goods, wares, or merchandize whatever fhall be imported or exported, or carried coaftwife, contrary to the provifions of this act, or any of them, all fuch goods, wares, and merchandize, and alfo the fhip or veffel, with all her guns, furniture, ammunition, tackle, and apparel, fhall be forfeited; and if any fhip fhall fail in ballaft, or fhall fail to be employed in fifhing along the coaft in manner herein before mentioned, or, being required to be manned and navigated with a mafter and a certain proportion of Britifh mariners, in manner herein before directed, fhall not be manned and navigated accordingly, fuch fhip or veffel, with all her guns, furniture, ammunition, tackle, and apparel, and all the goods, wares, and merchandize on board, fhall be forfeited. f. 10.

All goods, wares, and merchandize, and all veffels, forfeited by this act, may be feized by the commander of any of his majefty's fhips of war, or any commiffioned, warrant, or petty officer fpecially appointed, or by any officer or officers of his majefty's cuftoms or excife.

If any Britifh fhip fhall be found at fea, having on board a greater number of foreign mariners than is allowed by this act, or any law in force or hereafter to be made, and the mafter of fuch veffel fhall produce a certificate of the actual neceffity of engaging fuch foreign mariners in fome foreign port, by occafion of the ficknefs, death, or defertion of the like number of Britifh mariners, or of the fame having been taken prifoners during his voyage, and that Britifh mariners could not be engaged at fuch foreign port to fupply their place, and that for the fafe navigation of fuch fhip or veffel, it became neceffary to engage and employ fuch foreign mariners, under the hand of his majefty's conful at the foreign port where the mariners are fo engaged, or, if there be no fuch conful there, under the hands of two known Britifh merchants at fuch foreign port, no feizures fhall be made by the perfons authorifed under this act, nor fhall fuch fhips be molefted or detained at fea; but fuch perfons fhall indorfe the certificate fo produced, teftifying the production thereof, and when and where met with at fea, and that the number of foreign mariners correfpond with the certificate of fuch Britifh conful, or fuch known Britifh merchants, for the confideration and inveftigation of the commiffioners of his majefty's cuftoms in England and Scotland refpectively.

By 34 G. III. c. 68. f. 14, no transfer, nor agreement for transfer, of the property in any fhip or veffel, either in whole or in part, fhall be made but by a bill of fale or inftrument in writing, which fhall contain a recital in words at length of the certificate of regiftry.

If a fhip be at fea at the time when the transfer is made, fo that an indorfement and certificate cannot be immediately made, the fale, or contract for fale, fhall, notwithftanding, be made by fome inftrument in writing, and a copy thereof fhall be delivered to the perfon authorifed to make regiftry, who is to indorfe an entry thereof on the oath or affidavit, make a memorandum in the book of regifters, and give notice to the commiffioners of the cuftoms as before directed: and within ten days after the fhip returns to port, an indorfement fhall be made on the certificate of regiftry, and a copy thereof delivered as before-mentioned; otherwife fuch fale fhall, to all intents and purpofes, be void. f. 16.

Where the owner of any fhip fhall, at the time of transferring the property in any fhips, be abroad, fo that an indorfement, &c. or fuch bill of fale, cannot be immediately made, the fame may be done at any time within fix months after fuch transfer, in which cafe, within ten days after the arrival of the owner or his agent in this kingdom, (if the fhip be in any port thereof, and if not, within ten days after fuch fhip's arrival) an indorfement on the certificate of regiftry fhall be made, &c. as before directed. f. 17.

Mafters of fhips refufing to deliver up the certificate of regiftry to the proper perfon empowered to make regiftry, upon being required fo to do by the owner or owners, or the major part of the owners, (if fuch mafter have not any property

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perty therein,) or by the other owner or owners, or major part thereof, (if ſuch maſter have any ſhare therein,) and upon oath being made by ſuch owner, owners, or major part thereof, before any juſtice of the peace near where ſuch refuſal ſhall be, ſuch juſtice may grant his warrant to bring the maſter before him; and if it ſhall appear that the ſaid certificate is *wilfully* detained, ſuch maſter ſhall pay one hundred pounds, and on failure of payment ſhall be committed to the common gaol, for not leſs than ſix months, nor more than twelve. ſ. 18.

Upon the juſtice's certifying the above *wilful* refuſal of the maſter of any veſſel to deliver up the certificate to the perſon authoriſed to make regiſtry, he ſhall regiſter the ſaid ſhip *de novo*, the terms and conditions of the law being complied with. ſ. 19.

When property in any ſhip or veſſel belonging to any of his majeſty's ſubjects ſhall be transferred by ſale, and ſuch veſſel ſhall be required to be regiſtered *de novo*, it ſhall not be done unleſs there be produced to the regiſter, the bill or other inſtrument of ſale. Provided always, that the commiſſioners of cuſtoms, and the governor, lieutenant-governor, or commander-in-chief for the time being of the iſlands of Guernſey or Jerſey, or of any colony, plantation, iſland, or territory belonging to his majeſty, may, upon due conſideration of the particular circumſtances of the caſe, give directions for the regiſtering ſuch veſſel *de novo*, and granting a certificate of ſuch regiſtry, notwithſtanding ſuch bill or other inſtrument of ſale ſhall not have been produced as aforeſaid; and ſuch regiſtry ſhall be made, and ſuch certificate thereof ſhall be accordingly granted, if all the other regulations required by the laws in force concerning the regiſtry of ſhips *de novo* be complied with. ſ. 20.

If there ſhall be any alteration of property at the ſame port, and the owner ſhall be deſirous of having the ſhip regiſtered *de novo*, ſuch ſhip may be ſo regiſtered, provided all the rules, regulations, and conditions are complied with relative to veſſels regiſtered *de novo*. ſ. 21.

In caſe of any transfer of property in any ſhip whilſt at ſea, ſuch ſhip ſhall proceed directly to the port for which the cargo then on board is deſtined, and ſhall ſail from thence to the port of his majeſty's dominions to which ſhe belongs, or to any other ſuch port in which ſhe may be legally regiſtered; and ſuch ſhip may take on board in the port for which her original cargo was deſtined, or in any other port in the courſe of her voyage home, ſuch cargo as may be legally carried to ſuch port of his majeſty's dominions where ſhe may be ſo regiſtered *de novo*. And if ſuch transfer of property ſhall be made while ſuch ſhip is in any foreign port, as ſoon as the maſter of ſuch ſhip ſhall become acquainted therewith, ſuch ſhip, after having delivered the cargo then on board at the port for which ſhe is deſtined, ſhall ſail thencefrom to the port to which ſhe belongs, or to any other ſuch port in which ſhe may be legally regiſtered; and may take on board at the port for which her original cargo was ſo deſtined, or at any other port in the courſe of her voyage home, ſuch cargo as may be legally carried to ſuch port of his majeſty's dominions where ſhe may be ſo regiſtered *de novo*. And if ſuch transfer of property ſhall be made while ſuch ſhip is on a fiſhing voyage, as ſoon as the maſter of ſuch ſhip ſhall become acquainted therewith, ſuch ſhip, after having finiſhed ſuch fiſhing voyage, without touching at any foreign port, except for the purpoſe of repairs or refreſhments, or for delivering any part of her cargo, ſhall ſail to the port of his majeſty's dominions to which ſhe belongs, or to any other ſuch port where ſhe may be legally regiſtered, and may take on board at the foreign port or ports laſt deſcribed, or at any other ports in the courſe of her voyage home, ſuch cargo as may be legally carried to ſuch port of his majeſty's dominions; and every ſuch ſhip as aforeſaid ſhall be regiſtered *de novo*, as ſoon as ſhe returns to the port of his majeſty's dominions to which ſhe belongs, or to any ſuch port in which ſhe may be legally regiſtered by virtue of the ſaid act; on failure whereof ſuch ſhip ſhall be deemed from thenceforth to be a foreign ſhip or veſſel, and ſhall not again be regiſtered, or be entitled to the privilege of a Britiſh ſhip or veſſel, unleſs upon ſpecial repreſentation of the circumſtances of the caſe to the commiſſioners of cuſtoms, or to the governor, lieutenant-governor, or commander-in-chief for the time being of the iſlands of Guernſey or Jerſey, or of any colony, plantation, iſland, or territory to his majeſty belonging, as the caſe may be: provided nevertheleſs, that in no caſe the ſhip or veſſel of which the property is ſo transferred, ſhall be entitled to the privileges of a Britiſh ſhip or veſſel, unleſs ſhe ſhall return to the port to which ſhe belongs, or to ſuch other port in which ſhe may be regiſtered *de novo*, within the period of twelve months after the date of ſuch transfer of property, if ſuch ſhip ſhall not be on a voyage to the eaſt of the Cape of Good Hope, or to the weſt of cape Horn; or within two years, if the ſhip is on the above voyages at the time ſuch transfer of property ſhall take place, except by the order of the ſaid commiſſioners, governor, lieutenant-governor, or commander-in-chief reſpectively. ſ. 22. See *Marine* Insurances, and Policy.

REGIUS Professors. King Henry VIII. founded five lectures in each of our univerſities: *viz.* of Divinity, Hebrew, Greek, Law, and Phyſic; the readers of which lectures are in the univerſity ſtatutes called *regii profeſſores*.

Regius, in *Medicine*. See Jaundice.

REGLE *de l'Octave*, Fr., a rule for accompanying the octave aſcending and deſcending in the baſe; giving to each note of the ſcale its appropriate harmony in every key. This rule, well known and practiſed in the 24 keys, major and minor, will enable ſtudents in thorough-baſe to figure a baſe themſelves, and to accompany modern muſic without figures.

It is diſputed in France who was the inventor of this rule: Rameau and Rouſſeau aſſign it to De Laire, M. Laborde to Campion. "This formula," ſays Rouſſeau, "was firſt publiſhed by De Laire in 1700." If this date could be aſcertained, it would remove all doubts concerning the author of the rule; as Campion's "Treatiſe of Accompaniment" is not pretended to have appeared till after 1705.

This rule aſcertains what chords or harmony belong to every diatonic movement of the baſe, aſcending and deſcending. See Accompaniment, or Thorough-base; where the baſe will be figured, and the chords written over it. We confine the infallibility of this rule to modern muſic, as no proviſion is made for 4ths and 9ths, which ſo frequently occur in Corelli, Geminiani, and Handel. But theſe diſcords, and ſeveral other combinations, are conſidered in the articles Counterpoint and Accompaniment, or *Thorough-baſe*; which ſee.

By this formula it will appear, that to the key-note there is always a common chord; to the 2d of the key, a $^{6}_{3}$; to the 3d of the key, a 6th; to the 4th of the key, a $^{6}_{5}$; to the 5th of the key, a common chord. Thus far the chords are rigorouſly in one key; but in order to connect the 6th to the 5th, Rameau gives the chord of the $^{6}_{3}$ to the 6th, as in deſcending, which makes it the 2d of a new key; but then to recover the modulation into the original key, he gives $^{6}_{5}\natural$ to the 7th or *note ſenſible* of the key, and then terminates

minates the fcale by a common chord to the octave of the key-note.

In defcending, it is neceffary to imagine the harmony in the 5th of the key for the four firft notes: as, fuppofing the fcale to be in C major, after repeating the common chord to the octave, the 7th of C muft be regarded as 3d of the key of G, and be only accompanied by the 6th. A, as 2d of G, by a $\substack{6\\4\\3}$, as in afcending; and the 5th of the key by a common chord, or clofe in G. The 4th of the key in defcending has a $\substack{6\\4\\2}$, or chord of the 5th of the key repeated; the next three chords are the fame as in afcending.

In minor keys, in all which fuppofing A natural to be the archetype, the chords are much the fame; only whenever the 7th of the key is wanting in the afcending fcale, it muft be accidentally fharp: as to A, a common chord minor; to B, the 2d of the key, a $\substack{6\\4\\3}$; to the 3d of the key, a 6th; to the 4th, a $\substack{6\\5}$; to the 5th, a common chord, with a fharp 3d; to the 6th, if natural, a 6th; if fharp, a $\substack{6\\4\\3}$; to the 7th fharp, $\natural\substack{6\\5}\natural$, and a common chord to the octave.

In defcending, to the 7th natural, a 6th; to the minor 6th, a $\substack{3\\3}$, or 6 doubling the 3d; to the 5th of the key, a fharp 3d; to the 4th of the key, the fame chord, or $\substack{6\\4\\2}$; and to the three laft, the fame as in afcending.

Thefe chords will be more clearly comprehended in notation on the thorough-bafe plates, to which we refer.

Though the regle de l'octave only provides for the regular afcent and defcent of the bafe in plain counterpoint, we know, by long experience, that it teaches more thorough-bafe and counterpoint in a fhort time, than any other rule that has been propofed fince the laws of harmony were fettled. See Thorough-base, Accompaniment, and Composition.

REGLET, or Riglet, in *Architecture*, a little flat narrow moulding, ufed chiefly in compartiments, and pannels, to feparate the parts or members from one another, and to form knots, frets, and other ornaments.

The word is a diminutive of the French, *regle, rule.*

The reglet, according to Daviler, differs from the *fillet* and *liftel*, in that it projects equally, like a ruler.

Reglets, or *Riglets*, in *Printing*, are thin rulers, or flips of wood, of different dimenfions, placed in the chafe, between the pages, and at the extremes of them, to keep them afunder, and to hold them tight.

The reglets make the chief part of what they call *the furniture of the chafe*. See Chase.

They are particularly denominated from the place they hold in refpect of the pages, *head-flicks, gutter-flicks,* &c.

The term reglets is alfo ufed abroad for a ruler of metal, three quarters of an inch long, but which may be lengthened out by joining feveral together; ufed to feparate the columns, in books that have feveral in the fame page; as alfo for lines to place the notes on, in printing of mufic. See Printing.

Reglet is alfo ufed for a little thin flip of wood, occafionally, though feldom, ufed by compofitors for the prefs to take off the lines from the compofing-ftick, and place them on the galley, where the lines are of an extraordinary length: and where the lines are at great diftances, thofe diftances are made by leaving a reglet between each line, when printed.

REGMALARD, in *Geography*, a town of France, in the department of the Orne; 9 miles E.N.E. of Belefme.

REGNANO, a town of Naples, in Capitanata; 16 miles from Manfredonia.

REGNANT Queen. See Queen.

REGNARD, John-Francis, in *Biography*, a French poet and writer of comedy, was born of a good family, at Paris, in 1647. His earlieft paffion was that for travelling, and he firft made the tour of Italy. On his return, in an Englifh fhip, the veffel was taken by the Algerines, and the crew made flaves at Algiers. Regnard, by his fkill in cookery, ingratiated himfelf with his mafter: he poffeffed another art, which had nearly proved fatal to him. His perfon and manners recommended him to the attention of the ladies, whofe advances he encouraged, and being difcovered, the alternative was given him of being burnt to death or becoming a difciple of the Koran. He was, however, releafed from this difficulty by the interpofition of the French conful, and the proper application of a confiderable bribe. He gained his liberty, and returned to France, and in 1681 departed upon a new tour to the northern countries of Europe. After an abfence of three years he came back to Paris, and fettled quietly, with the view of cultivating his tafte for literary purfuits. He compofed a number of comedies for the French theatre, which were acted with fuccefs, and which, in the general opinion, placed him next to Moliere in true comic humour. Gaiety is the predominant character of Regnard's comedies, which is fometimes maintained at the expence of morality. He excelled not lefs in the elevated or genteel comedy, than in the low, or familiar. His two beft pieces are faid to be "Le Joueur," and "Le Legataire;" for defcribing, to the life, the fcenes of the firft, he was extremely qualified, being himfelf a lucky gamefter. He wrote eight comedies, fome pieces for the Italian theatre, and an opera. He alfo publifhed mifcellaneous poems, confifting of fatires, epiftles, &c. In profe he gave a relation of his travels, of which the only part that excited much intereft was his account of Lapland. Regnard died at the age of 62. His works have been printed collectively, of which the beft edition is that of Paris, in 1790, in 4 vols. 8vo.

REGNAVADSOE, in *Geography*, a fmall ifland in the North fea, near the coaft of Norway. N. lat. 69° 50′.

REGNI, in *Ancient Geography*, a name given to the ancient inhabitants of Surrey and Suffex, and perhaps of part of Hampfhire. They were feated E. of the Belgæ, and S. of the Atrebatii. As thefe people poffeffed fo large a tract of the fea-coaft in the fouth part of this ifland, it is very probable that they had come from the continent, and fettled here not very long before the Roman invafion, perhaps at the fame time with their neighbours the Belgæ. The Belgæ and the Regni had been near neighbours on the continent; the one having migrated from the country of the Sueffiones, now Soiffons, and the other from the country of the Rhemi, now Reims. The Regni, like all the other Belgic Britons, early fubmitted to the Roman power, and continued fteady in their obedience, without engaging in any revolt. It is not known who was fovereign of the Regni when they fubmitted to the Romans, but foon after their fubmiffion, they were put under the government of Cogidunus, king of the Dobuni. For this prince, who was then very young, had got fo much into favour with the emperor Claudius, and his minifters, that he was not only allowed to keep his own dominions, but he had feveral other neighbouring ftates put under his authority. It feems probable, from a famous infcription difcovered at Chichefter, that Cogidunus governed the Regni in quality of the emperor's lieutenant, or legatus Augufti; for in that infcription he is fo ftyled. He continued a faithful and ufeful friend and ally to the Romans above 60 years, and thus he was fo much endeared to them, that

that, according to their cuftom in other countries, they permitted his pofterity to fucceed him, perhaps for feveral generations. Although the Regni were very early and very obedient fubjects of the Roman empire, yet as they were long after under the immediate government of Britifh princes, few of the Romans feem to have fettled among them. This is, without doubt, the reafon that we meet with fo few veftiges of thofe great and active people in thofe countries which were anciently inhabited by the Regni. Chichefter was certainly a confiderable place in the time of the Romans, and probably the capital of the Regni, which led the Romans to call it Regnum. However, Camden, Gale, Baxter, and others, are unanimous in fixing Regnum, the capital of the Regni, at Ringwood; but Mr. Horfley has produced feveral reafons for fuppofing it to have been fituated where Chichefter now ftands. The Neomagus of Ptolemy, and the Noviomagus of the Itinerary, was a city of the Regni, and it is generally placed at Woodcote, near Croydon, in Surrey; though Mr. Baxter and fome other antiquaries contend for Ravenfham, in Kent. In the moft perfect ftate of the Roman government in Britain, the country of the Regni made a part of the province called Flavia Cæfarienfis, and was governed by the prefident of that province.

REGNIER, Mathurin, in *Biography*, a French poet, was born at Chartres in 1573. He is faid to have difplayed, at a very early period, a great propenfity to fatire, which his father in vain attempted to reprefs by chaftifement. The exercife of his fatirical talents procured him patrons, among whom were the cardinal Francis de Joyeufe, and Philip de Bethune, both of whom he accompanied to Rome. By the intereft of thefe great men he received confiderable preferment in the church, but the dignity and gravity of the clerical character was no reftraint upon his pleafures, and he died at the age of forty, worn out with licentious practices. The works of Regnier confift of fatires, epiftles, elegies, ftanzas, odes, &c.: of thefe his fatires are moft efteemed, and they were thought to make a kind of epoch in French poetry. The poems of Regnier have been frequently printed; the beft editions are thofe of Rouen, 1729, and of London, 1734, with remarks.

REGNIER-DESMARAIS, Francis-Seraphin, a French author of confiderable reputation, was born at Paris in 1632, of a family originally from Saintonge. Being the younger fon of a numerous family, he had to depend folely upon his own exertions for making his way in the world, and he fucceffively attached himfelf to feveral perfons of rank, whom he accompanied in their travels. Making a proper ufe of his opportunities, he acquired a knowledge of the Italian and Spanifh languages, and he became fo much a mafter of the former, that when he attended the duke of Crequi on his embaffy to Rome, in 1662, he wrote the official letters in Italian with fo much purity, that they were not known to be the compofitions of a foreigner. But he obtained a ftill greater triumph, by paffing upon the academicians of Della Crufca one of his own odes for a newly difcovered piece of Petrarch. In confequence of this he was elected, in 1667, a member of that celebrated academy. At the age of thirty-fix he took ecclefiaftical orders, for the purpofe of enjoying a priory given him by Lewis XIV., as a recompence for his public fervices, and in 1670 he was admitted a member of the French Academy, in the hope that he might become a contributor in the compilation of their dictionary. Soon after this, at the requeft of the Jefuits, he tranflated from the Spanifh language a treatife "On Chriftian Perfection." In his capacity of academician, Regnier difplayed fo much activity and zeal, that on the death of Mezerai, in 1684, he was appointed to fucceed him as fecretary. When the dictionary was completed, the fecretary by order of the Academy, drew up a preface, and an epiftle dedicatory to the king; but, during his abfence, other members, who were infpired with the defire of emulating him in this honour, procured a preference for their own productions. This difappointment drew from Regnier fome critical remarks upon the rival performances, tinged with that cavilling and difputatious fpirit, to which it appears he fo often gave way, that he obtained the title of the abbè Pertinax. He was fo attached to his own opinion, that he could feldom be prevailed upon to give up his point, or to drop a difpute. Fontenelle, being once prefent at an academical difcuffion, in which Regnier was warmly engaged, exclaimed, "this is a difpute that might be prevented from ever ending, and therefore it ought to be ended immediately." Regnier obtained feveral benefices, and would probably have been promoted to the very higheft dignity in the church, had he not been fufpected of tranflating a fcene in the "Paftor Fido," which feems to inculcate a licentious morality, and likewife fufpected of writing a ftill more objectionable copy of verfes. He was occafionally employed in public bufinefs. He died at Paris in 1713, at the age of 81. He had drawn up a great many of the moft important articles in the dictionary of the French academy, and he publifhed, as the refult of his long ftudy of the principles of the French language, his "Grammaire Françoife," in 2 vols. 12mo., which is confidered as a very valuable performance. His other works in profe were "L'Hiftoire des Dèmeles de la France, avec la Cour de Rome, au Sujet de l'Affaire des Corfes." Tranflations of feveral of Cicero's pieces. In verfe he gave an Italian verfion of the Odes of Anacreon, and mifcellaneous poems in Latin, French, Italian, and Spanifh. His French poems are varied, ingenious, and well turned, but they are allowed not to poffefs much fire or force. We have alluded to the abbe's unyielding difpofition: but it muft be added, that he was ftedfaft in his friendfhips, inflexibly upright, and fcrupuloufly veracious. The laft quality, fays his biographer, he nobly expreffed, when, on being urged to violate the truth in favour of a man in power, and under the penalty of lofing his friendfhip, he faid, "I had rather quarrel with him than myfelf."

REGNO, in *Geography*, a town of Sweden, in Eaft Gothland; 28 miles N. of Nordkioping.

Regno, *Ne exeat*, in *Law*. See Ne *exeat*, &c.

REGNUM. See Regni.

Regnum *Ecclefiafticum*, a denomination given to one of the two kingdoms, which the clergy fuppofed to have exifted in fome countries: this, they pretended, was abfolute and independent of any but the pope, comprehending ecclefiaftical men and caufes, and exempt from the fecular magiftrate: the other was a *regnum feculare* of the king or civil magiftrate, which was fubordinate and fubject to the ecclefiaftical kingdom: but thefe ufurpations were exterminated here by Henry VIII. 2 Hale's Hift. P. C. 324.

REGNY, in *Geography*, a town of France, in the department of the Rhône and Loire; feven miles E. of Roanne.

REGOLA, Ital., a rule in mufic, a canon.

Regola *Armonica*, a monochord.

REGOLETS, in *Geography*, a paffage from the gulf of Mexico into lake Pontchartrain, about ten miles long, and three or four hundred yards wide.

REGRADATION, Regradatio. See Degradation.

REGRATOR, Regratarius, a law-word, formerly ufed for one that bought wholefale, or by the great, and fold again by retail.

The

The term is now chiefly used, as it is described by stat. 5 & 6 Edw. VI. cap. 14. to denote one that buys corn, or other dead victuals, in any market, and sells them again, in the same market, or within four miles of the place.

Regrating is an offence against the public, and is liable, by the statute just cited, to the same penalty with engrossing and forestalling.

REGRATOR is also used for a person who furbishes up old moveables, to make them pass for new. See FRIPPERY.

Among masons, &c. to regrate is to take off the outer surface of an old hewn stone, with the hammer and ripe, in order to whiten and make it look fresh again.

REGRESSION, or RETROGRADATION of curves, &c. See RETROGRADATION.

REGUINY, in *Geography*, a town of France, in the department of the Morbihan; five miles N.W. of Josselin.

REGULA. See RULE.

REGULA, in *Architecture*. See REGLET.

REGULAR, REGULARIS, denotes the relation of any thing that is agreeable or conformable to the rules of art.

In this sense, the word stands opposed to *irregular*, or anomalous.

Thus we say, a regular proceeding, a regular building, regular poem, regular verb, &c.

REGULAR *Figure*, in *Geometry*, is a figure which is both equilateral and equiangular; *i. e.* whose sides, and consequently its angles, are all equal.

The equilateral triangle and square are regular figures. All other regular figures, consisting of more than four sides, are called regular polygons.

Every regular figure may be inscribed in a *circle*; which see.

For the dimensions, properties, &c. of regular figures, see POLYGON.

REGULAR *Body*, called also *Platonic body*, is a solid terminated on all sides by regular and equal planes, and whose solid angles are all equal.

The regular bodies are five in number; *viz.* the *cube*, which consists of six equal squares; the *tetrahedron*, or regular triangular pyramid, having four equal triangular faces; the *octahedron*, having eight; the *dodecahedron*, having twelve pentagonal faces; and the *icosahedron*, having twenty triangular faces. See each under its proper article. Besides these five, there can be no other regular bodies in nature.

To measure the surface and solidity, &c. of the five regular bodies.—The solidity, &c. of the cube is shewn under the article CUBE. The tetrahedron being a pyramid, and the octahedron a double pyramid; and the icosahedron consisting of twenty triangular pyramids; and the dodecahedron of twelve quinquangular ones, whose bases are in the surface of the icosahedron and dodecahedron, and their vertices meeting in a centre; the solidities of these bodies are all found from what we have shewn under PYRAMID.

1. Their surface is had by finding the area of one of the planes, from the lines that bound it; and multiplying the area thus found by the number from which the body is denominated: *e. gr.* for the tetrahedron, by 4; for the hexahedron, or cube, by 6; for the octahedron, by 8; for the dodecahedron, by 12; and for the isocahedron, by 20. The product is the superficial area.

Or, the superficial contents of any of the five Platonic bodies may be had by the following proportion; as 1 is to the square of the side of the given Platonic body,

$$\text{so is} \left\{ \begin{array}{l} 1.7320508 \\ 3.4641016 \\ 6.0000000 \\ 8.6602540 \\ 20.6457788 \end{array} \right\} \text{to the superficial content of the} \left\{ \begin{array}{l} \text{tetrahedron.} \\ \text{octahedron.} \\ \text{hexahedron.} \\ \text{icosahedron.} \\ \text{dodecahedron.} \end{array} \right.$$

Hence we have the following rule: multiply the proper tabular area, taken from the preceding table, by the square of the side of the given solid, for the superficies.

2. The diameter of a sphere being given, to find the side of any of the Platonic bodies, that may be either inscribed in the sphere, or circumscribed about the sphere, or that is equal to the sphere.

As 1 is to the number in the following table, respecting the thing sought, so is the diameter of the given sphere to the side of the Platonic body sought.

The diameter of a sphere being unity, the side of a	That may be *inscribed* in the sphere, is	That may be *circumscribed* about the sphere, is	That is *equal* to the sphere, is
Tetrahedron	0.816497	2.44948	1.64417
Octahedron	0.707107	1.22474	1.03576
Hexahedron	0.577350	1.00000	0.88610
Icosahedron	0.525731	0.66158	0.62153
Dodecahedron	0.356822	0.44903	0.40883

3. The side of any of the five Platonic bodies being given, to find the diameter of the sphere, that may be inscribed in that body, or circumscribed about it, or that is equal to it. As the respective number, in the above table, under the title, *inscribed*, *circumscribed*, or *equal*, is to 1, so is the side of the given Platonic body to the diameter of its inscribed, circumscribed, or equal sphere, in solidity.

4. The side of any of the five Platonic bodies being given, to find the side of either of the Platonic bodies, which are equal in solidity to that of the given body. As the numbet under the title *equal*, against the given Platonic body, is to the number under the same title, against the body whose side is sought, so is the side of the given Platonic body to the side of the Platonic body sought.

5. To find the solid contents of any of the five Platonic bodies. As 1 is to the cube of the side of any of these bodies, so is 0.1178513 to the solid content of a tetrahedron, 0.4174045 to that of the octahedron, 1.0000000 to that of the hexahedron, 2.1816950 to that of the icosahedron, and 7.6631189 to the solid content of the dodecahedron.

Hence we have the following rule: multiply the tabular solidity by the cube of the side or linear edge, for the solid content. The demonstration of this rule, and that for the superficies above given, is as follows:

The tabular numbers denote the surface and solidity of each body, when its side or edge is one; and, because, in similar bodies, the surfaces are as the squares of the linear edges, and the solidities as the cubes of the same, the truth of the rules is manifest.

If one of these bodies be required to be cut out of the sphere of any diameter, let $d\,r$ (*Plate* XII. *Geometry*, *fig.* 9.) be the diameter of any sphere, and $d\,a$ one-third of it, $= a\,b = b\,r$. Erect the perpendiculars $a\,e$, $c\,f$, and $b\,g$; and draw $d\,e$, $d\,f$, $e\,r$, $f\,r$, and $g\,r$; then will (1) $r\,e$ be the side of the tetrahedron; (2) $d\,f$, the side of the hexahedron; (3) $d\,e$, the side of the octahedron; (4) and cutting $d\,e$ in extreme and mean proportion in h, $d\,h$ will be the side of the dodecahedron; (5) setting the diameter $d\,r$ up perpendicular at r, from the centre c, to its top, draw the line $c\,g$, cutting

cutting the circle in g, let fall the perpendicular $g\ b$; fo is $b\ r$ the fide of the icofahedron.

REGULAR *Curve.* See CURVE.

REGULAR *Architecture*, *Fortification*, &c. See ARCHITECTURE, and FORTIFICATION.

REGULAR *Attacks*, in a fiege, are thofe that are made in form, or by regular approaches. See PARALLELS.

REGULAR *Baftion.* See BASTION.

REGULAR *Place.* See PLACE.

REGULAR, in the *Monaftic Senfe*, denotes a perfon who has made the vows in fome religious houfe. See RELIGIOUS and VOW.

Under regulars are comprehended the whole body of monks, friars, and mendicants, &c.

The denomination of regulars, in this cafe, arifes hence, that they are bound to obferve the regula or rule of the order they are entered into. Hence,

REGULAR *Prieft* is ufed for a prieft who is in fome religious order, in oppofition to a *fecular* prieft, who lives in the world, or at large.

A cardinal is reputed both regular and fecular, and is intitled to the privileges of both ftates.

Regulars may be promoted to bifhoprics and archbifhoprics, as well as feculars; but their promotion fecularizes them; the epifcopal dignity difpenfing them from the obfervation of the rule of which they had before made profeffion.

REGULAR *Abbots.* See ABBOT.

REGULAR *Benefices*, are fuch as can only be held by monks or religious; or at leaft, *per cupientem profiteri*, by a perfon defirous to embrace the monaftic life. See BENEFICE.

It is a maxim in the Romifh canon law, *regularia regularibus*, *i. e.* regular benefices are to be conferred on regular priefts. The abbeys that are chiefs of their refpective orders are all regular, and can only be ferved by monks and cardinals. All benefices are prefumed to be fecular, unlefs they be proved regular.

Anciently the regular benefices were almoft all conferred by way of adminiftration or curacy; the religious incumbents being always *ad manum* to their fuperiors, who difplaced them at pleafure. Hence the common maxim among the canonifts, *omne beneficium regulare manuale.*

The benefices appropriated to regulars are abbeys, conventual priories, fimple priories, and clauftral offices. They may be conferred on feculars *in commendam.*

REGULAR *Canons.* See CANON.

REGULAR *Places*, are thofe within the boundary or inclofure of the convent; as the cloifter, dormitory, chapter, and refectory. In oppofition to thofe deftined for guefts, and for the neceffaries of the houfe, which are reputed without the inclofure.

REGULAR *Corporation.* See CORPORATION.

REGULATION, a rule or order prefcribed by a fuperior, for the uniform and orderly management of fome branch of policy, juftice, or the like.

REGULATOR *of a Watch*, is a fmall fpring belonging to the balance, ferving to adjuft the going, and to make it go either fafter or flower.

REGULATOR *of Velocity*, in *Mechanics*, is a contrivance for regulating or governing the motion of a mill, or other large machine, by means of which it will always be caufed to preferve an equable and regular velocity in the motion of its parts, notwithftanding any accidental increafe of the moving force, or decreafe of the refiftance that may occafionally arife. A regulator muft be connected with fome lever, or other parts of the machine, which commands the fupply of whatever conftitutes its moving force, as the fhuttle of a water-wheel, the fail-cloth of a wind-mill, or valve of a fteam-engine; and it fhould have the property of acting fuddenly upon this lever, or other part, the inftant any increafe or decreafe of velocity in the motion takes place, either to elevate or deprefs it, and thus regulate the fupply in a degree proportioned to the quantity of alteration in the velocity; and it is by the fenfibility and accuracy of the regulator in this refpect that its perfection is eftimated.

The regulator moft commonly ufed is called a *governor.* This confifts of two or more pendulums fufpended from joints, which are fupported upon a vertical axis: this being caufed to revolve by the machine, and the pendulums accompanying it, the balls will, by the centrifugal force, recede from the axis or centre a quantity proportioned to the velocity of the motion and length of the pendulum: then, on any acceffion of the motion, they recede ftill further from the axis, or *vice verfâ*, if the velocity diminifhes. This motion is contrived to actuate the lever which regulates the velocity of the machine in a fteam-engine: it is connected with the valve which admits the fteam from the boiler to the cylinder, in a water-wheel with the fhuttle, through which the water flows, or in a wind-mill with the mill-ftones, or fail-cloths. See a farther defcription under MILL-WORK, STEAM-*Engine*, and WINDMILL.

The principle of the governor is the fame with the circular or conical pendulum, of which Huygens has laid claim to the invention, as well as of the long pendulum for regulating clocks, who fays he difcovered it nearly at the fame time as the other. The conical pendulum circulates feconds when of the fame length with the common pendulum, which will vibrate only half feconds. To explain it, we muft fuppofe a ball or weight to be fufpended by a ftring or rod, fo that the ball can defcribe in a horizontal circle by a motion of the rod round a vertical axis, with which the centre of fufpenfion coincides. In this motion the rod of the pendulum will defcribe the furface of a cone, of which the point of fufpenfion is the vertex, and the horizontal circle which the ball defcribes is the bafe: it is hence called the circular or conical pendulum. The ball has liberty to recede from, or approach to, the axis, by moving upon its centre of fufpenfion, and thus the circle the ball defcribes will be enlarged or diminifhed; and it is this circumftance which gives it the property of circulating or performing a revolution always in the fame fpace of time which a fimple pendulum of four times the length would vibrate; for this takes place equally whether the ball is extended to defcribe a large circle, or retracted to revolve in a fmall one; though, it fhould be obferved, that this is only true in the fuppofition that the pendulum-ball, in moving from the vertical axis upon its centre, will defcribe a parabola inftead of a circle, in the fame manner as the ball of a common pendulum is required to move in the arc of a cycloid inftead of a circle, to caufe all the vibrations, both long and fhort, to be performed in equal fpaces of time. Mr. Martin has, in his Inftitutions, given a very complete explanation of the principle of this pendulum, by fuppofing an inverted parabola, with its axis placed in a vertical pofition; then fuppofing a bowl or veffel excavated by the revolution of this figure upon its axis a paraboloid will be formed. A heavy globe or ball being put in this bowl, may, by agitating the veffel, be caufed to perform a revolution in a horizontal circle within the veffel, and it will be found to circulate in the fame period of time, whether it defcribes a fmall circle near the bottom of the veffel, or a large circle in its upper part, where the diameter is larger.

The

The governor or flying-ball is the regulator moft generally ufed in machinery, although there are other means which, in particular inftances, are preferable, from the circumftance of their poffeffing a greater power to operate upon the regulating part of the machine. One of thefe, called the water-regulator, confifts of a pump, which, being worked by the machine, will raife water into a ciftern, from which a conftant ftream flows off by a pipe and cock; a float is placed upon the furface of the water in the ciftern, and this communicates with the fteam-valve of the engine, or fhuttle of the water-wheel. The operation of this regulator is eafily explained, for the pump will raife a quantity of water exactly proportioned to the velocity of the machine, or the number of ftrokes it makes; whereas the ftream which flows off by the cock is a conftant quantity, and equal to that which the pump will fupply when the machine moves with its intended velocity. When this is the cafe, the furface of water in the ciftern will ftand at the fame height; but if the velocity is increafed, the pump will raife more water into the ciftern than the pipe and cock will carry off, and the furface rifing, elevates the float, which, by its action to diminifh the fupply of power to the machine, will correct the acceleration which has taken place in its velocity. The oppofite effect takes place if the velocity decreafes, *viz.* that the fupply to the ciftern being diminifhed whilft the efflux is conftant, the furface will fink, and the float defcending, opens the valve or fhuttle, and increafes the fupply of power to the machine until it regains the original velocity. The great advantage of this regulator is, that it can fo readily be made to keep the machine fteady at any velocity which may be required, and this by merely opening or clofing the cock: thus, if it is opened to carry off a greater quantity, the furface will fubfide, and the float, by defcending, opens a greater fupply of power to the machine, and occafions it to move quicker; but this, though it raifes more water by means of the pump, will not raife the furface of the water in the ciftern to fo great a height as it ftood at before, becaufe the efflux is now equal to the increafed fupply.

In all cafes this regulator will caufe the machine to work at fuch a rate, as to make the pump raife the fame quantity of water as the cock emits, and its rate may be afcertained before it is put to work; for if the quantity of water which the cock will difcharge in a minute, or other given fpace of time, is known, and the dimenfions of the pump; then it may eafily be calculated what number of ftrokes *per* minute the pump muft make to raife an equal quantity of water. The fenfibility of this regulator will be increafed by making the ciftern of a fmall fize, becaufe then any deviation from the intended rate of working will caufe the greater elevation or depreffion of the furface, and a greater action on the float: and, for the fame purpofe, it is beft to make the ciftern gradually diminifh in area, fo as to be fmaller both towards the top and at the bottom, than at the place where the furface is expected to ftand when the machine moves with the proper velocity. By this means it will rife or fall more rapidly, in confequence of the diminifhed area of the ciftern, when the alteration of velocity is confiderable, and a greater correction is required, than when the alteration is only trifling. It is neceffary that the pump fhould raife a conftant ftream of water into the ciftern, both in the afcent and defcent of its bucket: to do this, two pumps, acting alternately, may be ufed, or by a very fimple contrivance a fingle pump may be made to effect the fame; thus, upon the rod of the pump a cylinder of wood is fixed, which is of fuch a diameter, that its area is equal to half the area of the pump-barrel, and its length being equal to the length thereof, its content will be equal to one-half of the barrel: this is fixed on fuch a part of the rod, that it will, by the rifing and falling of the rod, be drawn up out of water as much as the rod and bucket moves: now, when the pump-bucket is drawn up, the rifing of the cylinder above the furface of the water increafes the capacity of the ciftern one-half as much as the quantity of water which is thus drawn up into it, and the efflux of water by the cock being juft equal to the other half, the furface will be ftationary; and when the bucket defcends, and no water is raifed, the cylinder going down into the water diminifhes the capacity of the ciftern a quantity equal to the quantity of water which will flow off in the fame time, and thus fupplies the wafte of water which flows off in the fame time. A regulator of this kind may, in many cafes, be formed from fome part of the machine, without any additional apparatus: thus, the cold water-pump of a fteam-engine will raife the neceffary water into a ciftern for the float to act in, and this float muft be connected with the arm of the fteam-valve. Alfo, in an engine for blowing a furnace, where it has a water-regulator (fee Blowing), the rife of the water in the external ciftern may regulate the motion of the engine, the whole machine being of the fame kind with the regulator we have defcribed.

A regulator would be applied with great advantage to a machine which is ufed in the *Cotton* Manufacture (fee that article), for drawing a piece of cotton cloth regularly and flowly over a red-hot cylinder of iron by two rollers, from one of which it is wound to the other: now, if the men who turn thefe ftop but for a moment the cloth is burnt through, but by a regulator it might be lifted off the hot iron the inftant the motion was fo far diminifhed as to endanger the firing of it.

The water-regulator is rendered more powerful by fufpending the ciftern from the end of a lever, like a fcale-beam, the oppofite end of which has a counterpoife fufficient to balance the weight of the ciftern when the water in it ftands at the intended height; but if the water increafes in the ciftern from the caufes above defcribed, the box will defcend, and the motion of the lever will act upon the machine to make the regulation the fame as the motion of the float: on the other hand, when the water in the ciftern diminifhes, the counterpoife will draw it up and give motion to the lever. The water from the pump is introduced to the ciftern by a fpout, and all the other parts have the fame conftruction as we have defcribed.

It is a defect of both the regulators we have above defcribed, that they do not operate upon the machine until the alteration of velocity has actually taken place, although they immediately correct it. It would be defirable to have others which would make the correction before the evil takes place: for inftance, in a wind-mill, which is more fubject to irregularity than any other machine, a large vane may be fufpended by a heavy pendulum, and oppofed to the wind; now the force of the latter, when blowing regularly, will caufe the pendulum to incline a certain quantity from the perpendicular; but if the wind increafes or diminifhes, it will incline more or lefs, and this motion may be communicated to the fhuttle which regulates the feed of corn, fo as to give more or lefs to the ftones in proportion to the power of the wind for grinding it, thus adapting the refiftance to the power; and if this fhould increafe beyond all bounds, the fame motion may be made to act upon the grip of the mill to check its acceleration effectually. In the fame manner a water-wheel may have a float placed in the dam or head to act upon the fhuttle whenever the furface thereof rifes or falls above or

below

below the intended level, fo as to apportion the fupply to the fall, and keep the velocity uniform.

There is another kind of regulator fometimes ufed in machines to caufe a fufficient refiftance to the motion to prevent acceleration, fuch as a crane or lowering machine, which is to let down a heavy weight, a coal winding machine, &c.; a very good one for thefe purpofes is a vertical axis with pendulums, like the governor, but having a broad vane to meet the air inftead of heavy balls, which indeed may be added alfo: this, when put in motion, will oppofe a very great refiftance to the acceleration, becaufe the centrifugal force caufing the vanes to recede from the centre, they muft defcribe a larger circle in the air in proportion to the velocity, or, by collapfing, they make but little refiftance when the velocity is fmall.

REGULO, a title given to the fons of the emperor of China.

REGULUS, Marcus Attilius, in *Biography*, a celebrated Roman general, was raifed to the confulfhip the firft time in the year 267 B. C., and, in conjunction with his colleague Libo, obtained the honour of a triumph on account of their fuccefs over the Salentines, from whom they took their capital Brundufium. During the firft Punic war the Romans elected Regulus conful, together with Lucius Manlius Vulfo, B.C. 256, and gave them orders to carry their arms into Africa. They failed with a very powerful fleet, and in their voyage encountered a fuperior Carthaginian force, under Hanno and Hamilcar, which they totally defeated. After refitting in Sicily, and taking frefh troops aboard, the confuls failed for the African coaft, where they took poffeffion of the town of Clupea. They next advanced towards Carthage, which city was thrown into the utmoft confternation by this unexpected invafion; and, after plundering the country almoft to its gates, they returned to Clupea loaded with booty of all kinds. Very foon after this, orders arrived from Rome for the return of Manlius, leaving Regulus with part of the fleet and army to conduct the war in Africa. Regulus afked for his recall upon the following plea: he was poffeffed of a farm of feven acres, from which his family derived their fubfiftence, and being informed that his fervants were carrying off his ftock, he begged that he might return to fave his family from ftarving. The plea was over-ruled, by an order that they fhould be maintained by the public during his abfence upon the fervice of his country. He again advanced towards Carthage, croffed the river Bagrada (in paffing which, according to the Roman hiftorians, he was encountered by a monftrous ferpent,) and laid fiege to a town not far from the metropolis. Hamilcar attempted to relieve the place, but Regulus met him and gave him a very fignal defeat. After this he took feveral towns, without any refiftance. A revolt of the Numidians reduced the Carthaginians to ftill greater diftrefs, fo that it appears the enemy fought for peace. The terms, however, offered by Regulus were fo unreafonable, that the fenate of Carthage could not for a moment liften to them, and refolved upon a vigorous profecution of hoftilities. During the interval of negociation a body of Greek mercenaries arrived at Carthage, commanded by Xantippus, a Spartan, by whom the Romans were completely defeated, with the lofs of 30,000 men, befides 15,000 taken prifoners, among whom was Regulus himfelf, whom the Carthaginians brought in triumph into that city, which, but a few hours before, he had not only infulted, but, in his own mind, devoted to deftruction. Hitherto, fays the hiftorian, Regulus had appeared only as a Roman commander, and not one of the moft confpicuous; the concluding fcenes of his life are thofe which entitle him to rank among the firft of Roman patriots. The Carthaginians behaved to their other prifoners humanely, but Regulus they treated with all the barbarity which they could devife; but, when the fortune of war appeared to turn againft them, they began to ufe him with more lenity, in order that they might engage him to endeavour to obtain an accommodation. At their defire he went with their ambaffadors to Rome, having firft taken an oath that he would return to his prifon, if the negociation fhould not fucceed. When he arrived at the gates of the city he refufed to enter, being, as he faid, a flave to the Carthaginians; and when his wife and children came out to meet him, he viewed them as ftrangers, and declined their careffes. The fenators affembled to give audience to the Carthaginian ambaffadors, preffed him to take his feat among them, but he refufed, till commanded by his mafters to accept it. When he was called on for his opinion, he fpoke ftrongly both againft granting the Carthaginians peace, and exchanging himfelf and the other Roman captives for the prifoners of importance whom they had taken from that nation. Though convinced by his arguments, the fenators were unwilling to fend back fo noble a citizen, and a fubterfuge was fuggefted to him by which he might be releafed from his oath, but he inftantly rejected the bafe fuggeftion, and declared his refolution to return to Carthage in the face of the cruel punifhment that he knew awaited him. Acting upon the idea that he was ftill a flave, he took no leave of his family, but, with an unmoved countenance, made his way in filence through the crowds of his admiring countrymen. The Carthaginians were told that their offers of peace were not only rejected at Rome, but chiefly fo through the means of Regulus, whom now they refolved to punifh in the fevereft manner poffible. For fome days he was expofed to the rays of a meridian fun, and afterwards confined in a barrel, whofe fides were every where filled with large iron fpikes, till he died in the greateft agonies. His fufferings were heard of at Rome, and the fenate permitted his widow to inflict whatever punifhment fhe pleafed on fome of the moft illuftrious captives of Carthage, and fhe took a fevere revenge, till at laft the fenate interpofed, and put a ftop to the barbarity of her punifhments. Regulus perifhed in the year B.C. 251. Univ. Hift.

Regulus, *Petty King*, in our *Ancient Cuftoms*, is a term frequently ufed, in the Saxon councils, for comes or count.

Hence *fub-regulus* was alfo ufed for a vice-comes or vifcount: though in many places the two feem ufed indifferently for the fame dignitary. Thus in the archives of the cathedral of Worcefter, Uthredus fometimes ftyles himfelf regulus, and fometimes fub-regulus, of the city of Worcefter.

But in other places we find a diftinction: "Offa, rex Merciorum; Uthredus, regulus; Aldredus, fub-regulus, &c."

Regulus, *Konig*, Germ., in *Chemiftry*, denotes, in its moft extenfive fenfe, a metal in the proper metallic ftate. The term is now little ufed, though the old chemifts chiefly employed it as a diftinctive appellation in thofe cafes where a metal and one of its ores happened to be called by the fame name. Thus, the grey fulphuret of antimony was not known by the name of antimony long before it was fufpected to contain a peculiar metal; when this difcovery took place, the metal was called regulus of antimony, in order to diftinguifh it from the ore from which it was procured. For the fame reafon, the metals arfenic and cobalt were denominated the reguli of arfenic and cobalt.

Regulus *of Antimony*. See Antimony.

Regulus, *Martial, of Antimony.* See Antimony.

Regulus *of Arsenic.* See Arsenic.

Regulus *of Cobalt.* See Cobalt.

Regulus, in *Astronomy*, is a star of the first magnitude, in the constellation Leo; called also, from its situation, *Cor Leonis*, or the *Lion's Heart*; by the Arabs, *Albabor*; and by the Chaldeans, *Kalbeleced*, or *Kalbeleceid*; from an opinion of its influencing the affairs of the heavens; as is observed by Theon. See Leo.

Regulus, in *Ornithology*, a species of *Falco*; which see. —Also, a species of *Motacilla*; which see.—See also Wren.

REGUSSE, in *Geography*, a town of France, in the department of the Var; 9 miles N.E. of Barjols.

REGYA, a river of Africa, which runs into the Mediterranean; 16 miles E. of Algiers.

REHABERE *facias seisinam*, quando vicecomes liberavit seisinam de majore parte, *quam deberet*, in *Law*, a writ judicial; of which there is another of the same name and nature. (Reg. Jud. 13, 51, 54.) It lay when the sheriff in the *Habere facias seisinam* had delivered more than he ought.

REHABILITATION, Rehabilitatio, in the *Civil* and *Canon Law*, an action by which a prince or pope, by dispensation or letters patent, restores a delinquent to the condition he was in before his delinquency. See Degradation.

The king alone can rehabilitate an officer, noted, condemned, and degraded; or a gentleman who has derogated from his rank.

The pope alone pretends to rehabilitate, *i. e.* to render capable of benefices and orders, such as had fallen into heresy or other irregularities.

In Romish countries, an ecclesiastic who assists at the execution of a sentence of death, is to be rehabilitated by an absolution, called *a sævis*.

By the *rehabilitation* of a convict in the Code Napoleon, or French criminal jurisprudence, is understood his restoration to all the rights and privileges which he had forfeited by being subjected to a painful or infamous punishment. He cannot demand it till five years have elapsed since the execution of his sentence, during the whole of which time he must have resided in the same *arrondissement*; or unless he has been domiciled during two complete years in the territory of the municipality to which the demand is addressed. It must also be supported by testimonials of his good conduct from the municipal authorities. The criminal court receives the demand, and pronounces on it at the end of three months: if their judgment be unfavourable, the application may be renewed at the end of five years, with the same advantage; but if the party rehabilitated into society should offend again, he becomes incapacitated for ever.

REHBURG, in *Geography*, a town of Westphalia, in the principality of Calenberg; 18 miles W.N.W. of Hanover.

REHEARING, in the *Court of Chancery*, is a process to which either party, that thinks himself aggrieved, may have recourse, before the execution of a final decree. Every petition for a rehearing must be signed by two counsel of character, certifying that they apprehend the cause is proper to be reheard. And upon the rehearing, all the evidence taken in the cause, whether read before or not, is now admitted to be read; because it is the decree of the chancellor himself, who only now sits to hear reasons why it should not be enrolled and perfected; at which time, all omissions of either evidence or argument may be supplied. But after the decree is once signed by the chancellor, and enrolled, it cannot be reheard or rectified, except by bill of review, or by appeal to the house of lords.

REHEARSAL, in *Music* and the *Drama*, an essay or experiment of some composition, which is made in private, previous to the representation or performance of it in public; to habituate the actors or performers, and make them more ready and perfect in their parts.

REHOBOTH, in *Geography*, a post-town of America, in Bristol county, Massachusetts, on a branch of Providence river, a few miles from Providence, in Rhode island, 40 miles southerly from Boston. It was called "Seconnet" by the Indians; incorporated in 1645, and contains 4866 inhabitants.

REHUT, a town of Hindoostan, in the circar of Gohud; 20 miles S.S.W. of Gwalior.

REI *Domesticæ Domesticus.* See Domesticus.

REICH, in *Geography*, a town of Austria; 7 miles N.W. of Schwanestadt.

REICHARDT, John Frederic, in *Biography*, chapelmaster to Frederic II. king of Prussia, at Berlin, was born at Königsberg, in Prussia, in 1751, and studied under the organist of the principal church. Richter taught him the harpsichord, and formed his taste. He likewise practised the violin, and was powerful upon that instrument, particularly in double stops. With these talents he travelled in 1771, distinguishing himself in Upper and Lower Saxony, Dresden, Leipsic, Brunswick, Hamburgh, and Berlin; where he was appointed by the king, in 1775, chapelmaster, in the station which Graun had formerly illustrated.

The first composition which he produced in his new office, was a prologue to Graun's opera of "Angelica e Medoro," which he set on occasion of a visit to the king of Prussia by the grand duke of Russia, in 1776; in which prologue he composed the famous air "Nell' orror d'Atra Foresta," for Mad. Mara.

In 1783 he went to Paris, and gave proofs of his abilities at the concert spirituel; and in 1784, he was present at the commemoration of Handel in London. He married the daughter of Francis Benda, born the same year as himself, an excellent singer.

REICHELIA, in *Botany*, Schreb. Gen. 200. (Sagonea; Aubl. Guian. t. 111. Juss. 134. Lamarck Illustr. t. 212.) Reduced by its author, on the suggestion of Swartz, to *Hydrolea*; Schreb. 826. There have been two botanists of the name of Reichel; but Schreber, most probably, had principally in view George Christian Reichel, professor of medicine at Leipsic, who published a dissertation on the Spiral Vessels of Plants, and died in 1771, at the age of 44.

REICHELSBERG, in *Geography*, a lordship of Germany, in the circle of Franconia, deriving its name from a mountain citadel, near the town of Aube, in the duchy of Wurzburg.

REICHELSBURG, a town of the duchy of Wurzburg; 20 miles S.E. of Wurzburg.

REICHELSDORF, a town of Bavaria, in the territory of Nuremberg; 7 miles S. of Nuremberg.

REICHELSHEIM, a town of the duchy of Wurzburg; 4 miles W. of Arnstein.—Also, a town of the principality of Nassau Weilburg, insulated in the bishopric of Fulda; 30 miles S. of Marburg.

REICHELSWAND, a town of Bavaria, in the territory of Nuremberg; 3 miles E. of Lauf.

REICHENAU, an island in the lake of Constance, about two miles long, and abounding with vines and other fruit

fruit trees, with a celebrated abbey, and the villages of Upper and Lower Zell.—Alfo, a town of Bohemia, in the circle of Chrudim; 9 miles W.N.W. of Politzka.—Alfo, a town of Auftria; 5 miles S.W. of Freyftadt.—Alfo, a town of Saxony, in the Vogtland, near Pawfa.—Alfo, a town of the Helvetian republic, at the union of the two branches of the Rhine; 6 miles S.W. of Coire.—Alfo, a town of Bohemia, in the circle of Bechin; 6 miles E. of Rofenberg.—Alfo, a town of Bohemia, called "New Reichenau," in the circle of Bechin; 8 miles E.S.E. of Pilgram.—Alfo, a town of Pruffia, in the province of Oberland; 8 miles S.E. of Ofterrod.—Alfo, a town of Pruffia, on the Offa; 22 miles E.N.E. of Culm.

REICHENBACH, a town of Saxony, in the Vogtland, containing about 700 houfes, two churches, and a Latin fchool. The inhabitants are chiefly clothiers, and dealers in cloth. Their method of dyeing is held in high eftimation, the moft beautiful fcarlet in the whole electorate being made at this place; 10 miles S.W. of Zwickau. N. lat. 50° 31′. E. long. 12° 16′.—Alfo, a town of Silefia, in the principality of Schweidnitz, containing two churches and an hofpital. The town has fome confiderable manufactures of linen, canvas, and fuftian; 9 miles N. of Schweidnitz. N. lat. 50° 35′. E. long. 16° 35′.—Alfo, a town of France, in the department of the Sarre; 8 miles S. of Lautereck.—Alfo, a town of Lufatia; 4 miles S.W. of Camenz.—Alfo, a town of Pruffia, in the province of Oberland; 7 miles S.S.W. of Holland.—Alfo, a town of Germany, in the county of Henneberg; 3 miles N. of Smalkalden.—Alfo, a town of Germany, in the principality of Culmbach; 12 miles E.N.E. of Neuftadt.—Alfo, a town of Germany, in the margraviate of Anfpach; 2 miles N.W. of Schwabach.

REICHENBERG, a mountain of Swabia; 6 miles N.W. of Huiffingen.—Alfo, a town of Bohemia, in the circle of Bolellaw. Twenty thoufand pieces of cloth are fuppofed to have been made in this town in one year; 25 miles N.N.E. of Jung-Buntzlau.—Alfo, a town of Pruffia, in the province of Ermeland; 3 miles S.W. of Heilfberg.—Alfo, a town and caftle of Weftphalia, in the county of Catzenelnbogen; 5 miles E. of St. Goar.

REICHENBURG, a town of the duchy of Stiria; 12 miles S.S.E. of Cilley.

REICHENECK, a town of the duchy of Stiria; 5 miles E.S.E. of Cilley.

REICHENFELS, a town with a caftle in Saxony, in the principality of Reuffen; 8 miles N.W. of Greitz.—Alfo, a town of the duchy of Carinthia; 24 miles N.E. of Clagenfurt.

REICHENHALL, a town of Bavaria, on the Sala, with a rich falt fpring, the water of which is partly boiled here, and partly, by means of a large wheel 36 feet in diameter, thrown up to the higher parts of a lofty houfe, and thence conveyed by means of leaden pipes to the diftance of 12 miles, over mountains, towards Traunftein, and there boiled, on account of the convenience of wood, and alfo of exportation. An aqueduct of fquared flints, two miles long and five feet broad, with an arched roof, was formed fome centuries ago, for conveying water to turn the wheels and other engines, and to carry off any fuperfluous falt water. This aqueduct, after running to a depth of 12 fathoms under the town, and from thence under the gardens and fields, at laft difcharges its water in a ftrong torrent. The current of the water is fo ftrong, that a boat with torches may fail from one end to the other in a quarter of an hour. In the aqueduct are five apertures in the form of towers, and through fome of thefe a perfon may fpeak from the ramparts of the town with thofe who fail upon the canal; 9 miles S.W. of Salzburg. N. lat. 47° 40′. E. long. 12° 50′.

REICHENSTAIN, a town of Auftria; 19 miles N.E. of Steyregg.

REICHENSTEIN, a town of Silefia, belonging to the principality of Brieg, but infulated in that of Munfterberg; 16 miles W. of Neiffe. N. lat. 50° 15′. E. long. 16° 40′.—Alfo, a town of France, in the department of the Roer; 21 miles S. of Juliers.

Reichenstein, *Unter*, a town of Bohemia, in the circle of Prachatitz; 3 miles W.S.W. of Berg Reichenftein.

REICHENTAL, a town of Auftria; 3 miles E. of Haderfdorf.

REICHENWALT, or Riecherswalde, a town of Pruffia, in Oberland; 4 miles N.W. of Liebftat.

REICHERSDORF, a town of Tranfylvania; 4 miles E. of Medies.

REICHMANSHAUSEN, a town of the duchy of Wurzburg; 10 miles E.N.E. of Schweinfurt.

REICHNAW, a town of Bohemia, in the circle of Konigingratz; 17 miles E.S.E. of Konigingratz.—Alfo, a town of Lufatia; 6 miles W. of Gorlitz.

REICHNICH, a town of the duchy of Stiria; 6 miles N.E. of Windifch Gratz.

REICHOLDSGRUN, a town of Germany, in the principality of Culmbach; 2 miles S. of Kirch Lamitz.

REICHSHOFEN, a town of France, in the department of the Lower Rhine; 9 miles N. of Haguenau.

REICHSTHABER, in *Commerce*. See Rix-dollar.

REICHTHAL, in *Geography*, a town of Silefia, in the principality of Breflau; 32 miles S. of Breflau. N. lat. 51° 9′. E. long. 17° 52′.

REID, Thomas, in *Biography*, an eminent divine and moralift, was born at Strachan, in Kincardinefhire, of which parifh his father was minifter, in the year 1710. The elements of learning he received at the parifh fchool of Kincardine, after which he was fent to a claffical fchool at Aberdeen; and fo rapid was his progrefs in his ftudies, that about the age of thirteen he was found fully qualified for the univerfity, and entered as a ftudent in Marifchal college. Here he diftinguifhed himfelf by his proficiency in the various branches of learning taught during the ufual courfe of four years, particularly in mathematics. At this period he probably took his degree of M.A., and afterwards commenced the ftudy of theology, and in due time was licenfed as a preacher. He was foon appointed librarian to the univerfity, and became intimately acquainted with Mr. John Stewart, the profeffor of mathematics. This connection ftrengthened and confirmed his predilection for mathematical ftudies. Occafionally he read lectures for his friend, in which he difcovered a happy faculty of making every thing intelligible to the ftudents, which he clearly apprehended himfelf. In 1736 Mr. Reid refigned his fituation of librarian, and accompanied Mr. Stewart on an excurfion into England, and became acquainted with many illuftrious characters in London, at Oxford, and at Cambridge. In the following year, Mr. Reid was prefented by the King's college of Aberdeen to the living of New Machar; but his entrance into the functions of his office was very unpropitious. His unwearied attention, however, to the duties of his office, the mildnefs and forbearance of his temper, and the active fpirit of his humanity, foon overcame all their prejudices; and not many years afterwards, when he was called to a different fituation, the fame perfons, who had taken a fhare in the outrages againft him, followed him, on his departure, with their prayers and tears.

tears. "We fought," faid fome of them, "againft Mr. Reid, when he came; and would have fought for him, when he went away."

The greater part of his refidence at New Machar was devoted to the moft intenfe ftudy; and by way of amufement, he had recourfe to gardening and botany, of which he was extremely fond, even in old age. In the year 1748 he publifhed a paper in the Tranfactions of the Royal Society of London, entitled "An Effay on Quantity, occafioned by reading a Treatife, in which fimple and compound Ratios are applied to Virtue and Merit." The treatife here referred to was Dr. Hutchefon's "Inquiry into the Origin of our Ideas of Beauty and Virtue."

The profeffors of King's college, Aberdeen, in the year 1752, appointed Dr. Reid to be profeffor of philofophy: the choice originated wholly from the high opinion they were led to entertain of his talents and erudition. It is not known what particular plan he purfued in the courfe of his lectures; but his department comprehended mathematics, and phyfics, logic, and ethics. Soon after his removal to this fituation, he projected, in conjunction with his friend, Dr. John Gregory, a literary fociety, which fubfifted many years, and which, it is believed, had confiderable effect in exciting and directing that fpirit of philofophical refearch, which has fince fo particularly diftinguifhed the north of Scotland. The writings of Reid, Gregory, Campbell, Beattie, and Gerard, evince the numerous advantages which the members derived from this inftitution, as they were in the habit of bringing fuch works as they intended for publication to the teft of friendly criticifm. Among thefe the moft original was that of our author, publifhed in 1764, entitled "An Inquiry into the Human Mind, on the Principles of Common Senfe;" intended to refute the philofophy of Locke and Hartley, by denying the connection which they fuppofed to fubfift between the feveral phenomena, powers, and operations of the mind; and accounting for the foundation of all human knowledge on a fyftem of inftinctive principles. About the time when this "Inquiry" made its appearance, the author received from the college of Aberdeen the degree of doctor of divinity; and by the univerfity of Glafgow he was invited to the profefforfhip of moral philofophy. On the duties attached to this office he entered in 1764; and he was enabled, by means of a handfome income, to concentrate all his attention to his favourite purfuits, which had hitherto been diftracted by the mifcellaneous nature of his academical engagements. The refearches of Dr. Reid concerning the human mind, were extended and methodized in a courfe, which employed five hours every week, during fix months in every year. The fubftance of thefe lectures was afterwards given to the world, in a more improved form, in the laft of his publications. In the year 1773 appeared, in the form of an appendix to the third volume of lord Kames' "Sketches of the Hiftory of Man," a brief account of Ariftotle's logic, with remarks by Dr. Reid. In the year 1781 Dr. Reid withdrew from his public labours, but he was not inactive: his fubfequent works afford proof of the affiduity with which he availed himfelf of his literary leifure. In 1785 he publifhed his "Effays on the Intellectual Powers of Man;" and in 1788, thofe "On the Active Powers." Thefe volumes complete the fyftem of philofophy, begun in his "Inquiry" many years before.

Notwithftanding his advanced age, Dr. Reid continued to profecute his ftudies with unabated ardour and activity. The modern improvements in chemiftry attracted his particular notice, and he applied himfelf with his accuftomed diligence to the ftudy of its theories and nomenclature. He amufed himfelf alfo, at times, in preparing for a philofophical fociety, of which he was a member, fhort effays on particular topics, which happened to intereft his curiofity, and on which he thought he might derive or afford ufeful hints in the courfe of friendly difcuffion. His laft effay appears to have been written in the 86th year of his age, and was read by the author to his affociates but a fhort time previoufly to his death. In the month of September 1796, he was feized with a violent diforder, with which he for fome time maintained a fevere ftruggle; but which, together with fome paralytic attacks, put an end to his ufeful life on the 7th of October, in the 87th year of his age. In point of bodily conftitution, few men have been more indebted to nature than Dr. Reid. His form was vigorous and athletic, and his countenance was ftrongly expreffive of deep and collected thought; but when brightened up by the face of a friend, what chiefly caught the attention was a look of good will and of kindnefs. The moft prominent features of his character were intrepid and inflexible rectitude, a pure and devoted attachment to truth, and an entire command over his paffions. In private life, no man ever maintained, more eminently or more uniformly, the dignity of philofophy; combining with the moft amiable modefty and gentlenefs, the nobleft fpirit of independence. As a public teacher, he was diftinguifhed by unwearied affiduity in inculcating principles, which he conceived to be of effential importance to human happinefs. In his elocution and mode of inftruction, there was nothing peculiarly attractive. Such, however, were the fimplicity and perfpicuity of his ftyle; fuch the gravity and authority of his character, that he was always liftened to with profound refpect, and, in his latter years, with a veneration, which age added to great wifdom always infpires. Stewart's Life of Reid.

REIDEN, in *Geography*, a town of Switzerland, in the canton of Lucerne; 18 miles N.N.W. of Lucerne.

REJECTIO, a word ufed by medical authors for the cafting any thing up preternaturally by the mouth, whether it be by vomiting or by fpitting.

REIFF, in *Geography*. See RIVA.

REIFFERSCHEID, a town of France, in the department of the Sarre, and chief place of a canton, in the diftrict of Prum. The place contains 311, and the canton 3542 inhabitants, in 45 communes. Alfo, a town of France, in the department of the Rhine and Mofelle, capital of a county in the archbifhopric of Cologne; 42 miles W. of Coblentz. N. lat. 50° 33′. E. long. 6° 27′.

REIFFLING, a town of the duchy of Stiria, on the river Enns; 28 miles N.W. of Pruck.

REIFFNITZ, a town of Middle Carniola; 4 miles N. W. of Gottfchee.

REIFTENBERG, a town of Auftria; 59 miles S.E. of Goritz.

REIGELSBERG, a lordfhip of the duchy of Wurzburg.

REIGNAC, a town of France, in the department of the Gironde; 9 miles N.E. of Blaye.

REIGNIER, a town of France, in the department of the Léman, and chief place of a canton, in the diftrict of Geneva. The place contains 1280, and the canton 9046 inhabitants, on a territory of 102½ kilometres, in 14 communes.

REIGNING WINDS, in *Meteorology*, are thofe winds which ufually prevail in any particular coaft or region, the knowledge of which is effentially neceffary to every pilot, who is charged with the navigation in thofe feas.

REIKENES, in *Geography*, a cape on the S. coaft of Iceland. N. lat. 63° 43′.

REIKEVIG, a sea-port town of Iceland, consisting of about 60 or 70 houses, standing in two rows of nearly equal length, at right angles to each other, the high street being encumbered with rock. Among the rocks, which on every side surround the town, are scattered wretched hovels, a little raised above the level of the ground. The adjacent country much resembles the summit of some of the highest mountains in Scotland, being composed of fragments of rocks, and presenting only a few patches of alpine vegetation. Almost all the houses of Reikevig are of Norwegian construction, and inhabited by Danes. The women of this town are principally employed in the operation of drying fish. On the little island of Akarve, near this town, are bred eider ducks in great numbers. About six miles to the south of Reikevig is an immense bed of lava, extending a length of 25 miles, and having its black and desolate surface broken into masses and fragments, which render it difficult and dangerous to traverse it, especially where quantities of the "trichostomum" conceal the hollow parts from view. The breadth of this remarkable current varies from two to ten miles; and its hideously shattered aspect is supposed to have resulted from the expansive force of elastic fluids which escaped during the cooling of the lava. Most of the produce of the Icelanders is brought to Reikevig; and the inhabitants of the interior of the country take back, in exchange for their tallow and skins, the dried heads of the cod-fish, and such fish as are injured by the rain and not fit for exportation. These form the principal article of their food, and are eaten raw, with the addition of butter, &c. Bishop Videlinus in this place has a library of 5 or 600 volumes. The author of the work now cited states the height of Hecla at about 5000 feet, and the population of Iceland at about 48,000 persons, who, from the rigour and instability of their climate, can never rely on their native produce even for the necessary articles of subsistence. The principal articles of export are dried fish, (especially cod of a superior quality,) mutton, lamb, beef, butter, tallow, train-oil, coarse woollen cloth, the skins of sheep, lambs and foxes, eider-down and feathers; and their chief importations are timber, fishing tackle, various implements of tin, tobacco, bread, spirituous liquors, salt, linen, &c. A large proportion of their food consists of fish, butter, and various preparations of milk. Hooker's Journal of a Tour in Iceland in 1809.

REILLANE, a town of France, in the department of the Lower Alps; 7 miles S. of Forcalquier.

REIMBURSEMENT, in *Commerce*, the act of repaying or returning what monies a person had received, by way of advance, &c. or what another had disbursed or paid for him. A person who gives a bill of exchange in payment, is to reimburse it, if it come to be protested, for want of being accepted or paid.

REIMBURSING is also used for paying the price a commodity costs its owner.

REIMS, or RHEIMS, in *Geography*, one of the most ancient and celebrated cities of France, and principal place of a district, in the department of the Marne, seated on the Vesle. Before the revolution this city was the see of an archbishop, who was the first duke and peer of France, and always crowned the king. In this place was the abbey of the Benedictines of St. Remy, the noblest of that order in the kingdom of France; and on the altar of its church, under which St. Remigius was buried, was kept the holy vial, which, as tradition reports, was, in the year 496, at the baptism of Clovis by bishop Remigius, brought from heaven by a dove in deference to the prayer of that saint; the crowd obstructing his passage to the font with the usual oil. The university of Reims was founded in 1547, and in the following year authorised by the parliament of Paris. This city contains 30,295 inhabitants, in the three parts into which it is divided, and it has three corresponding cantons, the first containing 12,140, the second 10,107, and the third 10,874, in three, four, and five communes respectively, on a territory of 117½ kiliometres. Rheims carries on a considerable trade in wine, woollen and silk stuffs, and gingerbread. It has several remains of Roman antiquities, particularly the three gates of the city, which still bear the names of as many Pagan deities, *viz.* the Sun, Mars, and Ceres. It was taken by the English in the reign of Henry V. N. lat. 49° 15′. E. long. 4° 6′.

REIN, a town of the duchy of Stiria; 9 miles N.W. of Gratz.—Also, a town of the same duchy, on the river Save; 20 miles E. of Cilley.

REIN-*Deer*, in *Zoology*. See CERVUS *Tarandus*.

REINDORFF, in *Geography*, a town of Bavaria; 4 miles S.S.W. of Bamberg.

REINECCIUS, REINIER, in *Biography*, a learned German, who flourished in the 16th century, was a disciple of Melancthon, and taught the belles lettres in the universities of Frankfort and Helmstadt till his death, in 1595. He is known to the learned world by several works on history and genealogy, in which he was profoundly versed. His chief publications are, "Syntagma de Familiis Monarchiarum trium priorum," 1574; "Familiæ Regum Judæorum;" "Chronicon Hierosolymitanum;" "Historia Orientalis;" "Historia Julia," three vols. folio; "Methodus Legendi Historiam."

REINECK, in *Geography*, a town of France, in the department of the Rhine and Moselle, late capital of a burgravate, deriving its name from it, and situated between the duchy of Juliers and electorate of Cologne, on the borders of the Rhine; 14 miles N.N.W. of Coblentz.

REINEN. See RHEINE.

REINERTZ, a town of Silesia, in the comté of Glatz, on the borders of Bohemia; famous for its manufactures of beautiful cloth and plush, and excellent paper, equal to the best in Holland; 11 miles W. of Glatz. N. lat. 50° 14′. E. long. 16° 10′.

REINFELDT, a town of Prussia, in the province of Pomerelia; 12 miles S.W. of Dantzic.

REINFORCE, in *Gunnery*, is that part of a gun next to the breech, which is made stronger, to resist the force of the powder. There are generally two reinforces in each piece, called the first and second reinforce: the second is somewhat smaller than the first, upon the supposition that when the powder is inflamed and occupies a greater space, its force is diminished, which is very absurd. See CANNON.

REINFORCE *Rings* of a cannon, are flat mouldings like iron hoops, placed at the breech-end of the first and second reinforce, projecting beyond the rest of the metal about one-fourth of an inch. See CANNON.

REINFORCEMENT, in *War*, a supply, or new provision of men, arms, ammunition, &c.

REINGUS, in *Geography*, a town of Austria; 12 miles N.N.W. of Waidhoven.

REINHARTSBRUNN, a town of Germany, in the principality of Gotha; 10 miles S.S.W. of Gotha.

REINHARTZ, a town of Saxony; two miles W. of Schmiedelberg.

REINHEIM, a town of the principality of Hesse Darmstadt; 5 miles S.E. of Darmstadt.

REINHOLD, ERASMUS, in *Biography*, an eminent German mathematician, was born at Salfeldt, in Thuringia, a province in Upper Saxony, in the year 1511. He was educated

educated at the univerſity of Wittemberg, where his genius chiefly inclined him to the ſtudy of the mathematics, which he cultivated with great ſucceſs. He afterwards became a profeſſor of thoſe ſciences in the ſame univerſity, and acquired very high reputation, not only by his lectures, but by the learned and uſeful writings which he communicated to the public. Of theſe, which are very numerous, we may mention "Theoriæ Novæ Planetarum G. Purbachii," augmented and illuſtrated with diagrams and ſcholia. "Ptolemy's Almageſt, with a Latin Verſion, and Scholia." In 1551 he publiſhed "Prutenicæ Tabulæ Cœleſtium Motuum," which were ſeveral times reprinted. In carrying on this work, which coſt ſeven years' labour, he was encouraged by the munificence of Albert, duke of Pruſſia. They were conſtructed by him from a compariſon of the obſervations of Copernicus with thoſe of Ptolemy and Hipparchus, and he has fully explained the uſe of them in a great number of precepts and canons, forming a complete introduction to practical aſtronomy. Reinhold alſo made many aſtronomical obſervations, but he never had any better inſtrument than a wooden quadrant. The reſult of theſe obſervations were ſhewn to Tycho Brahé after the death of Reinhold, who expreſſed his ſurprize that ſo great and meritorious a cultivator of aſtronomical ſcience was not furniſhed with better inſtruments. Reinhold died in 1553, when only in the 42d year of his age, pronouncing the following verſe a ſhort time before he expired.

"Vixi, et quem dederas curſum mihi, Chriſte, peregi."

He had a ſon of the ſame name, eminent as a mathematician and phyſician, who publiſhed a ſmall work in the German language "On Subterranean Geometry;" alſo a tract concerning the new ſtar which appeared in Caſſiopeia in 1572.

REINISCHDORF, in *Geography*, a town of Sileſia, in the principality of Neiſſe; 5 miles N. of Neiſſe.

REINS, in *Anatomy*, the kidneys. See KIDNEY and RENES.

The word, according to Varro, is formed from the Greek, ῥεῖν, *quaſi rivi obſceni humoris ab iis oriantur.*—The Greeks call the rein νεφρος, from the verb νεφειν, *to rain, ſnow*, &c.

In the manege they ſay, a horſe ſhould have *double* reins; that is, he ſhould have them a little more elevated on each ſide of the back-bone, than upon it; ſo that, paſſing your hand along it, you find it large, well-furniſhed, and double, by the hollow that goes all along the back-bone. The back ſhould be firm and not hollow, or bending from the withers to the croup, but ſtraight.

REINS, of a bridle, alſo denote two ſtraps of leather meeting in the bridle-hand of the horſeman, in order to make the bit bear, and keep the horſe under ſubjection. See BRIDLE.

It is alſo a name given by the duke of Newcaſtle to two ſtraps or ropes of a caveſſon, which he ordered to be made faſt to the girths, or the pommel of the ſaddle, with intent that the rider ſhould pull them with his hand, in order to bend and ſupple the neck of the horſe.

REIN, *Falſe*, is a lath of leather, paſſed ſometimes through the banquet, to bend the horſe's neck, which is diſapproved of by the duke of Newcaſtle, becauſe it ſlacks the curb, and makes the bit no more than a trench that has no curb.

REINS, in *Rural Economy*, the long thongs or ſtrips of leather, or other materials, by which horſes or other animals are directed in carriages or teams. Theſe reins are much uſed in ſome counties, as Norfolk and Suffolk, in directing the plough-teams, in order to ſave the expence of another perſon, the ploughman directing them in this way himſelf, the driver being by this means diſpenſed with.

REINS, *Check*, a term ſignifying the ſame thing as a ſort of rein, and which is made uſe of in particular diſtricts, in checking and directing the animals.

REINS, *Whip*, a term uſed to ſignify a ſort of hempen rein, employed for directing the team in ploughing in ſome diſtricts, ſo called in conſequence of being uſed inſtead of whips.

REINS *of a Vault*. See VAULT.

REINSBERG, or RHINSBERG, in *Geography*, a town of Brandenburg, in the Middle Mark; 10 miles N.N.E. of New Ruppin. N. lat. 53° 4′. E. long. 12° 58′.

REINSCHNICK, DER, a mountain of Stiria; 12 miles S.E. of Landſperg.

REINSDORF, a town of Saxony, in the circle of Erzgebirg; two miles E.S.E. of Zwickau.

REINSPURG, a town of Bavaria, in the territory of Rothenburg; ſix miles S.S.W. of Rothenburg.

REINSTATING, the reſtoring of a perſon or thing to its former ſtate or condition, from whence it had been diſturbed or diſplaced. See REHABILITATION.

REINSTEIN, in *Geography*. See REGENSTEIN.

REINSURANCE, or RE-ASSURANCE, in *Commerce*, a contract by which a firſt inſurer relieves himſelf from the riſks which he has undertaken, and devolves them upon other under-writers, called re-inſurers, or re-aſſurers. When a policy of inſurance has been once ſigned, the under-writers are bound by the terms of it; nor can they be releaſed from their contract without the conſent of the inſured. But if an under-writer repent of what he has done; if he be afraid to encounter the riſk which he has engaged to run; or if he find that he has incautiouſly engaged himſelf to a greater amount than he may be able to diſcharge, he may ſhift it, or part of it, from himſelf to other inſurers, by cauſing a re-inſurance to be made on the ſame riſk, upon the beſt terms in his power, and the new inſurers will be reſponſible to him in caſe of loſs, to the amount of the re-inſurance. But in ſuch caſe, the new inſurers are reſponſible to the original under-writer only, and not to the original inſured, who can have no remedy againſt him, in caſe of loſs, even though the original inſurer become inſolvent; becauſe there is no privity of contract between the original inſured and the re-inſurer. If, therefore, the original inſurer fail, ſo that the original inſured receive only a dividend, however ſmall, the re-inſurer can gain nothing by this, but muſt pay the full amount of the loſs to the original inſurer. Such is the law on this ſubject, in moſt of the commercial ſtates of Europe. But in this country it was found, about the time when the ſtatute 19 Geo. II. c. 17. was made, that this mode of inſurance, though perfectly reaſonable, when confined to its proper object, had been perverted from its original uſe, and was employed as a mode of ſpeculating in the riſe and fall of premiums; and the legiſlature foreſeeing that it might be uſed as a colour for wager policies, and a means of evading the proviſions of that act, declares (ſect. 4.) "that it ſhall not be lawful to make re-inſurance, unleſs the inſurer ſhall be inſolvent, become bankrupt, or die; in either of which caſes, ſuch inſurer, his executors, adminiſtrators or aſſigns, may make re-inſurance to the amount of the ſum before by him inſured; provided it be expreſſed in the policy to be a re-inſurance." This clauſe, having no words to confine its operation to ſhips belonging to Britiſh ſubjects, like the firſt clauſe of the act reſtraining inſurances, *intereſt or no intereſt*, extends to re-inſurances made in England in foreign ſhips, even when they are inſured abroad. This has been ſo determined; though it is obſervable that the following caſe, in which

which that queſtion was made, was not the ſpecies of re-inſurance above deſcribed, and to which only the ſtatute refers, but a *ſecond inſurance,* effected on account of the *original inſured.*

That was the caſe of an inſurance made in London, on a French veſſel, which had before been inſured at Marſeilles for the ſame ſum, by an inſurer there, who, at the time of ſubſcribing the ſecond policy, was living and ſolvent, and who, in fact, afterwards paid the ſum inſured by him. Upon this caſe the court determined that the latter policy was void by the words of the act; for though the firſt clauſe of the act which prohibits inſurances, 'intereſt or no intereſt,' is confined to inſurances on Britiſh ſhips, yet the fourth ſection being general, and without any ſuch reſtrictive clauſe, every re-inſurance in this country, either by Britiſh ſubjects, or foreigners, on Britiſh or foreign ſhips, is declared void by the ſtatute, unleſs the firſt inſurer be inſolvent, become bankrupt, or die.

There are two other kinds of re-inſurance; the one where the inſured inſures the ſolvency of the inſurers; the other, where he makes a new inſurance, in conſequence of the inſolvency of an inſurer during the continuance of the riſk.

The inſurance of the ſolvency of an inſurer is permitted and practiſed in ſome foreign countries; but it ſeems never to have been in uſe among us; not, perhaps, as has been ſuppoſed, becauſe the ſolvency of an under-writer is not an inſurable intereſt, or that ſuch an inſurance would be deemed a wager; but, more probably, becauſe the inſolvency of an inſurer ſeldom happens in England; beſides, a *double inſurance* would better anſwer the end propoſed.

If France, if an inſurer fail during the continuance of the riſk, the inſured may inſiſt on the diſſolution of the contract, unleſs the creditors of the inſolvent inſurer, in order to entitle themſelves to receive the premium, (which is rarely paid in that country till after the riſk is ended,) will give ſecurity for the payment of the ſum inſured, in caſe of loſs. At Marſeilles, (for in France different practices prevail in different provinces,) the inſured, in ſuch caſe, ſues the inſolvent inſurer, till he obtains a ſentence, authorizing him to re-inſure at the expence of the inſolvent, which he may deduct from the ſtipulated premium, if it be not paid, and if this be inſufficient, then out of the effects of the inſolvent.

Double inſurance is where the inſured makes two inſurances on the ſame riſk, and the ſame intereſt; and it differs from a re-inſurance in this, that it is made by the *inſured,* in order that he may be entitled to receive a double ſatisfaction, in caſe of loſs; whereas, a re-inſurance is made by a former inſurer, his executors or aſſigns, to protect himſelf and his eſtate from a riſk to which they were liable by the firſt inſurance. A re-inſurance, except in the caſes permitted by the ſtat. 19 Geo. II. c. 37. § 4, is abſolutely void; but a double inſurance, though it be made with a view to a double ſatisfaction in caſe of loſs, and is therefore in the nature of a wager, is not void by the law of England. The two policies are conſidered as making but *one inſurance.* They are good to the extent of the value of the effects put in riſk: but the inſured ſhall not be permitted to recover a double ſatisfaction. He may ſue the under-writers on both the policies, but he can only recover the real amount of his loſs, to which all the under-writers ſhall contribute in proportion to their ſeveral ſubſcriptions. And therefore, if he ſhould content himſelf with ſuing only on one of the policies, the under-writers on that policy may recover a rateable contribution from thoſe on the other.

In conſequence of the determination of lord Mansfield, in 1763, it has been agreed to be the courſe of practice, that, upon a double inſurance, though the inſured is not entitled to two ſatisfactions, yet, that in an action upon the firſt policy, he may recover the whole ſum inſured, and may leave the defendants therein to recover a rateable ſatisfaction from the other inſurers. Formerly, in the caſe of an *over-inſurance,* that is, where, in a ſingle policy, the ſums ſubſcribed amount to much more than the value of the effects inſured, the firſt under-writers on the policy were holden to be anſwerable to the extent of the loſs, and the ſubſequent ones diſcharged. Although only a ſingle ſatisfaction can be recovered on a double inſurance by the ſame perſon, yet different perſons may inſure the ſame thing, and each recover the full value of the thing inſured. To enable the defendant, in an action on a policy, to diſcover whether there be a double inſurance, he may, by the authority of the ſtatute 19 Geo. II. c. 37. § 6, call upon the plaintiff to declare in writing, what ſums he has inſured in the whole, and how much he has borrowed on bottomry or reſpondentia. Marſhal's Treatiſe on the Law of Inſurance, vol. i. ch. 4. § 4.

REINTAL, in *Geography,* a town of Auſtria; four miles E.S.E. of Feldſberg.

REINTEGRATION. See Redintegration.

REJOICING Fire, in *Military Affairs,* is uſed on obtaining a victory, or in celebrating ſome public feſtival: of this there are two ſorts, *viz.* one by a volley, and the other by a running fire, from the right to the left of the battalion or line.

REJOINDER, in *Law,* the defendant's anſwer to the plaintiff's replication.

The order of the court of chancery is thus; firſt, the defendant puts in an anſwer or plea to the plaintiff's bill, which is ſometimes alſo called an *exception;* the plaintiff's anſwer to this is called a *replication;* and the defendant's anſwer to that, a *rejoinder.*

The plaintiff may anſwer the rejoinder by a *ſur-rejoinder,* upon which the defendant may *rebut;* and the plaintiff may anſwer him by a *ſur-rebutter;* which pleas, replications, rejoinders, ſur-rejoinders, rebutters, and ſur-rebutters, anſwer to the *exceptio, duplicatio, triplicatio,* and *quadruplicatio* of the Roman laws. See Pleading.

REJOINTING, or Rejoynting, in *Architecture,* the filling up of joints of the ſtones in old buildings, &c. when worn hollow by the courſe of time, or by weather.

Rejointing is to be performed with the beſt mortar, as that of lime and cement; ſometimes alſo with plaiſter; as in the joints of vaults, &c.

REIPOLTZHEIM, in *Geography,* a town of the duchy of Wurzburg; three miles N.E. of Schwarzbach.

REIPOLTZKIRCHEN, a caſtle of France, in the department of Mont Tonnerre, which gave name to a lordſhip, ſituated in the Hunſruck; five miles E. of Lautereck.

REIS, Re, or *Res,* in *Commerce.* See Rees.

REISBACH, in *Geography,* a town of Lower Bavaria, in the Vils; 35 miles W. of Paſſau.

REISCH, a town of Moravia, in the circle of Iglau; 18 miles S. of Iglau.

REISCHSTADT, a town of Bohemia, in the circle of Boleſlau; two miles N.W. of Nimes.

REIS-EFFENDI, in the *Turkiſh Empire,* one of the ten members of the *divan,* (which ſee,) or council of the grand viſir, of which the viſir and mufti are the preſidents. The reis-effendi is a kind of ſecretary of ſtate, high chancellor of the empire, and miniſter for foreign affairs. He ſigns all the orders of the Porte, which do not directly concern the finances and the military operations; he treats with all the European miniſters who are at Conſtantinople: in a word, every thing that concerns the foreign powers, and every

every thing that relates to the interior adminiſtration, paſs through the channel of the reis-effendi; but he does nothing without communicating it to the grand viſir, and taking his orders. In this council there are alſo two *ex-reis-effendi.*

REISENBERG, in *Geography*, a town of Auſtria, on the Reiſenpach river; 12 miles S.E. of Vienna.

REISENBURG, a town of Pruſſia, in the province of Oberland, built in the year 1169, and anciently the reſidence of the biſhops of Pomerania. The chief ſubſiſtence of the inhabitants is derived from brewing and agriculture; near it is an ancient caſtle; 78 miles S.W. of Konigſberg.

REISENGEBERG, a town of Bohemia, in the circle of Konigingratz. N. lat. 50° 40′. E. long. 15° 30′.

REISENPACH, a river of Auſtria, which runs into the Danube; 12 miles below Vienna.

REISHOFFEN, a town of France, in the department of the Lower Rhine; 21 miles N. of Straſburg.

REISJARVI, a town of Sweden, in the government of Ulea; 47 miles E. of Gamla Karleby.

REISKE, John James, in *Biography*, a learned philologiſt, born in 1716, at Zorlis, in Miſnia, was the ſon of a tanner in that place. He was, at the age of twelve, ſent to the orphan-ſchool at Halle, where he made a rapid progreſs in the learning of the place. In 1733 he entered at the univerſity of Leipſic, and being deſtined for the theological profeſſion, he ſpent five years chiefly in the ſtudy of rabbinical writings, and in the ſtudy of the Arabic language. To the latter he became ſo ardently attached, and his paſſion for Arabic books was ſo ſtrong, that he almoſt deprived himſelf of neceſſaries to purchaſe them. He went to Holland with the view of improving himſelf in his favourite language, and while there, he ranſacked all the Oriental treaſures of the library at Leyden, while, for his ſubſiſtence, he was obliged to become a corrector of the preſs. He paſſed his time in a ſtate of indigence that brought upon him hypochondriac affections, the effects of which never left him. During his reſidence at Leyden, he was preſented with a gratuitous degree in phyſic, but he never intended to avail himſelf of it in the way of practice: "Poverty," ſays his biographer, "was his perpetual companion, and his ſcanty reſources were derived from correcting the preſs, tranſlating, and performing other taſks for bookſellers." Many learned pieces in Oriental and Greek literature occaſionally proceeded from his pen, which made him well known in the learned world: and ſeveral of the works edited by him are held in very high eſtimation. He was at laſt nominated rector of the college of St. Nicholas, in Leipſic, a ſituation which enabled him to purſue his literary labours more according to his inclination. At the age of forty-eight he married Erneſtine Muller, a young woman of twenty-five, who, under his inſtructions, acquired ſo much knowledge of the Greek and Latin, and ſome modern languages, that ſhe became extremely uſeful to her huſband in his editorial employments. He died at the age of fifty-eight, in the year 1774. Of the moſt valuable works of Reiſke, are "Diſſertatio de Principibus Muhamedanis qui aut ab Eruditione aut ab Amore Literarum inclaruerunt;" "Animadverſiones in Sophoclem;" "Animadverſiones in Auctores Græcos;" "Oratorum Græcorum," 8 vols.; "Plutarchi Opera omnia;" "Maximi Tyrii Diſſert.;" "Apparatus Critici ad Demoſthenem," 3 vols. And after his death were publiſhed his "Conjecturæ in Jobum et Proverbia Salomonis, cum Oratione de Studio Arabiæ Linguæ." The "Acta Eruditorum" were much indebted to the pen of Reiſke.

REISNITZ, in *Geography*, a town of the duchy of Carniola; four miles N.W. of Gottſchee.

REISSENDORF, a town of Sileſia, in the principality of Neiſſe; four miles N. of Patſhkau.

REISTEN, a town of the duchy of Wurzburg; ſix miles N.N.E. of Arnſtein.

REISTERSTOWN, a poſt-town of America, in Baltimore county, Maryland; ten miles S.E. of Weſtminſter.

REITERATED Grafting. See Grafting.

REITERATING, in *Printing*. See Printing.

REITERATION, the act of repeating a thing, or doing it a ſecond time.

The church does not allow of the reiteration of baptiſm. St. Gregory obſerves, that it is no reiteration when there are wanting proofs of the thing's having been regularly done before.

REITLENGIN, in *Geography*. See Reutlengin.

REITTERECK, a town of Stiria; ſeven miles E. of Voitſburg.

REITTERS, an ancient title given the German cavalry. The word is originally High Dutch, and ſignifies a horſeman, cavalier, or even knight.

REITZ, in *Geography*, a town of Portugal, in the province of Beira; three miles N. of Viſeu.

REKEK, a ſmall iſland in the Eaſt Indian ſea. S. lat. 1° 33′. E. long. 128° 40′.

RELAIS, in *Fortification*, a French term, the ſame with *berme*.

RELAND, Adrian, in *Biography*, an eminent orientaliſt and polite ſcholar, was born in the year 1676, at a village in North Holland. He was educated at Amſterdam, and made ſuch progreſs in learning, that, having gone through the uſual claſſical courſe when he was only eleven years old, he employed the next three years in making himſelf acquainted with the Hebrew, Syriac, Chaldee, and Arabic languages. At the age of fourteen he was ſent to the univerſity at Utrecht, and in three years was admitted to the degree of doctor in philoſophy, and on this occaſion he ſuſtained a theſis "De Libertate Philoſophandi." After a reſidence of ſix years at Utrecht he removed to Leyden, and was in a ſhort time choſen by the earl of Portland as preceptor to his ſon. At the age of twenty-four, the univerſity of Harderwyk nominated him to the chair of philoſophy, but he did not remain long in that ſituation, for the univerſity of Utrecht, on the recommendation of king William, invited him to the profeſſorſhip of the Oriental languages and Jewiſh antiquities, which he accepted, and occupied with high reputation during the remainder of his life. He died at the age of 43, in the year 1719. Few writers have met with more general applauſe than Reland. His principal works, which are all extremely valuable, are; 1. "Paleſtina Monumentis veteribus illuſtrata," 2 vols. 4to. 2. "Diſſertationes de nummis veterum Hebræorum." 3. "Antiquitates ſacræ veterum Hebæorum." 4. "Introductio ad Grammaticam Hebræam." 5. "De Spoliis Templi Hieroſolymitani in Arcu Titiano Romæ conſpicuis." 6. "De Religione Muhamedica." Beſides theſe he publiſhed many other things. In private life he was diſtinguiſhed by his modeſty, humanity, and learning, and carried on a correſpondence with the moſt eminent ſcholars of his time. Moreri.

RELAPSE, in *Medicine*, the recurrence of a diſeaſe during the period of convaleſcence.

Relapſes of all diſeaſes, whether acute or chronic, are deemed more dangerous than the original attack; becauſe the conſtitution, being already debilitated and reduced by the previous illneſs, is leſs capable of reſiſting the farther ravages of diſeaſe. This may be ſaid to be true of all acute diſeaſes,

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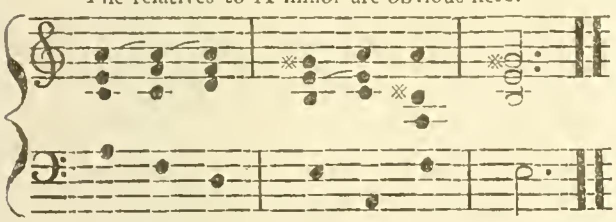
diſeaſes, ſuch as fevers, dyſenteries, inflammations of the lungs, liver, &c. Nevertheleſs, relapſes of theſe diſorders are not always fatal; becauſe, as the weaker conſtitution is leſs capable of being excited to violent action, ſo theſe ſecond attacks are ſometimes milder, and more eaſily influenced by remedies. Relapſes of chronic diſeaſes, ſuch as dropſies or jaundice, are more unfavourable; becauſe their recurrence implies that the internal diſeaſe, from which they originate, is not removed, but has only been temporarily alleviated.

RELATIO, Lat., *Relation*, Engl., in *Muſic*. Relative ſounds are in general ſuch as belong to two or more chords, as in the key of C. The chords of A, F, G, and E, are relative chords; as E, the 5th of A, is 3d of C: in the chord of F, C is the 5th; in the chords of G and E, each of thoſe ſounds is a part of the chord of C.

C major.

The relatives to A minor are obvious here.



In the modulation by riſing and falling a 3d in the baſe, two relative notes are in common with each chord. The moſt agreeable relation of a minor key to a major, is in the modulation from a minor key to the 3d above: as from A to C, or D to F; the ſcales of both keys being the ſame in deſcending. But falling a 3d in the baſe from a minor 3d to a major, as from A to F, or from D to B♭, is ſtill more pleaſing.

Falſe relation is C✕ againſt C♮, or G✕ in the chord of C♮. But even theſe falſe relations are allowed now, as *paſſing-notes* of taſte, though not in the body of the harmony.

RELATION, Relatio, in *Philoſophy*, the mutual reſpect of two things; or what each is with regard to the other.

The word is formed *a referendo:* relation conſiſting in this, that one thing is referred to another: whence it is alſo called *reſpect*, *habitude*, and *compariſon*.

The idea of relation we acquire, when the mind ſo conſiders any thing, that it doth, as it were, bring it to, and ſet it by, another, and carry its view from the one to the other. Hence the denominations given to things intimating this reſpect, are called *relatives;* and the things ſo brought together, are ſaid to be *related*.

Thus, when I call Caius *huſband*, or this wall *whiter*, I intimate ſome other perſon or thing in both caſes, with which I compare *him* or *it*. Hence the wall is called by the ſchoolmen the *ſubject;* the thing it exceeds in whiteneſs, the *term;* and the whiteneſs, the *foundation* of the relation.

Relation may be conſidered two ways; either on the part of the mind referring one thing to another; in which ſenſe relation is only a mode or affection of the mind, by which we make ſuch compariſon; or on the part of the things referred, which being no other than ideas, relation, in this ſenſe, is only a new idea reſulting or ariſing in the mind upon conſidering of two other ideas. So that relation, take it as you will, is only in the mind, and has nothing to do with the things themſelves.

Any of our ideas, Mr. Locke obſerves, may be the foundation of relation. Though where languages have failed to give correlative names, the relation is not eaſily taken notice of; as in concubine, which is a relative name, as well as wife.

There is, in effect, no idea but is capable of an infinite number of relations: thus, one ſingle man may at once ſuſtain the relations of father, brother, ſon, huſband, friend, ſubject, general, European, Engliſhman, iſlander, maſter, ſervant, bigger, leſs, &c. to an almoſt infinite number; he being capable of as many relations as there can be occaſions of comparing him to other things in any manner of agreement or diſagreement, or any reſpect whatſoever.

The ideas of relations are much clearer and more diſtinct than thoſe of the things related; becauſe the knowledge of one ſimple idea is oftentimes ſufficient to give the notion of a relation; but, to the knowing of any ſubſtantial being, an accurate connection of ſeveral ideas is neceſſary.

The perception we have of the relations between the various ideas in which the mind acquieſces, makes what we call *judgment*. Thus, when I judge that twice 2 make 4, or do not make 5, I only perceive the equality between twice 2 and 4, and the inequality between twice 2 and 5.

The perception we have of the relations between the relations of various things, conſtitutes what we call *reaſoning*. Thus, when from this that 4 is a ſmaller number than 6, and that twice 2 is equal to 4, I gather, that twice 2 is a leſs number than 6; I only perceive together the relation of the numbers twice 2 and 4, and the relation of 4 and 6.

The ideas of cauſe and effect, we get from our obſervation of the viciſſitude of things, while we perceive ſome qualities or ſubſtances begin to exiſt, and that they receive their exiſtence from the due application and operation of other beings. That which produceth, is the cauſe; that which is produced, is the effect.

Thus, fluidity in wax is the effect of a certain degree of heat, which we obſerve to be conſtantly produced by the application of ſuch heat.

The denominations of things taken from time are, for the moſt part, only relations. Thus, when it is ſaid, that queen Elizabeth lived ſixty-nine, and reigned forty-five years, no more is meant, than that the duration of her exiſtence is equal to ſixty-nine, and of her government to forty-five, annual revolutions of the ſun; and ſo are all words anſwering to how long.

Young and old, and other words of time, that are thought to ſtand for poſitive ideas, are indeed relative, and intimate a relation to a certain length of duration, of which we have the ideas in our minds. Thus, we call a man young or old, that had lived little or much of that time which men uſually attain to: and thus a man is called young at twenty, but a horſe old at the ſame period.

There are other ideas that are truly relative, which we ſignify by names that are thought poſitive and abſolute; ſuch as great and little, ſtrong and weak. The things thus deno-

minated

minated are referred to fome ftandards, with which we compare them: thus, we call an apple *great*, which is bigger than the ordinary fort of thofe we have been ufed to; and a man *weak*, that has not fo much ftrength or power to move as men ufually have, or as others of his own fize have.

Authors give various divifions of relations. The fchool philofophers commonly divide them into thofe of *origination*, under which are comprehended the relations of caufe and effect; thofe of *negation*, which are between oppofite things; and thofe of *affirmation*, which are relations of agreement between whole and part, the fign and thing fignified, the adjunct and fubject. This divifion is founded upon this, that the mind can only compare things three ways; *viz.* by inferring, denying, and affirming.

Others divide relations into thofe of *origination;* thofe of *agreement*, *e. gr.* fimilitude, parity, &c.; thofe of *diverfity;* and thofe of *orders*, as priority, pofteriority, &c.

Others divide them into *predicamental* and *tranfcendental*. Under the firft come thofe relations between things that belong to the fame predicament, *e. gr.* between father and fon. To the latter belong thofe which are more general than the predicaments, or are of different predicaments; as the relations of fubftance and accident; of caufe and effect; and of Creator and creature.

Mr. Locke gives us a diftribution of relations on a different principle. All fimple ideas, he obferves, in which are parts or degrees, afford an occafion of comparing the fubjects in which they are to one another, in refpect of thofe fimple ideas; as whiter, fweeter, more, lefs, &c. Thefe, depending on the equality and excefs of the fame fimple idea, in feveral fubjects, may be called *proportional* relations.

Another occafion of comparing things being taken from the circumftances of their origin, as father, fon, brother, &c. thefe may be called *natural* relations.

Sometimes the foundation of confidering things is fome act, by which any one comes by a moral right, power, or obligation, to do fomething: fuch are general, captain, burgher: thefe are *inftituted* and *voluntary* relations, and may be diftinguifhed from the natural, in that they are alterable and feparable from the perfons to whom they fometimes belonged, though neither of the fubftances fo related be deftroyed. But natural relations are not alterable, but are as lafting as their fubjects.

Another relation is the conformity or difagreement of men's voluntary actions to a rule, to which they are referred, and by which they are judged of: thefe may be called *moral* relations.

It is this conformity or difagreement of our actions to fome law (by which good or evil is drawn on us from the will and power of the law-maker, and is what we call *reward* or *punifhment*) that renders our actions morally good or evil.

Of thefe moral rules or laws there feem to be three forts, with their different enforcements. Firft, the divine law; fecondly, civil law; thirdly, the law of opinion or reputation. By their relation to the firft, our actions are either fins or duties; to the fecond, criminal or innocent; to the third, virtues or vices. Locke's Effay, vol. i. chap. 25, 26. 33.

Relation, in *Logic*, is an accident of fubftance, accounted one of the ten categories or predicaments.

Each fubftance admits of an infinity of relations. Thus the fame Peter confidered with regard to Henry, is in the relation of a mafter; with regard to John, in that of a tenant; with regard to Mary, in that of a hufband, &c. Again, with regard to one perfon, he is rich; with regard to another, poor; with regard to another, he is far, near, tall, fhort, a neighbour, ftranger, learned, unlearned, good, bad, equal, &c. It is difputed among the fchool philofophers, whether or no the relation be a thing formally and really diftinct from the foundation of the fubftance.

Relation, *Relatio*, in *Rhetoric*, is fometimes ufed to fignify the fame with *recrimination;* which fee.

Relation is alfo ufed, in the *School Theology*, to denote certain of the divine perfections, called *perfonal* ones; becaufe by thefe one Divine Perfon is referred to another, and diftinguifhed from it.

Hence the fchoolmen teach, that in God there is one nature, two proceffions, three perfons, and four relations.

Thefe relations are paternity, filiation, active fpiration, and paffive fpiration.

Relation, in *Geometry*, *Arithmetic*, &c. is the habitude, or refpect of two quantities to one another, with regard to their magnitude. This we more ufually called *ratio* or *reafon*. See Ratio.

The equality or famenefs of two fuch relations we call *proportion;* which fee.

Relation, in *Grammar*, is the correfpondence which words have to one another in *conftruction;* which fee. See alfo Regimen and Syntax.

Faulty and irregular relations are the things chiefly to be guarded againft in writing correctly; they make the fenfe obfcure, and frequently equivocal. Thus: the orator was attended to with a coldnefs, which was the more remarkable, as the audience were under fome emotion before he began. Here coldnefs being put indeterminately, the relative *which* can have no juft and regular relation to it.

Relation is alfo frequently ufed for analogy, or what feveral things have in common. See Analogy.

In painting, architecture, &c. a certain relation of the feveral parts and members of the building, or picture, conftitutes what we call *fymmetry;* which fee.

Relation, in *Law*, is where two things, as times, &c. are confidered as if they were one; the thing fubfequent being confidered as taking effect, by relation, at the time preceding.

As if A deliver a writing to B, to be delivered to C, as the deed of A; the writing fhall be deemed to be delivered to C, at the time when it was given to B, by relation.

When the execution of a thing is done, it hath relation to the thing executory, and makes all but one act to record, although performed at feveral times. (1 Rep. 199.) Judgment fhall have relation to the firft day of the term, as if given on that very day, unlefs there is a memorandum to the contrary; as where there is a continuance till another day in the fame term. (3 Salk. 212.) A verdict was given in a caufe for a plaintiff, and there was a motion in arreft of judgment within four days; the court took time to advife, and in four days afterwards the plaintiff died: it was adjudged, that the favour of the court fhall not prejudice the party, for the judgment ought to have been given after the firft four days; and though it is given after the death of the party, it fhall have relation to the time when it ought to have been given. (1 Leon. 187.) Rule was had for judgment, and two days after the plaintiff died; yet the judgment was entered, becaufe it fhall have relation to the day when the rule was given, which was when the plaintiff was alive. (Poph. 132.) Judgment againft an heir of the obligation of his anceftor fhall have relation to the time of the writ *firft* purchafed; and from that time it will

will avoid all alienation made by the heir. (Cro. Car. 102.) If one be bail for a defendant, and before judgment he leafes his lands; they fhall be liable to the bail, and judgment by relation.

By ftat. 29 Car. II. c. 3. § 16. writs of execution fhall bind the property of goods taken in execution, only from the time of their delivery to the officer. Sale of goods of a bankrupt, by commiffioners, fhall have relation to the firft act of bankruptcy; and be good, notwithftanding the bankrupt fells them afterwards. (Stat. Jac. I. c. 15.) If a man buys cattle in a market, which are ftolen, and felleth them out of the market, though the cattle are afterwards brought into the market, and the fecond bargain confirmed, and money paid, &c., this bargain will not be good; for it fhall have relation to the beginning, which was unlawful. (Dyer 99.) Fines, being but common affurances, fhall be guided by the indentures precedent; and the execution of them have relation to the original act. (Cro. Jac. 110.) Letters of adminiftration relate to the death of the inteftate, and not to the time when they were granted.

So bills in parliament to which the king affents on the laft day of parliament, fhall relate and be of force from the firft day thereof. Coke calls this *fictio juris*.

Relation, in *Mufic*. See Relatio.

RELATIVE Propositions, are fuch as include fome relation and comparifon.

Thus, where the treafure is, there will the heart be; As much as thou haft, fo much thou art worth, &c. are relative propofitions.

Relative *gravity*, *levity*, *motion*, *neceffity*, *place*, *fpace*, *time*, *velocity*. See the feveral fubftantives.

Relative *Terms*, in *Logic*, are words which imply a relation, or a thing confidered as compared to another.

Relative terms include a kind of oppofition between them; yet fo, as that the one cannot be without the other.

Such are *father* and *fon*, *hufband* and *wife*, *king* and *fubjects*, &c.

Relative, in *Grammar*, is a word or term, which in the conftruction anfwers to fome word foregoing, called the *antecedent*; which fee.

All relatives are faid to reciprocate, or mutually infer each other; and, therefore, they are often expreffed by the genitive cafe.

Relative *Pronoun*. See Pronoun.

RELATOR, in *Law*, a rehearfer, or teller, applied to an informer. See Information.

RELAXATION, in *Law*, is ufed for a *releafing*. See Release.

In this fenfe, we fay the relaxation of an attachment in the court of admiralty.

The tenor of indulgence is a relaxation, or a diminution, of the pains of purgatory.

Relaxation, in *Surgery*, is a preternatural extenfion, or ftraining of a nerve, tendon, mufcle, or the like; either through violence or weaknefs.

Hernias are defcents or relaxations of the inteftines, &c. From the fame caufe arife defcents or prolapfions of the anus, &c.

RELAY, a frefh equipage, horfe, &c. fent before, or appointed to be ready, for a traveller to change, to make the greater expedition; as in riding poft.

The term is borrowed from the French, *relais*, which fignifies the fame thing. In France, the general of the pofts entitles himfelf fuperintendant of the relays.

Relay *Horfes*, in the *Artillery*, are horfes that march with the artillery or baggage, and are ready to relieve others, or to affift in going up a hill, or through bad roads, &c.

Relays, in *Hunting*, are frefh fets of dogs, or horfes, or both, difpofed here and there for readinefs, in cafe the game come that way, to be caft off, or to mount the hunters in lieu of the former, which are fuppofed to want refpite.

Relay, in *Tapeftry*, is an opening left in a piece of tapeftry, where the colours or figures are to be changed; becaufe on thofe occafions, the workmen are changed; or elfe the places are left to be filled up, till the reft of the work is done. See Tapestry.

RELEASE, Relaxatio, in *Law*, denotes an inftrument, by which eftates, rights, titles, entries, actions, and other things, are fometimes extinguifhed and annulled, fometimes transferred, fometimes abridged, and even fometimes enlarged: and it is a fpecies of conveyance which prefuppofes fome other conveyance precedent, and ferves to enlarge, confirm, alter, reftrain, reftore, or transfer the intereft granted by fuch original conveyance.

A releafe is either in fact or in law. A releafe *in fact*, is that which the very words do exprefsly declare.

A releafe *in law*, is that which acquits by way of confequence, or intendment of law. A releafe is the giving or difcharging of a right of action, which a man hath claimed, or may claim, againft another, or that which is his: or it is the conveyance of a man's intereft or right which he hath to a thing, to another who hath poffeffion of it, or fome eftate in it. (4 New Abr.) According to Coke releafes are diftinguifhed into exprefs releafes in deed, and thofe arifing by operation of law; and are made of lands and tenements, goods and chattels; or of actions real, perfonal and mixed. (1 Inft. 264.) Releafes of land may enure, or take effect, either, 1. By way of *enlarging an eftate*, or *enlarger l'eftate:* as if there be tenant for life or years, remainder to another in fee, and he in remainder releafes all his right to the particular tenant and his heirs, this gives him the eftate in fee. (Litt. § 465.) But in this cafe the releffee muft be in poffeffion of fome eftate, for the releafe to work upon: for if there be a leffee for years, and, before he enters and is in poffeffion, the leffor releafes to him all his rights in the reverfion, fuch releafe is void for want of poffeffion in the releffee. (Litt. § 459.) But when it is faid, that a releafe, which enures by enlargement, cannot work without a poffeffion, it muft be underftood to mean, not that an actual eftate in poffeffion is neceffary, but that a "vefted intereft" fuffices for fuch a releafe to operate upon. By comparing this with the operation of a Lease *and Releafe* (which fee) it will be feen, that not only eftates in poffeffion, but eftates in remainder and reverfion, and all other incorporeal hereditaments, may be effectually granted and conveyed by leafe and releafe; but it is an inaccuracy to fay, that the releffees are, in thefe cafes, in actual poffeffion of the hereditaments: the right expreffion is, that they are actually vefted in him, by virtue of the leafe in poffeffion and the ftatute. 1 Inft. 270. (*a*) n. 3.

To make releafes operate by enlargement, it is generally neceffary, that the releffee, at the time the releafe is made, fhould be in actual poffeffion of, or have a vefted intereft in, the lands intended to be releafed; that there fhould be a privity between him and the releffor; and that the poffeffion of the releffee fhould be notorious.

2. By way of *paffing an eftate*, or *mitter l'eftate:* as when one or two co-parceners releafeth all her right to the other, this paffeth the fee-fimple of the whole. (1 Inft.

(1 Inft. 273.) And in both thefe cafes there muft be a privity of eftate between the releffor and the releffee; that is, one of their eftates muft be fo related to the other, as to make but one and the fame eftate in law. 3. By way of *paffing a right*, or *mitter le droit:* as if a man be diffeifed, and releafeth to his diffeifor all his right; hereby the diffeifor acquires a new right, which changes the quality of his eftates, and renders that lawful which before was tortious or wrongful. (Litt. §. 466.) 4. By way of *extinguifhment:* as if my tenant for life makes a leafe to A for life, remainder to B and his heirs, and I releafe to A; this extinguifhes my right to the reverfion, and fhall enure to the advantage of B's remainder as well as of A's particular eftate. (Litt. §. 470.) 5. By way of *entry and feoffment:* as if there be two joint diffeifors, and the diffeifee releafes to one of them, he fhall be fole feifed; and fhall keep out his former companion; which is the fame in effect as if the diffeifee had entered, and by that means put an end to the diffeifin, and afterwards had enfeoffed one of the diffeifors in fee. (1 Inft. 278.) And hereupon we may obferve, that when a man has in himfelf the poffeffion of lands, he muft at the common law convey the freehold by feoffment and livery; which makes a notoriety in the country: but if a man has only a right or a future intereft, he may convey that right or intereft by a mere releafe to him that is in poffeffion of the land: for the occupancy of the releffee is a matter of fufficient notoriety already. Blackft. Com. book ii. See LEASE *and Releafe*.

Littleton fays, that the proper words of a releafe are "remififfe, relaxaffe, and quietum clamaffe," which have all the fame fignification. Lord Coke adds, "renunciare, acquietare," and fays, that there are other words which will amount to a releafe; as, if the leffor grants to the leffee for life, that he fhall be difcharged of the rent; this is a good releafe. (Litt. § 445. 1 Inft. 264. Plowd. 140.) So a pardon, by act of parliament, of all debts and judgments, amounts to a releafe of the debt: the word pardon including a releafe. (1 Sid. 261.) An exprefs releafe muft regularly be in writing and by deed, according to the common rule, "eodem modo oritur, eodem modo diffolvitur," fo that a duty arifing by record muft be difcharged by matter of as high a nature: fo of a bond or other deed. (Co. Litt. 264. *b*. 1 Rol. Rep. 43. 2 Leon. 76. 213. 2 Rol. Abr. 408. 2 Sand. 49. Morr. 573. pl. 787.) But a promife by words may, before breach, be difcharged or releafed, by word of mouth only. (1 Sid. 177. 2 Sid. 78. Cro. Jac. 483. 620. See Cro. Car. 383. 1 Mod. 262. 2 Mod. 259. 1 Sid. 293.) A releafe of a right in chattels cannot be without deed. (1 Leon. 283.) A covenant perpetual, as that the covenantor will not fue beyond a certain limitation of time, is an abfolute releafe. But if the covenant be, that he will not fue *till* fuch a time, this does not amount to a releafe, nor is pleadable in bar as fuch, but the party hath remedy only on his covenant. If two are jointly and feverally bound in an obligation, and the obligee, by deed, covenants and agrees not to fue one of them; this is no releafe, and he may notwithftanding fue the other. (Cro. Car. 551. 2 Salk. 575.) But if two are jointly and feverally bound, a releafe to one difcharges the other. L. Raym. 420.

It feems agreed, that a will, though fealed and delivered, cannot amount to a releafe; and, therefore, where in debt on an obligation, by the reprefentative of a teftator, a defendant pleaded, that the teftator by his laft will in writing releafed to the defendant; this was adjudged ill, and that no advantage could be taken by plea. (1 Sid. 421.) But it hath been held in equity, that though a will cannot enure as a releafe, yet provided it were expreffed to be the intention of the teftator that the debt fhould be difcharged, the will would operate accordingly; and that, in fuch cafe, it would be plainly an abfolute difcharge of the debt, though the teftator had furvived the legatee. (1 P. Wms. 85. 2 Vern. 521.) If a debt is mentioned to be devifed to the debtor, without words of releafe, or difcharge of the debt, and the debtor die before the teftator, this will not operate as a releafe, but will be confidered as a lapfed legacy, and the debt will fubfift. (2 Vern. 522.) A debt is only a right to recover the amount of the debt by way of action; and as an executor cannot maintain an action againft himfelf, or againft a co-executor, the teftator, by appointing the debtor an executor of his will, difcharges the action, and confequently difcharges the debt. Still, however, when the creditor makes the debtor his executor, it is to be confidered merely as a fpecific bequeft or legacy, devifed to the debtor to pay the debt; and, therefore, like other legacies, it is not to be paid or retained till the debts are fatisfied; and if there be not affets for the payment of the debts, the executor is anfwerable for it to the creditors. In this cafe, it is the fame whether the executor accepts or refufes the executorfhip. On the other hand, if the debtor makes the creditor his executor, and the creditor accepts the executorfhip, if there be affets, he may retain his debt out of the affets againft the creditors in equal degree with himfelf; but if there be not affets, he may fue the heir, when the heir is bound. 1 Inft. 264. *b* in *n*. See EXECUTOR.

Littleton fays, that a releafe of all demands is the beft releafe to him, to whom it is made; and Coke fays, that the word "demand" is the largeft word in law, except "claim;" and that a releafe of all demands difcharges all forts of actions, rights, and titles, conditions before or after, breach, executions, appeals, rents of all kinds, covenants, annuities, contracts, recognizances, ftatutes, commons, &c. (Litt. § 508. Co. Litt. 291.) A releafe of all actions difcharges a bond to pay money on a future day. But a releafe of actions does not difcharge a rent before the day of payment. (Co. Litt. 292.) By a releafe of all manner of actions, all actions, as well criminal as real, perfonal and mixed, are releafed. Co. Litt. 287. See Jacob's Law Dict. by Tomlins.

RELEGATION, RELEGATIO, a kind of exile or banifhment, by which the obnoxious perfon is commanded to retire to a certain place prefcribed, and to continue there till he be recalled.

Lord Coke calls relegation a banifhment for a time only; Courtin more adequately defines relegation a banifhment to a certain place for a certain term.

In Rome, relegation was a lefs fevere punifhment than deportation, in that the relegated perfon did not thereby lofe the rights of a Roman citizen, nor thofe of his family, as the authority of a father over his children, &c.

RELHANIA, in *Botany*, received that name from the pen of the late M. l'Heritier, in honour of the Rev. Richard Relhan, F.R.S. and A.L.S., author of the Flora Cantabrigienfis. — L'Herit. Sert. Angl. 22. Schreb. 563. Willd. Sp. Pl. v. 3. 2135. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 91. Thunb. Prodr. 145. Poiret in Lamarck Dict. v. 4. 93. (Eclopes; Gærtn. t. 169. Lamarck Illuftr. t. 689.)—Clafs and order, *Syngenefia Polygamia-fuperflua*. Nat. Ord. *Compofitæ difcoideæ*, Linn. *Corymbiferæ*, Juff.

Gen. Ch. *Common calyx* oblong, imbricated, with oblong chaffy fcales. *Cor.* compound, radiated; united florets in the difk numerous, tubular, funnel-fhaped, fivecleft; female ones in the radius ligulate, ovate-oblong. *Stam.*,

Stam., in the perfect florets, filaments five, very fhort; anthers combined into a tube. *Pift.* in the perfect florets, germen oblong; ftyle fimple; ftigmas two, reflexed: in the female ones, germen oblong, rather incurved; ftyle fimple; ftigmas two, recurved. *Peric.* none, except the permanent unchanged calyx. *Seeds*, to all the florets alike, folitary, angular, with a membranous, many-cleft, fhort crown. *Recept.* chaffy.

Eff. Ch. Receptacle chaffy. Seed-crown membranous, fhort, cylindrical. Calyx imbricated, chaffy. Florets of the radius numerous.

M. l'Heritier diftinguifhes this genus from *Athanafia* by the prefence of a radius; from *Ofmites* by the florets of that radius producing perfect feeds; and from *Leyfera* by the want of a feathery feed-down. Gærtner remarks that his *Eclopes*, adopted from fir Joseph Banks's and Dr. Solander's papers, is nothing more than an *Athanafia*, furnifhed with a radius. A due attention to the fyngenefious clafs foon teaches us to miftruft this character, which is unftable, even in feveral fpecies of that clafs; witnefs the genera *Coreopfis* and *Bidens*. Still lefs is the fertility or barrennefs of the radiant florets capable of diftinguifhing natural genera, though Linnæus has, unadvifedly, founded a diftinction of orders, in the clafs in queftion, upon thofe differences. We cannot but affent, therefore, to the opinion of Poiret, that the genus of *Relhania* is not naturally diftinct from the Linnæan *Ofmites*, at leaft, which laft name being already eftablifhed, ought to have been retained. However ftriking the radiating, chaffy, fhining inner fcales of the calyx may be in a few fpecies of *Ofmites*; approaches towards that character are found in the *Relhaniæ*, as *genifti-folia*, and ftill more in *paleacea*. We are far from intending to do away the claims of our friend, Mr. Relhan, to botanical commemoration, even were that honour beftowed in general far lefs indifcriminately than it is. For the prefent, the *Relhania* of L'Heritier is received; and if that be at any time abolifhed, there ought to be one eftablifhed on more folid principles.

Willdenow has nineteen fpecies of this fuppofed genus; all natives of the Cape of Good Hope, moftly of a fhrubby bufhy habit, green-houfe plants in England, where only one of them indeed appears to be cultivated. Their flowers are moftly corymbofe, fmall, of a dull yellow, not remarkable for beauty. We felect a few examples.

R. *fquarrofa*. Hook-leaved Relhania. Willd. n. 1. Ait. n. 1. (Athanafia fquarrofa; Linn. Sp. Pl. 1180. Amœn. Acad. v. 6. 98. Santolina fquarrofa; Linn. Am. Acad. v. 4. 329.)—Leaves elliptical, pointed; recurved at the point.—Sent to Kew by Mr. Maffon, in 1794. It flowers in the green-houfe in May and June. The whole *fhrub* is fmooth, much branched. *Leaves* numerous, fomewhat imbricated, about a quarter of an inch long, elliptical, obfcurely fingle-ribbed beneath, entire, acute; ftrongly recurved, fmooth, finely dotted on both fides. *Flowers* folitary, on flender axillary ftalks, thrice the length of the leaves. *Calyx* about half an inch long, very fmooth, rather fhining. This fhould feem a different plant from *R. fquarrofa* of Thunberg, who defines his "with terminal umbels," and has thus led Willdenow, contrary to the defcription of Linnæus, to refer the fpecies in queftion to the firft fection of the genus, "*with aggregate flowers.*" It appears, by fpecimens in the Linnæan herbarium, that the *flowers* are fometimes fo crowded about the ends of the branches, as to affume a corymbofe appearance, though each ftalk is really axillary. Such a fpecimen probably was defcribed by Thunberg.

R. *geniftifolia*. Broom-leaved Relhania. Willd. n. 2. (Athanafia geniftifolia; Linn. Syft. Nat. ed. 12. v. 2. 540. Mant. 464.)—Leaves obovato-lanceolate, pointed, fingle-ribbed beneath, entire, fmooth, fomewhat imbricated. Flowers terminal, umbellate.—A bufhy *fhrub*, very much branched. *Leaves* a quarter of an inch, or hardly fo much, in length, numerous, crowded, dotted, entire, fmooth; the lower ones obovate, and fmalleft; the upper more lanceolate and elongated; all bluntifh, with a minute, often hooked, point, and fingle-ribbed at the back only. *Flowers* fmaller than the preceding, from five to eight together, in little terminal umbels. *Calyx* fhining.

R. *vifcofa*. Glutinous Relhania. L'Herit. Sert. 23. Willd. n. 5. (Eclopes vifcida; Gærtn. v. 2. 440. t. 169.)—Leaves linear-lanceolate, pointed, vifcid, obfcurely fingle-ribbed beneath, rather flefhy; the upper ones fomewhat crenate.—The *flowers* are much like the laft-mentioned; but the *leaves* are twice as large, more elongated in fhape, more flightly ribbed, the edges of the upper ones rough or crenate, and all of them extremely glutinous. When bruifed, the dried *leaves* are found to retain a powerful aromatic fcent, approaching to that of orange-peel.

R. *pedunculata*. Long-ftalked Dwarf Relhania. L'Herit. Sert. Angl. 23. Willd. n. 7. (R. pumila; Thunb. Prodr. 146. Athanafia pumila; Linn. Suppl. 362. Zoegea capenfis; ibid. 382.)—Leaves linear, villous, and glandular. Stem diffufe. Flower-ftalks axillary, much longer than the leaves.—A fmall herbaceous annual fpecies, whofe *root* is furnifhed with numerous capillary fibres. *Stem* a fpan high, branched from the bafe, round, purplifh, fpreading; glandular and flightly cottony in the upper part, as well as the *leaves*; which are about an inch long, very narrow, fomewhat triangular. *Flowers* fmall, yellow, on long, ftoutifh, downy, axillary ftalks, about the fummits of the branches. This occurs twice in the *Supplementum*, having, in one inftance, been defcribed by Linnæus himfelf, from a wild fpecimen, and in the other, adopted by his fon, unfeen, from Thunberg's communications.

R. *paleacea*. Chaffy-flowered Relhania. L'Herit. Sert. Angl. 24. Willd. n. 11. Thunb. Prodr. 146. (Leyfera paleacea; Linn. Syft. Veg. ed. 13. 641. L. ericoides; Berg. Cap. 294. Eclopes; Lamarck f. 2? Afterophorus fruticofus luteus, foliis rorifmarini crebris, ovariis hirfutis; Vaill. Act. German edition, 585.)—Leaves linear, triangular, channelled, hoary; recurved at the point. Flowers terminal, folitary, feffile. Calyx turbinate.—Communicated by Van Royen to Linnæus, and by Sherard, as it appears, to Vaillant. The *ftem* is fhrubby, a fpan high, branched. *Leaves* numerous, about an inch long, narrow, clothed, as well as the young *branches*, with fine hoary down. *Calyx* ovate, fmooth, a quarter of an inch in diameter; its inner fcales much elongated, lanceolate, acute, and membranous, refembling the fcales of the *receptacle*, which ftand prominent and erect, above the florets of the difk. This plant has fo much of the external afpect of *Leyfera gnaphalodes*, that we can hardly wonder at Linnæus, for having referred it, by the habit alone, to the fame genus. Upon a careful examination, however, the characters, and even the appearance, of the parts of fructification, are abundantly different in the two plants.

Moft of the other fpecies of *Relhania*, in Willdenow, are adopted from the fhort fpecific definitions of Thunberg and L'Heritier; nor have we been able to determine them all with certainty. It is remarkable that no figure of any has appeared, except in Gærtner and Lamarck, nor is the latter very happy or difcriminative, in what he has exhibited of this genus, called by him, after Gærtner, *Eclopes*.

RELICS, Reliquiæ, in the *Romifh Church*, certain remains of the body or clothes of fome faint or martyr, devoutly preferved in honour to his memory, carried at proceffions, kiffed, revered, &c.

The abufes of that church in point of relics have been very flagrant. F. Mabillon, a Benedictine, complains of the great number of fufpected relics expofed on altars: he owns, that were there to be a ftrict inquifition into the relics, vaft numbers of fpurious ones would be found offered every where to the piety and devotion of the faithful; and adds, that bones are frequently confecrated, fo far from belonging to faints, that, in all probability, they do not belong to Chriftians.

The catacombs are an inexhauftible fund of relics; yet it is ftill difputed who were the perfons interred in them.

In the eleventh century, a method was introduced of trying fuppofed relics by fire. Thofe which did not confume in the fire were reputed genuine; the reft not.

It is an ancient cuftom, which ftill obtains, to preferve the relics in the altars on which mafs is celebrated. To this purpofe, a fquare hole is made in the middle of the altar, big enough to receive the hand; and in that is the relic depofited, being firft wrapped in red filk, and inclofed in a leaden box.

The Romanifts allege a confiderable degree of antiquity in behalf of their relics. The Manichees, it feems, out of hatred to the flefh, which they held an evil principle, are recorded as refufing to honour the relics of faints; which is efteemed a kind of proof, that the Catholics did it in the firft ages.

Indeed, folly and fuperftition blended themfelves with religion at too early a period. Even the touching of linen cloths on relics, from an opinion of fome extraordinary virtue derived from them, appears to be as ancient as the firft ages; there being a hole made in the coffins of the forty martyrs at Conftantinople, exprefsly for this purpofe.

This practice of honouring the relics of faints, on which the church of Rome, in fucceeding ages, founded her fuperftitious and lucrative ufe of them, as objects of devotion, as a kind of charms or amulets, and as inftruments of pretended miracles, feems to have originated in a very ancient cuftom, that prevailed among Chriftians, of affembling at the cœmeteries or burying-places of the martyrs, for the purpofe of commemorating them, and of performing divine worfhip. When the profeffion of Chriftianity obtained the protection of the civil government, under Conftantine the Great, ftately churches were erected over their fepulchres, and their names and memories were treated with every poffible token of affection and refpect. (See Saints.) In procefs of time, this reverence of the martyrs exceeded all reafonable bounds; and thofe prayers and religious fervices were thought to have a peculiar fanctity and virtue, which were performed over their tombs. Hence probably proceeded the practice, already mentioned, which obtained in the fourth century, of depofiting relics of the faints and martyrs under the altars in all their churches. This practice, however, was then thought of fuch importance, that St. Ambrofe would not confecrate a church, becaufe it had no relics; and the council of Conftantinople in Trullo ordained, that thofe altars fhould be demolifhed, under which there were found no relics. The rage of procuring relics for this and other purpofes of a fimilar nature became fo exceffive, that, in 386, the emperor Theodofius the Great was obliged to pafs a law, forbidding the people to dig up the bodies of the martyrs, and to traffick in their relics.

Such was the commencement of that refpect for facred relics, which, in after ages, was perverted into a formal worfhip of them, and became the occafion of innumerable proceffions, pilgrimages, and miracles, from which the church of Rome hath derived incredible advantage. Towards the clofe of the ninth century, it was not enough to reverence departed faints, and to confide in their interceffions and fuccours: it was not enough to clothe them with an imaginary power of healing difeafes, working miracles, and delivering from all forts of calamities and dangers; their bones, their clothes, the apparel and furniture they had poffeffed during their lives, the very ground which they had touched, or in which their putrified carcafes were laid, were treated with a ftupid veneration, and fuppofed to retain the marvellous virtue of healing all diforders both of body and mind, and of defending fuch as poffeffed them againft all the affaults and devices of Satan. The confequence of this wretched notion was, that every one was eager to provide himfelf with thefe falutary remedies; for which purpofe, great numbers undertook fatiguing and perilous voyages, and fubjected themfelves to all forts of hardfhips; while others made ufe of this delufion, to accumulate their riches, and to impofe upon the miferable multitude by the moft impious and fhocking inventions. As the demand for relics was prodigious and univerfal, the clergy employed all their dexterity to fatisfy thefe demands, and were far from being nice in the methods they ufed for that end. The bodies of the faints were fought by fafting and prayer, inftituted by the prieft, in order to obtain a divine anfwer and an infallible direction; and this pretended direction never failed to accomplifh their defires: the holy carcafe was always found, and that always in confequence, as they impioufly gave out, of the fuggeftion and infpiration of God himfelf. Each difcovery of this kind was attended with exceffive demonftrations of joy, and animated the zeal of thefe devout feekers to enrich the church ftill more and more with this new kind of treafure. Many travelled with this view into the Eaftern provinces, and frequented the places which Chrift and his difciples had honoured with their prefence, that, with the bones and other facred remains of the firft heralds of the gofpel, they might comfort dejected minds, calm trembling confciences, fave finking ftates, and defend their inhabitants from all forts of calamities. Nor did thefe pious travellers return home empty; the craft, dexterity, and knavery of the Greeks found a rich prey in the ftupid credulity of the Latin relic-hunters, and made a profitable commerce of this new devotion. The latter paid confiderable fums for legs and arms, fkulls and jaw-bones, (feveral of which were Pagan, and fome not human,) and other things that were fuppofed to have belonged to the primitive worthies of the Chriftian church: and thus the Latin churches came to the poffeffion of thofe celebrated relics of St. Mark, St James, St. Bartholomew, Cyprian, Pantaleon, and others, which they fhew at this day with fo much oftentation. But there were many, who, unable to procure for themfelves thefe fpiritual treafures by voyages and prayers, had recourfe to violence and theft: for all forts of means, and all forts of attempts, in a caufe of this nature were confidered, when fuccefsful, as pious and acceptable to the Supreme Being.

Befides the arguments from antiquity to which the Papifts refer, in vindication of their worfhip of relics, of which the reader may form fome judgment from this article, Bellarmine appeals to fcripture in fupport of it, and cites the following paffages, *viz.* Exod. xiii. 19. Deut. xxxiv. 6. 2 Kings, xiii. 21. 2 Kings, xxiii. 16, 17, 18. Ifaiah, xi. 10. Matth. xi. 20, 21, 22. Acts, v. 12—15. Acts, xix. 11, 12. See Popery.

Relics are forbidden to be ufed or brought into England by feveral ftatutes; and juftices of peace are empowered to fearch houfes for Popifh books and relics, which, when found, are to be defaced and burnt, &c. 3 Jac. I. cap. 26.

RELICT, Relicta, in *Law*. See Widow.

RELICTA Verificatione, is when a defendant relinquifhes his proof or plea, and thereupon judgment is entered for the plaintiff.

RELIEF, Relevium, *Levamen*, a fine paid the chief lord, by a perfon at his coming to the inheritance of land held by military fervice.

This was faid *relevare hereditatem caducam;* and the money thus paid was called *relevamen*, *relevium*, or *relief*. Relief is ufually to the value of a year's rent or revenue.

The origin of the cuftom is thus: a feudatory or beneficiary eftate in lands being at firft only granted for life, after the death of the vaffal, it returned to the chief lord; and was hence called *feudum caducum*, *q. d.* fallen to the lord by the death of the tenant.

In courfe of time, thefe feudatory eftates being converted into inheritances by the connivance and confent of the lord; when the poffeffor of fuch eftate died, it was called *hæreditas caduca*, *q. d.* an inheritance fallen to the lord, from whom it was to be recovered, by the heir's paying a certain fum of money. But this fum was arbitrary, and at the will of the lord; fo that, if he pleafed to demand an exorbitant relief, it was in effect to difinherit the heir. The Englifh ill brooked this confequence of their new-adopted policy; and, therefore, William the Conqueror by his laws (cap. 22, 23, 24.) afcertained the relief, by directing (in imitation of the Danifh heriots), that a certain quantity of arms and habiliments of war fhould be paid by the earls, barons, and vavafours refpectively; and if the latter had no arms, they fhould pay 100*s*. William Rufus broke through this compofition, and again demanded arbitrary uncertain reliefs, as due by the feodal laws; thereby in effect obliging every heir to new-purchafe or redeem his land: but his brother Henry I. by his charter, reftored his father's law; and ordained that the relief to be paid fhould be according to the law fo eftablifhed, and not an arbitrary redemption. But afterwards, when, by an ordinance in 27 Hen. III. called the Affife of Arms, it was provided that every man's armour fhould defcend to his heir, for defence of the realm, and it thereby became impracticable to pay thefe acknowledgments in arms, according to the laws of the Conqueror, the compofition was univerfally accepted of 100*s*. for every knight's fee; as we find it ever after eftablifhed. (Glanv. l. ix. c. 4. Litt. § 112.) But it muft be remembered, that this relief was only then payable, if the heir at the death of his anceftor had attained his full age of twenty-one years.

Relief, *Reafonable*, called alfo *lawful* and *ancient* relief, is that enjoined by fome law, or fixed by ancient cuftom; and which does not depend on the will of the lord.

Thus in a charter of king John, mentioned by Matthew Paris:—"Si quis comitum vel baronum noftrorum, five aliorum tenentium de nobis in capite per fervitium militare, mortuus fuerit, & cum deceflerit, hæres fuus plenæ ætatis fuerit, & relevium debet, habeat hæreditatem fuam per antiquum relevium."

What this was, may be feen in the laws of William the Conqueror, &c. Bracton fays this fine was called a relief, "quia hæreditas, quæ jacens fuit per anteceffloris deceffum, relevatur in manus hæredum, &c."

A relief is alfo paid in focage-tenure, or petit ferjeanty; where a rent, or other thing, is paid by rendering as much as the rent or payment referved. But the manner of taking relief upon focage-tenure is very different from that upon tenure in chivalry. The relief on a knight's fee was 5*l*., or one-quarter of the fuppofed value of the land; but a focage-relief is one year's rent or render, payable by the tenant to the lord, be the fame either great or fmall (Litt. § 126.); and, therefore, Bracton (l. 2. c. 37. § 8.) will not allow this to be fo properly a relief, but "quædam præftatio loco relevii in recognitionem domini." So, too, the ftatute 28 Edw. I. c. 1. declares, that a free fokeman fhall give no relief, but fhall double his rent after the death of his anceftor, according to that which he hath ufed to pay his lord, and fhall not be grieved above meafure. Reliefs in knight-fervice were only payable, if the heir at the death of his anceftor was of full age; but in focage they were due even though the heir was under age, becaufe the lord has no wardfhip over him. (Litt. § 127.) The ftatute 12 Car. II. referves the reliefs incident to focage-tenures; and, therefore, whenever lands in fee-fimple are holden by a rent, relief is ftill due of common right upon the death of a tenant. 3 Lev. 145.

By the cuftom of Normandy, relief is due for lands held in villainage as well as in fee. By the cuftom of Paris, relief is not due upon inheritances in the direct line.

The quantity of the relief is very different; there are *fingle* reliefs, *double* reliefs, &c. The quality, too, is diverfe: there are *reliefs of property*, paid by the heir; *reliefs of bail*, or *tutorage*, paid by the guardian for his minor, or by the hufband for the fiefs of his wife, &c.; *relief of horfe and arms*, &c.

By the laws of king Canutus, the relief of an earl, paid to the king, was eight war horfes with their bridles and faddles, four cuiraffes, four helmets, four fwords, four hunting-horfes, and a palfrey. The relief of a baron or thane was four horfes, &c.

Relief, in *Chancery*, denotes an order fued out for the diffolving of contracts, and other acts, on account of their being unreafonable, prejudicial, grievous, or from fome other nullity, either *de jure*, or *de facto*.

Minors obtain relief againft acts paffed in their minority. Majors have relief in cafes of enormous damage, deceit, violence, over-reaching, extravagant bargains, &c.

Among the Romanifts it is a rule, that the church obtains relief any time, and againft all acts paffed in its prejudice; no prefcription prevailing againft it.

Relief, *Aid de*. See Aid.

Relief *of a Hare*, among *Hunters*, is the place where fhe goes to feed in the evening.

Relief, in *Sculpture*. See Relievo.

RELIEVE, in the *Military Senfe*. To relieve, is to take the poft of another body. Hence, to relieve the guard, to relieve the trenches, &c. is to bring frefh men upon the guard, or to the trenches, and to fend thofe to reft who have been upon duty before. They alfo fay, relieve a fentinel, which is generally done every two hours, by a corporal who attends the relief; relieve the fteerfman, &c.

To relieve a place that is befieged, is to furnifh it with a fupply of men, provifions, ammunition, &c.

RELIEVER, in *Artillery*, is an iron ring fixed to a handle by means of a focket, fo as to be at right angles to it. It ferves to difengage the firft fearcher of a gun, when any of its points are retained in a hole, and cannot be got out otherwife.

RELIEVING Tackles, in a *Ship*, are two ftrong tackles, ufed to prevent a fhip from overturning on the careen, and to affift in bringing her upright after that operation is completed. The relieving tackles are furnifhed with

with two ſtrong *guys*, or pendants, by which their efforts are communicated, under the ſhip's bottom, to the oppoſite ſide, where the ends of the guys are attached to the lower gun-ports. The other ends of the tackles are hooked to the wharf or pontoon, by which the veſſel is careened. Thus, if a ſhip is firſt to be laid down on the larboard ſide, which is neareſt the wharf, the relieving tackles are paſſed under her bottom from the ſaid wharf, and attached to the ſtarboard ſide, by which they will reſtrain her from falling lower than is neceſſary. Falconer.

Relieving *Tackle*, is alſo a name given to the train tackles of a gun-carriage.

RELIEVO, or Relief, *Imboſſment*, is applied to a figure which projects, or ſtands out prominent, from the ground or plane on which it is formed, whether that figure be cut with the chiſſel, moulded, or caſt. There are three kinds of relievo; *viz. alto, baſſo,* and *demi-relievo.*

Relievo, *Alto, haut relief,* or *high relievo,* is when the figure is formed after nature, and projects as much as the life.

Relievo, *Baſſo, bas relief,* or *low relievo,* is when the work is but raiſed a little from its ground, as we ſee in medals, and in the frontiſpieces or buildings, particularly the hiſtories, feſtoons, foliages, and other ornaments in friezes. See Basso *Relievo.*

Relievo, *Demi,* is when one-half of the figure riſes from the plane, *i. e.* when the body of a figure ſeems cut in two, and one-half is clapped on a ground. When in a baſſo relievo there are ſome parts that ſtand clear out, detached from the reſt, the work is called a *demi-boſſe.*

Relievo, in *Architecture,* denotes the ſally or projecture of any ornament.

This, Daviler obſerves, is always to be proportioned to the magnitude of the building it adorns, and the diſtance at which it is to be viewed.

If the work be inſulate, and terminated on all ſides, it is called a *figure in relievo,* or a *round emboſſment.* Such are ſtatues, acroters, &c.

Relievo, in *Painting,* denotes the degree of force or boldneſs by which a figure ſeems, at a due diſtance, to ſtand out from the ground of the painting, as if really imboſſed.

The relievo depends much on the depth of the ſhadow, and the ſtrength of the light; or on the light of the different colours bordering on one another; and particularly on the difference of the colour of the figure from that of the ground.

When the light is well choſen, to make the neareſt parts of figures advance; and well diffuſed on the maſſes, ſtill diminiſhing inſenſibly, and terminating in a large ſpecious ſhadow, brought off inſenſibly; the relievo is ſaid to be *bold,* and the claire obſcure, *well underſtood.*

RELIGION, Religio, that worſhip or homage that is due to God, conſidered as Creator, Preſerver, and, with Chriſtians, as Redeemer of the world.

The foundation of all religion is, that there is a God; and that he requires ſome acknowledgment and ſervice from his creatures.

Accordingly, religion, in the true meaning of the term, neceſſarily ſuppoſes and includes an intercourſe between God and man; *i. e.* on the part of God diſcoveries and manifeſtations of himſelf and his perfections, and of his will with regard to the duties which he requires; and on the part of man, a capacity and readineſs to receive and improve thoſe diſcoveries, and to conform to all the ſignifications of the divine will. For it is an undeniable principle, that whatſoever plainly appeareth to be the mind and will of God, whatever be the way in which we obtain the knowledge of it, we are indiſpenſibly obliged to obſerve. And as there are two ways by which God may be ſuppoſed to manifeſt himſelf and his will to mankind, *viz.* by his works and by his word, religion has been uſually diſtributed into *natural* and *revealed.* Theſe are not two kinds of religion, eſſentially different, much leſs contrary or contradictory to each other, becauſe they both have God for their object, and proceed from him; nor are they altogether the ſame, and differing merely in the mode of their communication. Although all true revealed religion muſt be conſiſtent with, and in no reſpect contrary to, the clear light of nature and reaſon, yet it may diſcover and reveal ſeveral things pertaining to truth and duty, which that light, if left to itſelf, could not have diſcovered at all, or not with ſufficient clearneſs and certainty. Theſe ſhould not be oppoſed to one another; nor is the one of them deſigned to exclude the other.

Religion, *Natural,* has been taken in different acceptations. Some underſtand by it every thing in religion, with regard to truth and duty, which, when once diſcovered, may be clearly ſhewn to have a real foundation in the nature and relations of things, and which unprejudiced reaſon will approve, when fairly propoſed, and ſet in a proper light. Accordingly ſome Chriſtian philoſophers and divines have comprehended under their ſcheme or ſyſtem of natural religion, a conſiderable part of what is contained in the ſcripture revelation, *e. gr.* the important truths and principles relating to the exiſtence, the unity, and attributes of God, his governing providence and moral adminiſtration, the worſhip that is due to him, the law that is given to mankind; or the whole of moral duty in its juſt extent, as relating to God, our neighbours, and ourſelves, the rewards and puniſhments of another ſtate, and other articles nearly connected with theſe, and dependent upon them. Having taken great pains to ſhew, that all this is perfectly agreeable to ſound reaſon, and founded in the nature of things, they have honoured the whole with the name of *natural religion.* None can heſitate to allow, that it is a real and great ſervice to religion to ſhew, that the main principles and duties of it are what reaſon muſt approve; and thoſe are unqueſtionably entitled to praiſe, who have undertaken to demonſtrate this with great clearneſs and force of argument. But it does not follow that, becauſe theſe things, when once clearly diſcovered, may be proved agreeable to reaſon, and to have a real foundation in the nature of things, reaſon alone, in the preſent ſtate of mankind, if left to itſelf, without higher aſſiſtance, would merely, by its own force, have diſcovered all of them, with their genuine conſequences, and have applied them to their proper uſes, for directing men in the true knowledge and practice of religion. Many things, ſays Mr. Locke, in his "Reaſonableneſs of Chriſtianity," are taken for unqueſtionable truths, and eaſily demonſtrable, without conſidering how long we might have been in doubt or ignorance reſpecting them, if revelation had been ſilent. Native and original truth is not ſo eaſily wrought out of the mine, as we who have it ready dug and faſhioned to our hands, are apt to imagine To the ſame purpoſe Dr. Clarke obſerves, (Diſc. on Nat. and Rev. Religion,) that it is one thing to ſee, that theſe rules of life, which are before-hand plainly and particularly laid before us, are perfectly agreeable to reaſon, and another thing to find out theſe rules merely by the light of reaſon, without their having been firſt otherwiſe made known. Accordingly ſome able and ſtrenuous aſſertors of natural religion, or the law of nature, though they contend that it is founded in the nature of things,

things, and agreeable to right reafon, derive the promulgation of it from divine revelation. Hence it may be concluded, that natural religion, or the Law *of Nature* (which fee), is not fo called, becaufe it was originally difcovered by natural reafon, but becaufe, when once made known, it is what the reafon of mankind, duly exercifed, approves, as founded in truth and nature.

Natural religion, in the fenfe now explained, is very confiftent with the fuppofition of an extraordinary divine revelation, for the purpofe of difcovering and promulgating it at firft, and alfo of re-eftablifhing and confirming it, when, through the corruption of mankind, the important principles and duties of it were funk into fuch darknefs, and fo confounded with pernicious errors, that an extraordinary affiftance was neceffary to recover men to the right knowledge and practice of it.

Natural religion is underftood by others in a fenfe which is abfolutely exclufive of all extraordinary revelation, and in direct oppofition to it. By natural religion, they mean that religion which men difcover by the fole exercife of their natural faculties and powers, without any other or higher affiftance. Thefe perfons difcard all pretences to extraordinary revelation, as the effects of enthufiafm or impofture. It is in this fenfe, that thofe who call themfelves Deists (fee that article) underftand natural religion, which they highly extol as the only true religion, the only difcovery of truth and duty upon which we may fafely depend; and which comprehends the whole of what is neceffary to be known and done, in order to our obtaining the favour of God, and attaining to true happinefs. But thofe who take natural religion in this fenfe entertain different opinions of the fubject, and exprefs their fentiments varioufly. The ableft advocates for natural religion, as oppofed to revelation, maintain, that it is clear and obvious to the whole human race, and that all men have a natural knowledge of it. They argue, that fince religion is equally the concern of all mankind, the wifdom and goodnefs of God require, that it fhould be actually known to all. To this purpofe is the reafoning of lord Herbert, who alleges, that God hath imprinted on the minds of all men innate ideas of the main principles of religion and morality. Tindal alfo, and the author of "Chriftianity as old as the Creation," argue in a fimilar manner: the former afferts, that this clear univerfal light that fhines into the minds of all men cannot be made clear to any man by an external extraordinary revelation: with the latter it is a kind of fundamental principle, that the law, or religion, of nature was a perfect fcheme of religion and morality, fairly drawn on the mind and heart of every man, in fuch a manner, that it is not poffible for any man to miftake it: and he even affirms, that the moft illiterate of the human race have naturally and neceffarily a clear and intimate perception of the whole of religion and of their duty. Hence it will be eafily owned, that there is no need of an extraordinary revelation to teach men what they all naturally and neceffarily know. This fcheme, however plaufible it may at firft appear, and though it feems to exhibit a beautiful reprefentation of the dignity of our fpecies, and of the univerfal goodnefs of God to the human race, appears to be altogether vifionary, when brought to the teft of fact and experience: whilft it fuppofes, that religion, in its true nature and juft extent, is naturally known to all men, fo that they cannot miftake it, it contradicts the teftimony of the authentic hiftory of mankind in all ages, which evinces that they have miftaken religion in its important principles and obligations.

Senfible of the inconveniences of this fcheme, others, by natural religion, underftand not merely that which is naturally and neceffarily known to all men, but that which reafon, duly exercifed and improved, is able, by its own natural force, to difcover, without the affiftance of any extraordinary revelation. In order to form a juft conception of this theory, we might inveftigate the extent of the powers and abilities of human reafon in judging concerning matters of religion, independently of all revelation: but without entering on a fpeculation of this kind, the difquifition of which would be more curious in the procefs than fatisfactory in the refult, we fhould recur to the fureft and plaineft mode of judging, which is the examination of the conclufions that may be deduced from fact and experience. Let us then inquire, what hath human reafon actually done in this way, by its own force, without any extraordinary affiftance? The fatisfactory anfwer to this inquiry cannot be obtained from any fyftems formed by perfons who have lived in ages and countries which have enjoyed the light of divine revelation; fince in this cafe it may reafonably be fuppofed, that they have borrowed light from revelation, though they are not willing to acknowledge it, or may not themfelves be fenfible of it. Syftems, therefore, that have been drawn up by our modern admirers of natural religion in Chriftian countries, cannot be alleged in proof of the force of unaffifted reafon in matters of religion; and the fame may be faid of thofe Pagan philofophers who have lived after Chriftianity had made fome progrefs in the world. Nor can we fairly infer the fufficiency of the light of natural reafon, without the aid of revelation, from the fyftems of the ancient philofophers, lawgivers, and moralifts, who lived before the Chriftian revelation was publifhed; unlefs it can be fhewn, that they themfelves derived the religious and moral principles which they taught, folely and entirely from the refearches and difquifitions of their own reafon, and difclaimed their having had any affiftance, with regard to thofe truths and principles, from tradition or divine inftruction. And it is no hard matter to fhew, by teftimonies from the moft celebrated ancients, that this was not the cafe, nor was it what they affumed to themfelves. It is well known, that the moft admired philofophers of Greece did not pretend to fet up merely on their own ftocks, but travelled into Egypt, and different parts of the Eaft, for the purpofe of improving their knowledge by converfation with the fages of thofe countries; who themfelves profeffed to have derived their knowledge, not merely from the difquifitions of their own reafon, but from a higher fource, from very ancient traditions, to which, for the moft part, they affigned a divine original. After all it muft be allowed, that the moft celebrated and fagacious of the ancient philofophers made pathetical complaints of human darknefs and ignorance, and of the great difficulties they experienced in fearching after truth. Many of them were fenfible of the great need there was of divine inftruction and affiftance, for enlightening and directing mankind in matters of religion and their duty: fo that no argument can be juftly drawn from the wife men and philofophers among the ancients, to fhew that the knowledge of what is ufually called natural religion, in its juft extent, is wholly and originally owing to the force of human reafon, exclufive of all divine revelation. And perhaps, fays the excellent writer whofe obfervations we are now citing, it would not be eafy to mention any nations, among whom any true knowledge of religion has been preferved, concerning which we can be affured, that they never had any benefit from the light of divine revelation; and that the principles of religious truth and duty, which were to be found among them, were originally the mere product of natural reafon, without any higher affiftance. Several things may be obferved among them, which feem to be the remains of an ancient univerfal tradition, or primeval religion, derived from the remoteft antiquity, and which, probably, had their original fource in divine revelaton, though in procefs of time it was greatly altered and corrupted. Leland's Advantage and Neceffity of the Chriftian Revelation, vol. i. § 1.

Religion, *Revealed*, is commonly underftood to be that knowledge of religion, which was originally communicated from God to men in a way of extraordinary revelation, for inftructing them in important religious truth, and directing and engaging them to the practice of their duty. In a general fenfe, all truth, and the manifeftation of it, may be faid to come from God, even that which we difcover in the ordinary ufe of thofe rational faculties which God hath given us. But revealed religion, as diftinguifhed from that which is ufually called natural, denotes that knowledge of religion which was originally communicated in an extraordinary and fupernatural way. Leland, ubi fupra. See Revelation.

The firft kind of religion, above-mentioned, or natural religion, flows immediately from the relation between the creature and the Creator; the latter, or revealed religion, does not follow from fuch a relation, but is fuperadded from the mere will and pleafure of the Creator.

The firft we ordinarily call morality, or ethics; becaufe immediately converfant about the manners and duties of men towards one another; and towards themfelves, confidered as creatures of that Being. See Ethics, Morality, and *Moral* Philosophy.

The latter we call, by way of eminence, religion, as being the rule of our duty immediately to God himfelf.

The firft fuppofes a God, a providence, and a future ftate, of rewards and punifhments; the latter likewife fuppofes an immediate miffion from God himfelf, attefted by miracles, &c. See Christian *Religion*.

Religion is more particularly ufed for that fpecial fyftem of faith and worfhip, which obtains in a particular age, fect, or country, &c.

In this fenfe we fay the Romifh religion, the Reformed religion, the religion of the Greeks, the Mahometan religion, the Jewifh religion, &c. See Judaism, Mahometanism, &c.

The Siamefe hold the diverfity of religions, *i. e.* the different manners of honouring God, to be pleafing to him; inafmuch as they have all the fame object, and all tend to the fame end, though by different means. Claude.

This fentiment of thefe idolaters is doubtlefs more juft than that of our zealots, who hold all but thofe of their own religion odious to God. The feveral fects in religion fee under their proper articles. See alfo Sect.

Of the religion of the ruling part of the world, you may find a lively defcription in a chorus in Seneca's Troas, at the end of the fecond act, beginning thus: "Verum eft, an timidos fabula decipit? umbras corporibus vivere conditis, &c." This, according to Patin, is the religion of princes, and great men, of magiftrates, monaftic fuperiors, and even fome phyficians and philofophers. M. Du Maine, head of the leaguers in France, ufed to fay, that princes have no religion till after they are turned of forty. "Cum numine nobis mors inftat, majore facit." Patin. Lett. Choif. 106.

Under this article we are naturally led to difcufs the fubject of national religion, in its connection with religious eftablifhments. It muft appear, on the flighteft reflection, that religion has a very confiderable influence, not only on the difpofition and character of individuals, but on the ftate of fociety in general. Accordingly legiflators and rulers have often found it one of the moft powerful inftruments of civil policy; and the hiftory of almoft every country affords numerous inftances of its being an excellent ally to the power of the civil magiftrate, or the moft dangerous rival. By religion we now mean that principle which influences men by the dread of evil or the hope of reward, from unknown and invifible caufes; whether the good or the evil be expected to take place in this world or in another; and in this general fenfe of the term, it comprehends enthufiafm, fuperftition, and every other fpecies of falfe religion as well as the true. It would lead us too far, if we attempted to trace the influence of this principle in the more barbarous or more civilized nations of antiquity. Enthufiafm and fuperftition have been more powerful and more efficacious on many occafions, which hiftory records, than political wifdom in the cabinet, or martial fkill and valour in the field. In fome cafes religion has concurred with the views of the civil magiftrate; and in others, it has counteracted them even in favour of the beft interefts of mankind. It is an obfervation of Mr. Hume's, that the precious fparks of liberty were kindled and preferved by the Puritans in England, and that it is to this fect, whofe principles appear fo frivolous, and whofe habits fo ridiculous, as he fomewhat invidioufly defcribes them, that the Englifh owe the whole freedom of their conftitution. The affertion, however, is too general. The capital advantage derived from Chriftianity in this weftern part of the world, is the total abolition of flavery, in confequence of its raifing men's ideas of the importance of the human fpecies. It is a memorable fact, that after the introduction of Chriftianity into the Roman empire, every law which was made relating to flaves was in their favour, till at laft all the fubjects of the empire were reckoned equally free. Although, in later times, flavery has been revived and continued, for commercial purpofes, in countries calling themfelves Chriftian, we truft that laudable efforts, originating in the liberal fentiments and affections which Chriftianity inculcates, will be crowned with fuccefs, and gradually annihilate this nefarious kind of traffick in every nation of the globe. Chriftianity, indeed, is almoft incompatible with abfolute defpotic power, both in fovereigns and private perfons. The corruptions of Chriftianity, exemplified in the exorbitant power of the pope, and the fuperftition of the Popifh worfhip, have been indirectly productive of confiderable benefit. The union of the weftern churches under one fupreme pontiff facilitated the intercourfe of nations in barbarous ages; and the pomp of the Popifh power contributed in no fmall degree towards preventing the fine arts from being totally loft in the barbarifm of Europe, and to their fubfequent revival, previoufly to that of literature and fcience in this weftern part of the world. Erroneous notions of religion, and the fuperftition blended with its purer principles, have been, however, the occafion of the moft lamentable evils in the government of ftates. Beccaria fays, in his "Effay on Crimes and Punifhments," that more than 100,000 witches have been condemned to die by Chriftian tribunals. Falfe principles of religion have encouraged men to commit the moft horrid crimes; and to inflict tortures both on themfelves and others, which cannot be thought of without horror. The hiftorical page of perfecution is ftained with blood. But it is our prefent defign to fketch out the benefits refulting from religion to civil fociety, rather than the evils which the perverfion of its principles and genuine fpirit have produced. It is natural to imagine, that the civil magiftrate would take religion under his protection with a view to thefe benefits; neverthelefs, it is much to be lamented that by erroneous notions of its nature and defign, and a mifapplication of its influence, it has been rendered the in-

ftrument

ftrument of tyranny and oppreffion. If magiftrates and rulers availed themfelves of the affiftance which religion affords for meliorating the character and condition of the members of the community over which they prefide; if they patronized and encouraged the principles and profeffion of it for the purpofe of reftraining the profligate and vicious, and of promoting a virtuous conduct with a view to the welfare and profperity of the ftate; and if they made ufe of the mighty powers with which religion furnifhes them merely for the purpofe of maintaining order and peace in the community to which they belong, and of fecuring and advancing its true interefts; there could be no reafon for alarm or complaint. Religion and civil government might unite their efforts for fuch laudable purpofes, and co-operate in promoting them, without any apprehenfion of danger; but lamentable experience has teftified that in too many inftances religion has been made fubfervient to ambition and worldly policy, infomuch that many perfons of juft reflection and comprehenfive views have dreaded the interference of civil governors in matters of religion. If, in fome cafes, they have done good, in others their interference has been pernicious, not only to religion, which has been thus corrupted and degraded, but to the civil community itfelf. Neverthelefs the opinion, that it is neceffary for the ftate to prefcribe the principles, and to regulate the modes of religion, has been almoft univerfally prevalent.

We are thus led briefly to difcufs the fubject of national eftablifhments of religion; and that we may do this without prejudice and partiality, we fhall ftate the arguments on both fides of the queftion, as much as poffible in the language of thofe who oppofe, and of thofe who defend them. Amongft thofe who have thought freely, and who have written as freely on this fubject, we find fome who contend againft eftablifhments in any degree whatever. They will not allow that religion fhould receive any fupport from the ftate, but infift that it ought to be left entirely to its own operation. There is naturally, they fay, no more connection between civil government and religion, than between the former and any thing elfe that depends upon opinion; lefs than the bufinefs of philofophy or religion. Becaufe thefe refpect the prefent life, with which civil governors have to do; whereas religion refpects the life to come, with which they have nothing to do. However, the conclufivenefs of this kind of reafoning feems to be materially affected by our preliminary remarks. Religion, it is faid, is a concern that lies out of the proper province of the civil magiftrate. Its object is invifible; its principles and affections, which are the fprings of moral and religious conduct, as well as its motives and fanctions, are not fubject to the direction and controul of fecular counfel and power; its feat is the underftanding and heart: nor is the external conduct, to which alone the cognizance of the civil magiftrate extends, of any importance in a moral view, independently of the internal principles in which it originates, and by which it is guided and governed. Befides, it has been urged that civil rulers have no right to prefcribe to the judgment in the province of religion, or to frame and enforce rules of moral conduct, for the obfervance or violation of which mankind are accountable only to God; nor are they competent or qualified for the exercife of fuch high powers. And if they cannot controul the faculties of the mind, their influence on the profeffion and practice, and that outward conformity to modes and rites of a religious nature which they may enforce, without the confent of the judgment and concurrence of the will, are calculated to do much greater harm than good; and to add to the number of hypocrites or martyrs. As the civil magiftrate cannot beftow the rewards, nor inflict the punifhments, that are appropriate to religion; and as he cannot eftimate the moral worth or demerit of his fubjects, he cannot, without culpable prefumption, affume, nor without intruding on the province of the fupreme and almighty God, exercife the authority of a fpiritual and final judge. Civil governors in general, fuch are their rank and ftation, the courfe of their education, and the habits of their lives, are lefs able than many others of lower condition, but of different views and connections, to decide concerning religious truth, or to determine who are qualified to advife and affift them. Moreover, it has been obferved, that neither magiftrates nor their ecclefiaftical advifers are warranted to eftablifh a ftandard either of religious faith or moral conduct, to which all the members of a community are required to conform, and from which they are not allowed to deviate without incurring fome lofs or damage. Such a ftandard, let it be ever fo liberally framed, or ever fo mildly enforced, is not likely to be fo comprehenfive, as to include all the teachers and all the profeffors of religion, who are entitled to the protection of the ftate in which their lot is caft. Befides, if fuch a ftandard of faith and practice could be devifed, thofe who object to religious eftablifhments on the ground now ftated, conceive, that their civil rulers have no right to eftablifh and impofe it; and thus to deprive perfons, who cannot approve it, of worldly honours and benefits, to which they have naturally an equal claim with others of their fellow-fubjects;—a claim, which they do not forfeit by the exercife of their own judgment in the province of religion. It has alfo been argued, that Chriftianity, fo far from countenancing, rather difcourages every kind of religious eftablifhment, that interferes with the right of private judgment. The language of the divine Author of our holy religion is, "Render to Cæfar the things that are Cæfar's, and to God the things that are God's;—Search the fcriptures;—Call no man mafter on earth;—My kingdom is not of this world." And that of his apoftles, "Let every man be fully perfuaded in his own mind;—Judge ye what I fay;" &c. &c. The adverfaries of eftablifhments allege, that a national church, conftituted by the civil magiftrate, and governed by laws enacted by his authority, and the Chriftian church, founded on the doctrine of Chrift and his apoftles, are effentially diftinct; and they fay, that fuch a church, *e. gr.* the church of England, lefs exceptionable than many others, which claims and exercifes, according to its 20th article, "power to decree rights and ceremonies, and authority in matters of faith," has, agreeably to the true nature and conftitution of the Chriftian church, no fuch power and authority; that it is inconfiftent with the allegiance which Chriftians, as the fubjects of Jefus Chrift, owe to him, the only lawgiver and king in the church; who, as they fay, hath exprefsly commanded that no power of this kind fhall ever be claimed, or ever be yielded by any of his followers. In the profecution of this mode of reafoning, they farther add, that if the church of England hath really this authority and right, the church of Rome had it before, and, as the elder and mother-church, ought to have been obeyed; and confequently the reformation, as it has been called, was a rebellion againft fuperiors, a difobedience to the authority vefted in the church, and ought, as fuch, to be renounced by returning to the church of Rome. They alfo argue, that this power to order the manner of God's worfhip, and to fettle articles of faith, is not at all lodged in the bifhops or clergy, who are the fpiritual paftors and guides in the eftablifhed church, but entirely in the king and parliament of thefe realms. So far were the bifhops and clergy from having any concern in the firft forming our prefent eftablifhed church,

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or in ordering its rites and articles of faith, that it was done not only without, but in actual opposition to them. Hence they conclude, that the church of England is, in reality, a parliamentary church; that it is not, properly, an ally, as some have asserted, but a mere creature of the state. It depends entirely upon the acts and authority of parliament for its very essence and frame. The qualifications of its ministers, their power to officiate, the manner in which they are to administer the sacraments, are all limited and prescribed by authority of parliament; and this authority, which at first made, can alone alter and new-make it; can abolish, or add to its articles or rites, according to its pleasure, even though the whole body of bishops and clergy ever so much dislike or protest earnestly against it.

If it be asked, how came the civil magistrate to possess the authority which he exercises in the church of Christ? The objectors to establishments reply, that the subjection to higher powers, and obedience to magistrates, which the scriptures enjoin on Christians, relates only to civil, and not at all to religious matters, for this obvious reason, that the magistrate was at that time every where Pagan. They say, that Christianity is so far from enjoining, that it actually forbids, obedience to civil governors in things of a religious nature. It commands us "to call no man upon earth father or master" (Matt. xxiii. 8, 9.), *i. e.* to acknowledge no authority or jurisdiction of any in matters of religion, but to remember, that "one, one only is our master" and lawgiver, even Christ, and that all Christians are brethren: and that, though "the princes of the Gentiles exercise dominion over them, and they who are great exercise authority upon them, yet it shall not," says our Lord, "be so amongst you." (Matt. xx. 25.) Christ's kingdom is not of this world, and of course he is the sole lawgiver, judge, and sovereign in religious matters. (See Matt. xxiii. 8. xxviii. 18, 19. 1 Cor. viii. 6. Ephes. i. 22.) In the church of Christ, it is said, all authority and jurisdiction are vested originally in him, and flow from him, nor can any one lawfully exercise them without a commission from him; but in the church of England, the king, or queen, is "supreme head," possessing "all power to exercise all manner of ecclesiastical jurisdiction, and archbishops, bishops, archdeacons, and other ecclesiastical persons, have no manner of jurisdiction ecclesiastical, but by and under the king's majesty, who hath full power and authority to hear and determine all manner of causes ecclesiastical; and to reform and correct all vice, sin, errors, heresies, enormities, abuses whatsoever, which by any manner of spiritual authority or jurisdiction, ought, or may be lawfully reformed." (26 Hen. VIII. cap. 1. 37 Hen. VIII. cap. 17. 1 Eliz. cap. 1.) At the first establishment of this church under Henry VIII. and Edward VI. all the bishops took out commissions from the crown, for the exercising of their spiritual jurisdiction in these kingdoms, during the king's pleasure only; "and in their commissions acknowledge all sorts of jurisdiction, as well ecclesiastical as civil, to have flowed originally from the regal power, as from a supreme head, and a fountain and spring of all magistracy within his own kingdom." Burnet's Hist. Reform. part ii. Col. p. 92.

Yea, even the power of ordination itself, which is reckoned a peculiar of the episcopal office, the first reformers and founders of this church derived from the king, and exercised only as by authority from him, and during his pleasure. "Thus Cranmer, archbishop of Canterbury, Bonner, bishop of London, &c. took out commissions from the crown, importing, that because the vicegerent (Cromwell, a lay person) could not personally attend the charge in all parts of the kingdom, the king authorises the bishop, in his, (the king's or perhaps the vicegerent's) stead to ordain, within his diocese, such as he judged worthy of holy orders; to collate to benefices; to give institution; and to execute all other parts of the episcopal authority; and this during the king's pleasure only."

In consequence of this supremacy, the king or queen of this church hath power to excommunicate from, or to re-admit into it, independent of, yea, in direct opposition to, all its bishops and clergy. The king or queen revoke, if they please, any spiritual censures of the bishops or archbishops; yea, can suspend, deprive, or even excommunicate, themselves; or can, by their proclamation only, without the least confession, humiliation, or satisfaction for their offence, pardon and restore excommunicated persons, the vilest offenders, to the church's bosom again.

Yea, further, they have power to forbid all preaching for a time; as did king Henry VIII. king Edward VI. queen Mary, and queen Elizabeth; to limit, instruct, and prescribe to the clergy what they shall, and what they shall not preach; as did queen Elizabeth, king James I. king Charles I. king William, &c. Finally, to the king or queen only does it pertain to declare what is heresy, and authoritatively to pronounce what doctrines and tenets are, and what are not, to be censured as such: nor have all the bishops and clergy, assembled in convocation, the least authority to censure any tenet as heretical, if the prince on the throne refuse his consent.

Accordingly, the objectors to religious establishments allege, that in Christ's church, himself is the only sovereign and head; he only hath power to decree ceremonies and rites, to fix terms of communion and authority in points of faith: nor hath any earthly prince power to make laws in his kingdom, which shall bind the conscience of his subjects; or sovereignly to dictate to his servants and ministers what they shall believe, and what they shall preach. Yea, his subjects are expressly commanded and charged to receive nothing as doctrine or parts of religion, which are only commandments of men.

But in the church of England there is another sovereign, lawgiver, supreme head, besides Jesus Christ; an authority which commands things which Christ never commanded, which teaches doctrines he never taught, which enjoins terms of communion, and rites of religious worship, which Christ never enjoined. Hence they conclude, that these two churches are two distinct and quite different societies, framed after different models, consisting of different members, and governed by different officers, statutes, and laws. Whilst the objectors to established forms of worship esteem and reverence the great number of illustrious and excellent persons, both clergy and laity, of which the church of England can boast, they suggest, that the present established forms were drawn up when this kingdom just emerged out of Popish darkness; that in drawing them up special regard was had to the weakness of the people at that time, who could not be all at once entirely brought off from the old ceremonies and forms; and that there are several parts of our liturgy and ecclesiastical constitution, which even many of our bishops and clergy wish to see altered. Schemes have been proposed, and attempts have been made for omitting what is offensive, for correcting what is easily capable of amendment, and for accommodating the doctrine and forms of the established church, to the present advanced state of knowledge, and to the corresponding liberality of the modern professors of religion, both in and out of the church; but they have hitherto been unavailing: and it has been thought, that an exclusive establishment, appropriating to itself distinguished honours and benefits of a secular nature, and exposing those whom

whom it does not comprehend to privations, both of emolument and honour, has a tendency to difcourage every effort for improving its conftitution, and enlarging its boundaries. Some have alfo been of opinion that it reftrains freedom of inquiry, embarraffes integrity, and too much difpofes the uninftructed and uninformed to intolerance and perfecution. From whom, it has been faid, is a reform to be expected, but from thofe who have reafon for wifhing every thing to continue in ftatu quo? The dignitaries of the church, whofe emoluments induce them to reft fatisfied, and the ruling magiftrates of the ftate, who wifh things to remain quiet, and the great body of the laity, connected in one way or other with ecclefiaftical eftablifhments, cannot be fuppofed to be very anxious about a change in the conftitution of the church: nor will they be at a lofs for plaufible reafons for refifting any material alteration. The church and the ftate are fo incorporated, that nothing but a revolution, as it has been faid, in the latter, would caufe any very important amendment in the former. Neverthelefs, reformers have maintained, that if the liturgy, clergy, articles, canons, with all the ceremonies and rites of the eftablifhed church, were entirely vanifhed from the land; if its immenfe revenues were applied to eafe our heavy taxes, and for the payment of the public debts; and if preachers were paid only by voluntary contributions; the ftate would not fuftain fo effential a lofs and damage, that it could not thenceforward poffibly fubfift. Would, fay they, the Britifh monarchy be overthrown; our courts of judicature be fhut up; the courts of law be ftopped; parliaments no more meet; commerce and trade ftagnate, becaufe the national church was no more? On the contrary, however great the convulfion might be, the government, both civil and military, might remain the very fame. A timely reformation, however, would, as they imagine, prevent its total deftruction, and contribute to its permanence and profperity.

Some notice fhould here be taken of the learned Warburton's famous argument in favour of an eftablifhed church. The church, fays this prelate, has, by contract or alliance, refigned her fupremacy in matters ecclefiaftical, and her independency, to the ftate. In confequence of this, the ftate hath drawn up for her articles of faith, and forms of public worfhip, which it requires the church to fubfcribe and ufe. This alliance is a mere phantom, created by the warm imagination of the paradoxical bifhop, whofe ingenuity and learning have not been fufficient to render it popular, even among the moft zealous advocates of religious eftablifhments. Neither our hiftory nor our laws know any thing at all of it. The nature of our conftitution utterly difowns it; and avows the church to be not an ally, but a fubject to the ftate. An alliance fuppofes independency in the powers between which it fubfifts. But it is needlefs to enlarge on this topic.

Whilft it is allowed that religion has an influence on the conduct of men in this life, it is pleaded, on the other hand, that this beneficial influence of religion is promoted in all denominations of Chriftians, and as much in thofe which are reprobated by the ftate as in thofe which are encouraged by it. It has been alfo faid, that the fubject of religion is fo interefting to the generality of mankind, that if government did not interfere, the contention about it would be fo violent, that the public peace could not be preferved. To this argument in favour of eftablifhments, it has been replied, that thefe contentions are much increafed by the favour fhewn to one mode of religion, and the opprobrium which is confequently thrown on the reft; and that, where temporal intereft is not concerned, mere opinions will not occafion any differences at which government need to be alarmed. Chriftianity was introduced and eftablifhed, and fubfifted for about three hundred years, without any favour or protection from the governing powers; and the example of America, in fome provinces of which there is, ftrictly fpeaking, no eftablifhment of religion, and in which numerous forms of religion are openly profeffed, ferves to fhew, that the want of an eftablifhment is attended with no danger to the ftate. It is farther objected, that the ftate, by undertaking the care of religion, the truth and utility of which will, under providence, enfure its permanence, has taken upon itfelf a great, dangerous, and unneceffary burden; and from its jealoufy of fectaries, often deprives itfelf of the fervices of fome of its beft and moft able fubjects; and at fome times it has been induced to perfecute and deftroy them, becaufe if they were left free, and even fuffered to live, it was apprehended their principles might fpread to the rifk of the eftablifhment. To the national eftablifhment of our own country, the enlightened advocates of which abhor and difcountenance intolerance and perfecution, it has been objected, that it deprives the people of the choice of their own teachers and paftors; that it impofes fubfcription to creeds of doubtful evidence, and the obfervance of forms of queftionable utility, on its own minifters; that it renders the fupport of them burdenfome to thofe who avail themfelves of their labours, and to others who derive no benefit from them; and that it excludes by obnoxious ftatutes a confiderable clafs of loyal fubjects from offices which they are competent to difcharge, as well as emoluments and honours of which they have a right to participate. See DISSENTERS, SUBSCRIPTION, TEST, and TYTHES.

We now proceed to ftate the arguments that have been urged in favour of national eftablifhments of religion; and we fhall here avail ourfelves of the reafoning of an excellent writer, who has done ample juftice to the fubject, and who, at the fame time, has difcuffed it with a liberality and moderation, which have a tendency to conciliate thofe whofe fentiments may be different from his own. "A religious eftablifhment," he fays, "is no part of Chriftianity; it is only the means of inculcating it." It cannot be proved, that any form of church government has been laid down in the Chriftian, as it had been in the Jewifh fcriptures, with a view of fixing a conftitution for fucceeding ages; and which conftitution, confequently, the difciples of Chrift would, every where, and at all times, by the very law of their religion, be obliged to adopt. Certainly no command for this purpofe was delivered by Chrift himfelf; and though the apoftles ordained bifhops and prefbyters among their firft converts, and appointed alfo deacons and deaconeffes, invefting them with functions different from any that now fubfift, fuch offices were at firft erected in the Chriftian church, as the good order, the inftruction, and the exigencies of the fociety at that time required, without any declared defign of regulating the appointment, authority, or diftinction of Chriftian minifters under future circumftances. After this conceffion, our author founds the authority of a church eftablifhment in its utility; and in judging of the comparative excellence of different eftablifhments, he fuggefts, that the fingle view, under which we ought to confider any of them, is that of "a fcheme of inftruction," and the fingle end we ought to propofe by them is, "the prefervation and communication of religious knowledge." Every other idea, and every other end that have been mixed with this, as the making of the church an engine, or even an ally of the ftate; converting it into the means of ftrengthening, or of diffufing influence; or regarding it as a fupport of regal, in oppofition to popular forms of government, have ferved only

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to debafe the inftitution, and to introduce into it numerous corruptions and abufes. The notion, fays our author, of a religious eftablifhment comprehends three things, a clergy, or order of men fecluded from other profeffions to attend upon the offices of religion; a legal provifion for the maintenance of the clergy: and the confining of that provifion to the teachers of a particular fect of Chriftians. Without thefe, there exifts no national religion, or eftablifhed church, according to the fenfe which thefe terms are ufually made to convey. He, therefore, who would defend ecclefiaftical eftablifhments, muft fhew the feparate utility of thefe three effential parts of their conftitution. Under the firft head he maintains, that the knowledge and profeffion of Chriftianity cannot be maintained in a country without a clafs of men fet apart by public authority to the ftudy and teaching of religion, and to the conducting of public worfhip; and that for thefe purpofes they fhould be precluded from other employments; and that of courfe they ought to derive a maintenance from their own. If they depended for this maintenance upon the voluntary contributions of their hearers, he is of opinion, that few would ultimately contribute any thing at all. To the confideration of the difficulty with which congregations would be eftablifhed and upheld upon the *voluntary* plan, he adds, that of the condition of thofe who are to officiate in them. Preaching, he thinks, would in this cafe become a kind of begging; and the preacher, being at the mercy of his audience, would be obliged to adapt his doctrines, and alfo his ftyle and manner of preaching, to the pleafure of a capricious multitude; and to live in conftant bondage to tyrannical and infolent directors; which he could not do without a facrifice of principle, and a depravation of character. Admitting thefe circumftances to be fairly ftated, which perhaps an objector would reluctantly allow. Dr. Paley concludes, that a legal provifion for the clergy, compulfory upon thofe who contribute to it, is expedient; and then proceeds to inquire, whether this provifion fhould be confined to one fect of Chriftians, or extended indifferently to all. This queftion, it fhould be recollected, *can* never offer itfelf where the people are agreed in their religious opinions, and *ought* never to arife, where a fyftem of doctrines and worfhip may be fo framed as to comprehend their difagreements, and which might fatisfy all by uniting all in the articles of their common faith, and in a mode of divine worfhip that omits every fubject of controverfy or offence. Where fuch a comprehenfion is practicable, the comprehending religion ought to be made that of the ftate. But where this comprehenfion is impracticable, and feparate congregations and different fects muft continue in the country, the queftion fairly recurs, whether, under fuch circumftances, the laws ought to eftablifh one fect in preference to the reft; that is, whether they ought to confer the provifion affigned to the maintenance of religion upon the teachers of one fyftem of doctrines alone. This queftion is intimately connected with, and in a great meafure dependent upon, another; and that is, in what way, or by whom, ought the minifters of religion to be *appointed?* In that fpecies of patronage which fubfifts in this country, and which allows private individuals to nominate teachers of religion for diftricts and congregations, to which they are abfolute ftrangers, fome teft fhould be propofed to the perfons nominated, in order to prevent that difcordancy of religious opinions that might otherwife arife between the feveral teachers and their refpective congregations. The requifition of fubfcription, or any other teft by which the national religion is guarded, may be confidered merely as a reftriction upon the exercife of private patronage. Wherefoever, therefore, this conftitution of patronage is adopted, a national religion, or the legal preference of one particular religion to all others, muft almoft neceffarily accompany it. If we fuppofe that the appointment of the minifter of religion was in every parifh left to the choice of the parifhioners, might not this choice be fafely exercifed, without its being limited to the teachers of any particular fect? The effect, fays our author, of fuch a liberty muft be, that a Papift, or a Prefbyterian, a Methodift, a Moravian, or an Anabaptift, would fucceffively gain poffeffion of the pulpit, according as a majority of the party happened at each election to prevail; and on every choice, it is apprehended, that violent conflicts would be renewed, and bitter animofities be revived. If the ftate appoint the minifters of religion, this conftitution will differ little from the eftablifhment of a national religion: for the ftate would undoubtedly appoint only thofe whofe religious opinions, or rather whofe religious denomination, agree with its own; unlefs it be thought that religious liberty would derive any advantage from transferring the choice of the national religion from the legiflature of the country to the magiftrate who adminifters the executive government. The only plan which feems to render the legal maintenance of a clergy practicable, without the legal preference of one fect of Chriftians to another, is that of an experiment which has been attempted (and which is faid to have fucceeded) in fome of the new ftates of North America. The nature of the plan is thus defcribed. A tax is levied upon the inhabitants for the general fupport of religion: the collector of the tax goes round with a regifter in his hand, in which are inferted, at the head of fo many diftinct columns, the names of the feveral religious fects that are profeffed in the country. The perfon who is called upon for the affeffment, as foon as he has paid his quota, fubfcribes his name in which of the columns he pleafes; and the amount of what is collected in each column is paid over to the minifter of that denomination. In this fcheme it is not left to the option of the fubject, whether he will contribute, or how much he fhall contribute, to the maintenance of a Chriftian minifter: it is only referred to his choice to determine by what fect his contribution fhall be received. The above arrangement, fays Paley, is undoubtedly the beft that has been propofed upon this principle; it bears the appearance of liberality and juftice; and it may contain fome folid advantages. But our author thinks that its inconveniences will be found to overbalance all its recommendations. It is fcarcely compatible with the firft requifite in an ecclefiaftical eftablifhment, which is the divifion of the country into parifhes of a commodious extent. If the parifhes be fmall, and minifters of every denomination be ftationed in each, which the plan feems to fuppofe, the expence of their maintenance will become too burdenfome a charge for the country to fupport. If, for reducing the expence, the diftricts be enlarged, the place of affembling will, in fome cafes, be too far removed from the refidence of the perfons who ought to refort to it. Befides, if the pecuniary fuccefs of the different teachers of religion be made to depend upon the number and wealth of their refpective followers, this would naturally generate ftrifes and indecent jealoufies amongft them, as well as produce a polemical and profelyting fpirit, founded in or mixed with views of private gain; which would both deprave the principles of the clergy, and diftract the country with endlefs contentions.

If it be expedient, fays our author, to eftablifh a national religion, that is, one fect in preference to all others, fome *teft*, by which the teacher of that fect may be diftinguifhed from the teachers of different fects, appears to be an indifpenfable confequence. The exiftence of fuch an eftablifhment

ment ſuppoſes it: the very notion of a national religion includes that of a teſt. But the neceſſity of a teſt has furniſhed to almoſt every church a pretence for extending, multiplying, and continuing ſuch teſts beyond what the occaſion juſtified. For though ſome purpoſes of order and tranquillity may be anſwered by the eſtabliſhment of creeds and confeſſions, yet they are at all times attended with ſerious inconveniences. They check inquiry; they violate liberty; they enſnare the conſciences of the clergy, by holding out temptations to prevarication; and in proceſs of time, they contradict the opinions of the church, whoſe doctrines they profeſs to contain; and they often perpetuate the proſcription of ſects and tenets, from which any danger has long ceaſed to be apprehended. Although teſts and ſubſcriptions may not be aboliſhed, they ſhould be made as eaſy and ſimple as poſſible. They ſhould be adapted from time to time to the varying ſentiments and circumſtances of the church in which they are received; nor ſhould they at any time advance one ſtep farther than ſome ſubſiſting neceſſity requires. Promiſes of conformity to the rites, liturgy, and offices of the church, if ſufficient to prevent confuſion in the celebration of divine worſhip, ſhould be accepted in the place of ſtricter ſubſcriptions. If any agreements, not to preach certain doctrines, nor to revive certain controverſies, denominated articles of *peace*, would exclude indecent altercations amongſt the national clergy, and alſo ſecure to the public teaching of religion as much of uniformity and quiet as is neceſſary to edification; then confeſſions of faith ought to be converted into articles of peace. In a word, it ought to be held, ſays Dr. Paley, a ſufficient reaſon for relaxing the terms of ſubſcription, or for dropping any or all of the articles to be ſubſcribed, that no preſent neceſſity requires greater ſtrictneſs.

It is a queſtion that has been long agitated in the reformed churches of Chriſtendom, whether a parity amongſt the clergy, or a diſtinction of orders in the miniſtry, be more conducive to the general ends of the inſtitution? Our author is inclined to the latter alternative, for reaſons which he has ſtated.

In diſcuſſing the ſubject of a national eſtabliſhment of religion, the right of the civil magiſtrate to interfere at all in matters of religion offers itſelf to conſideration; and although this right may be acknowledged whilſt he is employed ſolely in providing means of public inſtruction, it may be queſtioned whether he ſhould inflict penalties, and impoſe reſtraints or incapacities on the account of religious diſtinctions. Our author, deducing the authority of civil government from the will of God, and inferring that will from public expediency alone, concludes that the juriſdiction of the magiſtrate is limited by no conſideration but that of general utility; or that whatever be the ſubject demanding regulation, it is lawful for him to interfere, whenever his interference, in its general tendency, appears to be conducive to the common intereſt. Our author conceives, that there is nothing in the nature of religion, as *ſuch*, which exempts it from the authority of the legiſlator, when the ſafety or welfare of the community requires his interpoſition. To the objection, that religion, pertaining to the intereſts of a life to come, lies beyond the province of the civil government, the office of which is confined to the affairs of this life, Dr. Paley replies, that when the laws interfere even in religion, they interfere only with temporals; their effects terminate, their power operates only upon thoſe rights and intereſts, which confeſſedly belong to their diſpoſal. He proceeds to obſerve, probably without ſatisfying the objector, "that the acts of the legiſlator, the edicts of the prince, the ſentence of the judge, cannot affect my ſalvation; nor do they, without the moſt abſurd arrogance, pretend to any ſuch power: but they may deprive me of liberty, property, and even of life itſelf, on account of my religion; and however I may complain of the injuſtice of the ſentence, by which I am condemned, I cannot allege that the magiſtrate has tranſgreſſed the boundaries of his juriſdiction; becauſe the property, the liberty, and the life of the ſubject, may be taken away by the authority of the laws, for any reaſon, which, in the judgment of the legiſlature, renders ſuch a meaſure neceſſary to the common welfare. Moreover, as the precepts of religion may regulate all the offices of life, or may be ſo conſtrued as to extend to all, the exemption of religion from the control of human laws might afford a plea, which would exclude civil government from every authority over the conduct of its ſubjects. Religious liberty is like civil liberty, not an immunity from reſtraint, but the being reſtrained by no law, but what in a greater degree conduces to the public welfare."

By way of qualifying this reaſoning, which may be thought exceptionable, Dr. Paley obſerves, that "ſtill it is right to obey God rather than man."—"When human laws interpoſe their direction in matters of religion, by dictating, for example, the object or the mode of divine worſhip; by prohibiting the profeſſion of ſome articles of faith, and by exacting that of others; they are liable to claſh with what private perſons believe to be already ſettled by precepts of revelation, or to contradict what God himſelf, they think, hath declared to be true. In this caſe, on whichever ſide the miſtake lies, or whatever plea the ſtate may allege to juſtify its edict, the ſubject can have none to excuſe his compliance. The ſame conſideration alſo points out the diſtinction, as to the authority of the ſtate between temporals and ſpirituals. The magiſtate is not to be obeyed in temporals more than in ſpirituals, where a repugnance is perceived between his commands, and any credited manifeſtations of the divine will; but ſuch repugnancies are much leſs likely to ariſe in one caſe than in the other." The general propoſition laid down by our author is as follows: "That it is lawful for the magiſtrate to interfere in the affairs of religion, whenever his interference appears to him to conduce, by its general tendency, to the public happineſs." To others this propoſition will appear to be in many reſpects exceptionable. The magiſtrate of courſe is to be the judge, what are the occaſions in which he may interfere; and theſe occaſions will occur whenever he pleaſes. Dr. Paley has therefore endeavoured to guard it againſt miſapprehenſion and miſapplication. Having ſtated, that it is the *general* tendency of the meaſure, or, in other words, the effects which would ariſe from the meaſure being *generally* adopted, that fixes upon it the character of rectitude or injuſtice, he then proceeds to inquire what is the degree and the ſort of interference of ſecular laws in matters of religion, which are likely to be beneficial to the public happineſs. In ſettling this point he premiſes two maxims; the firſt is, that any form of Chriſtianity is better than no religion at all; and the ſecond is, that of different ſyſtems of faith, that is the beſt which is the trueſt. From the firſt propoſition it is inferred, that when the ſtate enables its ſubjects to learn *ſome* form of Chriſtianity by diſtributing teachers of a religious ſyſtem throughout the country, and by providing for the maintenance of theſe teachers at the public expence; that is, when the *laws* eſtabliſh a national religion, they exerciſe a power and interference, which are likely, in their general tendency, to promote the intereſt of mankind.

But after the right of the magiſtrate to eſtabliſh a particular religion has been, upon this principle, admitted; a doubt ariſes, whether the religion he ought to eſtabliſh be that which he himſelf profeſſes, or that which he obſerves to prevail amongſt the majority of the people. Aſſuming it to be an equal chance, which of the two religions, that of the magiſtrate or that of the people, contains more of truth, it becomes a conſideration of ſome importance, to which arrangement we may attach the greater efficacy; that of an order of men appointed to teach the people their own religion, or to convert them to another; and as in our author's opinion the advantage lies on the ſide of the former ſcheme, it becomes the duty of the magiſtrate, in the choice of the religion which he eſtabliſhes, to conſult the faith of the nation rather than his own. For our author's reaſoning on other topics connected with a national eſtabliſhment of religion, we refer to the articles Subscription, Test, and Toleration. He cloſes the diſcuſſion of the general ſubject with the following ſummary of his argument: the reſult of our examination of thoſe general tendencies, by which every interference of civil government in matters of religion ought to be tried, is this: "That a comprehenſive national religion, guarded by a few articles of peace, and conformity, together with a legal proviſion for the clergy of that religion; and with a *complete* toleration of all diſſenters from the eſtabliſhed church, without any other limitation or exception, than what ariſes from the conjunction of dangerous political diſpoſitions with certain religious tenets, appears to be, not only the moſt juſt and liberal, but the wiſeſt and ſafeſt ſyſtem, which a ſtate can adopt: inaſmuch as it unites the ſeveral perfections, which a religious conſtitution ought to aim at—liberty of conſcience, with means of inſtruction; the progreſs of truth, with the peace of ſociety; the right of private judgment, with the care of the public ſafety." Paley's Principles of Moral and Political Philoſophy, vol. ii. ch. 10.

In moſt countries where religion is eſtabliſhed, it is that of the majority of the people; and on this principle the writers in defence of eccleſiaſtical eſtabliſhments vindicate them. But in a part of the united kingdom of Great Britain, *viz.* in Ireland, we have a remarkable exception to this rule. There the eſtabliſhed religion is not that of the majority, but of a ſmall minority of the people. Ever ſince the reformation the members of the church of England have kept poſſeſſion of the tithes of the whole iſland, where they have long deſpaired of bringing the people over to that religion for which they pay ſo dear.

In connection with the national eſtabliſhment of religion we ſhall here remark, that in this country the care which government takes of religion extends itſelf to the buſineſs of *education*, confining the univerſities, which are ſupported by the national funds, to the education of the members of the church of England, and rigorouſly excluding all ſectaries, either by requiring ſubſcription to the thirty-nine articles at the time of matriculation, or of taking certain degrees, or obliging the ſtudents to attend the ſervice of the eſtabliſhed church, and to declare that they are *bona fide* members of it.

Among the offences againſt religion enumerated by judge Blackſtone, and puniſhable by the laws of England, are *apoſtacy* and *hereſy*, which ſee reſpectively; and alſo thoſe which affect the eſtabliſhed church. Theſe latter are either poſitive or negative; poſitive by reviling its ordinances, or negative, by non-conformity to its worſhip. See Reviling, &c. Common *Prayer*, Non-conformists, Dissenters, Papists, and Popery. See alſo Blasphemy, Profaneness, Conjuration and Witchcraft, *Religious* Impostors, Sunday, *Falſe* Prophecies, Drunkenness, Lewdness, and Simony.

Religion, again, is applied to a military order, conſiſting of knights who live under ſome certain rule, &c.

In this ſenſe we ſay, the *religion of Malta*, &c. See Malta.

Religion is ſometimes alſo uſed for a convent. Thus, we ſay, there are religions of men, *i. e.* monks; religions of women, *i. e.* nuns.

Religion, *The*, uſed abſolutely, denotes the Reformed in France. Thus, they ſay, d'Ablancourt and Dacier were of the religion. See Huguenots.

RELIGIOUS, in a general ſenſe, ſomething that relates to religion.

We ſay, a religious life, religious ſociety, &c. Churches and church-yards are religious places. A religious war is alſo called a *croiſade;* which ſee.

Religious is more particularly uſed for a perſon engaged by ſolemn vows to the monaſtic life; or a perſon ſhut up in a monaſtery, to lead a life of devotion and auſterity, under ſome rule or inſtitution.

The male religious we popularly call *monks* and *friars;* the female, *nuns* and *canoneſſes*. See Canon, Monk, Nun, &c.

M. Nicole obſerves, that ſome domeſtic chagrins, and a certain pride, which leads people to abſcond when they cannot make a figure to their mind, make as many religious as real piety. He adds, that a girl muſt often be made a religious for no other reaſon, but becauſe ſhe cannot be married anſwerable to her condition.

Great influence, however, may be attributed to enthuſiaſm and ſuperſtition, and to thoſe miſtaken notions of duty and of perfection of character, which have often originated in theſe ſources, and which have produced effect on honeſt minds of a peculiar temperament and diſpoſition. Whilſt no kind of argument can juſtify this retirement from the world, and total ſecluſion from the occupations and pleaſures of ſocial life, it would manifeſt a want of candour as well as ignorance of human nature indiſcriminately to condemn all who have devoted themſelves to ſuch a kind of indolent and uſeleſs life.

A religious cannot make any will. By the council of Trent, a religious may reclaim his vows within five years.

Anciently the religious were all laymen, and it was even prohibited them to take up orders. In 1557, the parliament of Paris made a difficulty of receiving a biſhop of Laon to the oath of a duke and peer, by reaſon of his being a religious: yet a religious, being promoted to a biſhopric, is thenceforth ſecularized or diſpenſed from the obſervation of his rule.

In ancient deeds and conveyances of lands, we often find the ſeller reſtrained from giving or alienating it, *viris religioſis, vel Judæis*, to religious, or to Jews; to the end the land might not fall into *mortmain;* which ſee.

In a memorial directed by king John to his viſcounts, they are ordered to proclaim through their reſpective counties, that nobody, as they love their bodies and cattle, injure the religious or clerks, either in word or deed, on penalty of being hanged up on the next oak. "Nulli, ſicut diligunt corpora et catalla ſua, malum faciant vel dicant viris religioſis vel clericis. Si quem inde attingere poſſimus, ad proximam quercum eum ſuſpendi faciemus."

Religious *Houſes*, denote houſes ſet apart for religious purpoſes,

purposes, such as monasteries, churches, hospitals, and all other places where charity is extended to the relief of the poor and orphans, or for the use or exercise of religion. See "Notitia Monastica," or "A short History of the religious Houses in England and Wales," by Tanner, 8vo.; in which, according to the alphabetical order of counties, is accurately given a full account of the founders, the time of foundation, tutelar saints, the order, the value, and the dissolution; with reference to printed authors and MSS. which preserve any memoirs relating to each house; with a preface of the institution of religious orders. Cowel.

Religious *Impostors*. See Impostors.

Religious *Order*. See Order.

Most military orders pretend likewise to be religious; as those of Malta, who make vows, &c. See Malta.

RELINQUISHMENT, in *Law*, is a forsaking, abandoning, or giving over. It hath been adjudged, that a person may relinquish an ill demand in a declaration, &c. and have judgment for that which is well-demanded.

RELIQUA, the remainder or debt, which a person finds himself debtor in, upon the balancing or liquidating an account.

Hence *reliquitary*, the debtor of a reliqua; as also a person who only pays piece-meal.

The term reliqua is pure Latin.

RELIQUÆ, Relics, in *Antiquity*, the ashes and bones of the dead, which remained after burning their bodies; and which they very religiously gathered, and put into urns, and afterwards deposited in tombs. See Relics.

RELIQUARY, a shrine or casket, in which the relics of a dead saint are kept.

RELIQUE. See Relics.

RELIQUIA, in *Natural History*, a term used to express the fossile remains of certain substances found in different parts of the earth. In the article Petrifactions we have given the Linnæan division of the fifth class of minerals, and a pretty full description of the eight genera into which it is divided. In this place we shall present our readers with a very brief view of Mr. Martin's "Systema Reliquiorum." He considers the regnum fossile, or fossile kingdom, to be divided into five classes, *viz.*

I. Reliquia, or fossile remains from animals or plants.
II. Terræ, earths.
III. Salia, salts.
IV. Inflammabilia, inflammable substances.
V. Metalla, metallic substances.

The reliquia he divides into two orders, *viz. animal* and *vegetable* remains: of the former he gives eight genera; of the latter only one genus, which are as follow:

Order I. Reliquia Animalia.

Innata.

Genus 1. Mammodolithus, or remains of Mammalia.
2. Ornitholithus, - - Birds.
3. Amphibiolithus, - - Amphibia.
4. Ichthyolithus, - - Fishes.
5. Entholithus, - - Insects.
6. Helmintholithus, of the parts of worms not fabricated.

Fabricata.

7. Conchyliothus, or remains of Testacea.
8. Erismatolithus, of fulciments, or fabricated supports of worms.

Order II. Reliquia Vegetalia.

9. Phytolithus, the remains of Plants.

Mr. Martin has given certain fundamental principles, on which he conceives the study of reliquia may be scientifically conducted: these are as follow.

1. All natural bodies without life found on or beneath the surface of the earth, and which are not susceptible of putrefaction, belong to the fossile kingdom, and are either reliquia or minerals. Fossils are usually denominated "bodies destitute of an organic structure:" now though it be admitted that all fossils are, according to the common acceptation of the term, unorganized, they are not destitute of the structure which distinguishes an organized body. This being admitted, it follows that a line must be drawn between animal and vegetable matter recently buried in the earth, and which has acquired a genuine fossile character. This line will depend perhaps on putrefaction, to which even organic substances, after they have become fossile, are no longer subject.

2. An organic structure, whether of a plant or animal, is the essence of an extraneous fossil or reliquium. By this alone it is characterised, or distinguished from a mineral.

3. It is the organic form alone on which the arrangement of reliquia must be founded. Every system of natural bodies should assume for its basis but one principle, and this should be drawn from the most essential characteristics of the bodies under arrangement. It is on this account the form is pointed out as furnishing the only genuine principle, on which the classification of reliquia can be established.

4. The primary divisions of the arrangement, *viz.* orders, genera, &c. should agree with such natural divisions of plants and animals as are determinable by the form of the fossile subjects.

5. The specific differences in reliquia depend on the specific differences of form in the original bodies. One species of plant or animal can give but one real or genuine species of extraneous fossil. For if the essence of the reliquium be an organic form, its other affections, arising from substance, mode, and soil, are accidental, and cannot be used as specific distinctions, which must always depend on something essential to the body which we wish to discriminate. *Form*, therefore, must furnish specific differences of reliquia, and it of course follows that there will be as many genuine species of reliquia, as there are genuine specific forms in the animal and vegetable prototypes or originals: and that the number of fossile species are not increased by a separation of parts, or other accidental circumstances to which the original bodies may have been subjected during their change into fossils.

6. Specific distinctions of reliquia being founded only on the organic form, it follows, that their geological and mineralogical affections, with their modal diversities, merely characterise specimens.

7. The specific descriptions of reliquia are to be given according to the principles of botany and zoology. Those of the specimens, according to the principles of mineralogy and geology. The *essential* form of the reliquium must be distinguished from the *accidental*, that is, the form of the original body, from that which has arisen in the fossil from the mode of mineralization, the constituent substance, and the soil of the specimen.

8. The nomenclature of reliquia should manifest the extent of the present state of knowledge with respect to the original bodies.

To what has been said, we shall add an account of our author's "Delineations of Reliquia."

The leading parts in the delineation of a reliquium are the

the ſpecific character or diagnoſis, and the general deſcription.

The *ſpecific character* contains the marks that diſtinguiſh the ſpecies to which they belong, from all others in the ſame genus. Specific characters of reliquia ſhould be ſo conſtructed as to diſtinguiſh permanent from temporary ſpecies; and thoſe whoſe originals have not, as yet, been diſcovered. The ſpecific character of the recent ſpecies of plants or animals frequently depends on parts often or conſtantly wanting in the foſſile ſubject. When that is the caſe, another diagnoſis muſt be given to diſtinguiſh the reliquium; that of the recent ſpecies being marked as a parentheſis. The generic and trivial names are prefixed to the ſpecific character. And, generally, the name of the family, or ſubdiviſion of the genus to which the reliquium belongs: after which is to be detailed in diſtinct claſſes, 1. The ſynonyms or names by which the ſpecies has been diſtinguiſhed by authors, with references to the figures given of it. 2. The varieties of the ſpecies, with their ſynonyms. 3. The vernacular name. 4. The mode or ſtate in which the reliquium is found. 5. Its ſoil or geological ſituation. 6. Its geographic ſituation, and then the general deſcription.

The deſcription delineates in appropriate terms all the parts conſtituting the eſſential form of the reliquium, according to their number, figure, proportion, and ſituation: it muſt primarily refer to the original of the reliquium, as no juſt or perfect delineation of the ſpecies can be given, until the nature of its prototype be aſcertained.

The terms employed in deſcribing reliquia, which derive their form from the external parts of animals and plants, muſt be thoſe uſed by zoologiſts and botaniſts of the Linnæan ſchool. But thoſe which derive their form from the internal parts of organic bodies, are to be deſcribed in ſuch terms as anatomiſts would uſe in diſtinguiſhing the ſame parts in the recent ſubjects.

As appendant parts to the general deſcription of the reliquium muſt be given, 1. An enumeration of the ſpecimens which exhibit the various accidental forms under which the ſpecies has been found. 2. An enumeration of the various ſubſtances which have been obſerved as conſtituting the reliquium and its matrix.

Having given this brief account of Mr. Martin's ſcientific delineations of reliquia, we ſhall preſent our readers with the ſubſtance of two very intereſting communications ſent to the Royal Society ſince the printing of the article PETRIFACTIONS. Of theſe, the firſt is "An Account of ſome Organic Remains found by Mr. Trimmer, near Brentford, in Middleſex."

"The ſpecimens," ſays Mr. Trimmer, "have been collected from two fields, not contiguous to each other; therefore, to avoid confuſion, I ſhall take each field ſeparately, firſt deſcribing the ſtrata as far as they have come within my knowledge, and afterwards I ſhall ſpeak of the organic remains as they were reſpectively found in thoſe ſtrata.

"The firſt field is about half a mile north of the Thames at Kew bridge; its ſurface is about twenty-five feet above the Thames at low water. The ſtrata here are, firſt, ſandy loam from ſix to ſeven feet, the loweſt two feet ſlightly calcareous. Second, ſandy gravel, a few inches only in thickneſs. Third, loam ſlightly calcareous, from one to five feet: between this and the next ſtratum, peat frequently intervenes in ſmall patches, of only a few yards wide, and a few inches thick. Fourth, gravel containing water; this ſtratum varies from two to ten feet in thickneſs, and is always the deepeſt in the places covered by peat; in theſe places the lower part of the ſtratum becomes an heterogeneous maſs of clay, ſand, and gravel, and frequently exhales a diſagreeable muddy ſmell. Fifth, the main ſtratum of blue clay, which lies under this, extends under London and its vicinity; the average depth of this clay has been aſcertained, by wells that have been dug through it, to be about two hundred feet under the ſurface of the more level lands, and proportionally deeper under the hills, as appears from lord Spencer's well at Wimbledon, which is five hundred and ſixty-ſeven feet deep. This ſtratum, beſides figured foſſils, contains pyrites and many detached nodules; at the depth of twenty feet there is a regular ſtratum of theſe nodules, ſome of which are of very conſiderable ſize.

"In the firſt ſtratum, as far as my obſervation has extended, no remains of an organized body has ever been found, and as my ſearch has not been very limited, I may venture to ſay it contains none. In the ſecond ſtratum, ſnail-ſhells, and the ſhells of river-fiſh, have been found, and a few bones of land animals, but of inconſiderable ſize, and in ſuch a mutilated ſtate, that it cannot be aſcertained to what claſs they belong. In the third ſtratum, the horns and bones of the ox, and the horns, bones, and teeth of the deer, have been found, and alſo, as in the ſecond ſtratum, ſnail-ſhells, and the ſhells of river-fiſh. In the fourth ſtratum were found teeth and bones of both the African and Aſiatic elephants, teeth of the hippopotamus, bones, horns, and teeth of the ox.

"A tuſk of an elephant meaſured, as it lay on the ground, nine feet three inches, but, in attempting to remove it, it broke into ſmall pieces. When this ſtratum dips into the clay, and becomes a mixed maſs, as before ſtated, it is ſeldom without the remains of animals. In the fifth ſtratum, namely, the blue clay, the extraneous foſſils are entirely marine, with the exception of ſome ſpecimens of fruit and pieces of petrified wood, the latter of which may be conſidered as marine, becauſe, when of ſufficient ſize, they are always penetrated by teredines. The other foſſils from this ſtratum are nautili, oyſters, pinnæ marinæ, crabs, teeth and bones of fiſh, and a great variety of ſmall marine ſhells; this ſtratum has been penetrated hitherto in this field only to the depth of thirty feet, throughout which the ſpecimens found were diſperſed without any regularity.

"The ſecond field is about one mile to the weſtward of the former, one mile north of the Thames, and a quarter of a mile to the eaſtward of the river Brent; its height above the Thames, at low water, is about forty feet. The ſtrata are, firſt, ſandy loam, eight or nine feet, in the loweſt three feet of which it is ſlightly calcareous. Second, ſand, becoming coarſer towards the loweſt part, and ending in ſandy gravel from three to eight feet. Third, ſandy loam highly calcareous, having its upper ſurface nearly level, but gradually increaſing in thickneſs from a feather-edge to nine feet. Below this are two ſtrata of gravel and clay, as in the other field; but as theſe ſtrata have been only occaſionally penetrated in digging for water, nothing therefore is known with reſpect to them, but that they exiſt there.

"In the firſt ſtratum, as in the other field, no organic remains have been obſerved. In the ſecond, but always within two feet of the third ſtratum, have been found the teeth and bones of the hippopotamus, the teeth and bones of the elephant, the horns, bones and teeth of ſeveral ſpecies of deer, the horns, bones and teeth of the ox, and the ſhells of river-fiſh.

"The remains of hippopotami are ſo extremely abundant, that, in turning over an area of 120 yards in the preſent ſeaſon, parts of ſix tuſks have been found of this animal, beſides a tooth and part of the horn of a deer, part of a tuſk, and part of a grinder of an elephant, and the horns, with a ſmall part of the ſkull, of an ox. One of theſe horns I had an opportunity of meafuring as it lay on the ground, and found it to be $4\frac{1}{2}$ feet in length, and five inches in diameter at the large end; it was found impracticable to remove it, otherwife than in fragments, which I have preferved, and have hopes of being able to put a confiderable part of it together. The immenfe fize of this horn is rendered more remarkable by another horn from the fame fpot, which meafures but fix inches in length. Though this ftratum is fo extremely productive of the remains of animals, yet there are but few good cabinet fpecimens from it, owing, it is prefumed, to their having been crufhed at the time they were buried, and to the injury they have fince received from moifture. It is neceffary to remark, that the gravel-ftones in this ftratum do not appear to have been rounded in the ufual way by attrition, and that the bones muft have been depofited after the flefh was off, becaufe, in no inftance, have two bones been found together which were joined in the living animal; and further, that the bones are not in the leaft worn, as muft have been the cafe had they been expofed to the wafh of a fea-beach.

"In the third ftratum, *viz.* calcareous loam, have been found the horns, bones and teeth of the deer, the bones and teeth of the ox, together with fnail-fhells, and the fhells of river-fifh.

"Brentford, in the neighbourhood of which are the fields I have mentioned, is fituated on the north bank of the Thames, and is fix miles weft of London.

"The fall of the Thames from Brentford to its mouth at the Nore, is eftimated at feven feet."

The next communication is in relation to a foffile human fkeleton, found imbedded in lime-ftone lately brought from the ifland of Guadaloupe by the honourable fir Alexander Cochrane, and prefented by the admiralty to the Britifh Mufeum. Of this highly curious fpecimen Mr. Konig has given an account that, to naturalifts, will be regarded as highly important and interefting.

"On the hiftory of the ftrata produced by the more recent cataftrophes of the globe," fays Mr. Konig, "moft light has been thrown by the indefatigable exertions of M. Cuvier. Superlatively fkilled in comparative anatomy, this gentleman has fucceeded in determining the foffile bones of no lefs than 78 fpecies, of which 49 are entirely unknown among the exifting races of animals; about 12 are identified with known fpecies, and the remainder ftrongly refemble exifting fpecies, although their identity has not been completely afcertained. From the multiplied obfervations which this naturalift has communicated in his numerous memoirs, we may gather that the viviparous quadrupeds appear at a much later period in the foffile ftate than the oviparous; the latter being probably coeval with the fifhes, whilft the former are found only in the neweft formations, in which, according to Brongniart and Cuvier's interefting difcovery, marine beds are obferved to alternate with thofe of frefh water, and which (in the neighbourhood of Paris) overlay the coarfe fhell lime-ftone, which conftitutes the laft ftrata formed, as it would appear, by a long and quiet ftay of the fea on our continent.

"All the circumftances under which the known depofitions of bones occur, both in alluvial beds and in the caverns and fiffures of flœtz lime-ftone, tend to prove, that the animals to which they belonged met their fate in the very places where they now lie buried. Hence, it may be confidered as an axiom, that man, and other animals, whofe bones are not found intermixed with them, did not co-exift in time and place. The fame mode of reafoning would further juftify us in the conclufion, that, if thofe cataftrophes which overwhelmed a great proportion of the brute creation were general, as geognoftic obfervations in various parts of the world render probable, the creation of man muft have been pofterior to that of thofe genera and fpecies of mammalia which perifhed by a general cataclyfm, and whofe bones are fo thickly diffeminated in the more recent formations of rocks.

"The human fkeletons from Guadaloupe are called Galibi by the natives of that ifland; a name faid to have been that of an ancient tribe of Caribs of Guiana, but which, according to a plaufible conjecture, originated in the fubftitution of the letter *l* inftead of *r*, in the word Caribbee. No mention is made of them by any author except general Ernouf, in a letter to M. Faujas St. Fond, inferted in vol. v. (1805) of the Annales du Mufćum; and by M. Lavaiffe, in his Voyage à la Trinidad, &c. publifhed in 1813. The former of thefe gentlemen writes, that, on that part of the windward fide of the Grande-Terre, called La Moule, fkeletons are found enveloped in what he terms "Maffes de madrépores pétrifiés," which being very hard, and fituated within the line of high water, could not be worked without great difficulty, but that he expected to fucceed in caufing fome of thefe maffes to be detached, the meafurements of which he ftates to be about eight feet by two and a half.

"The block brought home by fir Alexander Cochrane exactly anfwered this account with regard to the meafurements; in thicknefs it was about a foot and a half. It weighed nearly two tons; its fhape was irregular, approaching to a flattened oval, with here and there fome concavities, the largeft of which, as it afterwards appeared, occupying the place where the thigh-bone had been fituated, the lower part of which was therefore wanting. Except the few holes evidently made to affift in raifing the block, the mafons here declared, that there was no mark of a tool upon any part of it; and, indeed, the whole had very much the appearance of a huge nodule difengaged from a furrounding mafs.

"The fituation of the fkeleton in the block was fo fuperficial, that its prefence in the rock on the coaft had probably been indicated by the projection of fome of the more elevated parts of the left fore-arm.

"The fkull is wanting; a circumftance which is the more to be regretted, as this characteriftic part might poffibly have thrown fome light on the fubject under confideration, or would, at leaft, have fettled the queftion, whether the fkeleton is that of a Carib, who ufed to give the frontal bone of the head a particular fhape by compreffion; which had the effect of depreffing the upper, and protruding the lower edge of the orbits, fo as to make the direction of their opening nearly upwards, or horizontal, inftead of vertical.

"The vertebræ of the neck were loft with the head. The bones of the thorax bear all the marks of confiderable concuffion, and are completely diflocated. The feven true ribs of the left fide, though their heads are not in connection with the vertebræ, are complete; but only three of the falfe ribs are obfervable. On the right fide only fragments of thefe bones are feen; but the upper part of the feven true ribs of this fide are found on the left, and might at firft fight be taken for the termination of the left ribs. The right ribs muft, therefore, have been violently broken, and carried over to the left fide, where, if this mode of viewing the fubject be correct, the fternum muft likewife lie concealed below the termination of the ribs. The fmall bone dependent above the upper ribs of the left fide, appears to be the right clavicle. The right os humeri is loft; of the left nothing remains except the condyles in connection with the fore-arm, which is in the ftate of pronation; the radius of this fide exifts nearly in its full length, while of the ulna the lower part only remains, which is confiderably pufhed upwards. Of the two bones of the right fore-arm, the inferior terminations

tions are seen. Both the rows of the bones of the wrists are lost, but the whole metacarpus of the left hand is displayed, together with part of the bones of the fingers: the first joint of the fore-finger rests on the upper ridge of the os pubis, the two others, detached from their metacarpal bones, are propelled downwards, and situated at the inner side of the femur, and below the foramen magnum ischii of this side. Vestiges of three of the fingers of the right hand are likewise visible, considerably below the lower portion of the fore-arm, and close to the upper extremity of the femur. The vertebræ may be traced along the whole length of the column, but are in no part of it well defined. Of the os sacrum, the superior portion only is distinct: it is disunited from the last vertebra and the ilium, and driven upwards. The left os ilium is nearly complete; but shattered, and one of the fragments depressed below the level of the rest: the ossa pubis, though well defined, are gradually lost in the mass of the stone. On the right side the os innominatum is completely shattered, and the fragments are sunk; but towards the acetabulum, part of its internal cellular structure is discernible.

"The thigh-bones and the bones of the leg of the right side are in good preservation, but being considerably turned outwards, the fibula lies buried in the stone, and is not seen. The lower part of the femur of this side is indicated only by a bony outline, and appears to have been distended by the compact lime-stone that fills the cavities both of the bones of the leg and thigh, and to the expansion of which these bones probably owe their present shattered condition. The lower end of the left thigh-bone appears to have been broken and lost in the operation of detaching the block; the two bones of the leg, however, on this side are nearly complete: the tibia was split almost the whole of its length a little below the external edge, and the fissure being filled up with lime-stone, now presents itself as a dark-coloured straight line. The portion of the stone which contained part of the bones of the tarsus and metatarsus was unfortunately broken; but the separate fragments are preserved.

"The whole of the bones, when first laid bare, had a mouldering appearance, and the hard surrounding stone could not be detached, without frequently injuring their surface; but, after an exposure for some days to the air, they acquired a considerable degree of hardness. Sir H. Davy, who subjected a small portion of them to chemical analysis, found that they contained part of their animal matter, and all their phosphate of lime. Here follows an exact description of the rock, in which the fossile skeleton is found. The attention of geologists being now directed towards this object, it may be expected that a scientific examination of the circumstances under which this lime-stone occurs, will not fail ere long to fix its age, and assign to it the place it is to occupy in the series of rocks. All our present information respecting the Grande Terre of Guadaloupe amounts to this, that it is a flat lime-stone country, derived principally from the detritus of zoophytes, with here and there single hills (mornes) composed of shell lime-stone; while Guadaloupe, properly so called, separated from the upper part by a narrow channel of the sea, has no traces of lime-stone, and is entirely volcanic."

M. Lavaisse, alluded to above as the only author who mentions the galibies, except general Ernouf, speaks of the bed of lime-stone which incloses them, as the most remarkable of the calcareous rocks in the Leeward islands. Mr. Konig, therefore, expected to find in his work an exact statement of its mode of occurring; but the only positive information he could collect from this author is, that the bed is a kilomètre (nearly an English mile) in length, and that it is covered by the sea at high water. According to him, no trace of shells or organized bodies is discoverable in this rock; but in lieu of these, he was fortunate enough to meet with mortars, pestles, hatchets, &c. of a basaltic or porphyritic rock, which, we are informed, were petrified (petrifiés). From this very vague account, we should not be induced to lay much stress upon the circumstance that the position of the skeletons is east-west, and that the spot must, therefore, have been a cemetery, which time and circumstances have transformed into a hard calcareous rock.

"I have to apologise for this long letter on a subject," concludes Mr. Konig, "which may turn out to be interesting only so far, as the human bones from Guadaloupe are unquestionably the only bones we are acquainted with that have ever been found imbedded in a hard stony mass, that does not appear to belong to common stalactitical calcareous depositions. This circumstance admits of being easily ascertained by a close inspection of the locality; and I am perfectly of opinion, that a comparison of the nature of the different varieties of shell-sand, with which the neighbourhood of the Caribbee islands abounds, would alone be sufficient to remove many doubts relative to the origin of the bed in question. The sand from thence, which I had an opportunity of seeing, was unlike that of which the stone is composed."

RELL, Mouse, in *Zoology*, the English name of the white-bellied mouse, with a blackish back and long body. See Myoxus and Glis.

RELLING, in *Geography*, a town of the duchy of Holstein; 2 miles S.S.E. of Pinnenberg.

RELLINGEN, a town of France, in the department of the Moselle, and chief place of a canton, in the district of Thionville. The place contains 602, and the canton 9046 inhabitants, on a territory of 212½ kiliometres, in 36 communes.

RELLINGHAUSEN, a town of Germany, lately belonging to the abbey of Corvey; 16 miles N.N.E. of Dusseldorf.

RELLINGHUSEN, a town of the duchy of Holstein; 9 miles E. of Itzehoa.

REM, *Information in*, in *Law*. See Information.

REMAGEN, in *Geography*, a town of France, in the department of the Rhine and Moselle, and chief place of a canton, in the district of Bonn. The place contains 790, and the canton 7801 inhabitants, in 37 communes.

REMAIGHIAN, a town of Persia, in the province of Laristan; 10 miles N.W. of Tarem.

REMAINDER, Remanentia, in *Law*, an estate limited to take effect and be enjoyed after another estate is determined. As if a man seised in fee-simple granteth lands to A for twenty years, and, after the determination of the said term, then to B and his heirs for ever: here A is tenant for years, remainder to B in fee. In the first place, an estate for years is created or carved out of the fee, and given to A; and the residue or remainder of it is given to B. But both these interests are in fact only one estate; the present term of years and the remainder afterwards, when added together, being equal only to one estate in fee. (Co. Litt. 143.) Thus, also, if land be granted to A for twenty years, and after the determination of the said term to B for life; and after the determination of B's estate for life, it being limited to C and his heirs for ever: this makes A tenant for years, with remainder to B for life, remainder over to C in fee. In this case also, the first estate, and both the remainders, for life and in fee, are one estate only. Hence it is easy to infer, that no remainder can be limited after the grant of an estate in fee-simple (Plowd. 29.

 Vaugh.

Vaugh. 269.); because this is the higheft and largeft eftate that a fubject is capable of enjoying; and he that is tenant in fee, hath in him the whole of the eftate: a remainder, therefore, which is only a portion, or refiduary part of the eftate, cannot be referved after the whole is difpofed of.

The rules that are laid down by law to be obferved in the creation of remainders, are as follow. 1. There muft neceffarily be fome particular eftate, precedent to the eftate in remainder; which particular eftate is faid to fupport the remainder. (Co. Litt. 49. Plowd. 25.) 2. The remainder muft commence or pafs out of the grantor, at the time of the creation of the particular eftate (Litt. § 671. Plowd. 25.): as where there is an eftate to A for life, with remainder to B in fee; here B's remainder in fee paffes from the grantor at the fame time that feifin is delivered to A of his life-eftate in poffeffion. And it is this which induces the neceffity at common law of livery of feifin being made on the particular eftate, whenever a freehold remainder is created. (Litt. § 60. Co. Litt. 49.) 3. The remainder muft veft in the grantee during the continuance of the particular eftate, or *eo inftanti* that it determines. (Plowd. 25. 1 Rep. 66.) As if A be tenant for life, remainder to B in tail: here B's remainder is vefted in him, at the creation of the particular eftate to A for life: or if A and B be tenants for their joint lives, remainder to the furvivor in fee; here, though during their joint lives the remainder is vefted in neither, yet on the death of either of them, the remainder vefts inftantly in the furvivor; whence both thefe are good remainders. But if an eftate be limited to A for life, remainder to the eldeft fon of B in tail, and A dies before B hath any fon; here the remainder will be void, for it did not veft in any one during the continuance, nor at the determination, of the particular eftate: and even fuppofing that B fhould afterwards have a fon, he fhall not take by this remainder; for, as it did not veft at or before the end of the particular eftate, it never can veft at all, but is gone for ever. (1 Rep. 138.) Hence remainders are either *vefted* or *contingent*. *Vefted* remainders (or remainders executed, by which a prefent intereft paffes to the party, though to be enjoyed *in futuro*) are fuch where the eftate is invariably fixed, to remain to a determinate perfon after the particular eftate is fpent. As if A be tenant for twenty years, remainder to B in fee; here B's is a *vefted* remainder, which nothing can defeat or fet afide. *Contingent* or executory remainders (by which no prefent intereft paffes) are where the eftate in remainder is limited to take effect, either to a dubious and uncertain perfon, or upon a dubious or uncertain event; fo that the particular eftate may chance to be determined, and the remainder never take effect. (3 Rep. 20.) In the firft cafe, if A be tenant for life, with remainder to B's eldeft fon (then unborn) in tail, this is a contingent remainder, becaufe it is uncertain whether B will have a fon or not; and if A dies before B's fon is born, the remainder is abfolutely gone; even though A leaves his wife big with child, and after his death a pofthumous fon is born. (Salk. 228. 4 Mod. 282.) But to remedy this hardfhip, it is enacted by ftatute 10 & 11 W. III. cap. 16. that pofthumous children fhall be capable of taking in remainder, in the fame manner as if they had been born in their father's life-time; that is, the remainder is allowed to veft in them, while yet in their mother's womb. This fpecies of contingent remainder, to a perfon not in being, muft, however, be limited to fome one, that may by common poffibility, or *potentia propinqua*, be *in effe* at or before the particular eftate determines. (2 Rep. 51.) A remainder to a man's eldeft fon, who has none, is good; becaufe by common poffibility he may have one: but if it be limited in particular to his fon John or Richard, it is bad, if he have no fon of that name; for it is too remote a poffibility, that he fhould not only have a fon, but the fon of a particular name. (5 Rep. 51.) A limitation of a remainder to a baftard before he is born, is not good (Cro. Eliz. 505.); for though the law allows the poffibility of having baftards, it prefumes it to be a very remote and improbable contingency. In the fecond cafe, where land is given to A for life, and in cafe B furvives him, then with remainder to B in fee: here B is a certain perfon, but the remainder to him is a contingent remainder, depending upon the uncertainty of his furviving A. During the joint lives of B and A, it is contingent; and if B dies firft, it can never veft in his heirs, but is for ever gone; but if A dies firft, the remainder to B becomes vefted. Contingent remainders of either kind, if they amount to a freehold, cannot be limited on an eftate for years, or any other particular eftate, lefs than a freehold. Thus, if land be granted to A for ten years, with remainder in fee to the right heirs of B, this remainder is void (1 Rep. 130.); but if granted to A for life, with a like remainder, it is good. Contingent remainders may be defeated, by deftroying or determining the particular eftate upon which they depend, before the contingency happens, by which they become vefted. 1 Rep. 66. 155.

In devifes by laft will and teftament, remainders may be created in fome meafure contrary to the rules here laid down: though our lawyers will not allow fuch difpofitions to be ftrictly remainders; but call them by another name, that of executory devifes, or devifes hereafter to be executed. Blackft. Com. book ii. chap. 11. § 3.

Spelman makes the difference between a remainder and reverfion to confift in this; that by a reverfion, after the appointed term, the eftate returns to the donor, or his heirs, as the proper fountain; whereas by remainder it goes to fome third perfon or ftranger.

Or, a remainder is an expectancy, created by act of the parties; whereas a reverfion is created by act of law.

The limitations of perfonal goods and chattels, in remainder after a bequeft for life, are permitted in laft wills and teftaments: fo that if a man, either by deed or will, limits his books or furniture to A for life, with remainder over to B, this remainder is good. But where an eftate-tail in things perfonal is given to the firft or any fubfequent poffeffor, it vefts in him the total property, and no remainder over fhall be permitted on fuch a limitation. 1 P. Wms. 290.

Glanville obferves, that bifhops and abbots, in regard their baronies are the king's alms, cannot give any part of them by way of remainder.

Remainder, *Writ of formedon in the.* See Formedon.

Remainder, in *Mathematics*, is the difference; or that which is left after the taking a leffer number, or quantity, from a greater.

REMAL, in *Geography*, a town of Hindooftan; 18 miles N.W. of Agimere.

REMALAND, a town of France, in the department of the Orne, and chief place of a canton, in the diftrict of Mortagne. The place contains 1702, and the canton 11,68[illegible] inhabitants, on a territory of 202½ kiliometres, in 12 communes.

REMANCIPATE, *To*, in *Commerce*, is to fell or return a commodity to him who firft fold it.

REMANCIPATION, Remancipatio, among the Romans, a form of divorce obferved in marriages that had been contracted by *coemption*. This was done by delivering the wife into the hufband's hands; fo the marriage was diffolved

folved by the hufband's re-delivering the wife into any perfon's hands agreed upon between them.

REMAND, Fr., *To*, in *Military Language*, to fend back; as when a foldier, who has been brought out of prifon, or the guard-houfe, for the purpofe of being examined or tried, is fent back, without any thing final occurring relative to his cafe.

REMANSO, in *Geography*, a town of South America, in the province of Cordova; 170 miles N. of Cordova.

RE-MARRYING, the repeating of a marriage; or the going through the folemnities of a fecond marriage.

Clandeftine and uncanonical marriages are deemed null; and the parties are to be re-married in form; at leaft, it had always better be fo to avoid difputes.

It was anciently exprefsly forbid to re-marry in the firft year of viduity. M. Bayle obferves, that a perfon who does not re-marry, is anfwerable to the public for all the time loft in his viduity, or widowhood.

REMBANG, in *Geography*, a town on the N. coaft of the ifland of Java, where the Dutch had a refident merchant. It yields falt and timber, and was the place where the fmall veffels of the company were built; 45 miles N.E. of Samarang.

REMBERTUS, in *Biography*, the difciple, friend, and fellow labourer of Anfgarius, ftyled the apoftle of the north, was a native of Thurholt, in Flanders, in the monaftery of which, as well as in that of Corbey in Weftphalia, he officiated as fchool-mafter. He was one of the firft promoters of Chriftianity in Denmark, and in or about the year 860 he became bifhop of Ribe. After the death of Anfgarius, in 865, he was appointed to the archbifhopric of Hamburgh, which office he held till his death, in 888. He wrote, in conjunction with a friend, the life of Anfgarius, which is inferted in the firft volume of Langebeck's "Scriptores Rerum Danicarum." In this work Rembertus relates various facts, not elfewhere to be found, with regard to the ftate of Denmark at that period, but intermixed with fables. He collected extracts from Gregorius Magnus, whofe works no longer exift, and he wrote many letters, one of which only is to be found in the fecond volume of Langebeck's collection. An account of Rembert's life and miracles is given in the fame work. A Danifh writer, quoted in the General Biography, to which we are indebted for this article, in fpeaking of Rembert's labours, fays; "here we have not fo much the commencement of Danifh literature, as the feeds of it. They were fown by the exertions of Ebbo, Willehad, Anfgarius, and Rembert, but remained a long time, as it were, trodden down by the fevere perfecutions to which the Chriftians were expofed from Gormo the old, and other kings; and retarded in their growth by the rudenefs and barbarifm which formed the principal features in the character of a people, who were fonder of roving about on the feas to rob and murder, and of feafting and drinking, than of reading and writing books. At length, however, the feeds which he had fcattered took root, fprung up in the 11th century, and in the 12th and 13th produced abundance of fruit." Gen. Biog.

REMBERVILLERS, in *Geography*. See RAMBERVILLERS.

REMBRANDT, VAN RYN, in *Biography*, was born at a village near Leyden, in 1605. The real name of his family was Gerretfz; but he acquired that of Van Ryn, from having refided in early life at a village upon the banks of the Rhine.

The little which this extraordinary artift owed to tuition was derived firft from Zwanenburg, then from Peter Laftman, and afterwards from Jacob Pinas, from whofe manner fome are induced to think that Rembrandt drew his own inclination for powerful oppofitions of light and fhade; but whatever hints he may have obtained from others at the outfet of his practice, they were foon loft in the effulgence of his brilliant career, and abforbed in the luftre of his own over-powering abilities.

He was firft brought into notice by having taken a picture to the Hague, and offered it for fale to an able connoiffeur; who, confcious of his merit, treated him with kindnefs, and gave him a hundred florins for it. By this incident both himfelf and the public were made acquainted with his worth; and hence arofe the reputation and fuccefs he afterwards enjoyed. Inceffant occupation foon crowded upon him, and many pupils applied for admiffion into his fchool, with each of whom he received 100 florins a-year; and whofe copies of his pictures he not unfrequently fold as originals, after beftowing a fhort time upon them himfelf. By thefe means, aided by inceffant induftry, and the fale of etchings, which he produced with great facility and fkill, he accumulated confiderable wealth: his income, according to Sandrart, being, for a length of time, at leaft 2500 florins yearly.

His place of refidence, during this fuccefsful difplay of his talents, was Amfterdam, where his peculiarities procured him the character of a humorift, whilft his abilities aftonifhed and delighted his contemporaries, and he produced thofe works which ftill gratify fucceeding ages.

The peculiarities of his mind are as much obfervable in the manner of producing his effects, as in the choice of the materials. The execution of his earlier works was in a ftyle highly laboured, with great neatnefs, and patient completion of the figures; fuch is that of the picture of the woman taken in adultery at Mr. Angerftein's. As he advanced in art, he took liberties with the pencil, wrought with all the broad fulnefs of the brufh, and left the touch undifturbed: he even employed the ftick, the pallet-knife, or his fingers, accordingly as they were moft capable of producing the effect he defired, when feen at a proper diftance, difregarding the appearance of the work upon a clofer infpection.

In his pictures is exhibited a total inattention to the tafte of the antique; he is even faid to have made it a fubject of ridicule, and to have jocofely denominated a collection of old armour and rich dreffes, which he had collected and employed to ftudy and paint from, "his antiques." Thefe he evidently ufed as his models, though frequently in moft heterogeneous combination; but by an innate power of feizing the moft ftriking effects produced by light and fhade, fuperadded to the moft perfect maftery over the materials of the pallet, he always excited an intereft, either by originality or beauty.

It is not, however, the approval of his power in the technical part of the art, which can or ought to fatisfy the obferver of the works of Rembrandt. Entering with the warmth of a poet into the nature of his fubjects, he produced pictures which terrify with their fublimity, delight with their fuavity, or gratify us with the moft perfect tranfcripts of Nature, in her moft varied afpects. Being himfelf poffeffed of the full force of his fubject, he impreffes it ftrongly, and notwithftanding the frequent vulgarity, and even deformity of the agents he exhibits, he extorts from us praife before we have time to confider the means by which we are ftimulated to beftow it. To him every time and feafon was alike eafy of reprefentation; and all degrees of illumination, in form or quantity, he managed with the greateft perfection; no matter whether the fcene arofe from the breadth of the noon-day blaze, the dimnefs of twilight,

the

the darknefs of night, or the glimmerings of the lonely taper; whether the light were fpread over an extended fpace and a multitude of figures, or confined to the interior of a room, and ferving only to illumine the books or the figure of a fequeftered philofopher.

He was certainly a genius of the firft clafs, although the objects upon which he exercifed his powers bore little or no proportional value when compared with thofe felected by the beft Greek and Italian mafters. His invention was abundantly fertile, but employed generally among low characters and materials, although the fubject he treated might be, as it frequently was, of a facred or fublime quality. In defigning the nude, he never appears to have had a thought of an elevated nature concerning form. Such as the model prefented, he imitated with exactnefs, when he wifhed to be moft perfect; but he fometimes feems to have fported with the idea of felection, by making figures demanding grace and beauty, fuch as Venus, Cupid, &c. ftill more vulgar, and in actions more difgufting, than thofe he drew of common life. The redemption of this vulgarity and meannefs refts with the extreme force, depth, richnefs, brilliancy, and truth of his colouring, and the perfection with which he treated his chiaro-fcuro; which conjointly fafcinate the eye, and hold it in admiration, in fpite of the deformities prefented in defign.

The power of Rembrandt in the art he practifed was perfectly original, and its exercife quite unlike that of any other painter; being drawn from nature with the moft faithful and difcriminating eye, but with the moft peculiar felection. Always powerfully and beautifully executed, but not unfrequently too artificial; and only agreeable becaufe it is perfectly effective. All imitations of his ftyle which are not well wrought, reduce it to manner, and only exhibit the artifice by which it is conducted.

To guefs from the number and finifh of his works, he muft have painted with amazing facility. His fyftem appears to have been that of ufing the ground as a half teint, and repeating the lights and darks till he had obtained the effect he fought for. His pencil, particularly in his earlier and more finifhed works, is remarkably delicate, yet full; and has never been exactly imitated; though fome of his fcholars, as Bohl and Eckhout, approached very near it: none of them, however, appear to have imbibed any large portion of his clear perception of natural effects, which fo powerfully appeals to our fympathy in his fcenes of twilight, of tempeft, and the fpirit-ftirring gloom of night.

His pictures are juftly and highly valued, and are rarely to be purchafed; and then only at very high prices. We are poffeffed of many fine fpecimens of his talents, both in hiftory and portraiture; and the gallery of the Louvre is rich in his fmaller productions. At Florence alfo, and at Genoa, his name is efteemed, and his works preferved with due refpect.

He lived to the age of fixty-eight, and died in 1674.

REMDA, in *Geography*, a town of Saxony, in the principality of Eifenach; 11 miles S.S.W. of Jena. N. lat. 50°45′. E. long. 11° 19′.

REMEDIAL *Part of a Law*. See Law.

Remedial *Statutes*, are thofe which are made to fupply fuch defects, and abridge fuch fuperfluities, in the common law, as arife either from the general imperfection of all human laws, from change of time and circumftances, from the miftakes and unadvifed determinations of unlearned judges, or from any other caufes whatfoever. And this being done, either by enlarging the common law where it was too narrow and circumfcribed, or by reftraining it where it was too lax and luxuriant, hath occafioned another fubordinate divifion of remedial acts of parliament into enlarging and reftraining ftatutes. *E. gr.* In the cafe of treafon, clipping the current coin of the kingdom was an offence not fufficiently guarded againft by the common law; therefore it was thought expedient by ftatute 5 Eliz. cap. 11. to make it high treafon, which it was not at the common law; fo that this was an enlarging ftatute. At common law alfo fpiritual corporations might leafe out their eftates for any term of years, till prevented by the ftatute 13 Eliz. cap. 10. This was, therefore, a reftraining ftatute. Blackft. Com. book i.

REMEDIOS, in *Geography*, a town of South America, in the province of Popayan; 71 miles S. of Santa Fé de Antioquia.

Remedios, or *Noftra Segnora de los Remedios de Pueblo Nuevo*, a town of Mexico, in the province of Veragua; 90 miles W.N.W. of St. Yago. N. lat. 8° 44′. W. long. 82° 16′.

Remedios, or *Payafal*, a town of Mexico, in the province of Yucatan, in lake Pue. N. lat. 17° 3′. W. long. 91° 46′.

Remedios, a town of New Navarre; 120 miles S. of Cafa Grande.

REMEDY, in *Law*, is the action or means given by law for the recovery of a right.

Remedy, *Remedium*, in *Medicine*, any phyfical agent by which a difeafe may be alleviated or cured.

Remedies are either *general* or *topical*; the former comprehending fuch as influence the actions of the whole frame, as blood-letting from any large vein, the cold-bath, and almoft all thofe medicaments or drugs which are taken into the ftomach; the latter including thofe which are applied to, or in the vicinity of, any particular part which is difeafed: thus, among *topical* remedies, are blood-letting by leeches or cupping, blifters, iffues, cataplafms, ointments, plafters, &c.

The operation of remedies is rather a queftion of experience than of logical inveftigation. Some remedies, the number of which appears to be very limited, poffefs a *fpecific* power of curing certain difeafes. There are, perhaps, not more than two medicines, however, that are fairly entitled to the appellation of *fpecifics*: thefe are mercury, which cures the venereal difeafe, and fulphur, which cures the itch. The bark of cinchona has, indeed, been deemed a fpecific for intermittent fevers; but it is not entitled to fuch a character: and the eau medicinale, which has recently been brought forward as a fpecific for the gout, appears to have loft much of its reputation. The pretended fpecifics daily advertifed for many difeafes by quacks, are mere impofitions, being commonly difguifed forms of the moft active and dangerous medicines which are employed cautioufly by the faculty; fuch as arfenic, corrofive fublimate, and other preparations of mercury; laudanum, hemlock, and other narcotics. Of the former fpecies are Ward's ague-drop, and his white drop; of the latter, are Dalby's carminative, Godbold's balfam, and many others. The danger refulting from the ufe of thefe noftrums, arifes from the indifcriminate adminiftration of them in many difeafes which have a fimilar name, but which vary much in different conftitutions, and at different periods of life. Much injury is done by the conftant fale of thefe pretended fpecifics, by the impreffion which it contributes to maintain, that each difeafe has its fpecific remedy; whereas no opinion can be farther from the truth. When it is confidered that almoft every difeafe, though fimilar in name, arifes from feveral caufes (which we have already illuftrated when fpeaking of Cough), it will be obvious that the fame remedies muft be applied, upon general principles, to difeafes of different name, and different remedies to thofe which have the fame same appellation; and that, therefore, the cure of diseases is not to be effected by applying a certain remedy to a certain disease nominally the same, but only by first ascertaining the laws of the living body, and of its various organs, both in a state of health and of disease: in other words, the proper application of remedies can only be learned by much observation of diseases, after a previous study of the anatomy and physiology of the animal frame.

Remedies *Appended*. See Appensa.

Remedy *for the Master of the Mint*, in *Coinage*, denotes a certain allowance for deviation from the standard weight and fineness of coins. In some places the remedy is allowed in the weight, in others in the fineness; but mostly in both weight and fineness. It is considered generally as an allowance for the fallibility of workmanship; but in some foreign mints it is made a source of emolument: and when governments issue coins at a rate above their intrinsic value, the profit thus made is called "seignorage." Out of every fifteen pounds of gold coined at the mint in London (according to the account published by the learned Mr. Folkes, in his curious tables of English silver coins), some pieces are taken at random, and deposited in a strong box, called the pix: at certain intervals, sometimes of one year and sometimes of several years, the pix is opened at Westminster, in the presence of the lord chancellor, the lords commissioners of the treasury, and others; portions taken from the pieces of each coinage are melted together, and an assay made of the collective mass by a jury of the goldsmiths' company. At this trial the mint-master is held excusable, though the monies be either too base, or too light; provided the imperfection and deficiency together are less than the sixth part of a carat, which amounts to forty grains of fine gold on the pound of standard, or the one hundred and thirty-second part of the value. It is said that this remedy is contained within as narrow limits, as any workers can reasonably be supposed to make themselves answerable for. The remedy for silver coins is two pennyweights in the pound. If the deficiency or excess of the coin should be more than this, either in the weight, or in the fineness, or in both together, the money must be recoined at the expence of the master of the mint; and no allowance is made for remedy unless the error is supposed to have casually happened.

REMEE, in *Geography*, a town of Bengal; 16 miles S. of Koonda.

REMEMBRANCE, is when the idea of something formerly known recurs again to the mind, without the operation of a like object on the external sensory. See Memory, Reminiscence, and Recollection.

REMEMBRANCERS *of the Exchequer*, are two officers, or clerks, therein, formerly called *clerks of the remembrance*.

They are now distinguished by the appellations of the *king's remembrancer*, and the *lord treasurer's remembrancer*. There is also another officer, called the *remembrancer of first-fruits*. Their business is to put the lord treasurer and justices of the court in remembrance of such things as are to be called upon, and dealt in for the king's benefit.

Rememberancer, *The King's*, enters into his office all recognizances taken there before the barons, for any of the king's debts; for appearance; or for observing orders; and makes out process against the collectors of customs, subsidies, excise, and other public payments, for their accounts. All informations upon penal statutes are entered in this office; and there all matters upon English bills in the exchequer-chamber remain. He makes the bills of composition upon penal laws; takes the statement of debts; has delivered into his office all manner of indentures, fines, and other evidences whatsoever that concern the assuring of any lands to the crown: he every year, *in crastino Animarum*, reads, in open court, the statute for election of sheriffs, and gives them their oath, and reads the oath of all the officers of the exchequer, where they are admitted.

Remembrancer, *The Lord Treasurer's*, is charged to make process against all sheriffs, escheators, receivers, and bailiffs, for their account; process of fieri facias, extent for any debts due to the king, either in the pipe, or with the auditors; and process for all such revenues as are due to the king, by reason of his tenures. He also makes record, by which it appears, whether sheriffs, or other accountants, pay their proffers due at Easter and Michaelmas. He makes another record, whether sheriffs, or other accountants, keep their days of prefixion: all estreats or fines, issues, and amerciaments, set in any of the courts of Westminster, or at the assizes or sessions, are certified into his office, and are by him delivered to the clerk of the estreats to write process upon them, &c.

Remembrancer *of the First Fruits*, he who takes all compositions and bonds for first fruits and tenths; and makes process against such as do not pay the same.

Remembrancer is also the title of an officer in the city of London, who is to attend the lord mayor on certain days, and whose business is to remind his lordship of the select days, when he is to go abroad with the aldermen, &c. He is to attend daily at the parliament-house during the sessions, and to report to the lord mayor their transactions.

REMI, St., in *Biography*, archbishop of Rheims, who converted Clovis to Christianity, and baptized that monarch. He died about the year 535. There are some letters which pass under his name, but they are of a very doubtful authority. There was another saint of this name, or, as he is sometimes styled, Remigius, who was archbishop of Lyons, and presided in the council of Valentia in 855. He was a steady supporter of the doctrine of St. Augustine, on grace and predestination, in several works that are now extant. He died in 875.

Remi, Joseph Honore, an advocate in the parliament of Paris, was born in 1738. At the age of eight he lost his sight, and it was believed irrecoverably, by the small-pox; but when he had attained the age of fourteen he was in the enjoyment of his eyes. He was author of a burlesque poem, entitled "Days," in opposition to Young's Night Thoughts; but his principal work is an eloge on the chancellor de L'Hôpital, which was crowned by the French academy in 1777, and censured by the Sorbonne. He also wrote the eloges of Moliere, Colbert, and Fenelon, and furnished the articles relating to jurisprudence for the French Encyclopædia. He died in the year 1782.

Remi of Auxerre. See Remigius.

Remi, *Order of St.*, or of the *Holy Vial*, an order of knighthood in France, which, according to the most approved historians of that kingdom, was instituted by Clovis, king of France, in the year 499. The reigning king of France is always sovereign of this order, and the knights companions are never more than four; nor is it ever conferred on any persons but the barons, Terrier, Belestre, Venestre, and Louverse, who stile themselves baron knights of the Holy Vial, and are the bearers of the canopy under which the vial is carried from the abbey of St. Remi to the cathedral of Rheims, for the inauguration of the kings of France at their coronations. The badge of this order, which is worn pendant to a black ribbon, is "a cross of gold, enamelled white, cantoned with four fleur-de-lis; on the cross, crofs, a dove defcending, dipping its beak into a vial held in a hand, all proper."

REMICH, in *Geography*, a town of France, in the department of the Forefts, and chief place of a canton, in the diftrict of Luxembourg, feated on the Mofelle; 12 miles E. of Luxembourg. The place contains 1480, and the canton 10,885 inhabitants, on a territory of 230 kiliometres, in 15 communes.

REMIGES, in *Ornithology*, denote the primary and fecondary wing-feathers.

REMIGIO, Fiorentino, in *Biography*, a man of letters in Italy, was a native of Florence. He entered at an early period into the Dominican order, and was called to Rome by pope Pius V. to fuperintend an edition of the works of St. Thomas. He was himfelf a confiderable author, and publifhed "A Commentary on the whole Scriptures;" tranflations of "Ammianus Marcellinus;" "Cornelius Nepos;" and "Fazello's Hiftory of Sicily;" "Reflections on Guicciardini's Hiftory;" "Italian Poems;" and "A Tranflation in Verfe of Ovid's Heroic Epiftles," of which an elegant edition was printed at Paris in 1762. He died at Florence in 1580, about the age of 62. Moreri.

REMIGIUS. See Remi.

Remigius of Auxerre, a learned French Benedictine monk in the ninth century, derived his furname from the abbey of St. Germain, at Auxerre, where he embraced the religious profeffion. He diftinguifhed himfelf by his proficiency in profane and facred literature, at a dark and barbarous period, and was placed at the head of the fchools belonging to his monaftery. About the year 882, he was called to Rheims by Foulques, the fucceffor of Hincmar in that fee, who gave him the direction of the literary feminary which he had founded in his metropolitan city. Here he taught with great reputation for feveral years, after which he went to Paris, where he opened the firft public fchool in that city, after the decline of learning which followed the ravages of the Normans. In the life of pope Formofus, by Platina, the name of Remigius of Auxerre is the only one that occurs of a perfon eminent for learning under that pontificate. He was author of "Commentarius in omnes Davidis Pfalmos," which was publifhed at Cologne in 1536. It confifts very much of the collected opinions and explications of St. Ambrofe, St. Auguftine, and Caffiodorus, reduced into one mafs.—Another work of this author was entitled "Enarratio in pofteriores XI. minores Prophetas," publifhed at Antwerp in the year 1545, with the "Commentaries" of Oecumenius upon the Acts of the Apoftles, and their Epiftles, and thofe of Arethas upon the book of Revelation; and "Expofitio Miffæ," deduced from the fentiments and authority of the fathers. Some critics have given, among the productions of Remigius, the "Commentary upon the Epiftles of St. Paul," which by others has been afcribed to St. Remi, or Remigius, but which in truth are fuppofed to belong to Haymo, a German bifhop, who flourifhed in the ninth century, and who was author of a long lift of theological works. Such at leaft is the opinion of Du Pin, in oppofition, indeed, to the authority of Mofheim. Moreri.

Remigius left behind him "A Commentary on the Mufical Treatife of Martianus Capella," which is ftill fubfifting among the MSS. in the king of France's library, N° 5304. He acquired his fcience from Heric. Heric was the difciple of Rabanus, and Hayman of Halberftadt, who had converfed with the Roman fingers fent into France by pope Adrian.

REMILLY, in *Geography*, a town of France, in the department of the Ardennes; 7 miles W. of Charleville.

REMINISCENCE, Reminiscentia, is that power of the human mind, by which it recollects itfelf, or calls again to its remembrance fuch ideas or notions as it had really forgot: in which it differs from *memory*, which is a treafuring up of things in the mind, and keeping them there, without forgetting them.

Hence memory may be confidered as a continual remembrance; and reminifcence as an interrupted memory.

How near akin foever the two faculties may feem, yet they are generally found feparated; fo that they who excel in the one, are generally defective in the other.

The ancient Platonifts were of opinion, that all learning and knowledge confifted in the reminifcence or recollection of notices which had been in the foul before its union with the body.

REMINISCERE, the fecond Sunday in Lent; anciently thus called from the firft word of the introit of the mafs faid for that day, "Reminifcere miferationum tuarum."

REMIREA, in *Botany*, Aubl. Guian. 44. t. 16. Brown Prodr. Nov. Holl. v. 1. 236. (See Miegia.) We are unacquainted with Mr. Brown's reafons for preferring the above name, whofe origin does not appear, and which the claffical Schreber rejected as barbarous.

REMIREMONT, in *Geography*, a town of France, and principal place of a diftrict, in the department of the Vofges; 10 miles S.S.E. of Epinal. The town contains 3250, and the canton 14,916 inhabitants, on a territory of 235 kiliometres, in 15 communes. N. lat. 48° 1'. E. long. 6° 40'.

REMISIT. — *Recto quando dominus Remifit.* See Recto.

REMISSAM, in *Geography*. See Remsa.

REMISSION, in *Law*, &c. denotes the pardon of a crime, or the giving up the punifhment due to it.

Remission, in *Medicine*, is when a diftemper abates, but does not go quite off, before it returns again: as is common in fevers which do not quite intermit. See Remittent.

Remission, *Remiffio*, in *Phyfics*, the abatement of the power or efficacy of any quality. In oppofition to the increafe of the fame, which is called its *intenfion*.

In all qualities capable of intenfion and remiffion, the intenfion decreafes as the fquares of the diftance from the centre of the radiating quality increafe.

Remission, *Remiffio*, ἄνεσις, in the *Ancient Mufic*, was ufed to fignify the paffage of the voice from acute to grave, being oppofite to intenfion.

REMIT, in *Commerce*. To remit a fum of money, bill, or the like, is to fend a fum of money, &c.

To remit is alfo ufed among bankers for what is accuftomed to be given a banker, or, as it were, difcounted with him, for his giving a bill of exchange.

To remit is alfo to give up part of one's due to a debtor; as, I would remit you a fourth of what you owe on condition of paying me the reft in hand.

REMITTANCE, in *Commerce*, the traffic or return of money from one place to another, by bills of exchange, orders, or the like.

A remittance is properly a bill of exchange, or the like, fent to a correfpondent, and the content of it to be received by him, or fome other perfon, on whom it is drawn. By means of thefe remittances, large fums of money are returned from one city to another, without danger, without carriage, &c.

In London it is eaſy to get remittances upon any city in the world; in the country it is more difficult.

Remittances, *Book of.* See Book.

Remittance is alſo uſed in ſpeaking of the payment of a bill of exchange.

Remittance alſo denotes the due or fee allowed the banker or merchant, both on account of his trouble, and the different value of the ſpecies in the place where you pay the money, and where he remits it.

This remittance is more uſually called *change* and *rechange*.

REMITTENT, in *Medicine*, implying alſo the word *fever*, is a fever which is characteriſed by a regular decreaſe and exacerbation of its ſymptoms every day, and differs from an *intermittent*, inaſmuch as the ſymptoms never diſappear altogether, and the exacerbation is neither begun by the complete rigors, nor terminated by the profuſe ſweat, which occur in the latter. The remittent fever, however, originates, in common with the intermittent, from the influence of marſh effluvia, but under particular circumſtances, which will be ſtated immediately.

It is ſcarcely neceſſary to deſcribe minutely the ſymptoms of the remittent fever after the ample detail which we have given of thoſe of fever in general (ſee Fever); and it varies extremely in its character, according to the ſeaſon, climate, and other circumſtances under which it appears. In its milder forms, the remittent begins with chillineſs, laſſitude, pains in the bones, head-ache, and a diſordered condition of the ſtomach, loſs of appetite, ſickneſs, and even vomiting. At night the febrile ſymptoms run high; the heat and thirſt are great, the tongue and mouth are parched, the pain of the head is violent, the patient is totally unable to ſleep, and is continually toſſing and tumbling about, and often becomes delirious. But generally in the morning, an imperfect ſweat brings on a remiſſion of all the ſymptoms. In the evening, the paroxyſm returns, but is not preceded by any cold ſit or ſhivering; yet it is commonly more ſevere than the former. Next morning it remits as before; and theſe periodical changes recur daily, becoming, however, leſs marked, if the diſeaſe be neglected, until the fever inſenſibly aſſumes a continued form. The pulſe is full and quick during the exacerbations, and continues during the remiſſions to indicate fever; but rigors ſeldom precede the fits after the firſt attack. Many patients diſcharge a bilious matter from their ſtomachs by vomiting, and all are diſordered in that organ. In the more violent forms, which take place in hotter ſeaſons and climates, the diſeaſe often ſeizes the patient at once with a burning and violent head-ache, with little or no ſenſible chillineſs preceding it. The thirſt and heat are intenſe, and acute pains in the back and all the limbs, with extreme laſſitude and inquietude, haraſs the patient, and nauſea, vomiting, and pain of the ſtomach enſue. In ſome inſtances, indeed, the head becomes ſo ſuddenly and violently affected, that a violent delirium, aſſuming the appearance of inſanity, ſeizes the patient without any previous indication, until the remiſſion evinces the nature of the diſeaſe. Many of the ſick become yellow, as if affected with jaundice. Indeed, the remittent fever aſſumes every degree of violence, from the autumnal bilious fever of temperate climates, to the moſt ſevere *yellow fever* of tropical countries.

The circumſtances under which theſe varieties of form occur, have been amply aſcertained by experience. The combination of marſh effluvia and great heat are neceſſary to the production of theſe fevers; and they are violent, nearly in proportion to the degree of the latter. In cold climates, and in cool ſeaſons, as the ſpring, the miaſmata excite but the common intermittent ague. But in the autumnal ſeaſon, eſpecially when the heat is conſiderable, and the quantity of miaſma great, as in the Low Countries, in particular years, the production of theſe fevers is very extenſive; they become actually endemic, and affect eſpecially thoſe perſons who are not accuſtomed to the climate. The experience of all our military expeditions to Holland and Flanders, in the autumnal ſeaſon, affords fatal proof of this truth. (See the writings of ſir John Pringle, Dr. Home, &c. on the Diſeaſes of the Army in the Campaigns of 1742—1748, incluſive. And the ſevere epidemic of Walcheren, at a more recent period, cannot be forgotten.) In theſe climates, the *remittent* uſually commences at the cloſe of ſummer, in a milder form, and gradually aſſumes a more violent and formidable character, as the heats of autumn advance. But if we extend our inquiries to the hotter regions of the globe, we find the diſeaſe under its moſt ſevere and fatal forms. In the ſouth of Europe, eſpecially in Spain, and thoſe parts of the Mediterranean coaſts where miaſmata are found, the autumnal remittent becomes a formidable malady in particular ſeaſons; but we muſt proceed to the Weſt Indies and America to diſcover the diſeaſe in its moſt terrific form; for although there may be a contagious fever, which puts on the *yellow* or bilious character, Dr. Bancroft appears to have demonſtrated, ſatisfactorily, that the *yellow fever*, commonly ſo called, is but the ſevereſt form of the endemic remittent of the hot ſeaſons of hot climates. (See his able "Eſſay on the Diſeaſe called Yellow Fever, &c." 1811). He affirms, indeed, that all fevers, occurring in thoſe countries in which the atmoſpheric heat riſes, during certain ſeaſons, to the 85th degree of Fahrenheit's thermometer, have a tendency to aſſume that violent and dangerous appearance, which is uſually conſidered as characteriſtic of the yellow fever.

The teſtimony of all experienced medical obſervers concurs in proving the origin of remittent fevers from the influence of miaſmata. Thus, among the hiſtorians of diſeaſe, as it occurs among ſeamen in warm climates, Drs. Lind, Blane, Hunter, and others, have demonſtrated the excluſive attacks of theſe fevers to be among thoſe men who have gone on ſhore, in ſwampy grounds, for water, &c.; and eſpecially among thoſe who ſpend the night on ſhore. Many inſtances are recorded, in which all the men ſo employed have been ſeized with fevers, while the reſt of the ſhip's company have remained in health. (See Dr. Lind, on the Diſeaſes incidental to Europeans in Hot Climates, p. 27. 221, &c. 5th edit. Dr. Blane, on the Diſeaſes of Seamen, p. 92, and 392.) Again, ſir John Pringle, in his valuable work on the diſeaſes of the army, has not only ſtated many facts which occurred under his own obſervation, but has adduced many proofs from the writings of ancient phyſicians and hiſtorians, in corroboration of the evidence that theſe fevers have, every where, and at all times, originated in hot ſeaſons, in circumſtances where miaſmata exiſted. (Part 3. chap. iv. ſect. 3.) In times, indeed, not very remote, when the want of proper means of carrying off the filth and refuſe of large towns by proper drains, and ſcavengers were not employed, and when the materials for the production of miaſmata were accumulated even in the ſtreets, the remittent and intermittent fevers were epidemic, in favourable ſeaſons, for the generation of the miaſmata, and the ſource of conſiderable fatality. Thus, even in London, Dr. Short remarks that, early in the ſeventeenth century, "one of forty of the whole that died of fevers, died of agues." (See his New Obſervations, &c. on Bills of Mortality, p. 203.) And Burnet, in his Hiſtory of the Reformation, ſays, that in the laſt year of queen Mary's reign, they "raged like a plague." At a later period, we have

have the teſtimony of Sydenham and Morton, in proof of the great prevalence of remittents in London; and Morton affirms that they were extremely deſtructive for ſeveral years before the great plague, *viz.* from 1658 to 1664. He ſtates that Oliver Cromwell died of an attack of remittent fever in the former of theſe years, and that he loſt his own father, who was himſelf an experienced phyſician, from the ſame diſeaſe, which had gone through his whole family. (Morton, Pyretologia, append. ad Exerc. ii.) "The reſult of the whole, therefore, is," to uſe the words of ſir John Pringle, "wherever the greateſt cauſes of moiſture and putrefaction in the air exiſt, there alſo will be ſeen the greateſt number and the worſt kinds of the remitting and intermitting fevers." This truth is farther confirmed by the negative evidence, that theſe fevers have ceaſed to exiſt where marſhes have been drained, where towns have become cleanly, when armies have moved to dry ſituations, and when the heats of particular ſeaſons have ceaſed, or failed to occur.

What the nature of theſe miaſmata is, the inveſtigations of philoſophers have not yet taught us. Dr. Bancroft has entered at great length, and with great ability, into this queſtion, reaſoning from a large collection of important evidence. He details a number of intereſting facts, which ſeem to lead ſatisfactorily to the concluſion, that the mere exhalations from *putrefying animal matter*, however offenſive to the ſenſes, are never productive of fevers. The ſame inference has been deduced, not leſs ſatisfactorily, by Dr. Chiſholm, in a very elaborate and able diſſertation upon this topic, publiſhed in the Edinburgh Medical and Surgical Journal for October, 1810, vol. vi. p. 389. However contrary to the general opinion, this doctrine, that mere putrefaction is not the ſource of contagion and fever, appears, indeed, by theſe writers to be eſtabliſhed. The experiment, in fact, has been tried on a large ſcale in France, in the caſe of the prodigious exhumations made in the church-yard of St. Eloi, at Dunkirk, in 1783, and in that of the ſaints Innocents at Paris, in 1786. In the latter caſe, nearly 20,000 bodies were taken up, in every ſtage of putrefaction, and a conſiderable part of the work was carried on during the greateſt heats of ſummer, rendering the whole city offenſive; yet no fever was occaſioned by this immenſe maſs of corruption. (See M. Thouret's Memoir in the Journal de Phyſique, for 1791, p. 253; and the Annales de Chimie, vol. vi.) The good health of nightmen, of perſons living in diſſecting-rooms, of thoſe employed in the manufactory near Bath of a ſort of ſpermaceti from putrefying fleſh of all deſcriptions, and many other ſtriking facts, detailed by the two authors juſt quoted, conſtitute a ſtrong evidence in proof of the abſence of inſalubrity from mere putrefaction.

Dr. Bancroft next proceeds to prove, by another ample collection of facts and teſtimonies, that it is not the mere *aqueous vapour* that conſtitutes the morbific quality of marſh-miaſms. The principal proofs that mere moiſture is incapable of producing theſe fevers, are, that ſailors at ſea for many months are generally very healthy; that no ſet of men are more uniformly ſo than the Newfoundland fiſhermen, who are uſually enveloped in the dampeſt fogs for ſeveral months together; that while perſons living on ſhore on unwholeſome iſlands, as at Walcheren, are ſpeedily attacked with fevers, thoſe who remain on ſhip-board, at a little diſtance from land, entirely eſcape them; and that the occurrence of theſe fevers has been frequently prevented by laying ſwampy ground under water, under which circumſtances the moiſture of the atmoſphere muſt be highly augmented.

Conſidering, then, that the mineral part of the ſoil is not vaporizable in any natural heat, and that animal ſubſtances in a ſtate of putrefaction are incapable of producing fever, as well as the mere aqueous vapour, Dr. Bancroft was diſpoſed to conclude, that the morbific exhalations in queſtion ariſe wholly from "the mutual decompoſition of vegetable matters and water;" and that thoſe ſwampy grounds are moſt likely to emit them, which contain the largeſt proportion of ſuch matters, and in which the decompoſition is moſt rapid and complete. This concluſion, he is of opinion, is confirmed by the facts that the exhalations from macerating hemp and flax are well known in Italy to produce fevers, and that thoſe ariſing from heaps of decaying indigo, in the Eaſt and Weſt Indies, have produced the ſame effects. See his Eſſay on Yellow Fever, above quoted.

Of the Treatment of Remittent Fevers.—As the violence of the ſymptoms, and conſequently the actual character of theſe diſeaſes, vary materially in different ſeaſons, climates, and circumſtances, under which they occur; ſo no uniform rule of treatment can be purſued for their cure. The ſame remedies, indeed, which at one period of the ſame fever are beneficial, are hurtful if reſorted to at another. This obſervation, however, is applicable to all febrile diſeaſes, and cannot be too often inculcated; ſince not only empiriciſm, but the routine of too many of the profeſſion, tends to the appropriation of ſome leading remedy, whenever the name of a particular fever is mentioned: with ſome it is bark, with others antimony, and with others mercury; the indiſcriminate uſe of any of which muſt be neceſſarily productive of injury.

In the more violent forms of the diſeaſe, which are common in hot climates, and in which the attack is marked by a ſudden and ſevere affection of the head, with a hard, full, and ſtrong pulſe, indicating, with other ſymptoms, an inflammatory affection of the brain, perhaps the only remedy which is capable of arreſting the diſeaſe, is ſpeedy and free *blood-letting*. In the moſt violent forms of all, this evacuation ſhould be reſorted to very early, as within the firſt twenty-four hours, or the miſchief will have advanced beyond the reach of this remedy. In milder caſes, a moderate bleeding from the temporal artery or jugular vein, or even from the arm, within the firſt day or two, will often remove the danger and ſeverity of the fever. The repetition and extent of the bleedings muſt be determined by a conſideration of the violence of the ſymptoms, the duration of the diſeaſe, and the vigour of the patient. The notion that theſe fevers of hot climates are of a *putrid* nature, becauſe they ſpeedily run on to ſymptoms of debility, or putreſcency, as they have been called, appear to be altogether erroneous; and it is now generally admitted, that the only effectual mode of preventing theſe ſymptoms, is by arreſting the violent inflammatory excitement in the beginning, of which they are the immediate effect.

The next moſt effectual remedy, if reſorted to alſo ſufficiently early, is purgation. The purgatives adminiſtered ſhould be ſuch as in bulk and quality are not calculated to offend the ſtomach, which is uſually in an irritable ſtate: calomel, with jalap, anſwers the purpoſe well; and it is in all probability by its purgative quality alone, that mercury has been found beneficial in theſe fevers. The efficacy of mercurial purgatives, indeed, ſeems to have been fully eſtabliſhed by the recent experience of our naval and military practitioners, in every quarter of the globe; while the mercurial practice, which had for its object the excitement of ſalivation, is ſhewn by Dr. Bancroft, from the teſtimony of Dr. Ruſh and others, its advocates, to have been by no means ſucceſsful.

This early excitement is alſo conſiderably alleviated by the application of *cold* in every mode. Almoſt all the modern

dern writers bear their teftimony to the important auxiliary operation of the cold and tepid affufion; although they admit that, alone, its effects are not fufficiently powerful or permanent to be depended upon. *Coolnefs* of the patient is to be promoted by every means; by the free ufe of cold aqueous drinks, by frequent wafhing, by the full admiffion of frefh air, and by the ufe of few and light coverings on the bed.

Thefe remedies fhould be actively employed, and repeated on the return or non-ceffation of the fymptoms of excitement. For as an intelligent phyfician has remarked, "the great object is the removal of the local affection of the brain, or other organ, and the production of a complete remiffion of the febrile fymptoms, in the leaft poffible time, by which the dangerous fymptoms of the latter ftages are prevented or greatly mitigated, and a perfect and rapid recovery infured." (See Dr. Burnett's Account of the Bilious Remittent Fever in the Mediterranean, p. 22. Lond. 1814.) This object is rather impeded, than affifted, by the adminiftration of emetics and fudorifics; and altogether defeated by the ufe of bark, cordials, or ftimulants of any kind, whether in the way of food or medicine. With refpect to emetics, they are objectionable in all ftages of the difeafe; for they not only fail in removing naufea, but actually increafe that diftreffing fymptom: their operation aggravates the affection of the head, of which the naufea appears to be fympathetic; and as the tendency of the difeafe is to augment irritability of the ftomach, which often becomes extreme and diftreffing in the latter ftages, fo they contribute to aggravate this and other dangerous fymptoms. Sudorifics are alfo to be condemned; for, in the firft place, they are unneceffary, becaufe a natural perfpiration will readily enfue, as foon as the excefs of heat above the ftandard of health has been removed, which can be accomplifhed with certainty by the proper application of cold water to the furface of the body; and, in the next place, the fudorifics which are ufed are apt to increafe the irritability of the ftomach; and if they fail to excite a diaphorefis, they increafe the heat and the determination to the head, and tend to lengthen the paroxyfm. With regard to the bark and cordials, they are invariably injurious in the firft ftage of the fever. When a diftinct remiffion has taken place, fome writers recommend the immediate adminiftration of cinchona; but even thefe admit, that "if it be given when there is a parched fkin, a hard pulfe, a dry tongue, great heat and pain at the ftomach, or delirium, it will generally be found to increafe and prolong thefe fymptoms." (See Bancroft, loc. cit. p. 76.) On the whole, however, the late experience in the Mediterranean led to the rejection of the ufe of bark, while any febrile fymptoms whatever remained. "Under its ufe," fays Dr. Burnett, "mortality has been great, relapfe frequent, and (as in the cafes of the Temeraire and Invincible) dyfentery attacked nearly all the patients who had fever in a fevere form; nor was there an inftance, as far as I could learn, that, when given during a fuppofed remiffion of the fymptoms, it prevented a return of the paroxyfm. Too often it has been given with wine at the commencement of this difeafe, when the tongue has foon put on a brown, dry, and furred appearance; the anxiety, delirium, and irritability of the ftomach, have been much increafed; the whole train of nervous fymptoms foon became formidable, refifting every means of alleviation, till death has put a period to the fufferings of the patient." Loc. cit. p. 34.

If any thing were wanting to corroborate the foregoing deductions from experience, in favour of the antiphlogiftic and evacuant plan of treatment, in the commencement of remittent fevers, the detail of the appearances obferved on diffection, after the death of patients in thefe fevers, would amply fupport them, by the proofs which it affords of the inflammatory condition of various organs of the body in thefe fatal cafes. In different inftances, inveftigated by Dr. Burnett and his colleagues in the Mediterranean, the veffels of *the brain* were generally diftended, and in many cafes completely gorged, with blood; the membranes of that organ were confiderably inflamed, often prefenting what that writer calls "a blood-fhot appearance," and depofitions of coagulable lymph were feen among the convolutions: there were occafionally alfo adhefions, and the ventricles were often diftended with a fluid, fometimes limpid, fometimes yellow. Appearances of *high inflammation* prefented themfelves in the cavity of the cheft, affecting the lungs, pericardium, and diaphragm; and thefe were connected with depofitions of lymph and effufions of ferum. In the abdomen, the liver was generally found enlarged, and fometimes exhibiting marks of inflammation; the ftomach diftended with air, more or lefs inflamed, and containing a dark coloured matter; and the inteftines in a fimilar condition, with frequent intus-fufception.

Thefe appearances, which are in fact the effect of the continuance of the febrile actions in the organs in queftion, fufficiently prove that the firft ftage is the time when active remedies, of an anti-inflammatory power, can be chiefly expected to produce a very decided removal of the difeafe. When the fever is a little more advanced, the principal object of the practitioner is to diminifh the violence of any local affection that may be fevere. Thus, if head-ache remains, with flufhed countenance, fuffufion of the eyes, and a firm pulfe, a fmall bleeding from the temporal artery (the pulfe being at the fame time carefully examined) may be employed with advantage: a blifter, applied to the head at this time, is alfo manifeftly beneficial; and daily evacuations of the bowels fhould be procured by gentle laxatives, fuch as caftor oil, or glyfters, the powerful cathartics being now laid afide. Irritability of the ftomach, which is often diftreffing at this period, is relieved by the effervefcing draught, and by the application of leeches, or of a large blifter to the pit of the ftomach. A degree of ftupor fometimes fupervenes, which is often removed by a blifter applied to the neck or forehead, or by the application of leeches to the temples. If there is any obvious affection of the abdominal vifcera, which fhould be carefully inquired into, blifters, and, above all, the warm bath, fhould be reforted to, as well as copious emollient glyfters.

If, however, from want of the means of relief, or from the violence of the difeafe, it has advanced to that ftage, in which the yellow fuffufion of the fkin appears, and various nervous fymptoms, fubfultus, tremors, &c. come on, with increafed uneafinefs about the ftomach, hiccup, or vomiting of a dark matter, refembling coffee-grounds, with ifchuria, and a finking or intermiffion of the pulfe, little more can be done than to look on, and endeavour to obviate fymptoms as they occur. "Singultus," to borrow again the words of Dr. Burnett, "is a dangerous, and commonly a moft haraffing fymptom at this time: it will often be relieved by camphorated julep, to which may be added opium and æther. If the pulfe fink, the ftimuli muft be increafed; and under thefe circumftances, I have found the carbonate of ammonia, with aromatic confection, of fingular benefit. But while we endeavour to reftore the circulation, *care muft be taken not to induce a ftate of fecondary excitement*; and as the pulfe rifes, the ftimuli fhould be decreafed. Conftant attention muft ftill be paid to the daily evacuation of the bowels; but at a period, when the excitability of the fyftem

tem is nearly deftroyed, powerful cathartics will be attended with the moft deleterious confequences: glyfters are particularly ferviceable at this time. As the difeafe advances, the fecretions are at times voided involuntarily: in a few I have obferved a retention of urine, and in thefe laft cafes the catheter fhould be ufed; but as a general fymptom, there is far oftener a deficiency in the fecretion of that fluid. Frequently in this ftate, the ftomach rejects every thing. We may now fafely indulge the patient *moderately* with any thing to which his fancy leads him. Bottled porter, wine, and brandy and water, have been found beneficial. But no remedy can be relied on with any degree of certainty: whatever calms the irritability of the ftomach, and moderately fupports the excitability of the fyftem, is ufeful. A few fpoonfuls of arrow-root or fago, with wine and fpice, given occafionally, will often be retained by the patient, and greatly at this period affift the cure." Burnett, loc. cit. p. 29.

During the *ftate of convalefcence* at every period, whether from a complete remiffion being procured early, or from a gradual ceffation of the difeafe, extreme caution is neceffary in regard to preventing repletion: in the former cafe, it is apt to induce a relapfe; and in the latter, it will retard the cure. During the whole progrefs of recovery, attention fhould be paid to the regularity of the bowels. Some light tonic, as an infufion of quaffia, gentian, or cinchona, with an aromatic or fulphuric acid, may be adminiftered. When the yellow fuffufion of the fkin has been great, a protracted convalefcence is commonly the confequence; and is often attended with irregular affections of the bowels, and fymptoms of indigeftion. In thefe cafes, fmall dofes of the mercurial pill, with an occafional gentle purgative of caftor oil or rhubarb, are very beneficial. It is almoft exclufively, indeed, in thefe protracted cafes, where a morbid affection of the liver, brain, or fome other vifcera, has been the refult of the uninterrupted violence of the firft ftage of the fever, and efpecially when there is reafon to fuppofe that affufion had taken place within the cranium, that mercury, in fmall dofes, is of any actual utility. Small dofes of calomel, or of the pilula hydrargyri, fhould be adminiftered until fome fenfible, but flight, effect be produced on the falivary fyftem; after which the difeafe often ceafes of itfelf, or is readily removed by the ufe of the Peruvian bark. See Burnett on the Bilious Remittent in the Mediterranean; Bancroft on the Yellow Fever; and Irvine on the Difeafes of Sicily. See alfo Fever, *Yellow*, and Miasma.

Remittent *Fever of Children*, the *febris infantum remittens* of Dr. Butter, which is a very common affection of children, when the abdominal organs are deranged, has already been defcribed at length, under the head of Infants, § 5. *Febrile Difeafes of*; which fee.

REMITTER, in *Law*. Where a man has two titles to land, and is feifed by the latter; and, that proving defective, he is remitted or reftored to the former more ancient title; this is called a *remitter*, from the Latin, *remittere, to fend back*.

If land defcend to him that had right to it before, he fhall be remitted to his better title, if he pleafe. 1 Inft. 347. *b.* Litt. § 659.

Remitter is claffed (with *retainer*) by judge Blackftone, among thofe remedies for private wrongs, which are effected by the mere operation of law, and is thus defcribed: remitter is where he, who hath the true property or *jus proprietatis* in lands, but is out of poffeffion thereof, and hath no right to enter, without recovering poffeffion in an action, hath afterwards the freehold caft upon him by fome fubfequent, and of courfe defective title: in this cafe, he is remitted, or fent back, by operation of law, to his ancient and more certain title. (Litt. § 659.) The right of entry, which he hath gained by a bad title, fhall be *ipfo facto* annexed to his own inherent good one; and his defeafible eftate fhall be utterly defeated and annulled, by the inftantaneous act of law, without his participation or confent. (Co. Litt. 358. Cro. Jac. 489.) As if A diffeifes B, that is, turns him out of poffeffion, and dies leaving a fon C; hereby the eftate defcends to C, the fon of A, and B is barred from entering thereon till he proves his right in an action: now, if afterwards C, the heir of the diffeifor, makes a leafe for life to D, with remainder to B the diffeifee for life, and D dies; hereby the remainder accrues to B, the diffeifee; who thus gaining a new freehold by virtue of the remainder, which is a bad title, is by act of law remitted, or in of his former and furer eftate. (Finch. L. 194. Litt. § 683.) For he hath hereby gained a new right of poffeffion, to which the law immediately annexes his ancient right of property.

If the fubfequent eftate, or right of poffeffion, be gained by a man's own act or confent, as by immediate purchafe being of full age, he fhall not be remitted. For the taking fuch fubfequent eftate was his own folly, and fhall be looked upon as a waiver of his prior right. (Co. Litt. 348. 350.) Therefore it is to be obferved, that to every remitter there are regularly thefe incidents; an ancient right, and a new defeafible eftate of freehold, uniting in one and the fame perfon; which defeafible eftate muft be *caft upon* the tenant, not gained by his own act or folly. The reafon given by Littleton (§ 661.), why this remedy, which operates filently and by the mere act of law, was allowed, is fomewhat fimilar to that given under the article Retainer; becaufe otherwife he who hath right would be deprived of all remedy. For as he himfelf is the perfon in poffeffion of the freehold, there is no other perfon againft whom he can bring an action, to eftablifh his prior right. And for this caufe the law doth adjudge him in by remitter; that is, in fuch plight as if he had lawfully recovered the fame land by fuit. For, as lord Bacon obferves (Elem. c. 9.), the benignity of the law is fuch, as when, to preferve the principles and grounds of law, it depriveth a man of his remedy without his own fault, it will rather put him in a better degree and condition than in a worfe. *Nam quod remedio deftituitur, ipfa re valet; fi culpa abfit.* But there fhall be no remitter to a right, for which the party has no remedy by action (Co. Litt. 349.): as if the iffue in tail be barred by the fine or warranty of his anceftor, and the freehold is afterwards caft upon him; he fhall not be remitted to his eftate tail. (Moor. 115. 1 Ann. 286.) For the operation of the remitter is exactly the fame, after the union of the two rights, as that of a real action would have been before it. As, therefore, the iffue in tail could not by any action have recovered his ancient eftate, he fhall not recover it by remitter.

The determination of the law, according to the doctrine of remitter above ftated, might feem fuperfluous to an hafty obferver; who perhaps would imagine, that fince the tenant hath now both the right and alfo the poffeffion, it little fignifies by what means fuch poffeffion fhall be faid to be gained. But the wifdom of our ancient law determined nothing in vain. As the tenant's poffeffion was gained by a defective title, it was liable to be overturned by fhewing that defect in a writ of entry; and then he muft have been driven to his writ of right, to recover his juft inheritance: which would have been doubly hard, becaufe, during the time he was himfelf tenant, he could not eftablifh his prior title by any poffeffory action. The law, therefore, remits him to his prior title, or puts him in the fame condition as if if he had recovered the land by writ of entry. Without the remitter, he would have had *jus, et feifinam*, feparate; a good right, but a bad poffeffion: now, by the remitter, he hath the moft perfect of all titles, *juris et feifinæ conjunctionem.* Blackft. Com. b. iii.

REMLINGEN, in *Geography*, a town of Germany, in the county of Wertheim; 9 miles E. of Wertheim.

REMNEY, or Rempney, a river of Wales, which rifes in Brecknockfhire, and, after feparating the counties of Monmouth and Glamorgan, falls into the mouth of the Severn, a little below Cardiff.

REMOLADE, in the *Manege*. See Charge.

REMOLLAN, in *Geography*, a town of France, in the department of the Higher Alps, on the Durance; 15 miles S.W. of Embrun.

REMON, a townfhip of Upper Canada, on the St. Laurence; N. lat. 44° 50′.

REMONSTRANCE, an expoftulation, or humble fupplication, addreffed to the king, or other fuperior, to befeech him to reflect on the inconveniencies, or ill confequences of fome order, edict, or the like.

Remonstrance is alfo ufed for an expoftulatory counfel or advice; or a gentle and handfome reproof, made either in general or particular, to apprife or correct fome fault.

REMONSTRANTS, Remonstrantes, a title given to the Arminians, by reafon of the *remonftrance* they made, in 1610, to the ftates of Holland, againft the fynod of Dort, in which they were condemned.

Epifcopius and Grotius were at the head of the Remonftrants. And as the patrons of Calvinifm prefented an addrefs in oppofition to their remonftrance, which they called their counter-remonftrance, they received, in confequence of this, the name of "Counter-remonftrants."

REMONTER, Fr. in *Mufic*, to new-ftring an inftrument.

REMONTOIR, or Remontoire, in *Horology*, is a fpecies of efcapement, in which a fecondary fpring frequently wound up, or a fmall fecondary weight frequently raifed, by means of the maintaining power of a watch or clock, is fubftituted for the maintaining power itfelf, for the purpofe of urging the balance or pendulum, at fhort intervals, by more equable impulfes than can be conftantly effected by the maintaining power alone, as varied by different degrees of friction in the train. When treating of Escapements in general, under their appropriate head, we defcribed three only out of the four claffes, and referved the fourth clafs, denominated *Remontoir*, till we arrived at our prefent article.

The firft remontoir was invented and made by a German artift in 1600, according to Berthoud; but Huygens, who applied one to his marine clock, defcribed it firft in his "Horologium Ofcillatorium," page 17, and, in conjunction with his cycloidal cheeks, it promifed to be a great improvement in his machine; but, as no compenfation had at that time been applied to the pendulum, and, as a pendulum is not calculated for a portable machine, particularly on the fea, the utility of the contrivance remained to be proved by fubfequent artifts. The contrivance under our confideration was a fmall weight, fufpended by an endlefs well-made metallic chain, that was coiled round the crown-wheel of the efcapement, and wound up a fmall fpace, at every vibration of a half-feconds pendulum, by the next wheel, which wheel took its motion from the maintaining power, through the medium of the train, as is ufual in common clocks; a ratchet and click, however, were a requifite appendage, to act in the way that the endlefs cord was applied, in winding up the maintaining power without ftopping the motion of the works; fuch as we have already defcribed in the fifth fection of our article Clock-work. One half of the weight of the remontoir actuated the efcapement wheel during its fmall fall, and the other half was fupported by the wheel that as often raifed it again to its original height, while both parts of the folded chain were ftretched alike by the faid weight. Leibnitz and Dr. Hooke alfo claimed the originality of a fimilar invention, but do not appear to have put it in practice, as Sully afterwards did.

Mr. Harrifon and Mr. Mudge fucceffively applied remontoir fprings, inftead of fufpended weights, to the efcapements of their time-pieces; but, as we have defcribed thefe under our article Chronometer with fufficient minutenefs, it is not neceffary to repeat here what we have there detailed of their conftructions.

Mr. Cumming and Mr. Nicholfon, on the contrary, had recourfe again to weights inftead of fprings in their aftronomical clocks; but as thefe weights did not act during the whole period of the vibration, we have already defcribed them in another clafs, in the 21ft and 38th fections of our Escapements.

After Huygens and Sully, who left no plans of their mechanifm behind them for the advantage of future workmen, who had not accefs to the original machines, Gaudron contrived a remontoir, which performed its office very well, but which was applied in a wrong place, fo as not to produce the defired effect of equalizing the impulfes given to the regulator; for, inftead of being applied to either the balance or balance-wheel, it was made to actuate the wheel preceding the minute-wheel; and, therefore, permitted the irregular friction of a confiderable portion of the train to affect the motions of the balance, which fault was avoided in the conftruction of Harrifon's and Mudge's time-keepers: the former of which had its fecondary fpring wound up eight times in every minute, and the latter had its two remontoir-fprings alternately coiled at every correfponding ofcillation.

Haley's.—In the year 1796, Mr. Charles Haley, of Wigmore-ftreet, Cavendifh-fquare, London, watch-maker, took out a patent for his invention of a new remontoir fpring for a marine time-piece, or chronometer; the fpecification of which is contained in the 6th volume of the Repertory of Arts and Manufactures. *Figs.* 1 and 2, of *Plate* XLI. of *Horology*, exhibit, the firft a perfpective fide view, and the fecond a plan of Mr. Haley's remontoir efcapement, as originally drawn; and we propofe to retain the fame letters of reference as are inferted in the original defcription. The utility of the invention is ftated to confift of its property of communicating an invariable force to the balance, which it does 150 times in the minute, in a train of 9000 beats in the hour. The fame letters of reference apply to both figures, and indicate the correfponding parts, which will mutually illuftrate each other. A B is the potance plate, and T the balance, the pivots of which, P, X, turn in the cock C and potance D; above the balance T is fixed a pendulum fpring S, in the ufual way; on the axis of the verge, below the balance, are placed two fmall fteel collets I and K, by friction, having each a ruby pallet projecting a little way beyond their furfaces. I is called the difcharging pallet, and K the impelled one; which pallets, together with the pendulum fpring, all vibrate with the balance, whenever it is put in motion. E is the balance-wheel of the ufual form, moving juft clear of the potance plate, and having its pivots fupported by the cocks F and G. W V is the axis of the remontoir, which the inventor calls the *renovating* fpring; and the three axes, or arbors, juft defcribed, ftand in the ftraight line in the direction A B. Below the remontoir fpring the round fteel pallet M is fixed, fo as juſt to eſcape touching the ends of the balance-wheel's teeth in its reſting poſition, and the notch cut in this pallet is to receive the impulſe of any tooth of the ſaid wheel that may, at any time, act againſt it, in paſſing the line A B. Juſt above this large pallet is fixed, by friction, another ſmaller pallet N, of ſteel, in the form of a ſnail-piece, and having inſerted into it, near the centre of motion, and at right angles, a ſmall ruby pallet, which points directly to the radial end of the notch cut in the large pallet M. A ſmall collet, twiſted faſt to the axis of the remontoir, juſt above this ſnail-pallet, receives the lower end of the ſpring R, while the upper end is made faſt to a piece in the cock H, near W, in a manner ſimilar to that by which the pendulum-ſpring is fixed. On the arbor of the remontoir, and under the plate A B, is twiſted on a pallet I, which may be called the remontoir's impelling pallet, becauſe it gives motion to the balance by ſtriking the pallet K, which the author alſo called the *impelling* pallet; but is, as we have named it, more properly the *impelled* pallet, becauſe it *receives* the impulſe which pallet I imparts. From this detail of the pallets it is obvious, that whenever the balance-wheel impels the large pallet M, the remontoir-ſpring R, the ſnail-pallet N, together with its ſmall ruby pallet and impelling pallet I, muſt have a contemporary motion, and will deſcribe each its reſpective circle round the common arbor W V.

In *fig.* 2, *a* is a detent-ſpring, fixed by a ſcrew and ſteady pin to the upper face of the potance plate, and pointing directly to the axis of the verge, which it nearly approaches. Its ſhape and mode of being fixed will be better underſtood from an inſpection of *fig.* 3, which gives a ſide view of it, and from which it will be ſeen that it is placed high enough above the plate, to come in the way of the diſcharging pallet I, in each revolution of the latter. Upon the ſide of the ſaid detent-ſpring *a*, next to the balance-wheel, a ſecond, but very ſlender ſpring is pinned, ſo that its projecting end exceeds that of the detent-ſpring, and comes nearer to the balance verge than that of the detent, as repreſented at *m*, in *fig.* 3. To the detent-ſpring is made faſt a ſmall ruby pallet *r*, ſeen alſo in *fig.* 3. The cock *b* is ſcrewed to the potance, and the hole at *i* is tapped to receive the ſcrew *c*, the head of which, being turned towards the centre of the ſnail, forms a banking for the detent-ſpring *a*, when ſtruck by the ſnail-pallet. This ſcrew, *c*, is removed from its due place in the drawing, to avoid confuſion; and for a reaſon, which will preſently appear, this double ſpring *a* may be called the remontoir-detent. On another ſide of the balance-wheel a ſecond detent-ſpring *d* is fixed, pointing towards the centre of the remontoir axis, and forming nearly a right angle with the former detent: this ſecond detent is adjuſted by the ſcrew *y*. The ſhape and ſituation of this ſecond detent, which may be called the locking detent of the balance-wheel, is better ſeen in *fig.* 4, where its ſapphire pallet *s* may be diſtinguiſhed, againſt which the tooth 3 of the wheel is ſuppoſed to be reſting in *fig.* 2. The ſituation of this pallet *s*, as adjuſted by the ſcrew *y*, determines the reſting-places of the teeth 1 and 2, while they are equally free from the edge of the pallet M. The locking detent *d* is likewiſe made faſt by a ſcrew to the upper face of the potance plate; and the ſcrew *f*, placed in the cock *e*, but out of its place in the figure, forms a banking to the ſapphire pallet *s*, while the ſcrew *g*, in a ſmaller cock, limits the excurſion of the detent-ſpring *d* itſelf.

Having deſcribed the various pieces of mechaniſm that compoſe this remontoir eſcapement, we will now proceed to explain its mode of acting. Firſt, let us ſuppoſe all the parts at reſt with the wheel locked by the pallet *s* laſt deſcribed, but that the wheel is ready to move in the direction of the arrow Z, by the action of the main-ſpring, through the train, whenever the ſingle detent *d* is by any force impelled back to its banking. Let it alſo be conceived that, when the ſnail-pallet N is carried by any means in a direction contrary to that of the wheel till it reaches the pallet *r* of the remontoir or double detent-ſpring, the remointoir-ſpring is wound up by ſuch motion, and *vice verſa*, and alſo that when the ſtroke of the ſnail-pallet has driven back this detent to its banking, by ſtriking the ſloped face of the ruby pallet *r*, the detent will inſtantly return by the force of its elaſticity, and the back part of the ſaid ruby pallet *r* will hold the ſnail-pallet locked at its return, till ſome other impulſe ſets it free again; but that when the unlocking takes place, the ſpring of the remontoir, now wound up, returns by its own force to its original ſituation; and that its axis brings back with it its affixed pallets. *Fig.* 1. will be of no uſe in deſcribing the action of this eſcapement, but in *fig.* 2. the parts are repreſented in a ſtate ready to commence motion; the wheel is locked by tooth 3 againſt the ſapphire pallet *s* of the ſingle detent *d*, and the remontoir-ſpring is wound up, and kept locked by the ſnail-pallet, reſting behind the ruby pallet *r* of the double detent: in this ſituation let the balance be wound round in ſuch direction that the diſcharging pallet I may ſtrike the end of the double or remontoir detent outwards, taking both its ſprings along with it, and thereby unlocking the ſnail-pallet; at this inſtant the remontoir-ſpring R begins to return, and brings all its four pallets with it, and during the return, pallet L, which we have called the impelling pallet, gives its ſtroke to pallet K on the verge, which we have called the impelled pallet, and through its medium to the balance itſelf, which now goes on in its oſcillation, till the pendulum or balance-ſpring is wound up; in the mean time the little unlocking ruby pallet, inſerted into the ſnail-pallet near its centre of motion, meets with the extreme end of detent *d*, and drives it back to its banking, thereby ſetting the tooth 3 of the wheel free from the ſapphire pallet *s*; the wheel, being urged by the train, now proceeds till tooth 2 falls into the notch of pallet M, and is checked, experiencing a little recoil; the balance-ſpring, being now wound up, returns, and alſo the wheel winds up the remontoir-ſpring, till it is again locked, by the ſnail-pallet, after its impulſe has driven back the detent: during this action the detent *d* returns by its own ſpring, and locks tooth 4 of the wheel, at the inſtant that tooth 2 eſcapes from the notch of pallet M, and the original ſituation of all the acting parts is now reſtored, except that the motion of the balance is not arreſted, the ſlender ſpring fixed to detent *a* allowing it to paſs in the return, without unlocking the ſaid detent; but when the backward oſcillation is finiſhed, and the balance returns, the ſame operation is repeated; *i. e.* the remontoir detent is unlocked, the pallets on its axis are brought back, the impulſe is next given to pallet K of the balance, to reſtore its loſs of momentum, and laſtly, the wheel is unlocked to wind up the remontoir-ſpring as before.

The obſervation we have to make on this ingenious remontoir eſcapement is this, that on enquiry from good authority we learn, that the theory could never be completely put into practice by the inventor, though he laboured to obtain his object full fourteen years. However well the parts of action were mechanically made, the locking of the remontoir-ſpring was never certain, for the *flirt* given to the ruby pallet *r* by the ſnail-pallet, drove back the detent ſo far, as frequently to enable the ſnail to be brought back by the remontoir-ſpring, before the detent returned to catch it, the conſequence of which was, that the pallets of the remontoir axis were all brought back, and the impulſe vainly expended

pended by pallet L, before the pallet K of the balance returned to its place to receive it. Mr. Hardy, however, has lately contrived a ſpecies of locking that is quite certain, as well as ſafe, which we ſhall preſently have occaſion to deſcribe.

Breguet's.—We have not been able to aſcertain the exact date of the French watch-maker Breguet's invention of a remontoir eſcapement, but as Berthoud has placed it after Haley's in his "Hiſtoire de la Meſure du Temps," we muſt conclude that it is of more recent origin. The mechaniſm is ſo complex, that the deſcription given in the French work is divided into three parts, which plan we propoſe to follow. *Figs.* 5. and 6. of *Plate* XLI. of *Horology*, will ſuffice to explain the different parts of Breguet's remontoir; *fig.* 5. being a plan of the whole, and *fig.* 6. exhibiting a perſpective view of ſuch parts as could not be well underſtood without ſuch repreſentation. The firſt portion of the mechaniſm conſiſts of two wheels of unequal numbers of teeth, with their planes in contact, and revolving on one common arbor concentrically, namely, the wheel B B′, and the wheel D, the firſt having many teeth and a larger diameter, and the ſecond having few, for a reaſon which will appear hereafter: theſe wheels are actuated by a pinion *g*, connected with the train, and having juſt ſo many leaves as there are teeth in the large wheel B B′, contained in the ſpace between two contiguous teeth of the ſmall wheel D; on the arbor of this pinion, near the pivot, is inſerted a fly with unequal arms, repreſented by the letters *i g h* in both figures, the longer arm of which, *g h*, is armed with a piece of ſteel of peculiar ſhape, ſeen in *fig.* 6. A ſpring-detent *r* F, made faſt to the cock at *r*, lies at right angles to the fly, when in a ſtate of reſt, and has a ruby pallet V at about one-third of its length from its interior end, which ſtops the fly by oppoſing its end *h* near *o*, and conſequently prevents the train from urging the double wheel, ſo long as no force unlocks the pallet from the end of the fly; but if any impulſe happen to bend the detent in a direction towards the pinion *g*, then the ruby pallet ſlips through a notch made in the ſteel part of the fly, and the fly makes an entire revolution, while the pinion revolves and urges the large wheel the ſpace of as many teeth as the pinion contains; that is, a ſpace correſponding to the diſtance between two contiguous large teeth in the ſmall wheel, which wheel alſo moves the ſame quantity, before the fly is again oppoſed and ſtopt.

The ſecond portion conſiſts of the following parts; a ſpring G, curved at the interior, or moveable end, ſerves at the ſame time for a remontoir-ſpring, and alſo for a pallet to give the impulſe to the balance; it has conſequently a heel-piece *n*, by which it is urged into a ſtate of tenſion by the ſmall wheel D, at every revolution of the fly, and alſo a ruby pallet *m*, with a locking notch cut in it; *a* H, made faſt at *a*, is a detent-ſpring, placed nearly at right angles to the ſpring G, and having a ſlender ſpring N made faſt to its ſide; this detent-ſpring carries a ſmall ruby *p*, which locks into the notch of the piece *m* in the ſpring G, when this is in a ſtate of tenſion. Another ruby, inſerted into the extreme end of the detent *a* H at *s*, is ſo placed, that the ſlender ſpring N can move from right to left without impediment, but when urged in an oppoſite direction againſt the ruby *s*, it takes the large or detent-ſpring along with it, and unlocks the remontoir-ſpring G, by removing the ſmall ruby *p* from the notch of *m*. The detent-ſpring H has at its extreme end a claw, againſt which the ruby *m* falls when this detent eſcapes back from a tooth of wheel D; and this claw has a pin in it, againſt which the ſlender ſpring N reſts; again, at the extreme end of the ſlender ſpring N are fixed two parallel chamfered plates, ſo contrived, that any preſſure made on the upper ſlope, or inclined edge, will depreſs the ſpring, but a ſimilar preſſure made on the under ſlope will elevate it again, the downward preſſure being employed to diſengage the ruby *m* from the claw, and the contrary.

The third portion conſiſts of the pieces or pallets K and *b*, borne by the ſuperior end of the verge of the balance, and fixed at a quarter of a circle from each other. When the oſcillation of the balance is from right to left, or in the direction from *b* to K, the unlocking pallet piece K, in its motion, bends the ſlender ſpring, and paſſes over it, but as the pallet *b* is placed above the plane of the wheel B B′, and under the ſpring H, this oſcillation from right to left is performed in freedom, except that the ſlender ſpring N requires to be a little bent out of the way; but when the oſcillation is made from left to right, the pin at H preſſes this ſlender ſpring againſt the ruby *s*, the ſpring H then gives way, and bending, allows the ruby *p* to eſcape from the notch at *m*, and the ſpring G, being unlocked, is at liberty to perform its office, which we now proceed to deſcribe.

The action of theſe three portions of the mechaniſm may be thus explained: at the inſtant that the ruby *p*, in the detent *a* H, is diſengaged from the notch at *m* in the remontoir-ſpring G, the pallet *b* of the balance is found pointing towards the common centre of the wheels, and ready to receive an impulſe from the extreme end *q* of the curved part of the remontoir-ſpring G, which end now gives its ſtroke to the balance through the medium of pallet *b*; immediately after which ſtroke, the ſame end *q* proceeds till it falls on the end F of the fly's detent, to which it now gives a puſh, and remains quiet; this puſh unlocks the fly, as has been before explained, and an entire revolution is immediately performed by it, while its pinion *g*, now at liberty to advance, urges on the double wheel, till another tooth in the ſmall wheel, catching the heel-piece *n* of the remontoir-ſpring, puts this ſpring again into a ſtate of tenſion; and the ruby *p*, falling into the notch of *m*, locks it as before, the balance in the interim completing its oſcillations: and in this manner the operation is repeated.

De Lafon's.—In the year 1801, the Adelphi Society for the Encouragement of Arts, &c. rewarded Mr. John de Lafons with thirty guineas for his invention of a new remontoir watch eſcapement, which comes next under our notice. *Figs.* 1 and 2 of *Plate* XLII. of *Horology*, are a plan and ſection of this eſcapement, as given by the inventor in the Society's Tranſactions of the year above-mentioned. In both theſe figures, A is the eſcapement wheel; B, the lever-pallet on an arbor with fine pivots, which has, at its lower end, the remontoir ſpiral ſpring C, fixed with a collar and ſtud in the uſual way; D is the pallet of the verge, having a roller turning in ſmall pivots, for the lever-pallet to act againſt without friction; at E are the pallets for diſcharging the locking, with a roller between, containing a ſmall notch; F is the arm of the locking pallets, continued at the other end beyond the centre of motion, to preſerve the equipoiſe, and having ſtuds and ſcrews for adjuſtment of the banking; *a* and *b* are the locking pallets, being portions of circles faſtened on an arbor, turning on fine pivots at the midway between the pallets; G is the triple fork, at the end of the arm of the locking pallets. In *fig.* 1, tooth 1 of the wheel having caught the interior end of the lever-pallet B, has urged it forwards and wound up the remontoir-ſpring, and the inſtant that the verge pallet D comes nearly in contact with the remote end of the lever-pallet, the diſcharging pallet E, taking one prong of the fork, removes the arm F, thereby relieving the tooth 3 from the convex part of the claw *a*, that locks the wheels.

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The wheel now advances a little way, juſt enough to allow the interior end of the lever-pallet to paſs back again, as urged by the ſpiral ſpring, while the remote end of the ſaid lever gives an impulſe to the balance, through the pallet D; the tooth 4 is then locked on the concave ſide of the locking claw *b*, and the interior end of the lever-pallet partly ſupports the following tooth; in this ſituation the oſcillation is finiſhed, and on the return of the balance pallet E, ſtriking the prong of the fork in a contrary direction, again unlocks the wheel from claw *b*, while the force of this wheel is partly ſuſpended by the end of the lever-pallet; being now at liberty, the wheel proceeds to wind up the remontoir-ſpring again, till another tooth falls on the claw *a*, now brought inwards, when the operation is completed, and the preſſure of the inner end of the lever pallet againſt its contiguous tooth again relieves the claw *a* from a part of the preſſure of the wheel, and thereby renders the unlocking as eaſy as before, when claw *b* was unlocked. This eſcapement appears to us an improvement on Haley's, both as to its ſimplicity and ſafety of locking, and the inventor propoſes a ſtill further ſimplification, by ſubſtituting a ſtraight remontoir-ſpring for the ſpiral one, particularly in time-pieces intended to remain in a ſtationary ſituation, where the weight of the ſpring would form no objection; but it does not appear that ſuch conſtruction was ever adopted. The ſimplicity of the locking of the remontoir-ſpring by the wheel itſelf, where this ſpring and the maintaining power mutually re-act, requires, as might be foreſeen, an unuſually ſtrong maintaining power, which is, perhaps, one of the greateſt objections to this mode of applying the remontoir; unleſs, indeed, what was remarked by the ſociety's committee be true, that the balance muſt vibrate in a large arc before the piece will continue to perform.

Maſſey's.—Mr. Edward Maſſey, of Hanley, in Staffordſhire, received a reward of fifty guineas from the Adelphi Society, in the year 1803, for his invention of two different clock eſcapements, one of which we have already deſcribed, under our article Escapement, as being without a verge; and the other we ſhall make the ſubject of our preſent ſection. *Fig.* 3. of *Plate* XLII. repreſents ſo much of Maſſey's remontoir eſcapement as is ſufficient to explain all the eſſential parts; in which A is the ſwing-wheel; B, C, are two detached pallets, moving on ſeparate arbors, at oppoſite ſides of the ſwing-wheel; B is ſeen urged by the remontoir-ſpring E, by the aid of a tail-piece fixed on the arbor of pallet B, which receives the action; and the other pallet muſt be conceived to have a ſimilar ſpring and tail-piece, which cannot eaſily be repreſented in the drawing; F is the verge bearing two arms without pallets, which preſs under the pins of the detached pallets, and raiſe them alternately, at each vibration of the pendulum, from the teeth of the ſwing-wheel, which had been previouſly impelled by the maintaining power, and K is the pendulum ſuſpended in the uſual way, and having a crutch to communicate its force to the verge at the moment of withdrawing the pallets. All, therefore, that the pendulum has to do, is, to diſengage the pallets from the teeth of the ſwing-wheel that locks againſt the inclined planes of the pallets; for the remontoir-ſpring then oppoſes the aſcent of the pendulum, and aids its deſcent, by means of the connection between the pins of the pallets and the arms of the verge, which muſt, from the nature of the conſtruction, continue in contact during a large portion of each excurſion of the pendulum. It is not ſtated in the author's account (Tranſ. Adel. Soc. vol. xxi.) at what part of the arc of vibration the pendulum unlocks either of the pallets, but it ſeems to us capable of being made to effect this office at its point of *greateſt velocity*, if it does not do that as now conſtructed. An attention to this particular is of the utmoſt importance in any eſcapement, ſince the natural law of gravity is the leaſt deranged, when any force is given, or taken away, when the pendulum is at the *loweſt point* of its arc, for the velocity it has at *that point* determines the height to which the ball ſhall riſe; but any addition or diminution of the pendulum's momentum, beginning at any other point of the arc, either adds to, or diminiſhes the natural length of the vibration, and injures the iſochroniſm. Beſides, a ſpring commencing both its accelerating and retarding influence at the point of the pendulum's greateſt velocity, acts, not only by a law commenſurate with the law of gravity, but their various forces, thus exerted, are contemporary, and, therefore, act together as one; a conſideration which never ſhould be loſt ſight of in the conſtruction of an eſcapement of any denomination. The principal advantages that the author ſeems to inſiſt on in this eſcapement, are, that the friction is diminiſhed at the acting parts of the pallets, the impulſe being given by a direct *puſh*, without, or with very little, ſliding motion; and that a certain regular momentum is kept up in the pendulum, independently of any variation which may occur in the wheel-work, or in the acting part of the pallets during the ſhort time of unlocking; but, what is the principal object of ſuch a contrivance, he has not ſtated, perhaps not conſidered, how this *certain regular momentum* is, or ought to be, *modified.*—Indeed, in ſpeaking of his other eſcapement without arbors, he ſays, that one of its advantages over this is, that during a *part* of the vibration the pendulum is *diſengaged;* from which remark, it ſhould ſeem, that he thinks the conſtant action of this remontoir-ſpring, however modified, an objection to be avoided.

Antis'.—In vol. xxiii. of the Tranſactions of the Society laſt mentioned, it is ſtated, that Mr. John Antis of Fulneck, near Leeds, ſent this ſociety a model of a new clock eſcapement in 1805, with a correſponding deſcription, for which a reward was voted him of twenty guineas. The model is depoſited in the room at the Adelphi appropriated for the reception of models, but as the deſcription is not publiſhed in the Tranſactions of the Society, nor an engraving given of the model, we muſt infer, that the contrivance either is not new, or is not of ſuch importance as to merit the particular notice that has been given by them to the inventors of like contrivances, who both preceded and followed him. Indeed, in the letters of Mr. Antis to the Society, publiſhed with their account of the rewards, it ſeems that two eſcapements were ſent them, one a *detached* one, and the other, one that "*would equaliſe* the *power* of the *impulſe*," which muſt, therefore, have been of the *remontoir* deſcription; but he confeſſes that theſe contrivances by him "may have been practiſed before." With reſpect to the latter eſcapement, he remarks, what is worthy of being recollected by clock-makers in general, that, by its means "a ſpring-clock will be as perfect as one which goes by weight, and more ſo if the latter has no remontoir." Should any of our readers have a wiſh to ſee and examine Mr. Antis' productions, which, he acknowledges, are done in a rough manner, and under diſadvantageous circumſtances, but which may not be the leſs ingenious on that account, there will be no difficulty in gaining admiſſion to the model room, where the original work is preſerved with a view to public inſpection, provided the applicant be properly introduced.

Mendham's.—It frequently happens that conſiderable improve-

improvements are made in mechanical contrivances, by men whofe principal employment has no connection with the art to the improvement of which they contribute; this was probably the cafe with Mr. Antis, and is confeffedly fo with Mr. Mendham, who was rewarded with the filver medal of the Adelphi Society, in the year 1807, (fee vol. xxv.) for a remontoir efcapement for a chronometer, which next offers itfelf for our defcription. *Figs.* 4, 5, and 6, of *Plate* XLII. are copied from the plate given by Mr. Mendham, *fig.* 4. being a fection of the whole efcapement, *fig.* 5. a plan of the wheel and locking pallet, and *fig.* 6. a detached view of the pallets and their common arbor. The letters *a a*, in *fig.* 4, are the two plates of the frame that contain the works; *b* is the balance, nearly of the ufual fhape and fize; *c* is the pallet that acts with the wheel, and *d* its arbor; *e* is the locking fingle fpring; and *f* is the unlocking pallet in the form of a pin, attached to *e*, and feen better in *fig.* 6. At the lower end of arbor *d* is placed *g*, the remontoir-fpring, that gives force both to the fmall pallet *f*, and alfo to the perpendicular pin *h*, that forms a part of the pallet *c*. The arbor *d* does not afcend above the upper plate of the frame, but the pin *h* does, and the plate being formed, as we fuppofe, like a rim, *h* is permitted to move in the vacant fpace within the rim, and fufficiently high to fall in the way of the finer pin *l*, inferted into and under the balance. The balance *i* has its verge immediately over the upper pivot of arbor *d*, point to point nearly, fo that the motions of the balance-pin *i*, and of the pin *h*, that impels it, may be concentric. The cock *k* fupports the upper pivot of the verge, and alfo holds the outer end of the balance or pendulum-fpring. The action of thefe parts may be thus explained; before motion is given to the balance, we muft conceive its pin *i* to be in contact, or nearly in contact with the pin *h* of the pallet *c*, and it muft be remembered, that the wheel refts on the pallet during the vibration of the balance: fuppofe now that the remontoir-fpring *g* is in the act of being wound up by the balance-wheel, as actuated by the train; and that the pin *i* of the moving balance has kept in contact with the impelling pin *h*, borne by the arbor of the remontoir, it is evident, that the force of the remontoir-fpring is here oppofed to the momentum of the balance and at laft ftops it, thereby forming a banking of an unlimited extent; but the tooth of the wheel in contact with pallet *c*, at the point of fhorteft radius, affifts to oppofe or wind up the faid fpring during a fpace of one-fifth of a circle, till the tooth has paffed and the wheel is locked; on the return of the balance the remontoir-fpring exerts all its force on the balance, but without a jerk, the pins *i* and *h* being already in contact, till it comes to the ftop; the balance then maintains its motion, and the fmall pallet *f* having unlocked the wheel by forcing out the detent, the next tooth of the wheel falls on the pallet *c*, and waits the return of the balance, when the fame operation is repeated.

Mr. Ramfay of Iflington was confulted on the merits of this efcapement, and, on confidering its properties, he gave a written report to this effect; that the impulfe is here given to the balance without friction, exactly as in Mudge's chronometer; and that the remontoir is wound up by the maintaining power in a fimilar way, except that the fhape of Mudge's tooth limited the quantity of tenfion of the fpring, which here depends on the amount of the maintaining power; but that this efcapement, having but one remontoir-fpring, is more fimple than Mudge's, and allows an unlimited arc of vibration, which advantages compenfate the foregoing difadvantage in the fhape of the tooth; and laftly, that it is fuperior to the detached efcapement, inafmuch as that it gives the impulfe without friction.

G. Prior's.—The filver medal and twenty-five guineas were voted to Mr. George Prior, junior, of Otley, in Yorkfhire, in the year 1809, by the Adelphi fociety (vol. xxvii.) for his invention of a new clock efcapement, in which an impelling (not however called a remontoir) fpring actuates, or profeffes to actuate, the pendulum at each alternate vibration. The account, particularly of the action, as printed in the fociety's Tranfactions, feems to us fo extraordinary, that we beg leave to tranfcribe it verbatim, in order to make fome remarks on it, that may enable the reader to judge of the efcapement's peculiar qualities, or at leaft of the manner in which they are defcribed. *Fig.* 7. of *Plate* XLII. already referred to, contains enough of this efcapement to anfwer the purpofe of the defcription in queftion, and therefore we will omit the references to *fig.* 1. in the original plate, and attend to its *fig.* 2. only. "*Fig.* (7) is a back view, which is fuppofed to be taken from behind the clock; *a* reprefents the axis of the fwing-wheel, or laft wheel of the train of the clock; *b d* is the fwing-wheel fixed upon it, having thirty ferrated teeth; it is turned round, in the direction from *b to d*, by the maintaining power of the clock; *g* is a fpring-detent, which locks againft one of the teeth of the fwing-wheel, and this prevents its running down by the action of the maintaining power; *h* is another fpring-detent, which is called the impelling fpring; when left at liberty, it unlocks the former, by pufhing againft the end of the fmall arc *e*, faftened to the detent *g*. and thus removing the end of the detent which obftructed the wheel's motion; *l* is the rod of the pendulum, fufpended by a cock fcrewed to the back plate of the clock; a fmall piece of brafs, *k*, projects at right angles from the impelling fpring *h*, fo as to intercept the pendulum-rod in its vibration, and at this place a fmall fcrew is put through the pendulum-rod *l*, the point of which moves the impelling fpring back: a fmall pin is fixed to the frame, in a line between the point of fufpenfion of the pendulum, and the centre of the fwing-wheel, againft which the impelling fpring ftops when at liberty.

"Suppofing the pendulum to be vibrating backwards and forwards, and the wheel locked as in the figure, the pendulum fwinging from *m* to *n*, the impelling fpring *h* follows by its elafticity, until the pendulum *l* arrives at its perpendicular (or loweft point of its arc); at this period the impelling fpring comes *to reft* againft the end of the arc *e*, which it *pufhes back*, fo as to releafe the tooth of the wheel from the detent-fpring *g*; the wheel now moves round a very fmall fpace before it meets the end of the impelling fpring *h*, and *is ftopped thereby*; in the mean time the pendulum continues its motion the extent of its vibration towards *n*, when it returns, and arriving at the *perpendicular*, it meets the *impelling fpring h*, and *carries it along with it*, until the tooth of the wheel which refts againft it efcapes from the end of it, and another tooth of the wheel comes to reft againft the fpring-detent *g*. The fucceeding vibration of the pendulum repeats the fame operation." This is the whole account, from which the reader is induced to believe that the pendulum, and impelling fpring *h*, act and re-act on each other *ad infinitum*, without any aid from the maintaining power through the medium of the wheel, which is never faid to raife, or otherwife to move the impelling (or remontoir) pallet, in order that it may, in its turn, impel the pendulum by its acquired force. Again, it is faid, the impelling fpring unlocks the detent *g* when it arrives at the perpendicular, or nearly, if not quite, at the point of its quiefcence, where it has *no force*, and from that point, not the

the wheel, but the pendulum unbends it into a ſtate of tenſion, to reſume its operation; that is, the pendulum raiſes the ſpring, that the ſpring may drive the pendulum back again; and thus the vibrations are maintained without the aid, and conſequently without the neceſſity, of either a maintaining power or train; and what is equally extraordinary, the impelling ſpring locks the wheel by its *reſiſtance*, near the perpendicular line (within the ſpace of one tooth), where it has almoſt the ſmalleſt force, or nearly the ſame ſmall force that it has when it *unlocks* the *detent*. According to this account, even ſuppoſing the action of the wheel on the remontoir pallet to be *omitted*, the pendulum is under the influence of the impelling pallet during nearly the whole of one excurſion, and free from it in the other. The model, however, is ſaid to be preſerved in the ſociety's room, and will explain itſelf.

G. Prior's improved.—Mr. George Prior, jun. again preſents an improved remontoir eſcapement for a clock to the ſociety we have repeatedly had occaſion to name in this article, in the year 1811 (vol. xxix.), and again receives a reward at their hands, of twenty guineas, for his improvement. The deſcription given of this eſcapement, and of its action, is ſufficiently clear, and the alteration made in the conſtruction is in many reſpects an improvement, though we ſhall take occaſion to ſhew, in our remarks on it, that it is ſtill liable to objections. In the plate laſt referred to, *fig.* 8. contains the original *fig.* 1, which will explain the account with ſufficient preciſion. "The ſwing-wheel A," ſays the author, "has thirty teeth cut in its periphery, and is conſtantly urged forwards by the maintaining power; C, D, are two ſpring-detents, catching the teeth of the wheel alternately; theſe are, at the proper intervals, unlocked by the parts marked 2 and 3 upon the pendulum-rod H, intercepting ſmall pins *a*, *b*, projecting from the detents, as it vibrates towards the one or the other; E is the renovating or remontoir-ſpring, fixed to the ſame ſtud, F, as the detents; it is wound up by the higheſt tooth of the wheel, its poſition, when unwound, being ſhewn by the perpendicular dotted line. This being the caſe, ſuppoſe a tooth of the wheel caught by the detent D, which prevents the wheel from moving any further, and keeps the renovating ſpring from eſcaping off the point of the tooth; in this poſition the pendulum is quite detached from the wheel: now if the pendulum be cauſed to vibrate towards G, the part of it marked 2 comes againſt the pin *b*, projecting from the renovating ſpring E, and puſhes this ſpring from the point of the wheel's tooth; on vibrating a little further, it removes the detent D, which detained the wheel, by the part 3 ſtriking the pin *a*, which projects from the detent; the maintaining power of the clock makes the wheel, thus unlocked, to advance, until it is detained by a tooth reſting upon the end of the detent C, on the oppoſite ſide; by this means the renovating ſpring will be clear of the tooth of the wheel as it returns with the pendulum, and gives it an impulſe by its pin *b* preſſing againſt the part 2 of the pendulum, until the ſpring comes to the poſition ſhewn by the dotted line, in which poſition it is unwound, and reſts againſt a pin fixed in the croſs-bar of the plate; the pendulum continues vibrating towards I, nearly to the extent of its vibration, when the part 1 meets the pin in the detent C, and removes it from the wheel and unlocks it; the maintaining power now carries it forward, puſhing the renovating ſpring E before it, until another tooth is caught by the detent D, which detains the wheel in the poſition firſt deſcribed." Agreeably to this deſcription, the pendulum is oppoſed in its aſcent, and accelerated in its deſcent, in one of its excurſions from the centre, or perpendicular line, by both the impelling ſpring E, and detent D, after it is unlocked, though not the whole diſtance; but is alternately accelerated and retarded in the other excurſion by the detent C alone, and only after the unlocking; theſe unequal checks, given at different parts of the arc of vibration, we apprehend, are by no means favourable to the natural iſochroniſm of the pendulum.

Hardy's.—Mr. Hardy, chronometer-maker, of Coppice-row, Clerkenwell, London, whoſe ingenious improvements in clock and watch-making have placed him high in public eſtimation, on contemplating Mr. C. Haley's failure in the locking of his remontoir detent, contrived a remedy which fully anſwers its purpoſe, and which, on that account, merits our particular notice.

Fig. 7. of *Plate* XLI. of *Horology*, repreſents the plan of Hardy's new remontoir eſcapement, which, though it appears to differ conſiderably in conſtruction from Haley's, yet reſembles it ſo much in its action, as well as principle, that we will put the ſame letters of reference to the ſame correſponding parts, in order that the reader who has peruſed our deſcription of Haley's remontoir with attention, may the more clearly comprehend our deſcription of Hardy's, and perceive in what the improvement conſiſts. As in Haley's conſtruction, T T repreſents the balance, or rather the place of the balance not ſeen; E the eſcapement, or balance-wheel; P the pivot of the verge; S the balance-ſpring, ſuſpended as uſual; K the impelled pallet; I the unlocking pallet of the remontoir; N the remontoir detent, or locking pallet, on the ſame axis with *a*, the arm of the ſlender or unlocking ſpring, which lies parallel with it; *n* the cock, taking the pivot of the remontoir detent's arbor, and alſo the upper end of its ſpiral ſpring; *c* the head of the banking ſcrew, and *i* its ſtud; H the cock that takes the pivot of the remontoir, or cylindrical ſpring at W, and alſo one end of the ſaid ſpring, repreſented by the ſmall circle at R; L is the impelling lever or pallet, for giving motion to the pallet K of the balance; M is a lever, inſtead of the notch in Haley's large circular pallet, by means of which the wheel winds up the ſpring R of the remontoir; O is a lever, in place of the ſmall ruby unlocking pallet of Haley, fixed to the ſnail; *d* is the ſpring-detent of the wheel, and *s* its ruby, or ſapphire pallet, on which the wheel is locked, *f* and *g* being the banking ſcrew and its ſtud, and *y* the place where it is fixed by a ſcrew on the potance plate; and laſtly, the ſectoral piece Q, in which the improvement chiefly conſiſts, is the addition introduced for rendering the locking of the remointoir-ſpring, when wound up, both certain and ſecure. The acting faces of the pallets *s*, M, K, N, and of the circular portion of Q, are of ruby, or other precious ſtone nicely poliſhed, and are properly ſhaped for their reſpective offices. From this deſcription of the mechaniſm before us, it will be perceived that the double ſpring *a*, and the detent with a claw pallet at N, are both faſt to the arbor of the ſpiral ſpring, which gently preſſes the detent at all times down upon the ſectoral piece Q, thereby preventing its being thrown back from its poſition for locking, as was the caſe with Haley's remontoir detent. It will alſo be ſeen that the arbor W, of the remontoir-ſpring R, has the ſaid ſectoral piece, the impelling lever L, the lever M impelled by the wheel, and the diſcharging lever O, all faſt to it at different heights, the two firſt being above, and the two laſt below, ſo that when one of theſe four pieces is moved out of its firſt ſituation by any external force, they all move together, as do alſo the remontoir detent N and its ſpring *a* on their common arbor, and as do likewiſe the pallets K and I on the verge of the balance. Theſe particulars being underſtood, and that levers in Hardy's conſtruction are uſed ufed for pallets in feveral inftances, we may proceed to explain the action of the different parts, and to fhew how they produce the defired effects of producing equable impulfes on the balance at all times, and of effecting certain and fecure locking of the remontoir-fpring. In the figure before us, tooth 1 of the wheel has juft proceeded far enough, by the action of the main-fpring and train, to wind up the remontoir-fpring, and its detent N, urged by its own fpiral fpring againft the curved face of the fectoral piece, after fliding fmoothly along it, has locked it; that is, by oppofing it at right angles, prevents its return, which would take place when the wheel leaves the arm M, or, which is the fame thing, when the remontoir-fpring, on the fame arbor with this arm, is wound up. The balance is now fuppofed to have commenced its motion, carrying the pallets K and I outwards from the wheel, but the fmall pallet I has not yet arrived at the flender fpring of the remontoir detent, though it is approaching it; the flender fpring, however, foon yields to the outward impulfe of this fmall pallet, without difturbing its arm or the detent N, therefore the remontoir-fpring remains locked: at the return of the balance, which takes place when its fpring is wound up, the faid little pallet I difplaces not only the flender fpring but its arm alfo, which lies next towards the wheel, the one not being liable to move in this inward direction without the other; the confequence is, that the detent N is now lifted by its connection with the arm of the flender fpring, and at that inftant the remontoir-fpring, being wound up, and at liberty to act, throws back the fectoral piece Q nearly its whole breadth, but not quite, for the claw of the detent in queftion refts on the curve of the fector during the motion we have defcribed, till the unlocking lever O ftrikes the end of the fingle detent-fpring *d*, and forces the ruby pallet *s* out of the wheel, which wheel inftantaneoufly refumes its motion from the train, and meeting with lever M winds up the remontoir-fpring a fecond time; in the mean time the impelling lever L has given its impulfe to the pallet or lever K, and confequently to the balance, which has thus had its momentum increafed; and on its returning vibration exactly the fame procefs is repeated. Thus the force of the maintaining power is expended in winding up at each alternate ofcillation the remontoir-fpring, which fpring, fo reinforced, impels the balance in its turn by quantities of force that are always the fame, whatever may be the irregularities of the force tranfmitted through the train that winds up the remontoir-fpring; therefore, properly fpeaking, the remontoir-fpring is the maintaining power that reftores, at each alternate ofcillation, the lofs of momentum that the balance has experienced from the refiftance of the air, and friction of the parts in action. This efcapement is, notwithftanding, of the detached kind, feeing the balance performs the greateft part of its ofcillations without any connection of even the auxiliary force derived at intervals from the remontoir-fpring; and a chronometer of this conftruction, made by Hardy for his royal highnefs the duke of Suffex, anfwers the maker's moft fanguine expectation, and will probably become a model for other makers when its merit is proved, and made public. The fame artift has made feveral experiments on the fame principle, with this difference, that the remontoir-fpring is retained by the lever refting on the tooth of the wheel, in place of being locked by the fectoral piece, as in the one before us.

Befides the preceding efcapement, Hardy invented one for the aftronomical clock he made for the Royal Obfervatory at Greenwich, which at firft fight appears to refemble Maffey's and Prior's improved one, with fpring pallets, but on clofe examination we difcovered that it has the following defirable properties peculiar to itfelf: 1ft, it gives the impulfe not only from remontoir-fprings, but ftrikes and unlocks the two feparate detents alternately, at the inftant when the pendulum has the *greateft velocity*; and, 2dly, the accelerating and retarding power imparted to the pendulum co-operates with the force of gravity, thereby deranging the natural law of gravity as little as poffible. We feel not at liberty to enter more minutely into the defcription of this efcapement, becaufe we underftand its inventor propofes giving an account of his machine himfelf, to be read before the Royal Society, as conftituting the companion to Troughton's tranfit circle, already defcribed by the aftronomer royal. We have permiffion, however, to fubjoin the rate of the clock in queftion for three quarters of a year, as taken at the Royal Obfervatory, which will afford the beft proof of its pretenfions to public notice. We have further to add, that the inventor has applied the fame principle of movement to a chronometer of a large fize, in which the balance has two metallic rods to adjuft it for temperature, in place of the metal being fluxed on the rim of the balance, as is common. See COMPENSATION.

Trial of Mr. Hardy's clock at the Royal Obfervatory at Greenwich in the year 1811.

	Daily Rate.	Mean of Thermometer.
April 12 to May 13 - -	— 0.86″	61°
May 13 to June 9 - -	— 0.74	63
June 17 to July 12 - -	— 0.74	64
July 18 to Auguft 17 - -	— 0.83	68
Auguft 17 to September 14 -	— 0.77	65
September 14 to October 4 -	— 0.61	60
October 17 to November 17 -	— 0.60	51
November 17 to December 10	— 0.50	46
December 10 to December 30	— 0.47	39

From the above ftated authentic document it appears, that for the nine months of trial, and in oppofite extremes of temperature, the daily rate never varied quite *four-tenths* of a fecond; and when the quantity of mercury proper for the compenfation of the pendulum is exactly afcertained, it may be expected that the performance will be ftill more accurate; feeing that the deviation in the rate depends evidently on the change of temperature, and not on the efcapement.

REMORA, in *Natural Hiftory*, the *fucking-fifh*; a little fifh, refembling a herring, called by the Greeks *echeneis*, famous for fticking to the fides of fhips. It belongs to the genus of *echeneis* and clafs of *thoracici* in the Linnæan fyftem.

Its characters, according to Artedi and Linnæus, are thefe: the branchioftege membrane on each fide contains about ten bones; the head is thick, depreffed, naked, and marked on the upper fide with tranfverfe rough ftriæ; the body is oblong, roundifh, and naked, but fomewhat compreffed; the back-fin is oblong, and placed very far toward the tail; its under jaw is longer than its upper; it has a great number of teeth in both jaws; the colour of its body is hoary, and it has feven fins; two pectoral ones, two ventral ones placed farther from the fnout than the pectoral ones, one at the anus, one on the back, and one at the tail; the ftriæ of the head are from eighteen to twenty-four in number, they are rough and tranfverfe, but are divided as it were into two feries by a middle longitudinal line. By means of thefe ftriæ or ridges the fifh can fix itfelf to any animal

animal or other ſubſtance, and has often been found adhering to the ſides of ſhips and the bodies of ſharks, &c.

Linnæus enumerates two ſpecies of the echeneis; the remora and neucrates: the former has a forked tail, and eighteen ſtriæ on the head; the latter has an entire tail, which is longer than that of the former, twenty-four ſtriæ, a larger body, and ſharper fins. They are both inhabitants of the Indian ocean. The remora is much talked of by the ancients, who, as we find from Pliny, lib. ix. cap. 25. lib. xxxi. cap. 31. unanimouſly believed it had the force to ſtop a veſſel in full ſail, or a whale in ſwimming; and hence called it *remora, a remorando*. (See Ælian's Hiſt. de Animal. lib. ii. cap. 17. Plutarch. Sympoſ. lib. ii.) But Mr. Cateſby obſerves, that even ſeveral of thoſe fiſhes together can do no more than ſhells or corals, and other foulneſſes of the ſame bulk, which make a ſhip ſail ſomewhat the ſlower. And in the ſame manner only they may be ſome ſmall hindrance to a whale. The author laſt mentioned aſſures us he has taken five of them off the body of a ſhark. Vide Phil. Tranſ. N° 438. p. 113.

REMORA, among *Surgeons*, is alſo an inſtrument uſed for ſetting broken bones.

REMORA *Mutiani*, in *Natural Hiſtory*, a name given by ſome to the genus of ſhells called *concha venerea*, and *porcelana*. See PORCELAIN *Shell*.

REMOTION, REMOTIO, in *Rhetoric*, the ſame with what is otherwiſe called *metaſtaſis*.

REMOVAL *of the Poor*. See POOR.

REMOVELLE, in *Geography*, a town of France, in the department of the Voſges; 5 miles E. of Neufchateau.

REMOVING *Obſtructions to Tillage*, the means of removing ſtones and any other ſubſtances that may be in the way of the plough.

The operations which are to be performed in theſe intentions are of ſeveral different kinds, as the removing of various ſorts and ſtates of ſtony matters, both from above and below the ſurface of the lands; the eradicating and deſtroying different kinds of woody materials of the tree, root, and plant ſorts, the taking away of the ſuperabundant wetneſs; the deſtruction of many aquatic vegetables, and ſome others. See LAND, STONE, TILLAGE, and WOOD.

REMOULIN, in the *Manege*, is uſed to denote a ſtar upon a horſe's forehead.

REMOULINS, in *Geography*, a town of France, in the department of the Gard, and chief place of a canton, in the diſtrict of Uzés; 7 miles S.E. of Uzés. The place contains 905, and the canton 4758 inhabitants, on a territory of 135 kiliometres, in 8 communes.

REMOUNT, in *War*. *To remount the cavalry*, or *dragoons*, is to furniſh them with freſh horſes, in lieu of ſuch as have been killed or diſabled in the ſervice.

REMPHAN, in *Antiquity*, the Egyptian name for the planet Saturn. Some think that remphan was the moon, others Mercury and Mars, and others the ſun. See CHIUN.

REMPLY, in *Heraldry*, ſomething *filled up*. The term is chiefly uſed to denote, that the chief is quite filled up with a ſquare piece of another colour, leaving only a bordure of the proper colour of the chief about the ſaid piece.

REMPORETTY, in *Geography*, a town of Hindooſtan; 30 miles N. E. of Travancore.

REMS, a river of Wurtemberg, which runs into the Neckar, 4 miles N.W. of Waiblingen.

REMSA, or REMISSAM, a town of Saxony, in the lordſhip of Schonburg; 2 miles N.N.E. of Glauchau.

REMSCHEIDT, a town of the duchy of Berg; 2 miles S.W. of Lennep.

REMSEN, a townſhip of America, in Oneida county, New York, E. of Leyden and adjoining it.

REMUNGOL, a town of France, in the department of the Morbihan; 7 miles S. of Pontivy.

REMURIA, among the Romans, a feſtival inſtituted in honour of Remus by his brother Romulus. See LEMURIA.

REMUZAL, in *Geography*, a town of France, in the department of the Drôme, and chief place of a canton, in the diſtrict of Nyons; 6 miles N.E. of Nyons. The place contains 514, and the canton 3724 inhabitants, on a territory of $272\frac{1}{2}$ kiliometres, in 17 communes.

REMY, a town of France, in the department of the Oiſe; 6 miles N. of Clermont.

REN, a town of Ruſſia, in the government of Novgorod; 16 miles S.E. of Uſtiuzna.

RENAISON, a town of France, in the department of the Rhône and Loire; 6 miles W. of Roanne.

RENAIX, a town of France, in the department of the Scheldt, and chief place of a canton, in the diſtrict of Audenaerde. The place contains 9499, and the canton 14,683 inhabitants, on a territory of 70 kiliometres, in 6 communes.

RENALIS, RENAL, in *Anatomy*, an epithet applied to the parts belonging to the kidney; as to the artery and vein of the organ, alſo called *emulgent*, of which the former comes from the aorta, the latter joins the inferior vena cava; ſee ARTERY and VEIN: to the plexus of nerves derived principally from the ganglia of the great ſympathetic; ſee NERVE: and to the ſmall bodies placed above the kidnies, called the *renal capſules*. See alſo KIDNEY.

RENALIS *Lapis*, in *Natural Hiſtory*, the name given by many authors to a ſort of ſiderochitum, or cruſtated ferruginous body of that kind, containing a nucleus of a different matter from that of the cruſts. It is found about Prague, and in ſome other places, lying near the ſurface in ſtrata of a yellow clay. Its uſual bigneſs is that of a ripe peach, and its cruſts are of a duſky ferruginous brown colour: and its internal nucleus of a pale yellowiſh-green, compoſed of a marley earth, and uſually of a kidney-like ſhape, whence its name.

RENASSAU, in *Geography*, a town of Hindooſtan, in Dowlatabad; 114 miles N.W. of Hydrabad. N. lat. 18° 30′. E. long. 79° 10′.

RENATHIA, a town of Aſiatic Turkey, in Caramania; 10 miles S.W. of Satalia.

RENAU D'ELISAGARAY, BERNARD, in *Biography*, a diſtinguiſhed engineer and naval architect, was born in the province of Bearn, in the year 1652. He was at an early age inſtructed in the mathematical ſciences, and was obſerved not to read a great deal, but to think moſt profoundly, and as he advanced in years, he was capable of thinking upon the moſt abſtruſe ſubjects, as well in the midſt of company, as in the cloſet. One of the firſt books that attracted his attention was Malebranche's "Reſearche de la Verité," and, it is ſaid, it made ſuch an impreſſion upon him, that nothing could efface it through the whole of life. It gave him a full conviction of the truths of religion, and preſerved his morals pure and uncorrupted. In 1679 he was placed with the count de Vermandois, admiral of France, as his inſtructor in naval affairs. When, by the royal command, conferences were held to determine upon a plan for bringing to perfection the conſtruction of veſſels, Renau was called upon for his opinion; and at length the ſyſtems of Du Queſne and that of Renau were alone left for conſideration, and to the honour of Renau, then young and almoſt unknown, his plan was adopted, and he himſelf was ſent to Breſt and the other ports to put it in execution.

In 1680, the Algerines having declared war againſt France, Renau propoſed the bombardment of Algiers, for which purpoſe he conceived the idea of bomb-veſſels, which were as yet unknown. This was at firſt regarded as viſionary; but reliance being placed on his talents, he was permitted to make the trial, and he brought five of theſe veſſels before the town, where, under the command of Du Queſne, the bombardment was executed with complete ſucceſs. In 1684 he was employed, as engineer, at the bombardment of Genoa; from this place he went to join Vauban, who was fortifying the frontiers of Flanders and Germany, and he contracted an intimate friendſhip with that great man. In 1688 he accompanied Vauban to the ſiege of Philipſburg, and afterwards conducted, or was preſent, at ſome other ſieges; yet in the midſt of theſe active ſervices he found leiſure to attend to his ſtudies, and publiſhed in 1689 his "Theorie de la Manœuvre des Vaiſſeaux:" ſome of the propoſitions in this work were conteſted by the celebrated Huygens. In this ſame year he endeavoured to prove, by argument, that the navy of France might be rendered capable of making head againſt that of England and Holland united, and his obſervation produced ſuch an effect upon the government, that an order was made to change all the 50 and 60-gun veſſels, on the ſtocks, into ſhips of a higher rate. About the ſame time he invented a new ſeries of naval evolutions, ſignals, and orders of battle. His merits were well underſtood by the government, who rewarded him with a penſion, and conſiderable rank in the ſervice. He was now ſent to Breſt for the purpoſe of inſtructing the naval officers in his newly invented evolutions, &c. He met with an oppoſition, which is not uncommon in endeavouring to change old eſtabliſhed cuſtoms. Of his opponents, two of the moſt diſtinguiſhed were put under arreſt and broke, though he did his utmoſt to prevent the puniſhment being carried to that extremity. He afterwards ſerved under Vauban at the ſiege of Namur, from thence he repaired to St. Malo after the battle of La Hogue, to ſave the relics of the French fleet which had taken ſhelter there. Having conſtructed a veſſel of 54 guns upon his own plan, Renau put to ſea with the view of intercepting two rich Engliſh Eaſt Indiamen, one of which he captured after a deſperate engagement. Among the booty were ſome packets of diamonds, which he thought of too great value to be claimed by himſelf, though the naval cuſtoms would have juſtified him in it, and he carried them to the king, who accepted the prize, and remunerated the captor with an annuity. When Philip V. ſucceeded to the crown of Spain, he ſent to his grandfather, Lewis XIV., to requeſt that he might have Renau to direct his engineers in fortifying his moſt important towns. He found means to render the crown of Spain the moſt important ſervices, and was, in 1704, employed in the ſiege of Gibraltar, which, it has been aſſumed by the French biographer, was about to ſurrender, when it was relieved by the Engliſh fleet. To the diſgrace of the court of Spain, whoſe intereſts he had effectually promoted, and in whoſe cauſe he had expended his own property, he was ſuffered to return to France with a ſingle piſtole in his pocket, though his Catholic majeſty had given him the title of lieutenant-general of the armies of Spain. The high reputation which Renau had acquired as an engineer, cauſed the grand-maſter of Malta to requeſt that he might be ſent to that iſland on an alarm of an invaſion, which was readily granted. Soon after this Lewis XIV. died, and the duke of Orleans ſucceeded to the regency, who appointed Renau to be counſellor of the marine council, and grand-croix of St. Louis. He died of a dropſy in 1719, and his death was, like that of La Trappe, in ardent aſpirations after another life: "What a difference," he exclaimed, "from one moment to the following! I am going to paſs in an inſtant from the thickeſt darkneſs to perfect light." He had been twenty years an honorary member of the Academy of Sciences, and was among the firſt after that claſs was inſtituted.

RENAUDOT, Eusebius, a learned writer on the eccleſiaſtical hiſtory and antiquities of the Eaſtern church, was born at Paris in 1646. He was educated at the Jeſuits' college, and entered the congregation of the oratory when he was about 19 years of age, though he had no intention of entering into holy orders, or to the taking any eccleſiaſtical degree. He was particularly attached to the ſtudy of the oriental languages, in the knowledge of which he far excelled almoſt all his contemporaries; and he applied with ſucceſs to the ſtudy of ſo many other tongues, that he was ſufficiently maſter of ſeventeen different languages, to be able to ſpeak the greater number of them with facility. He became well known at court, where his genius, his talents, and his politeneſs, made him much eſteemed and admired. Here he was noticed by M. Colbert, who was deſirous of eſtabliſhing printing-preſſes for the oriental languages at Paris, and conſulted Renaudot upon the ſubject, as a perſon who might ably contribute to render ſuch an eſtabliſhment uſeful to the ſtate as well as the church. To engage his aſſiſtance, he promiſed him the reverſion of the poſt of keeper of the king's library; but the miniſter died before the place became vacant. He received a ſimilar promiſe from the archbiſhop of Rheims, and was again diſappointed. He was, however, employed by the king in various confidential concerns of great importance relating to the affairs of Rome, England, Spain, &c. So much was his time occupied by theſe engagements, that he almoſt entirely diſcontinued his favourite ſtudies. In the year 1689 he was received into the French Academy, and in 1692 into the Academy of Inſcriptions and Belles Lettres. He found a patron in the cardinal de Noailles, archbiſhop of Paris, whom he accompanied to Rome in the year 1700, and into the conclave which elected Clement XI. to the papal dignity. While he remained in that city, the collections of the Vatican furniſhed him with new matter relating to the oriental churches, and revived an intention, which he had long before encouraged, of preparing for publication ſome pieces which ſerve to illuſtrate their hiſtory and opinions. In this deſign he was aſſiſted by the new pope, who perſuaded him to remain in Rome ſeveral months after the departure of cardinal de Noailles. His holineſs would gladly have conferred upon him ſome valuable benefices, but he refuſed to accept of any thing beyond a ſmall priory. The abbé Renaudot afterwards went to Florence, where he met with moſt flattering reception from the grand duke, who aſſigned him apartments in his own palace, loaded him with preſents, and on his departure directed that he ſhould be conveyed on board one of his own veſſels to Marſeilles. At Florence, likewiſe, he was made a member of the Academy de la Cruſca. Soon after his return from France, he was rouſed by an attack upon father Nicole's "Perpetuity of the Faith of the Catholic Church reſpecting the Euchariſt;" and in 1708 he publiſhed "A Defence of the Perpetuity of the Faith againſt the Calumnies, &c." He afterwards entered more fully into the ſubject which he defended, and diſplayed all his erudition and ingenuity in endeavouring to ſhew the conformity between the doctrine of the Greeks, and all the oriental Chriſtians, with that of the Latin church. What he wrote upon the ſubject extended to two vols. 4to. which were publiſhed in 1711 and 1713, by way of of ſupplement to father Nicole's work. During the regency of the duke of Orleans he made frequent efforts to obtain his encouragement of the plan for eſtabliſhing printing-preſſes for the oriental tongues, and was promiſed, but never obtained effectual ſupport. The latter years of his life he ſpent in completing numerous very learned and important publications, among which may be mentioned, "Hiſtoria Patriarcharum Alexandrinorum Jacobitarum:" "Liturgiarum Orientalium Collectio," in 2 vols., accompanied with very learned diſſertations: "Ancient Accounts of India and China, by two Mahometan Travellers in the 9th Century, tranſlated from the Arabic." Renaudot died in the year 1720, at the age of 74 years, greatly regretted by the literati of that age, to whom he was a communicative and moſt agreeable companion, and lamented by the poor, to whoſe relief he had dedicated a large portion of his income. Moreri.

RENAY, or Ronse, in *Geography*, a town of France, in the department of the Jemappe, with a magnificent chateau; 7 miles S. of Oudenarde.

RENCHEN, a town of the duchy of Baden; 4 miles N.N.W. of Oberkirch.—Alſo, a river of Baden, which riſes in the Ortnau, and runs into the Rhine, 10 miles N. of Oberkirch.

RENCOUNTER, formed from the French, *rencontre*, *meeting*, in the *Military Art*, the encounter of two little bodies or parties of forces.

In which ſenſe, rencounter is uſed in oppoſition to a pitched battle.

Rencounter, in ſingle combats, is uſed by way of contradiſtinction to duel.

When two perſons fall out, and fight on the ſpot, without having premeditated the combat, it is called a rencounter.

RENCOUNTRE, or Rencontre, in *Heraldry*, is applied to animals when they ſhew the head in front, with both eyes, &c. or when the face ſtands right forward, as if they came to meet the perſon before them.

Indeed, in deer, this is called *maſacre*; and, in the leopard, it is the natural ſituation. He bears ſable, in rencountre, a golden fleece.

RENDE, in *Geography*, a town of Naples, in Calabria Citra; 5 miles N.N.W. of Coſenza.

RENDER, in *Law*, a term uſed in levying a fine. A fine with render, is that by which ſomething is rendered back again by the cognizee to the cognizor.

The lawyers alſo ſay, there are certain things in a manor, which lie in *prender*, *i. e.* which may be taken by the lord, or his officers, when they pleaſe, without the tenant's leave; and others which lie in *render*, that is, muſt be rendered or anſwered by the tenant, as rents, reliefs, heriots, and other ſervices. See Prender.

Some ſervice conſiſts in ſeiſance, ſome in render.

RENDERING, in *Building*. See Pargeting.

Rendering, in *Sea Language*, is generally underſtood to be the effect of yielding or giving way, without reſiſtance, to the efforts of ſome mechanical power. It is uſually expreſſed of a complicated tackle, laniard or laſhing, when the effect of the power applied is communicated with facility to all the parts, without being interrupted in its paſſage. It is therefore uſed in contradiſtinction to jamming.

RENDEZVOUS, or Rendevous, a place appointed to meet in, at a certain day and hour.

The word is French, and is found ſo commodious, that moſt nations uſe it in its purity, for want of a word of equal import in their reſpective languages.

Thus, in a military ſenſe, the rendezvous is the place appointed by the general, where all the troops that compoſe the army are to meet at the appointed time, in caſe of an alarm; and the regiments have their particular rendezvous, called their quarters of aſſembly.

In a naval ſenſe, it denotes the port or place of deſtination, where the ſeveral ſhips of a fleet, or ſquadron, are appointed to rejoin the whole, in caſe of a ſeparation, occaſioned by tempeſtuous weather, or other unforeſeen accident.

Rendezvous *Bay*, in *Geography*, a bay on the S. coaſt of Antigua, W. of Falmouth harbour.

Rendezvous, *Iſland of*, an iſland, or rock, in the ſouthern Indian ocean, diſcovered in 1773 by M. de Kerguelen, near the N. coaſt of Kerguelen's land, and called by captain Cook "Bligh's Night-cap."

Rendezvous *Key*, a ſmall iſland in the bay of Honduras, near the coaſt of Mexico. N. lat. 16° 59'. W. long. 88° 40'.

RENDS, in a *Ship*, are the ſame as the ſeams between her planks.

RENDSBORG, in *Geography*, a town of Germany, in the duchy of Holſtein, ſeated on a canal which communicates with the Baltic, on the borders of Sleſwick, ſuppoſed to be one of the ſtrongeſt towns in the Daniſh dominions, and generally well garriſoned. The number of inhabitants is about 3600; 15 miles W. of Kiel. N. lat. 54° 22'. E. 9° 52'.

RENE', a town of France, in the department of the Sarthe; 15 miles N. of Le Mans.

RENEALMIA, in *Botany*, a new genus of Mr. Brown's, has lately received that name from him, in juſt commemoration of Paul Renealmus, or Renaulme, a phyſician at Blois, who publiſhed, in 1611, a thin quarto volume at Paris, entitled *Specimen Hiſtoriæ Plantarum*, with expreſſive, but ſtiff, and not neatly finiſhed, engravings in copper, in which each plant is diſtinguiſhed by an appropriate Greek name, moſtly of the author's invention. Mr. Brown obſerves, that this author was the firſt who paid attention to the differences in the number, ſituation, and proportion of the ſtamens. Linnæus, in his own copy of the work, has expreſſed a well-founded ſurprize, at its being never quoted by the Bauhins. Plumier was the author of the firſt *Renealmia*, now ſunk in the Linnæan *Tillandſia*. Linnæus, or his ſon, dedicated a monandrous genus, in the Supplementum Plantarum, to the memory of this meritorious botaniſt; but it proved not diſtinct from a more generally-received genus, of the ſame date, *Alpinia*. We wiſh the preſent *Renealmia* may be found ſufficiently different from *Siſyrinchium*, to which its ſpecies were originally referred by its learned author.—Brown Prodr. Nov. Holl. v. 1. addend. (Siſyrinchium; ibid. 304.)—Claſs and order, *Monadelphia Triandria*. Nat. Ord. *Enſatæ*, Linn. *Irideæ*, Juſſ. Brown.

Eſſ. Ch. Calyx none. Petals ſix, regular; three inner ones largeſt, contracted at the baſe. Style one. Stigmas three, thread-ſhaped, involute, acute. Capſule inferior, obovate, of three cells. Seeds angular.

The ſpecies are herbaceous, ſmooth, inhabitants of woods. *Roots* fibrous, ſometimes tuberous. *Leaves* graſſy, lax, ribbed. *Stem* roundiſh, ſometimes divided. *Flowers* in alternate umbellate bunches, with ſhort permanent ſheaths. *Corolla* regular, white, ſpreading, ſoon falling off; the outer petals generally greeniſh at the back; the inner often furniſhed with claws. *Filaments* either combined below, or diſtinct; their upper part ſpreading. *Capſule* membranous. *Seeds* in two rows, black.

1. R. *paniculata*. Panicled Renealmia. Brown n. 1.—Stem panicled. Leaves ribbed; roughiſh at the edge. Outer

petals

petals linear-lanceolate; inner scarcely twice as large, obovate-oblong. Filaments united half way up.—Gathered by Mr. Brown, near Port Jackson, New South Wales. The *leaves* are all from ten to eighteen inches long, and for the most part rough-edged.

2. R. *grandiflora.* Large-flowered Renealmia. Brown, under the former.—Stem panicled. Leaves ribbed; roughish at the edge. Inner petals four times as large as the outer. Filaments united half way up.—Gathered by the Rt. Hon. sir Joseph Banks, in New Zealand. Akin to the former, but differing in the proportion of its inner *petals*, which are four or five times the size of the outer.

3. R. *pulchella.* Elegant Small Renealmia. Brown n. 2. —Stem nearly simple. Leaves with smooth edges. Outer petals oval-oblong; inner obovate, with short claws. Filaments distinct.—Gathered by Mr. Brown near Port Jackson. The *leaves* are only three or four inches long.

RENE'E DE FRANCE, in *Biography*, duchess of Ferrara, born at Blois in 1510, was daughter of Lewis XII. and Anne of Britanny. She was affianced, when very young, to Charles of Austria, afterwards emperor, and some years after was fought in marriage by Henry VIII. of England, but neither of these matches took place, and Francis I. gave her to Hercules II. of Este, duke of Ferrara. This princess is celebrated for her talents: she had a great capacity, and an insatiable thirst for knowledge, and her studies were not limited to history, the languages, and mathematics, but embraced various other topics, especially astrology and theology. The religious controversies of the time greatly interested her, and she became zealously attached to the tenets of the reformers; her court at Ferrara became the refuge of all who were suspected of heresy; and her conduct gave so much offence to the court of France, that Henry II. sent a doctor to the duke with the following instructions: "If the duchess persist in her errors, she must be separated from all conversation: her children must be taken from her, and all her domestics who are suspected of heresy, and who are to be prosecuted; with regard to the princess herself, the king refers to the prudence of her husband to proceed against her as he shall judge proper, avoiding, nevertheless, what might occasion too much scandal." After the death of the duke, in the year 1559, this princess returned to France, and resided at her castle of Montargis. In the religious wars the duke of Guise summoned her to deliver up some partizans who had taken shelter with her, she replied, "I will never deliver up those who look to me for protection; and if you attack the castle, I will be the first to appear in the breach, to see if you will have the audacity to kill a king's daughter." She was, however, at length obliged, much against her will, to send away 460 persons, to whom she had afforded an asylum. She parted with them in tears, after providing for the expences of their journey. At the massacre of St. Bartholomew she was the means of saving the lives of a great number of Protestants. Her four children were taken successively from her, and brought into France, to be educated in the principles of the Catholic church. She died at Montargis, in the year 1575. Moreri.

RENEGADO REEF, in *Geography*, a rocky shoal in the bay of Honduras, near the coast of Mexico. N. lat. 16° 16′. W. long. 88° 50′.

RENEGATE, RENEGADO, a person who has apostatized, or renounced the Christian faith, to embrace some other religion, particularly Mahometanism.

They are the renegadoes who prove the most barbarous to the Christians when they fall into their hands. The renegate is thus called, *quasi re-negat Christum.*—Hoveden mentions this in the year 1192, under the name of *renier*, from the French, *renier, to deny again.*

RENDLE, in *Geography*, a river of France, which runs into the Seine near Rouen.

RENDLING CURD, in *Rural Economy*, a term used provincially to signify the broken curd in cheese-making. See CHEESE and DAIRYING.

RENES, in *Anatomy*, the Latin name for the kidnies. See KIDNEY.

RENES *Succenturiati*, the two small bodies, of which one is placed above each kidney. The literal translation of the expression, *reserve kidnies*, seems to indicate a notion, entirely unwarranted by our knowledge of their organisation and functions, that they might supply the place of the kidnies if they failed in their office. These bodies are also called capsulæ renales or atrabilariæ, and glandulæ suprarenales. They are described in the article KIDNEY.

RENESBONA, in *Geography*, a river of America, which runs into lake Erie, N. lat. 41° 47′. W. long. 81° 55′.

RENETTE, in the *Manege*, is an instrument of polished steel, with which they sound a prick in a horse's foot.

RENEWING *of Leases and Lives.* See REVERSION, ANNUITY, POLITICAL *Arithmetic*, &c.

RENFORCER, Fr., in *Music*, to reinforce, to pass from soft to loud, from loud to very loud, not all at once, but by degrees, swelling and augmenting the sound, whether a single note sustained, or a series of notes, till the order to reinforce the note or passage is fulfilled, and then return to the common degree of force.

RENFREW, in *Geography*, a royal borough-town in the county of Renfrew, Scotland, is situated near the south bank of the river Clyde, at the distance of six miles from Glasgow, and 49 miles W. by S. from Edinburgh. Though much inferior in magnitude and population to Paisley, it is the head-town, or capital of the county. This distinction it derives from its superior claims to antiquity, and from the circumstance of its being incorporated under a royal charter, originally granted by king Robert II., who had a palace in the immediate vicinity. In virtue of that deed it is governed by a provost, two baillies, and sixteen counsellors. In former times it sent one representative to the parliament of Scotland, and is now a contributary royal borough with Rutherglen in returning a member to the British legislature. About 200 years ago the Clyde passed close to the town, but the river afterwards deserted its ancient course, which has been converted into a canal communicating with its present channel. By this canal vessels of 200 tons burthen are enabled to reach the town in spring tides; but notwithstanding the advantage of that conveyance, the trade of Renfrew is very inconsiderable; owing, as Mr. Forsyth justly remarks, "to the pernicious effects of borough politics, in withdrawing men from industrious habits and pursuits." A small manufacture of thread, and some soap and candle works, on a confined scale, constitute the chief support of the town; but many of the lower orders are likewise employed in weaving for the manufacturers of Paisley and Glasgow. With respect to buildings, Renfrew consists chiefly of one principal street, about half a mile in length, with several lanes diverging from it. The houses are wholly constructed of stone, but are extremely irregular as to size, form, and position. The public buildings are the church, which is parochial, the town-hall, and a grammar-school. The last is under the patronage of the town-council, and is at present conducted with much ability. There is no regular market held here, but provisions of all kinds may always be obtained at a reasonable price. The fairs take place on the third Tuefday in May and July, the 29th of September, and the firft Friday in December. A general poft-office is eftablifhed at Renfrew. The revenue of the corporation exceeds 500*l.* *per annum*, arifing from the rents of lands, cuftoms, a falmon fifhery on the Clyde, and the profits of a public ferry over that river. This ferry is perhaps the object moft worthy of notice of any connected with the town. There is a ferry-houfe on each fide of the river, the property of the corporation; and a ferry-boat conftructed in fo convenient a manner, that a carriage, with a pair of horfes harneffed, can be ferried over and delivered by one man in five minutes. This is accomplifhed by fixing, on both banks of the river, a rope which runs upon rollers at each end of the boat, and being pulled by the boatman puts it in motion. Renfrew, as the fhire town, is the place where all county meetings are affembled, and where the county quarter feffions of the peace are held.

Renfrew parifh extends between three and four miles in every direction. The whole is level, inclofed, and in a high ftate of cultivation. The foil is a rich loam, and the climate is peculiarly healthy, though fubject to occafional heavy rains. The burgh lands confift of about a hundred acres. This parifh is interfected by the great road between Glafgow and Greenock. Ecclefiaftically confidered, it is within the prefbytery of Paifley, and the fynod of Glafgow and Ayr. According to the parliamentary returns of 1811, the number of its houfes is eftimated at 344, and its inhabitants amount to 2305. Beauties of Scotland, 8vo. vol. iii. Carlifle's Topographical Dictionary of Scotland, 4to. 1813.

RENFREWSHIRE, a county in the fouth-weftern divifion of the kingdom of Scotland, is bounded on the eaft by Lanarkfhire, on the weft, north, and north-eaft by the river Clyde, and on the fouth-weft by the hills of Ayrfhire. This county is of fmall extent, and of irregular fhape; and contains, according to the parliamentary returns of 1811, 8409 houfes, and a population of 92,596 perfons. In general, and efpecially along the northern parts of it, the furface of the ground is level; but there are neverthelefs feveral ridges of hills within its boundaries, fome of which, upon the borders of Ayrfhire, are of confiderable elevation. The hills of Balagich and of Dunware rife to the height of 1000 feet above the level of the fea; and the ifolated hill, called the Craig of Neilfton, to 820. This laft is covered with fine grafs to its very fummit. Thofe adjoining to Ayrfhire, however, are bleak and barren, but command very fine views. On the fouth and weft fides, the fertile vale of Cunningham, which feems at a diftance to be wholly covered with wood, ftretches itfelf to the fhore of the Clyde; while on the north and north-eaft are beheld the level parts of Renfrew and the city of Glafgow, with the lofty Ben-Lomond towering above the clouds, in the back ground.

The rivers and lakes of this county are not of very confiderable confequence in relation to themfelves, but by the induftry of the inhabitants on their banks, they have been rendered of great importance and utility to fociety. Unlike the romantic waters of Ayrfhire, adorned with wood and exciting intereft by the veftiges of ancient magnificence which they every where difplay, the ftreams of this diftrict are made fubfervient to the purpofes of human induftry. If they defcend from a height, it is not to add to the charms of the furrounding fcenery, but to give motion to extenfive machinery, inclofed within immenfe piles of building, where hundreds of mortals toil in the fervice of luxury, or form the materials which are to furnifh clothing to diftant nations. Here, if a ftream fpreads abroad its waters, it is not to embellifh a park, but to afford convenience to a bleach-field, or to ferve a refervoir for the mills in cafe of drought. In proportion as Glafgow is approached, every thing affumes an afpect of activity, of enterprife, of arts, and of induftry. The principal ftreams are the White-Cart, the Black-Cart, and the Grif, which fall into the Clyde below Inchinnan bridge. The White-Cart, which generally receives, by way of eminence, the Cart, runs in a direction from fouth-eaft to north-weft, nearly parallel with the Clyde. It takes its rife in the moors of Eaft Kilbride, Lanarkfhire, and is particularly celebrated in ancient record for its fine large pearls. Thefe, however, have long difappeared; but the river is become a fource of more certain and beneficial wealth by its utility to the manufacturing interefts of the county. Above Paifley, which ftands upon its banks, it winds its way through a variety of fmall hills capable of cultivation to their fummits; fometimes difappearing altogether, and again fpreading its waters abroad into the plain. Below the town it is navigable for fmall veffels, and is thus beneficial to commerce and trade by facilitating the conveyance of goods. The Black-Cart rifes out of Caftle-Semple loch, in the parifh of Lochwinnoch. From that beautiful lake it defcends northward, and receives in its courfe the waters of the Grif. This laft ftream has its fource in the elevated territory above Largs, which looks down upon the angle formed by the frith of Clyde. After its union with the Black-Cart, thefe conjoined rivers flow into the White-Cart at Inchinnan bridge. The lakes in the county, befides that of Caftle-Semple above mentioned, are Queenfide loch, in Lochwinnoch parifh, two lochs in Neilfton parifh, and various other fmaller ones, all of them appropriated to ufeful purpofes.

The mineralogy of this county, though not fo important as that of fome others in Scotland, is neverthelefs deferving of attention. In the parifhes of Eaglefham and Kilbarchan, the mineral called the ofmund ftone is frequently found. This remarkable ftone is of various colours, and when newly quarried, is fo foft that it may be cut with a chiffel; but afterwards becomes much harder. It breaks in all directions with unequal and harfh furfaces, readily abforbs water, and if recently heated, the abforption is attended with a hiffing noife. Acids do not affect it, nor is it rent or melted by a ftrong heat. Hence it is much ufed for paving ovens, furnaces, &c. When burnt, it affumes a darkifh colour, and lofes three *per cent.* of its weight, but afterwards regains it by abforption. Some of it is confiderably porous, and almoft femivitrified, in which cafe, when ftruck, it emits a clear and ftrong found. It is found in large maffes in the form of rocks, having the intervening fpaces filled with filiceous or calcareous fpar, and occafionally with zeolite, fteatites, and barytes. This laft mentioned fubftance is found in abundance at Balagich hill in the parifh of Eaglefham, where are likewife two very noted mineral fprings. But the chief field of minerals in Renfrewfhire is that in the vicinity of Paifley, which extends on the one fide into the parifh of Kilbarchan, and on the other towards Glafgow. That part of it which is moft fingular is the coal at Quarreltown, which is undoubtedly one of the moft extraordinary maffes of that mineral hitherto difcovered in the Britifh dominions. Its thicknefs, meafured at right angles, is fifty feet; and it confifts of five layers or ftrata in contact with each other. In confequence of its enormous depth, it is wrought in different floors, in the mode practifed in great open quarries. It is difficult to form a juft conception of the manner in which this fingular mafs of coal lies. In a field of fifteen acres, it is found to dip in various directions. At leaft, conceiving a nearly circular area of thefe contents, the coal, from the north, the eaft, and fouth quarters of that circle, dips pretty uniformly towards the centre. This,

 however,

however, is in fome meafure interrupted by feveral hitches, at one of which the mafs of coal is fuddenly thrown up about fifty feet, at another above thirty. Thefe hitches interrupt not only the direction, but the degree of the dip. On one fide of the northern hitch, it is about one foot in three; on the other fide, only one in fix. Some years ago, this bed of coal having taken fire, the pillars gave way and the ground funk, leaving the furface in a very rugged ftate. The difficulties thus produced, however, have been furmounted, and this mineral treafure reftored to all its utility. The other coal-mines in the county of Renfrew, are thofe of Hawkfhead, Cathcart, and Kilbarchan. The firft has been wrought above 200 years. In the fame neighbourhood, lime is quarried in great quantities, alfo in Cathcart parifh. Iron-ftone accompanies all the coal ftrata, but is more particularly abundant along the fhores of the Clyde.

On the agriculture of Renfrewfhire, it will be unneceffary to offer many remarks. Almoft every portion of the county is inclofed and cultivated, but grafs lands are far more predominant than arable fields. This arifes from the great demand which exifts for the products of the dairy, the garden, and the fold, in confequence of the vicinity of trading and manufacturing towns, and the vaft importation of grain which takes place from other parts of the country, or from abroad. Here the farmers are more fenfible than to object to a free commerce in that article; becaufe they do not envy the inhabitants of lefs populous diftricts, who find no better employment for their lands than that of fcourging them by endlefs crops of grain. One would imagine that the practice in this diftrict alone ought to decide the principle of the corn laws. Here, free importation, fo far from injuring the farmer, augments the value of the foil in every refpect, fimply by increafing the ratio of population.

The lands here differ according to their vicinity to the Clyde, or in the lower part of the county, according to their proximity to the waters of the Cart. In the parifhes of Eaft-Wood and the abbey of Paifley, the lands are beautifully interfperfed with fmall rifing hills, although the foil is generally of a thin clay. Here the farmers keep one half of their grounds in grafs, which they confider as the moft important crop. In the upper diftrict of the county, which comprehends the parifhes of Mearns, Eaglefham, Neilfton, Lochwinnoch, Kilbarchan, Erfkine, and Kilmalcolm, the lands are peculiarly adapted for pafturing fheep, but none of them are fo ftocked, excepting fome inclofures about gentlemen's feats, and a few parks in Neilfton parifh. The parifh of Mearns is perhaps unequalled in Scotland for numerous fmall hills. The farmers here make large quantities of butter. The cows are fmall, of a brown and white colour, and are chiefly of the Ayrfhire breed. Twelve of them afford, during the fummer months, about fixty Englifh gallons of milk daily. Towards the northern part of the county, in Kilmalcolm parifh, the enclofures are generally formed of ftones piled up to the height of four feet. The rotation of crops is three fucceffive crops of oats, and fix years of pafturage. Farm fervants are ufually unmarried, and live in the farmers' houfes. The horfes are of the beft kind, and draw, in a fingle horfe cart, from 17 cwt. to a ton. Farms throughout the whole county are on a fmall fcale; few of them exceed feventy acres.

Renfrewfhire contains one borough-town, Renfrew, and three large manufacturing and commercial towns; *viz.* Paifley, Greenock, and Port-Glafgow, all of which are noticed under their refpective names. Here are likewife feveral populous and thriving villages, fuch as Pollockfhaws, Bridge of Johnfton, and Lochwinnoch, which are chiefly inhabited by weavers, who derive employment from the manufactories of Glafgow and Paifley. The principal manufactured products are thread, filk-gauze, and different kinds of cotton goods.

Various remains of antiquity are ftill vifible in this county. At Paifley was a celebrated abbey for monks of the order of Clugni, the ruins of which are much admired. Here is alfo an old chapel, in the early pointed ftyle, which is noted as the burial place of Margery Bruce, and feveral of the earls of Abercorn. In the parifh of Kilbarchan, near Caftle-Semple, is one of thofe monftrous maffes of whinftone, believed to be a druidical altar. It is twelve feet in height, and fixty-feven feet in circumference; and is known by the name of Clochodrigftone, a corruption of the Gaelic, Cloch-a-Drugh, the Druid's ftone. It is compofed of the fame fort of whinftone of which the neighbouring hills are formed, and has probably been hewn from an elevated rock to the eaftward, on which is a farm-houfe, called alfo Clochodrig; but by what mechanifm it was conveyed cannot, in the prefent application of the mechanical arts, be eafily determined. It refts upon a narrow bafe; but the lower part of it has been covered with ftones gathered from the land. At fome diftance are feveral large grey ftones, fuppofed to have been part of a facred circle furrounding the altar. The parifh of Cathcart is noted for being the fcene of the battle of Langfide, the laft contefted by the unfortunate queen Mary, to regain her authority. The place where the action was fought is an eminence rifing rapidly on the north and weft fides, and defcending very gradually on the fouth and weft fides. On the fummit is an elliptical intrenchment, commonly called queen Mary's camp; but which is undoubtedly of much higher antiquity, and probably of Roman origin. On an hill, oppofite to Langfide, is the old caftle of Cathcart, near which queen Mary ftood during the battle, and witneffed the difcomfiture of her friends, and the annihilation of her hopes. On the other fide of this range of hills is another ancient caftle, now in ruins, which belonged to the anceftors of the great reformer Knox; and at a fhort diftance from it, on an elevated rock, may be feen one of thofe green artificial hills, ufually called moats. It is of a fquare form, the fides facing the four cardinal points; the weftward refts on the precipitous edge of the fteep rock; and the remaining fides are defended by a deep trench, cut out of the folid ftone. Each fide of this mount meafures fixty feet in length at the bafe, and nineteen at the fummit; and is twenty-one feet high. The top appears to have been a hollow fquare, furrounded by a parapet, with an entrance on the eaftern fide. No fewer than five other artificial mounts can be feen from the one defcribed; alfo a Roman encampment near Paifley, diftant about five miles. On the top of Barhill are the remains of a rude encampment, which occupies the fummit of a precipice, formed of a perpendicular rock of a bafaltic appearance, which defends it on the north; and on the fouth it has a parapet of loofe ftones. The tradition in the neighbourhood is, that it was an encampment of the celebrated fir William Wallace. The pinnacle of rock is fhewn where they fay Wallace fat while he enticed the Englifh forces into a bog at the bottom of the rock, where they were all deftroyed; but no hiftorian confirms this ftatement. In an ifland of Caftle-Semple loch is ftill to be feen the Pail or Peel, an old caftle, to which the lairds of Semple were accuftomed to retreat in times of unufual danger. In the lake, canoes hollowed out of fingle trees, like thofe of the Indians, have been occafionally difcovered. Lower down the country the ruins of the caftle of Newark chiefly claim attention. It ftands on the eaftern point of the bay, on which the town and harbour of Port-Glafgow is fituated.

fituated. When entire it confifted of a fquare court, with a tower at one angle, which is by far more ancient than any other portion of the building. When, or by whom it was erected, is unknown: this caftle was long the property of the Dennieftouns of that ilk, and afterwards came into the poffeffion of the family of Maxwell. In this county is a variety of objects bearing the name of the renowned and patriotic Wallace, who was a native of the village of Elderflie, in the neighbourhood of the town of Paifley. See Wallace.

The only other objects of antiquarian intereft we fhall mention, are four communion cups, ftill preferved in Kilmalcolm parifh, and which were ufed by John Knox in adminiftering the facrament of our Lord's fupper. They appear to have been originally candlefticks; and it was perhaps only from the neceffity of the times that they were converted to this pious purpofe. They are of the pureft filver; and, whether from the affociation of ideas, or their actual fafhion, have a very antique and venerable appearance. Beauties of Scotland, vol. iii. 8vo. 1806.

RENGAH, a town of Sweden, in Weft Bothnia; 30 miles N.N.W. of Umea.

RENGO, a town of Sweden, in the province of Tavaftland; 8 miles S.S.W. of Tavafthus.

RENI, Guido, in *Biography*, the principal painter of the Caracci fchool, was born at Bologna in 1574. At an early age he became the difciple of Denis Calvart, a Fleming of great reputation, but afterwards ftudied under the Caracci, preferring the ftyle of Ludovico to that of Annibal, becaufe there appeared more of grandeur and of grace in his compofitions than in thofe of the others.

When he left the Caracci, he went to Rome; and with a mind intent upon forming a ftyle of art for himfelf, ftudied the works of Raphael, with which he feemed enraptured; but the vigour and force with which the recent works of Caravaggio were conducted attracted him, and for a while he attempted to follow it. Happily he was diverted from it by an obfervation of Annibal Caracci; *viz.* that the beft mode of rivalling the renown of Caravaggio might perhaps arife from a different mode of art, by contrafting his confined and lamp-like effects with a broader and more ample light; and for his vulgar forms, and obfcure outline, fubftituting clearnefs in the parts and forms, built upon the pure models of antiquity. This remark, made in fpleen by Caracci, operated powerfully on the mind of his fkilful pupil, and induced him to try its truth. He immediately devoted himfelf to the ftudy of what was graceful and agreeable in form, colour, and effect; and his fuccefs is teftified by numberlefs beautiful productions, of which we poffefs many in England; and France is ftill more rich in them.

His compofition is not, however, fo free from affectation as the nature of the fubjects he chofe demanded; the very attempt to make them graceful, too frequently militated againft its object, and he fubftituted the grace of the theatre for that of nature. In his female heads and proportions, his model was the antique: and the character and features of the daughter of Niobe is difcernible in moft of them. He dreffed them with becoming elegance, and executed the different parts with great freedom and truth of pencil; not unfrequently, however, in a tone of colour too light, or too leaden for flefh; with a greenifh hue, which rather characterifes the hand of death, or the coldnefs of marble, than the glowing warmth of life, and the flexile foftnefs of nature.

His difpofition of draperies was elegant; judicioufly applied to the filling up of voids in the grouping of limbs, or figures, and was wrought with the greateft freedom; yet finifhed with almoft minute attention to the foldings. Thefe he arranged in a grand ftyle, but they not unfrequently exhibit the ftudy which he beftowed upon them; and appear to arife rather from the neceffities of art, than the actions of the figures. The execution of his pictures is of the moft free and agreeable kind; manifefting a perfect underftanding of nature; the touch being light, full, and delicate; and though they are finifhed very highly, yet there remains no appearance of labour. In expreffion, he fometimes attained the greateft perfection; as in the head of our Saviour in the Louvre, and of which the prefident Weft has a very fine duplicate: but, in general, it was rather the grace and artifice of the theatre which guided him; and his figures appear to act more than to feel. Such was the refpect paid to his abilities, that he was crowned with honour and riches; but it is lamentable to add, that one vice, in which he indulged after he had paffed the meridian of life, *viz.* gaming, robbed him of both, and reduced him to poverty and difgrace; from which he was not able to free himfelf during the remainder of his life, which continued till he had attained the age of 67.

In the gallery of the Louvre there are between 30 and 40 of the works of Guido, large and fmall, and in his various manners; and as he there comes in immediate competition with his mafters, connoiffeurs have an excellent opportunity of judging of his comparative merit. We have alfo a great many of his cafel pictures in England, but they are fcattered about in various collections.

Reni, in *Geography*, a town of European Turkey, in Beffarabia, on the Danube; 40 miles W. of Ifmail. N. lat. 45° 23′. E. long. 28° 44′.

RENIFORME Folium, in *Botany*, a kidney-fhaped leaf. See Leaf.

RENITENCY, Renitentia, or *Renifus*, among *Philofophers*, that force in folid bodies, by which they refift the impulfe of other bodies; or re-act as much as they are acted on.

RENKY, in *Rural Economy*, a term provincially fignifying tall or high, when applied to animals, &c.

RENNEBAUK, in *Geography*, a river of America, in the province of Maine, which runs into the Atlantic, N. lat. 43° 20′. W. long. 70° 27′.

RENNEBO, a town of Norway, in the province of Drontheim; 36 miles S. of Drontheim.

RENNEL's Sound, a bay of the North Pacific ocean, on the W. coaft of Queen Charlotte's ifland. N. lat. 53° 28′. W. long. 133°.

RENNERSDORF, a town of Silefia, in the principality of Neiffe; 8 miles E. of Neiffe.

RENNES, a city of France, and chief city of the department of the Ille and Vilaine; and, before the revolution, the fee of a bifhop, and capital of Bretagne; fituated on the Vilaine, by which it is divided into two parts. It is large and populous, containing eight parifh churches, befides the cathedral and feveral convents. The four parts which it comprehends are denominated the north-eaft, fouth-eaft, fouth-weft, and north-weft The firft contains 5950 inhabitants, and its canton 13,147, on a territory of $142\frac{1}{2}$ kiliometres, in 7 communes; the fecond contains 5253 inhabitants, and its canton 12,064, on a territory of $97\frac{1}{2}$ kiliometres, in 4 communes; the third contains 3081 inhabitants, and its canton 12,254, on a territory of $142\frac{1}{2}$ kiliometres, in 9 communes; and the fourth part contains 11,620 inhabitants, and its canton 14,332, on a territory of $37\frac{1}{2}$ kiliometres, in 3 communes. N. lat. 48° 7′. W. long. 1° 36′.

RENNET,

RENNET, in *Rural Economy*, a term applied to the coagulum for making cheeſe. It is prepared from the bag, maw, or ſtomach, of the young calf, by a ſort of ſalt pickle. It is of vaſt advantage in the art of cheeſe-making to have good ſweet rennet, the particular mode of managing which may be ſeen under the heads CHEESE, DAIRY, and DAIRYING.

The preparation is formed in different modes, in different cheeſe diſtricts, in the different parts of the kingdom; but moſtly either in the manner of a ſolution, or that of a dry ſkin. As there is, however, much variation in the quality or ſtrength of the different ſkins, it is probably the beſt method to reduce them into the ſtate of a ſolution; as, by that means, the neceſſary quantity, in every caſe, may be the beſt aſcertained.

In ſome places, it is found the moſt certain practice to prepare the whole of the dried maw ſkins, which are required for a ſeaſon, at one time, by pickling and ſteeping them in different ſeparate quantities of pure ſpring water and ſalt, in an open veſſel, or veſſels, mixing the different infuſions together, and then paſſing them through a fine linen ſieve, afterwards adding rather more ſalt to the whole than can be retained in the ſtate of ſolution, as ſhewn by the appearance of ſome at the bottom of the veſſel. The extraneous ſcummy matter, that comes to the ſurface, is continually to be removed as it riſes, and freſh portions of ſalt occaſionally ſupplied, as they may be wanted. In this ſtate it is ready for uſe, about four ounces being ſufficient for a large cheeſe.

In other parts, the maw ſkins are ſimply well ſalted, and ſteeped in ſalt pickle for ſome length of time; then well dried, by being ſpread out by means of ſmall pieces of ſticks; in which ſtate they are made uſe of, by cutting pieces from the top and bottom parts of them, about the ſize of a half-crown for a middling-ſized cheeſe, as thoſe parts are in general the ſtrongeſt.

And the following method of preparing rennet is practiſed in the northern parts of the iſland, and deſcribed as the moſt approved method in the Report on Agriculture for Argyleſhire. Take the maw ſkin of a calf, which has fed entirely upon milk: after it is cold, waſh it gently in water, fill it nearly with ſalt, and place it on a layer of ſalt in the bottom of an earthen mug. One or two more, with ſalt between, and a good deal above them, may be put in the ſame mug, and kept in a cool place, with a ſlate on the top, for ſix or eight months, or till cheeſe-making time next year. The ſkins are then taken out, and the brine allowed to drain from them; after which they are diſtended on ſmall hoops or ſplinters put croſs-wiſe within them, till they dry. Put the ſkins then in an open veſſel, with three pints of pure ſpring water for each ſkin. Let them ſtand twenty-four hours; after which take them out, and infuſe them other twenty-four hours in other water, but not more than a third of the former quantity. Mix theſe two infuſions together, paſs them through a fine linen ſieve, and give them ſalt till the water is more than ſaturated, and ſome remain undiſſolved at the bottom. Rather leſs than a gill will ſerve for thirty-eight pounds of cheeſe. It is remarked, that, inſtead of two infuſions, ſome uſe only one, giving four Engliſh pints to the ſkin, and direct the water to be firſt boiled, and mixed with ſalt into brine that will ſwim an egg, and then to let the heat go off till it is lukewarm, before the ſkin is put in twenty-four hours to ſteep.

It was formerly the practice to mix different kinds of aromatic herbs with the rennet; but the cuſtom is much laid aſide at preſent. The manner of doing it is this: when the maw ſkin is well prepared, two quarts of ſoft pure water ſhould be mixed with ſalt, in which ſhould be put ſweet briar, roſe-leaves, and flowers, cinnamon, mace, cloves, and, in ſhort, almoſt every ſort of ſpice and aromatic that can be procured. Boil them gently till the liquor is reduced to three pints, taking care it be not ſmoked. Strain it clear from the ſkins, and, when milk-warm, pour it into the maw; a lemon may then be ſliced into it, and remain a day or two, after which it ſhould be ſtrained, and put in a bottle well corked, and it will keep good for a year or more. A ſmall quantity will turn the milk, and give the cheeſe a pleaſing flavour.

RENNO, in *Geography*, a town of the iſland of Corſica; 3 miles N.E. of Vico.

RENO, a river of Italy, which riſes a little to the N. of Piſtoia, and runs into the Po, 4 miles above Ferrara.

RENO, a department of Italy, ſo named from the above-mentioned river. It conſiſts of part of the Bologneſe, and contains 199,300 inhabitants, who elect 15 deputies. The capital is Bologna.

RENOGRUND, a ſmall iſland on the E. ſide of the gulf of Bothnia. N. lat. 63° 59′. E. long. 23° 3′.

RENOVATOR, in *Horology*, is a watch that has the property of *renewing* the power of its main-ſpring, or of winding itſelf up, by periodic jerks that it receives from the human body in motion. Recordon of Charing-Croſs, London, took out a patent for this contrivance ſome years ago, which is more ingenious than uſeful; for, while it profeſſes to keep the watch going, without the uſual winding up, ſo long as the watch is worn in the pocket, it foregoes the more uſeful property of the fuſee, and renders the maintaining power very unequal at different times of the day. And ſhould the watch remain ſuſpended, or laid down in a ſtate of reſt, for more than 24 hours, it will ceaſe to perform; ſo that inſtead of being a watch that will go without winding, it requires to be wound many hundred times in the day, by ſmall ſucceſſive quantities, before it will continue to perform throughout the night. We have been favoured by the inventor with a copy of ſo much of the ſpecification as will ſuffice to give our readers an idea of the mechaniſm, and of its mode of action; both which we have examined, and found correſponding with the ſpecification. Others have varied the conſtruction; but the original, we conceive, will be deemed ſufficient for us to particularize, which we will do by a reference to *figs.* 1, 2, and 3, in *Plate* XLIII. of *Horology*, which are copied from the inventor's drawing.

Exact Copy of the Specification, N° 1.—"Letter H repreſents a weight of ſilver, or other metal, which is in equilibrium in the poſition it is viewed, being ſuſtained ſo by a ſpiral ſpring fixed to its arbor, as deſcribed by *fig.* 3. In wearing the watch, or by any external motion that lifts the watch up, it loſes its ſtate of reſt; and by its vis-inertiæ (matter) overcoming the ſtrength of the ſpring, it yields to the laws of gravity, and falls upon the lower ſpring, marked *e e*. When the watch, by the motion of the body, deſcends, the ſpring *e e*, and the aforeſaid ſpiral ſpring, are left at liberty to exert themſelves, and return the weight upwards, till it touches the other ſpring *e e*; and thus, by the motion of the body, is this weight alternately thrown up and down, which turning the ratchet-wheel, marked C in *fig.* 2, which is fixed on the arbor of the weight juſt below the ſpiral ſpring, gathers a few teeth every motion in the wheel P, and being prevented from returning by the click M, carries forward the wheel with a pinion of 10, marked E, which turns the wheel B; which having a pinion of 12 at G, takes into and turns a wheel under the barrel A, which is fixed on the barrel arbor, and by that means is the ſpring wound up.

The upper part of the barrel arbor, marked *b*, has a tooth, which gains a tooth in the wheel, *a*, every revolution; and that brings the pin *c* nearer to the centre, which, when it arrives in a certain position, raifes the piece K (*fig.* 1.), of which the centre, B, (not feen in the figure) is conical, in order that when the faid pin *c* comes near it, it raifes it with eafe, and forces it into the holes, marked N, N, N, in the weight marked H (*fig.* 1.), which effectually ftops its motion, and prevents the ill confequence of over-winding.

L is a cock that carries the pivot of the barrel's axis.

I is a cock that carries the pivot of the wheel H.

A is the barrel which carries a wheel, that catches the pinion D, which carries the minute-hand."

The patent was obtained in July 1780; and part 2d of the fpecification contains drawings, and a plan for applying the fame principle to the fufee; but we do not underftand that it has yet been made to anfwer.

RENRITH, in *Geography*, a town of Germany, in the county of Henneberg; 3 miles S. of Schleufingen.

RENS, RENSE, or *Rees*, a town of France, in the department of the Rhine and Mofelle; near which, in the Rhine, is a remarkable monument of antiquity, called the "Königftuhl," or "Thronus regalis," confifting of a round vault, built of free-ftone, and refting upon nine ftone pillars, one of which ftands in the middle. This vault is 80 feet in circumference, furnifhed above with feven feats, agreeable to the number of electors at that town. The afcent to it is by ftairs of ftone, confifting of 28 fteps, and it has two ftrong doors. On this regal chair the electors formerly held previous confultations for fome time, concerning the election of a king and emperor; and when that election could not be performed at Francfort, it was done at this place; and here were alfo tranfacted the notification and elevation of the elected perfonage, and alfo the confultations of the electors concerning the weighty matters of the empire, as well as a folemn confirmation of their privileges on the part of the emperors. Here alfo was eftablifhed, in the year 1338, the electoral league. Maximilian I. is thought to be the laft emperor who was brought hither; 5 miles S. of Coblentz. N. lat. 50° 18'. E. long. 7° 37'.

RENSEN, a lake of Pruffia, in the palatinate of Culm; 10 miles N.N.E. of Culm.

RENSSELAER, a county of New York, bounded N. by Wafhington county, S. by Columbia, E. by part of the ftates of Maffachufetts and Vermont, and W. by Hudfon river. It contains eight townfhips, *viz.* Troy, Greenbufh, Schodack, Stephentown, Peterfburg, Hofick, Pittftown, and Schactekoke. It contains 36,309 inhabitants.

RENSSELAERVILLE, or RENSSELAERWICK, a townfhip of Albany county, New York, bounded S. by Columbia county, and W. by Hudfon river. In this townfhip, oppofite to the city of Albany, is a medicinal fpring, combining moft of the valuable properties of the celebrated waters of Saratoga.

RENT, REDITUS, in *Law*, a profit, fuch as a fum of money, or other confideration, iffuing yearly out of lands or tenements, alienated on that condition.

The word rent, or render, *reditus*, fignifies a compenfation, or return; it being in the nature of an acknowledgment given for the poffeffion of fome corporeal inheritance. Co. Litt. 144.

It is thus called from the corrupt Latin, *rendita*, for *reddita*, of *redditus;* becaufe, as Fleta tells us, *retroit, et quotannis redit.*

The original of rents is to be fought for in the conftitution of the ancient feuds, which were of a military nature, and in the hands of military perfons: however, the feudatories, being under frequent incapacities of cultivating and manuring their own lands, foon found it neceffary to commit part of them to inferior tenants, obliging them to fuch returns in fervice, corn, cattle, or money, as might enable the chief feudatories to attend their military duties without diftraction; which returns, or *reditus*, were the original of rents.

Under the pure feudal fyftem, this reditus, return, or rent, confifted, in chivalry, principally of military fervices; in villenage, of the moft flavifh offices; and in focage, it ufually confifts of money, though it may ftill confift of fervices, or of any other certain profit.

Rent is regularly due and payable upon the land from whence it iffues, if no particular place is mentioned in the refervation (Co. Litt. 201.); but, in cafe of the king, the payment muft be either to his officers at the exchequer, or to his receiver in the country. (4 Rep. 73.) And ftrictly the rent is demandable, and payable before the time of funfet of the day in which it is referved; though fome have thought it not abfolutely due till midnight. 1 Saund. 287. Prec. Chanc. 555. Salk. 578.

The ufual remedy for non-payment of rent is diftrefs; however, by the common law, diftreffes were incident to every *rent-fervice*, and by particular refervation to *rent-charges* alfo, but not to *rent-feck*, till the ftatute 4 Geo. II. c. 28. extended the fame remedy to all rents alike. Moreover, by this ftatute it is enacted, that every landlord, who hath, by his leafe, a right of re-entry in cafe of non-payment of rent, when half a year's rent is due, and no fufficient diftrefs is to be had, may ferve a declaration in ejectment on his tenant, or fix the fame upon fome notorious part of the premifes, which fhall be valid, without any formal re-entry or previous demand of rent. And a recovery in fuch ejectment fhall be final and conclufive, both in law and equity, unlefs the rent, and all cofts, be paid or tendered within fix calendar months afterwards. Other remedies are action of debt, an affife of mort d'anceftor or novel diffeifin, the writ de confuetudinibus et fervitiis, which compels a fpecific payment of the rent, the writ of ceffavit, and the writ of right fur difclaimer.

For an account of the rental of England and Wales, fee POLITICAL *Economy*.

The lawyers ordinarily reckon three forts of rents, *viz.* *rent-fervice*, *rent-charge*, and *rent-fec*.

RENT-*Service*, is where a man holds lands of his lord by fealty, and certain rent; or by fealty-fervice, and certain rent; or that which a man, making a leafe of lands to another for term of years, referveth to be yearly paid for them.

Rent-fervice is fo called, becaufe it hath fome corporal fervice incident to it, as at the leaft fealty, or the feudal oath of fidelity. (Co. Litt. 142.) For, if a tenant holds his land by fealty, and 10*s*. rent; or by the fervice of ploughing the lord's land, and 5*s*. rent: thefe pecuniary rents, being connected with perfonal fervice, are therefore called rent-fervice. And for thefe, in cafe they be behind, or in arrear, at the day appointed, the lord may diftrein of common right, without referving any fpecial power of diftrefs; provided he hath in himfelf the reverfion, or future eftate of the lands and tenements, after the leafe or particular eftate of the leffee or grantor is expired. Litt. § 215.

RENT-*Charge*, is where a man makes over his eftate to another by deed indented, either in fee, or fee-tail, or for term of life; yet referves to himfelf, by the fame indenture, a fum of money yearly to be paid to him, with a claufe of diftrefs diſtreſs for non-payment: ſo called, becauſe, in this manner, the land is charged with diſtreſs for the payment of it. Co. Litt. 143.

Rent-*Sec*, or *Dry-Rent*, or *Barren-Rent*, is that which a man, making over his eſtate by a deed indented, reſerveth yearly to be paid to him, without any clauſe of diſtreſs mentioned in the indenture. There are alſo other ſpecies of rents, which are reducible to theſe three.

Rents *of Aſſize*, are the certain eſtabliſhed rents of the freeholders, and ancient copyholders of a manor; thus called, becauſe aſſized and certain, in oppoſition to *reditus mobiles*.

Thoſe of the freeholders are often called *chief rents*, *reditus capitales*, and both ſorts are indifferently denominated *quit rents*, becauſe by them the tenant goes quit and free of all other ſervices. When theſe payments were reſerved in ſilver or white money, they were anciently called *white* rents, or blanch-farms, *reditus albi;* in contradiſtinction to rents, reſerved in work, grain, or baſer money, which were called *reditus nigra*, or black-mail. 2 Inſt. 19.

Rent, *Fee-farm*, is a rent-charge iſſuing out of an eſtate in fee; of at leaſt one-fourth of the value of the lands at the time of its reſervation. (Co. Litt. 143.) *Rack*-rent is only a rent of the full value of the tenement, or near it. For a grant of lands, reſerving ſo conſiderable a rent, is indeed only letting lands to farm in fee-ſimple, inſtead of the uſual method for life, or years.

Theſe are the general diviſions of rent; but the difference between them (in reſpect to the remedy for recovering them) is now totally aboliſhed; and all perſons may have the like remedy by diſtreſs for rents-ſec, rents of aſſize, and chief-rents, as in caſe of rents reſerved upon leaſe. Stat. 4 Geo. II. c. 28.

Rents *Reſolute*, are reckoned among the fee-farm rents to be ſold by the ſtat. 22 Car. II., being ſuch rents or tenths as were anciently payable to the crown from the lands of abbeys and other religious houſes; which lands, upon the diſſolution of abbeys, being demiſed to others, the ſaid rents were ſtill reſerved, and made payable to the crown.

Rents, *aſſart*, *chauntry*, *chief*, *gold*, *paſchal*, *rack*, *quit*, and *white*. See the ſeveral adjectives.

Rent, in *Agriculture*, the price paid for lands as farms by the tenants of the proprietors. The rents of lands are ſo extremely various, according to the nature of the ſoil, ſituation, markets, the ſtate of the fences, buildings, and other conveniences, the eaſe of obtaining manures, and many other circumſtances, as to be almoſt incapable of having any general ſpecific prices affixed to them. They were formerly, eſpecially in the northern parts of the iſland, paid in produce and perſonal ſervices; but at preſent, according to Mr. Donaldſon, over the greateſt part of the iſland, they are paid in money, and at two periods or terms in the year. In England, Michaelmas and Lady-day are the cuſtomary terms of payment; the firſt payment commences ſix months after entry to the poſſeſſion of the farm. But that in Scotland, the ordinary terms are Martinmas and Whitſuntide, or Whitſuntide and Martinmas, the tenant being allowed twelve months' credit of the firſt half of the rent in the one caſe, and in the other eighteen. And he obſerves, that this difference in the terms of the payment of rents is material in the purchaſe of landed property, being in general nearly one year's purchaſe in favour of England. And it is farther ſtated, that it was the cuſtom of former times, in various parts of Great Britain, for the tenants to pay what was called *fore-hand* rents, that is, paying the half, and in ſome caſes, the whole year's rent immediately on entering to the farm, and before any benefit was derived from the poſſeſſion of it. This practice is, however, now generally diſuſed, although ſtill kept up in ſome parts of Staffordſhire and Perthſhire, in ſome degree. And we believe that it ſtill prevails in ſome places in Ireland. It is likewiſe added, that letting lands for a term of years at the former rent, but making the farmer pay a conſiderable ſum in ready money by way of fine, was alſo a very common cuſtom; but is now chiefly confined to the crown and church lands in England. This mode was evidently attended with bad conſequences. By draining the tenant of all, or greateſt part of his ready money, he was prevented from improving his farm. Leaſes of lands are conſidered in law as heritable property; therefore, in the event of the demiſe of the tenant, ſoon after having completed a tranſaction of this nature, his eldeſt ſon ſucceeded to the leaſe, and the widow and other children were of courſe, in many inſtances, reduced to poverty; all that was left to them being their proportion of the ſtock on this farm, and often thereby the heir was rendered incapable of keeping poſſeſſion of the farm. In a word, in nine caſes out of ten, it was robbing the tenant of the well-earned reward of his induſtry, during the exiſtence of the former leaſe, and depriving him of the means of turning his new acquiſition to the beſt account; without giving any ſolid advantage in return for it.

It is remarked alſo, that along the greateſt part of the eaſt coaſt of Scotland, which is the principal corn country in the kingdom, a conſiderable proportion of the rent of almoſt every farm is paid in grain and oatmeal. Theſe articles being leſs fluctuating in their value than money, this appears the moſt equitable mode in which the rents of corn farms can be paid. It may indeed affect the farmer's intereſt when any ſudden and unexpected riſe takes place in the price of grain; but if a judgment can be given from experience, it will be found this very ſeldom happens. On the contrary, for theſe laſt twenty years, with only two exceptions, 1783 and 1795, the price of grain, owing to the operation of the corn laws, has been extremely moderate, while every other production of a farm has been doubled in value, and in many caſes tripled. Since theſe periods, the price of this article has, however, riſen, and continued high. The public are often eſſentially benefited by ſo great a proportion of the rents being paid in this way. Many of the proprietors have granaries erected on their eſtates, where, in times of plenty, they ſtore the grain and meal which they receive from their tenants. And every perſon, who is in any degree acquainted with the agricultural exports and imports which take place between ſome diſtricts in Scotland and others, muſt, he thinks, know that the ſupplies afforded on many occaſions from theſe ſtorehouſes have been the means of preventing ſcarcity, and an unreaſonable advance in the price of theſe articles in the large manufacturing towns and other populous places. In Eaſt Lothian, according to the agricultural report of that diſtrict, it has been ſuggeſted by ſome proprietors, that one half of the rent ſhould only be paid in money, the other in kind; and aſſigned as a reaſon, that the profit or loſs ariſing from any material, as the riſe or fall in the price of grain, would, in that way, be equally divided between the landlord and tenant. This is a mode probably founded on equity and juſtice. And it is further ſtated, by the firſt writer, that in the moſt northern parts of Scotland, the rents are, to a certain extent, paid in perſonal ſervices. The tenants are bound to plough and harrow a certain portion of the landlord's farm, to reap, carry home, threſh, dreſs, and mill a certain quantity of the crop. They are alſo bound to pay poultry, eggs, butter, cheeſe, ſheep, ſwine, linen

linen yarn, fiſh, &c.; in a word, they are more the ſlaves of the landlord than their own maſters.

Theſe are ſhameful feudal practices, which the proprietors of ſuch lands ſhould remove as ſoon as poſſible, as without it their intereſts muſt ſuffer greatly from the lands remaining without improvement. Beſides, it is a ſpecies of bondage highly diſgraceful to civilized ſociety. The able author of the Agricultural Report of the county of Argyle in Scotland, thinks that all ſervices, whether paid to the maſter or to any under him, ſhould be entirely aboliſhed; and all rents formed into one ſum of money, including public burdens, ſuch as miniſters' ſtipends, ſchoolmaſters' ſalary, road money, &c. Thus, ſays he, the tenant would have always a clear view of the amount of his rent, and ſave time and trouble, and perhaps expence, by having to ſettle with one only inſtead of many. His time is precious, and ſhould never be thrown away without neceſſity.

In regard to the parliamentary and parochial taxes, they may be ſaid to be paid, the firſt writer ſays, by the tenants over the greateſt part of both kingdoms; and many leaſes contain a clauſe, he obſerves, binding the tenants to pay, not only all the taxes that are impoſed, but alſo all that may be impoſed. But, he thinks, that it appears abſurd that the proprietors, whoſe intereſt it is to attend to the increaſe or decreaſe of all ſuch taxes as more immediately concern their property, ſhould devolve the payment of thoſe taxes on their tenants. They muſt know, that whoever pays them in the firſt inſtance, to them the lands are of leſs value, in conſequence of ſuch taxes having been impoſed. They ought alſo, he thinks, to conſider that their influence might be the means of keeping the moſt extravagant of them, ſuch as the tithes and poors' rates, within more reaſonable bounds, than it is to be expected the utmoſt exertions of the tenants can be able to effect. And that, further, proprietors could aſcertain the value of their property with more minute exactneſs, were they, on the one hand, to receive from their tenants the full rents which their lands are worth, and, on the other, pay all taxes to which they are ſubjected. The intereſt of agriculture, and the eaſe and comfort of the farmers, would at the ſame time, he thinks, be eſſentially promoted, were they relieved from theſe teaſing exactions and compoſitions with which they are ſo frequently moleſted, particularly in this part of the kingdom.

And he ſuggeſts, in reſpect to the general price of renting lands, that when it is conſidered how many circumſtances operate in determining the rent of land, and how much theſe frequently vary in the ſame pariſh or lordſhip, it will be found impoſſible to form any correct idea in regard to the rents payable by the acre for the various kinds of ſoil over the whole iſland. Any conjecture that may be formed (for the ſubject admits, he ſays, no more) muſt be vague and incorrect. It is ſuppoſed, that the remarkable change that has taken place in the ſituation of the kingdom and the manners of the people, by the abolition of the feudal ſyſtem, the increaſe of commerce, manufactures, and agricultural improvements, with the immenſe additional quantity of paper-money introduced within theſe few years into circulation, have had the effect of enhancing both the value and rent of lands. While theſe flouriſh, and paper-money ſupports its nominal value, lands in property or leaſe muſt neceſſarily, he thinks, continue to advance. But that, ſhould any croſs accident interrupt the former, or depreſs the value affixed to the latter, the recent great advance in the rent of lands, in various parts of the iſland, would render ſuch calamities more univerſal in their effects, and of courſe of more ſerious conſequence to the country.

The rent of land is kept up by a great variety of local cauſes, as the particular nature of the farms, their extents, the goodneſs of the roads and markets, the convenience of canals and other ſorts of water carriage, and many other circumſtances of a ſimilar nature. In dairy and graſs diſtricts, as well as ſome others, rents are kept up by the particular modes of occupation, in many inſtances. Many little advantages are connected with the former; while the latter has not any heavy expences to contend with. Small farms are conſtantly higher rented than thoſe of the larger kind. Convenient carriage and large markets are always favourable to rents. Local convenience has invariably great influence in raiſing the rent of land. In ſhort, it has been ſuggeſted by an able writer, that every ſort of improvement in agriculture, as well as manufactures, has a tendency to advance the rent of land; and that, if, to the practical excellence of the former, improvements in the latter ſhould be added, with a more extended commerce, rents may be raiſed to an extraordinary degree. While the contrary of theſe matters is calculated to reduce the quantity of wealth, and, of courſe, to lower the rent of land; conſequently rent riſes and falls with the proſperity or declining ſtate of the agriculture, the manufactures, and the commerce of the country, the former of which is only to be preſerved by peace.

But though the rents of land have been greatly increaſed within theſe few late years, it is probable that they muſt feel the effects of the vaſt load of taxation and other charges which bear ſo hard upon agriculture at preſent.

But the aſcertaining of the rents of lands in the different diſtricts of the kingdom is a point of conſiderable importance both in a political and agricultural view, as by ſuch means the produce of them may be better and more certainly calculated.

Mr. Smith, in his valuable Agricultural Survey of Argyleſhire, ſtates, that the quality of the ſoil is there extremely different; ſo that ſuch valuations as have been lately made, differ, ſometimes on the ſame farm, from 2*s.* to 15*s.* the acre of arable ground. The paſture, too, being partly green hill, but moſtly heath, differs no leſs in its quality than the arable land. Some of it is valued below 4*d.* and ſome above 4*s.* the acre. In the neighbourhood of Campbelton, a few ſpots of arable land let from 2*l.* to 3*l.* the acre. But this price may be ſaid to be put, not altogether upon the land, but partly upon the accommodation. But what proportion the rent of a farm ſhould bear to its produce, depends ſo much on ſoil, climate, ſituation, and other circumſtances, that no general rule can, he thinks, be laid down on the ſubject. In regard to arable lands more particularly, it is a common, though perhaps not a juſt remark, that one-third of the produce ſhould go for rent, one-third for expence and management, and one-third for the farmer's profit, intereſt, &c.

But Mr. Middleton remarks, that the method practiſed by ſome gentlemen, of eſtimating the produce of land by trebling the rent, is very fallacious: three times the rent is not by any means equal to the value of the produce of the land under the beſt ſyſtem of huſbandry now in uſe; though under the old exploded courſe of fallow, wheat, oats, in the ſcanty produce of common fields, and when taxes and the expences of living were at one-half of the preſent amount, it was not very diſtant from the truth. But under the more improved courſes of huſbandry on land, at and under twenty ſhillings an acre, the produce is now, he thinks, more generally worth from five to ſeven times the rent.

In the North Riding of Yorkſhire, as ſtated in the report of that diſtrict, the average rent of farms of pretty good ſoil is from 15*s.* to 21*s.* *per* acre, in which there may be land rated at at from 5*s.* to 35*s.* *per* acre, fo that the average value of a farm will vary according to its proportion of good and bad land. Some farms of the latter kind may be let as low as 5*s.* *per* acre, and fome let cheaper at 30*s.*; fo great is the inequality of the foil, that nothing accurate on this head can be ftated. Near large towns, land for convenience in fmall parcels, and in the aggregate to no great amount, is let at 3*l.* or 4*l.* *per* acre.

But in the weftern diftrict of that county, as about Skipton and Settle, the lands were found to let as high as 40*s.* and 50*s.* the acre; while from the beft information in the corn part of the county at the fame time, 20*s.* and 30*s.* were confidered as a high rent, and in many places it was ftill much lower.

In Shropfhire, the rents of lands, where the roads are bad, and the grounds little improved, are from 8*s.* to 12*s.* the ftatute acre, and in more favourable diftricts and fituations, from 15*s.* to 20*s.* the farm together. But near towns, the price is much higher, as from 2*l.* to 6*l.* the acre.

And in Norfolk, according to Mr. Young, in the light fand diftrict, as marked in the Survey, the average price of letting is 6*s.* the acre; the various loams at 16*s.*; the better fands at 12*s.*; the rich loams 26*s.* and the marfh land clays 28*s.* In Suffolk the feveral foils are ftated to be rented as below, the whole county included, fheep-walk, wafte commons, &c. which are very large deductions from the rate of the cultivated lands:

	s.	*d.*
Strong, wet loam, *per* acre - - -	13	0
Rich loam - - - - -	14	0
Sea diftrict of fand - - -	10	0
Weftern diftrict of ditto - - -	5	0
Fens - - - - - -	2	6

But in all the diftricts, with the exception of the fen, there are tracts that are let at 20*s.* to 25*s.* and even higher, efpecially meadows.

In the county of Effex, the average rent of good landed farms may be ftated at about 20*s.* or 25*s.* the acre. They have lately increafed very much in fome places.

In Suffex, good land is rented at from 20*s.* to 30*s.* the acre, but there is a great deal let at much lower rents. Land has rifen much of late years in many parts of the country.

In the county of Oxford, the rent of land is very various. The red land lets on the average at 30*s.*, the mifcellaneous loams at 25*s.*; the ftone-brafh at 20*s.*; and the Chiltern at 16*s.* the acre. There are, however, large portions of land let at ftill lower rents in different parts.

In Chefhire, the land averages full 30*s.* the acre in rent as farms; and in Lancafhire, the rent of land is equally as high, if not higher.

In the very fouth-weftern diftrict of Cornwall, the rents of land fluctuate very greatly, as from 5*s.* to 50*s.* the acre in farms properly fo named. The circumftances affecting rents here, befides the quality of the foil, and the afpect or fituation, are the vicinity to fea fand, and to market towns. There are inftances of land letting very high in particular fituations, as at 13*l.* the acre about Penzance. And in the fame parifhes the rents of land fometimes vary from 8*l.* to 5*s.*; nay, even on the fame farm, not exceeding 150 acres, fome parts are worth 50*s.*, and others not 5*s.* the acre.

The neighbourhood of towns and large markets, as well as of extenfive manufactories, has, in all cafes, a tendency to raife the rent of land, whether as farms or otherwife, in every part of the kingdom.

In all parts of Scotland, even in the Highlands, the rife of rents has been gradual and progreffive for many years, and in fome places they have been more than doubled within thefe laft twenty-five or thirty years.

It has been ftated by Mr. Collingfworth, of Daventry, in the fourth volume of Communications to the Board of Agriculture, that in refpect to the principle of increafing rents, where liberty is given to break up old grafs or pafture lands that are under leafe, that he has known, within this five years paft, a double rent given for leave to plough up an old pafture for cropping for three years; and that confequently it appears to him that a ftatement of the expences and profits upon arable and pafture lands fhould be feverally made out, to afcertain by how much the balance of profit of the one exceeds that of the other. He therefore ftates them, upon a probable calculation, in the following manner:

Table of Expences.

	1.			2.			3.			4.			5.			6.			7.		
	Peafe.			Wheat.			Peafe.			Wheat.			Beans.			Sp. Wheat.			Total.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Rent and taxes - -	1	15	0	1	15	0	1	15	0	1	15	0	1	15	0	1	15	0	10	10	0
Seed - - - -	0	18	0	0	16	0	0	18	0	0	16	0	0	10	0	0	14	0	4	12	0
Ploughing - - -	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0	1	4	0	4	4	0
Harrowing - - -	0	2	6	0	2	6	0	2	0	0	2	6	0	2	6	0	2	6	0	14	6
Manure and carting -	0	0	0	0	0	0	2	10	0	0	0	0	2	10	0	0	0	0	5	0	0
Frightening birds - -	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	12	0
Weeding and hoeing -	0	1	6	0	1	6	0	1	6	1	6	0	0	3	6	0	1	6	0	11	0
Reaping and mowing -	0	6	0	0	10	6	0	6	0	0	10	0	0	6	0	0	10	6	2	9	6
Cocking and raking -	0	2	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	5	0
Carrying and ftacking -	0	4	0	0	4	0	0	4	0	0	4	0	0	2	0	0	4	0	1	2	0
Thatching - - -	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	6	0
Threfhing and winnowing	0	6	0	0	9	0	0	6	0	0	9	0	0	7	6	0	9	0	2	6	6
Carrying to market - -	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	1	4	0
Contingencies - -	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	1	4	0
	4	18	0	5	1	6	7	7	6	5	1	6	7	0	6	5	11	6	35	0	6

Produce.

Produce.

	£	s.	d.
1. Peafe, three quarters, at 48*s*. - - - - - - - -	7	4	0
2. Lammas wheat, three quarters and a half, at 52*s*. - - - - - -	9	2	0
3. Peafe, three quarters, at 48*s*. - - - - - - - -	7	4	0
4. Lammas wheat, three quarters and a half, at 52*s*. - - - - - -	9	2	0
5. Beans and turnips; five quarters of beans, at 30*s*.; turnips, 30*s*. - - -	9	0	0
6. Spring wheat, three quarters, at 48*s*. - - - - - -	7	4	0
Straw - - - - - - - - - - -	5	4	0
	54	0	0

Tillage produce - -	54	0	0
Ditto expences - -	35	0	6
	6)18	19	6(= 3*l*. 3*s*. 3*d*. profit *per* acre for the farmer.

Grazing Expences.

	£	s.	d.
Rent and taxes *per* acre - - - - - - - -	1	15	0
Labour ditto - - - - - - - - - -	0	10	0
	2	5	0

Grazing Profit.

	£	s.	d.
A bullock and a half to three acres, at 5*l*. *per* head - - - - - -	7	10	0
Three fheep upon ditto, at 25*s*. *per* head - - - - - - -	3	15	0
	11	5	0

Grazing produce of three acres -	11	5	0
Ditto expences of ditto - -	6	15	0
	3)4	10	0(= 1*l*. 10*s*. 0*d*. profit *per* acre to the grazier.

	£.	s.	d.
Then fay, grazing profit *per* acre - - - - - - - -	1	10	0
To which add for grafs feeds - - - - - - - - -	1	0	0
The additional rent to make up the fum as *per contra*, will be - - - -	0	13	3
	3	3	3

By this means the rent that can be afforded to be given may be afcertained with tolerable correctnefs in many inftances of farming. See Grass *Land*.

The author of the Argylefhire Agricultural Survey, after remarking that there is very little arable land in that county but which is capable of higher cultivation, befides the great quantity of wafte ground that may be improved in almoft every farm, fays, that the land is therefore capable of being made to yield a much higher rent when better cultivated; though not a great deal of it, as is generally thought, can bear much more, in the prefent ftage of improvement, than what is laid on already, unlefs it be under a different management, which in fheep lands might be by the introduction of better woolled breeds, and in arable lands by adopting a better fyftem of hufbandry.

It is conceived, that the idea of high rents being a fpur to improvement and exertion, is a common, and, to a certain extent, a juft maxim. No doubt there may be fome who, if they had the land for nothing, would be ruined by their indolence. But the more common cafe is, that when a tenant fees that all his exertions will not do, he becomes difpirited and defperate, and allows himfelf to be carried along by the ftream which he cannot ftem. The land fuffers, the tenant fails, the farm gets a bad name, and the rent muft be lowered. Thus the landlord, as well as the tenant, fuffers, by raifing the rent higher or fafter than the improvement of the land will bear. But he adds, that a fubftantial tenant is generally cautious of engaging to pay a rent that is exorbitant. He fees the fuccefs of thofe who inveft their money in other branches of bufinefs; and he follows their example, if he has not the profpect of a farm's yielding him full intereft for his money, and an adequate return for his diligence and labour. Whereas he who has leaft to lofe, is often the moft forward to offer, and the landlord is often tempted to accept the offer, without confidering that a capital is neceffary for paying the rent, and improving the land. Inftances of ruin to the tenant, and lofs to the landlord, from too high rents, are not unfrequent, efpecially on fome of the fmaller eftates. Moft of the farmers toil hard, live poorly; and for one who has a trifle for his pains, perhaps two give their pains for nothing. Many who have old leafes obtained before the late rife in land, and in its produce, took place, are very well, as are alfo many of thofe who have fheep ftocks; as their poffeffions are managed with lefs expence, and the value of fome of them was not well known till they were tried under the fheep fyftem. But even bad bargains are become good by the late rise on every article of produce; and most of those who have leases are at present at their ease.

It is concluded that the occupiers of land, whether in pasturage or tillage, ought certainly to be able, like labourers or tradesmen, to live by their occupation, and to support their families by their daily care and labour. The interest of money invested in their stock, with the proper allowance for tear, wear, and risk, they should be able to save as a provision for their families, and for old age; as the money so invested would give this return, if laid out on interest, without any trouble whatever. It cannot be considered as any part of the produce of the ground; and therefore no part of it ought, in equity, to enter into the payment of the rent; and yet not one in ten, perhaps, is able to save it; nor do they commonly advert that so much ought to be saved in justice. They are generally satisfied if they can keep their stock undiminished; so that the business, in general, returns much less to those engaged in it than almost any other. A happy predilection in favour of the occupation in which they were brought up, is, he thinks, what induces so many to follow it. Perhaps it may be also said, that there is implanted in the human mind, for wise purposes, a certain innate disposition, or instinct, which leads it to delight in rural occupations.

These remarks should be well attended to by the proprietors of farms, as their advantages, as well as that of their tenants, may be greatly promoted by such means.

In regard to the receiving of rents where they are of different kinds, as for cottages, tithes, in the form of compositions, chief rents, quit rents, and some other sorts, besides those of the farm kind, they require some attention and method, such as the fixing of distinct times in the same, or different days, for the reception of each, when on a large scale, so that the exact times of attendance for each may be known to those who have any thing to settle. So far as farm rents are concerned, the fixing of proper periods for receiving them is of great importance, though the matter has hitherto been little attended to, there being often no fixed time known to the holders, until signified by the precept of the receiver. And that is, in many cases, liable to alteration. This is very inconvenient to the farmers in many instances, as they must either sell their corn and live-stock to great disadvantage, many times, before it was necessary, and have large sums of money lying uselessly by them, or meet the receiver, perhaps, with only part of the rent. The propriety and necessity of having certain exact times for receiving rents are therefore evident, and, of course, the most suitable times for these are to be ascertained, as whatever enables the holders of land to turn their produce to the most advantage, increases the prosperity of the farms, and ultimately benefits the proprietor.

In this country it is said, by the author of the work on Landed Property, farm rents mostly become due at Lady-day and Michaelmas. But the proper times of paying them depend on the marketable produce of the land, and the season of the year at which it goes, and can be best sold in the markets. The holders of farms should never be forced to improper regulations in these respects, or be suffered to withhold the payment of their rents when they have obtained the money for their produce.

Upon corn farms, which are numerous in most parts of this country, Michaelmas is the most improper time in the whole year to call upon tenants for their rents. It is at the close or height of harvest, as the situation may be, when their pockets are drained by extra expensive labour, and when the grain cannot be threshed out to replenish them; also when much of the off-going live-stock is not ready for the market.

In the county of Norfolk the above writer paid great attention to this matter, and found that there, the latter end of February, or beginning of the succeeding month, was the most proper season for Michaelmas farm rents to be paid; and the month of June for those of Lady-day. And, by correct examinations, those most proper in other places may be found, keeping the above principles constantly in view. Farmers should never be obliged to do any thing improper in the disposal of their articles at unsuitable seasons or markets, or to raise money in any improper ways; nor be led into speculations with money while it lies idly by them.

The best seasons having been ascertained, the exact periods are to be fixed on, from the particular nature of the farms, the customs of the districts in respect to fairs and the dealers in different sorts of produce, which may generally be readily managed without much difficulty.

Rent *Accounts*, such as are kept on estates, whether of farms, cottages, chief rents, or any other sorts of annual payments, by the managers. They should be clear and comprehensive, containing every thing of importance about them, as their different circumstances may direct.

The management of the farms, in rent accounts, whether yearly or half yearly, must be the same as in the receiving rentals, as they appear on the general map; and as they naturally lie on the face of the estate, according to the ideas of the writer of the work on Landed Property. See Map *of Estates*.

The parishes, or manors, lying wholly or partially within the estate, are to be first geographically arranged, and then the farms on the same principle as they lie within the respective parishes. In this way it is constantly the same, and has the advantage of not being liable to be disturbed by changes of any sort, which affords much facility and convenience in all such accounts on many occasions.

Rent *Charges*, the fixed payments to which an estate or farm is subject to, such as chief rents, quit rents, annuities, endowments, schoolmasters' salaries, charitable donations, &c.

Rent *Days*, the particular days or times when the rents of estates or farms become due. They should, in all cases, be exactly and properly fixed as to season and other circumstances. See Rent.

Rent-*Roll*, a general statement of the gross annual income of an estate, or receivership, whether it arises from farms, woods, lands, quarries, cottages, or any other similar things; or from tithes, quit rents, or any other sort of rents, &c.

In forming rent-rolls, this sort of general view of income is best arranged, according to the writer of the work on Landed Property, in columns, as being the most plain and perspicuous; and for a schedule of farms, the following heads are proper. First, the numerals identifying the several farms in the general map. Secondly, the names of the farms. Thirdly, the contents or admeasurement of each. Fourthly, the names of the present holders. Fifthly, the amount of the existing rents. Sixthly, the amount of the outgoings, if any payable by the proprietor. And, seventhly, the expirations of the terms, if any. The farms should be arranged according to their situations.

In the receiving of rentals, they are the particulars. These are few where the rents are regularly paid, the farms under proper management, and the holders pay the taxes and repairs. But it may be necessary to see in the receiver, at one view, the name of the farm, and the name of the holder, as well as the amount of his half year's rent.

And

And where arrears are suffered, and, of course, accounts created, more particulars are necessary, such as the name of the farm and the tenant, his arrear at the last payment, his half year's rent, and any other charge that may be against him, as well as any allowance which is to be made to him, and the neat sum that is receivable—a blank being left for the sum received, and another for the arrear left. These things should be done in the manner of the best accountants, the arrangements being made in the same way as the rent-roll with an alphabetical index.

RENTA, in *Geography*, a lake of Albania, near Scutari.

RENTAL, a roll in which the rents of a manor are written and set down, and by which the lord's bailiff collects the same; it distinguishes the lands and tenements, and the names of the tenants, the several rents arising, and for what time, usually a year. See RENT-*Roll*.

RENTER WARDEN, an officer in most of the companies of London, whose business is to receive the rents or profits belonging to the company.

RENTERBACH, in *Geography*, a river of Saxony, which runs into the Elbe near Wittenberg.

RENTERIA, a town of Spain, in Guipuscoa; three miles S.E. of St. Sebastian.

RENTERING, FINE-DRAWING, in the *Manufactories*, the sewing of two pieces of cloth, edge to edge, without doubling them; so as that the seam scarcely appears at all: hence it is called *fine-drawing*.

The word is formed from the French, *rentraire*, which signifies the same thing; and which Menage, after Salmasius, derives from the Latin, *retrahere*, of *re*, *in*, and *trahere*, by reason the seam is drawn out of sight, and covered.

Serges, &c. are to be sewed: cloths fine-drawn. The author of one of the Let. Edif. et Cur., speaking of the great dexterity of the fine-drawers in the East Indies, assures us, that if you tear a piece of fine muslin, and give it one of them to mend, it shall be impossible for you to discover the place where it is rejoined, even though you had made a mark to know it by.

The dexterity of our own fine-drawers, though inferior to that above-mentioned, is nevertheless such, as puts them in a condition to defraud the king, by sewing a head or slip of English cloth on a piece of Dutch, Spanish, or other foreign cloth; or a slip of foreign cloth on a piece of English, so as to pass the whole, as of a piece; and by that means avoid the duties, penalties, &c. The trick was first discovered in France by M. Savary, author of the Diction. de Commerce.

To renter, in *Tapestry*, is to work new warp into a piece of tapestry damaged, eaten by the rats, &c. and on this warp to restore the ancient pattern, or design. The warp is to be of woollen, not linen. Among the titles of the French tapestry-makers, is included that of renterers.

Fine-drawing is particularly used for a rent, or hole, happening in the dressing or preparing of a piece of cloth, artfully sewed up or mended with silk.

All fine-drawings are reputed defects or blemishes; and ought to be allowed for in the price of the piece. Hence, M. Savary establishes it as a rule, which is certainly founded on natural equity, that every manufacturer mark the fine-drawings of his cloth with a piece of packthread tied to the list; to direct the draper to the spot: and that the draper apprize the taylor, or other person to whom he sells it, of the same, that he may not come to damage in the cutting; there being instances of drapers condemned to take back their cloth, when cut to pieces, for omitting to mention the fine-drawings, and other flaws.

On this occasion, M. Savary extols the procedure of an English merchant, who, sending a piece of cloth damaged in one spot, to his correspondent at Paris, put a piece of gold in the damaged place, to make up the damage. But as this example is perhaps the only one of its kind, that author recommends it to the merchant, or draper, to unfold all the pieces entirely, as they come to him; to discover the fine-drawings, and other flaws, in order to make the clothier accountable for them.

RENTERSHAUSEN, in *Geography*, a town of the duchy of Wurzburg; 7 miles E. of Lauringen.

RENTOWN, a town of Scotland, in Dumbartonshire, considerable for its manufactures; 5 miles W. of Dumbarton.

RENTRE'E, Fr. in *Music*, a return to the subject of a musical composition, after a pause, or some excursion or deviation from the theme; or in a fugue, an imitation of some particular passage or design.

RENTY, in *Geography*, a town of France, in the department of the straits of Calais, on the Aa; 9 miles S.S.W. of St. Omer.

RENTZ, a town of the island of Rugen; 11 miles S.S.W. of Bergen.

RENUENTES, in *Anatomy*, a pair of muscles of the head, thus called as being antagonists to the annuentes; and serving to throw the head backward, with an air of refusal.

From their situation they are also called rectus capitis, major et minor.

RENVERSE', Fr. in *Music*. With respect to intervals inverted, this term is opposed to direct. (See DIRECT.) With respect to chords, it is opposed to *fundamental*; which see.

RENVERSE', *inverted*, in *Heraldry*, is when any thing is set with the head downward, or contrary to its natural way of standing: thus, a chevron renversé is a chevron with the point downwards.

The same term they also use when a beast is laid on its back.

RENVERSED VOLTE. See VOLTE.

RENVERSEMENT, Fr. in *Music*, an inversion in the order of sounds which compose the chords, and in the parts which constitute the harmony: which is done by substituting, by octaves, treble notes for the base, and base notes for the treble. It is certain that every common chord has a fundamental and natural order pointed out by the harmonics of a single string, a great bell, or organ pipe. (See HARMONICS, and RESONANCE.) But the circumstances of the succession, taste, expression, selection of notes for melody, variety, approximation of the harmony, frequently oblige a composer to change this order, by inverting the chords, and consequently the disposition of the parts. As any three things may be arranged in six different ways, and four things in twenty-four ways, it seems at first as if a common chord was susceptible of six changes, and an accompanied discord of twenty-four; as the one is composed of three sounds, and the other of four; and that the inversion only consists in the transposition of octaves. But it must be remembered, that in harmony a change in the upper parts is not regarded as an inversion, provided the base or fundamental sound remains the lowest. Thus, these two orders of sounds, C*eg*, or C*ge*, are not regarded as inversions of the harmony. And in the chord of the 7th no change in the upper parts constitutes an inversion.

As long as the fundamental sound is the lowest part, the order is direct. But when this order is changed, or the fundamental sound is given by transposition to one of the upper parts, the harmony is inverted. In whatever part a discord is prepared, it must be resolved by the same part;

a sharp

a ſharp 7th muſt aſcend, a flat 7th muſt deſcend; falſe relations muſt be avoided. This is the key to the chief myſteries of compoſition. Binding notes in ſyncopation in the treble and baſe muſt be differently treated: in the 9th the chord is direct; in the 2d it is inverted, the diſcord being in the baſe.

Upon the organ, and other keyed-inſtruments, inverſions are neceſſarily made for the convenience of the hand, in giving different faces to the ſame chord. See FACE.

RENVERSING. See REVERSING.

RENUKA, or RENUCI, in *Mythology*. See RUNEKA.

RENUNCIATION, RENUNCIATIO, the act of renouncing, abdicating, or relinquiſhing any right, real or pretended.

Renunciations are ſometimes *expreſs*, as by contracts, &c.; ſometimes *tacit*, as by contrary acts.

To renounce an inheritance, a community, &c. is to paſs a ſolemn act before a notary, or public officer, by which a perſon declares he will not intermeddle in an inheritance, or profit in a company; but ſurrenders his part, and quits all pretenſions.

RENVOI, Fr. in *Muſic*, a reference to a ſtrain, or part of a ſtrain that is to be repeated; either implied by dots in the ſpaces of the ſtaff, or by an $\dot{S}$ dotted, which is the initial of *ſegno*, Ital. a ſign. See REPEAT.

RENWEZ, in *Geography*, a town of France, in the department of the Ardennes, and chief place of a canton, in the diſtrict of Mézières; 7 miles N.W. of Mézières. The place contains 1202, and the canton 6061 inhabitants, on a territory of 140 kiliometres, in 16 communes.

REOLLE, LA, a town of France, and principal place of a diſtrict, in the department of the Gironde. N. lat. 44° 35′. E. long. 0° 2′.

REORDINATION, REORDINATIO, the act of conferring orders on one already ordained.

The ceremony of ordination impreſſes what the divines call an indelible character; and cannot, therefore, be repeated: yet is reordination practiſed in England, with regard to the diſſenting miniſters, who conform to the church; the biſhops pretending that they alone have a right to confer holy orders, and that every prieſt or miniſter, who does not receive them at their hands, has no lawful or regular vocation.

This has formerly proved a great obſtacle to the re-union of thoſe miniſters to the church of England; many of whom, otherwiſe diſpoſed to conform, have ſcrupled to be re-ordained; inſomuch as re-ordination implies their former vocation to be null; that they had adminiſtered the ſacraments without any right thereto; and that all their miniſterial acts were invalid.

In the 11th century, the crime of ſimony having been very flagrant, many people fell into the error to believe, that the ſimoniacal biſhops could not ordain validly, and thoſe who had received orders at their hands ſhould be reordained. The people of this opinion made a party of themſelves, and were diſtinguiſhed by the title of "Reordinantes."

REORTHE, LA, in *Geography*, a town of France, in the department of the Vendée; 13 miles W. of Châtaigneraye.

REPAIR *a Statue, To*, or other piece of ſculpture, is to touch up a ſtatue, &c. (caſt in a mould) with a chiſſel, graver, or other inſtrument, to finiſh the places which have not come well off.

To REPAIR *a Caſt*, figure, or the like, they clear off the barb, and what is redundant in the joints and projectures. See STATUE.

To REPAIR *a Medal*, is to retouch it; ſo as, from ruſty and defaced as it was, to render it clean, neat, and perfect. In order to this, they take off the ruſt with a graver, touch up the letters, poliſh the ground, and raiſe and reſtore the figures which before were ſometimes ſcarcely ſeen. When the figures are eroded or broken, they ſit a piece of cement on the ſpot; and on this cut with a graver ſo dexterouſly, that the figures appear entire, and well kept; yet nothing ſpoils medals ſo much as repairing them. See MEDAL.

To REPAIR *a Ship*, is to amend any injuries, or ſupply any deficiencies, which a ſhip may have received by age, battle, tempeſtuous weather, &c. The repair is neceſſarily greater or ſmaller in proportion to the loſs or damage the veſſel has ſuſtained. Accordingly a ſuitable number of the timbers, beams, or planks, or a ſufficient part of either are removed, and new pieces fixed in their places. The whole is completed by *breaming*, *calking*, and *paying* the body with a new compoſition of ſtuff.

REPAIRERS, artificers who chaſe figures and beautify ſword-hilts, &c.

REPAIRING, in *Building*, *&c.* See REPARATION, and RESTAURATION.

The repairing of large walls, doors, ceilings, coverings, &c. belongs to the proprietor or landlord: the tenant is only charged with ſmall repairs, as glaſs windows, locks, &c. by the French called *locative* repairs.

REPAIRS, in *Hunting*, are the haunts and places which the hare runs to.

REPAIRS *of Farm Buildings*, in *Rural Economy*, the neceſſary means of putting and keeping them in proper order. This properly belongs to different ſorts of workmen, as maſons, carpenters, &c. It is a bad practice to let buildings of this nature fall much into decay, as by ſuch neglect a great deal of expence is frequently incurred that might otherwiſe have been avoided. See FARM-*Buildings*.

REPANDUM FOLIUM, in *Botany*, a leaf whoſe outline is undulating, without the ſurface, or ſubſtance, being otherwiſe than even. See LEAF, where, for *nyphæoides*, read *nymphæoides*.

REPARANDIS PONTIBUS. See PONTIBUS.

REPARATION, REPARATIO, the act of repairing, reeſtabliſhing, retrieving, or mending a building, or other work, damaged, or gone to decay.

The enemy repaired the breach as ſoon as it was made. The eſtabliſhment of turnpikes is for repairing of the roads. An eccleſiaſtical patron is by ancient cuſtom obliged to repair the choir or chancel of a church, and the pariſhioners the nave.

REPARATIONE FACIENDA, in *Law*, is a writ which lies in divers caſes, *e. gr.* where there are tenants in common, or joint tenants of a houſe, &c. which is fallen to decay, and the one being willing to repair it, the other two will not; in this caſe, the party willing ſhall have this writ againſt the other two.

REPARO, in *Geography*, a ſmall iſland near the coaſt of Braſil. S. lat. 29° 23′.

REPART, in the *Manege*, is to put a horſe on, or make him part a ſecond time.

REPARTEE. See REPARTY.

REPARTITION, REPARTITIO, a dividing or ſharing a thing a ſecond time.

REPARTY, or REPARTEE, a ready, ſmart reply: eſpecially in matters of wit, humour, or raillery.

The word in the original French, *repartie*, has the ſame ſignification.

Wicquefort obſerves, that there is a great difference between

between a free, fprightly reparty, and an offenfive *farcafm;* which fee.

REPAST, Repastum, a meal or refection, taken at a ftated hour.

In old law-books repaft is particularly ufed for a meal's meat given to fervile tenants, while at work for their lord.

The French call their meal *repaft;* the Latins, *paftus;* the Italians and Spaniards, *pafto.*

In antiquity the repafts were frequently facrifices; for which reafon we find them often prepared by kings themfelves.

REPEALING, in *Law,* the revoking or annulling of a ftatute, deed, or the like. See Abrogation, Revocation, &c.

No act of parliament fhall be repealed in the fame feffion it was made in. A deed or will may be repealed for a part, and ftand good for the reft.

Brook ufes the word *repellance* in the fame fenfe.

REPEAT, in *Mufic,* a character fhewing that what was laft played or fung muft be repeated, or gone over again.

The repeat ferves inftead of writing the fame thing twice over. There are two kinds of repeats; the *great* and the *fmall.*

The *great* repeat is only a double bar, dotted on each fide; or two parallel lines drawn perpendicular acrofs the ftaff; with dots on either hand. See its form under Characters *of Mufic.*

This mark fhews, that the preceding ftrain is to be repeated; that is, if it be near the beginning of the piece, all hitherto fung or played is to be repeated; or, if towards the end of a piece, all from fuch another mark.

In gavots, we ufually find the repeat at about the third part of a piece; in minuets, borees, courants, &c. towards the end.

Some make this a rule, that if there be dots on each fide the bar, they direct to a repetition both of the preceding and the following ftrain; if there be only dots on the fide, then only the ftrain on that fide is to be repeated.

The *fmall* repeat, is where only fome of the laft meafures of a ftrain are to be repeated: this is denoted by a character fet over the place where the repetition begins (fee Characters, in *Mufic*), and continues to the end of the ftrain.

When the fong ends with a repetition of the firft ftrain, or part of it, inftead of a repeat, they ufe the word *da capo, i. e.* from the beginning.

REPEATING Circle, an inftrument ufed in *Navigation, Aftronomy,* and *Surveying.* This inftrument derives its name from the property it has of giving the average of feveral repeated meafures of an angle, made round the whole circle, fo as to diminifh the errors of divifion and of excentricity; which is a very ufeful property, where the art of dividing is not brought to that perfection which it is in England. When the lunar method of determining the longitude, by the help of improved tables of the moon's motion, was propofed to be put in practice, Mayer offered a conftruction of the circle, which, by repeating the meafure of a lunar diftance, promifed to increafe the accuracy with which fuch diftance could be meafured; and after him, Borda went a ftep farther towards the attainment of the defired object, both whofe contrivances we have defcribed under our article Circle. Thefe inftruments, like Hadley's octants, meafured the angles by reflection, and were confequently ufed at fea; but the principle of repetition is not confined to reflecting inftruments; and Borda conftructed, or contrived the conftruction of, a repeating circle, which will meafure either vertical or horizontal angles without reflection, with a degree of accuracy that has placed it high in the eftimation of the French, among whom accurate dividing is yet a defideratum. This inftrument we have alfo defcribed, and likewife Troughton's improvement on it, in the article already referred to.

But the repeating principle was extended by Jofeph de Mendoza Rios in the reflecting circle, fo as to meafure both backwards and forwards, and to give *double* refults by means of a moveable or *flying* circle, which we have likewife defcribed under the article Circle, together with our obfervations on the peculiarities of its conftruction. It remains, therefore, that we now defcribe a recent conftruction of a reflecting and repeating circle, contrived by profeffor Hafsler of Philadelphia, who is a native of Switzerland, and who has refided feveral months in London, for the purpofe of collecting fuperior aftronomical and furveying inftruments, at the expence of the American government. The object of this ingenious foreigner was to unite the repeating principle of Borda, with the firm conftruction of Troughton's reflecting circle, fo that his new inftrument might be free from the objections of the repeating circles that preceded it, arifing from fhallow centre-work, and clamping after the contacts were made in an obfervation; and in the conftruction he has adopted, by the aid of Troughton, he has rendered his inftrument free from thefe objections, and given it every advantage which its original contriver contemplated: we cannot, however, admit, that in practice it is fuperior in accuracy, and certainly not in fimplicity, to Troughton's *reflecting circle,* which we have before defcribed, as giving the average of fix readings at two operations, in inverted pofitions, at the different fides of zero on the fixed circle. The union of Borda's and Troughton's conftructions is thus effected by Hafsler; the circular border of Troughton's inftrument is made moveable round the centre, like his three armed verniers, and is graduated like his, while a pair of oppofite verniers move round the fame centre, above the plane of the moveable or flying circle, having a clamping apparatus for flow motion at one of the two oppofite verniers, fo that the pair of verniers may be made to revolve with or without the graduated flying circle; another pair of verniers, fimilar to the former, and having alfo a clamping apparatus for flow motion, are made faft to the frame, and have the extreme ends of their connecting diametrical bar united by a graduated femicircle, that lies under the flying circle, and is hid thereby when the graduated face of the circle is uppermoft; the ufe of this femicircle is, to receive a pair of fliding pieces of brafs that act as ftops to the indices, when they are properly placed at the rough angle, to the right and left of zero on the flying circle, by a previous operation; fo that, when the bar of the verniers comes in contact with either of thefe ftops, it is known, even in the dark, that the place where a contact is to be made is nearly afcertained, and the vernier-bar may be made faft, for the fcrew of flow motion to be brought into action to complete the contact. The principle on which the meafurement is effected is this; the revolving verniers move forward from zero of the graduated circle, when the ftops are previoufly fet to the rough angle, till the index or vernier-bar touches the ftop to the left, when the graduated face is uppermoft, and is clamped to the fixed verniers; the clamping apparatus then fixes the verniers, and the tangent-fcrew completes the contact; the two revolving verniers might now give the angle, by two readings, but the repeating principle has not yet been introduced, and confequently no advantage is yet derived from this firft obfervation, over a common circle with a double vernier; the fixed verniers are in the next place unclamped, but as they have no motion, the flying circle and revolving verniers are brought back to the right together, acrofs the point zero, till

till the vernier-bar touches the fecond ftop, and during this motion, the revolving verniers have moved backwards juft *double* the rough diftance with the attached circle, that they did forwards before without it; confequently the fixed verniers will now read the fame angle at the right of zero, that the revolving verniers did on the left, when the clamping is again made and the contact completed; but ftill this is only a fecond mode of reading a fingle meafure of the angle, and nearly all that is yet gained in accuracy, is the extermination of the index error, and that of the dark glafs, if ufed; thefe errors having been alternately pofitive and negative, if any exifted. Thefe two meafures, feparately read, are equivalent to Borda's *croffed* obfervation, as he calls it, becaufe the motion of the vernier-bar *croffes* the point zero in his fixed circle: here it is prefumed that the two objects, that include the angle, are equally luminous; but if not, it will be neceffary to invert the face of the inftrument before each fecond, fourth, fixth, &c. contact, and then the motions will all be forward, or from right to left, which otherwife would be alternate: the fecond reading, however, may be omitted; the revolving verniers, being unclamped, muft be moved again to the firft ftop in the original pofition, where, the contact being complete, they will give a *double* meafure if examined; but the readings are yet omitted: the fixed verniers are now unclamped, the inftrument again inverted, and the contact completed, when thefe verniers, if examined, will alfo give double meafures; and thus treble and quadruple meafures muft be had fucceffively at both the revolving and fixed verniers, or even more, if the circle has not been paffed over by each pair of verniers, before the readings are required to be examined, and then the average of all the meafures by the fixed verniers, added to an average of all the meafures by the revolving verniers, will afford the means of getting an average of the whole number of meafures.

From this defcription of Hafsler's mode of applying the repeating principle, it will be obvious to the reader, that the diametrical bars of the two pair of verniers muft not be contiguous to each other, when the glaffes called the horizon-glafs and index-glafs are parallel; and accordingly we find, on examining an inftrument of this conftruction, that thefe bars crofs one another at right angles before the operations begin; but as there is but one zero in the circle, one pair of the verniers muft neceffarily begin at 90°, when the other pair begins at 0; confequently ninety degrees muft be deducted from the fum of the meafures of this pair before their average is taken: otherwife, if neither pair of the verniers begin at zero, the two numbers from which they refpectively commence muft both be deducted before the averages are taken, in which cafe it will be of no importance at what part of the flying circle the operations begin. Should the reader find any difficulty in comprehending this defcription of Hafsler's repeating circle, without a reference to a drawing, we recommend that he refer to our account of reflecting circles, defcribed under the article CIRCLE, where he will find the account of the two feparate inftruments of which this forms an union; and at the fame time will fee how it differs from Mendoza's, which gives *double* refults.

By way of illuftrating the ufe of Hafsler's repeating circle, we will fuppofe that fome known ftar is to the eaft or weft of the moon, and that the longitude of the place of obfervation is required from an actual meafurement of the diftance of the faid ftar from the moon's limb, when compared with its computed diftance as given for a certain hour on the fame evening at Greenwich, in the Nautical Almanac: we will fuppofe the glaffes of the circle adjufted, and the fmall telefcope fcrewed into its focket, and fo adjufted both for diftinct vifion, and comparative brightnefs of both objects, that the ftar can be brought to touch the moon's limb, and have a fenfible contact; in the firft place, hold the plane of the circle in fuch an inclined pofition that it may pafs through both objects, and get the ftar into the field of view, while the revolving verniers are at zero, and the fixed ones clamped at 90°; in the next place, move the revolving verniers with an equable motion, and let the eye follow the ftar, or rather the image of it, till it comes to the edge of the moon, which it may be made to approach by a proper motion of the body; then clamp the index there till the ftop is put on the femicircle very nearly to touch the edge of the index, where it muft remain; the fecond ftop muft alfo be put to the fame divifion on the femicircle at the other fide of its zero, provided this zero be co-incident with the zero of the circle; or, which is the fame thing, the diftance between the ftops muft be fomewhat more than double the angle to be meafured; the contact may now be completed by the tangent-fcrew; let the fixed verniers be unclamped, and the releafed circle and revolving verniers be made to recede together till the fecond ftop gives them a check, there they muft be clamped and the circle inverted, when the ftar will again be feen nearly in contact, which muft now be made entirely fo by the fcrew of flow motion; in the next place the moveable verniers, being firft unclamped, muft be carried again to the firft ftop and clamped, to make the contact as before, after the inverfion of the circle has again taken place; and in this manner the revolving verniers muft be moved to the firft ftop, and the verniers and circle together to the fecond ftop, before each inverfion and contact, till five, fix, feven, or more alternate operations have been gone through, and the whole circle has been travelled over, which may always be known from the pofition of the ftops. The exact times muft be noted at the beginning and end of thefe operations, which by an expert obferver will be gone through in a few minutes, and the mean time will be had of the moment correfponding to the mean of the repeated obfervations: at thefe times the affiftants muft alfo take each their two altitudes. Say now that the ftops were required to be nearly at 40° at each fide of zero of the femicircle, or that the diftance between them was 80°, within a few minutes over, and that there were nine obfervations thus made with the revolving verniers, and eight with the fixed ones, which numbers fuppofe the firft and laft meafures to be taken with the fame pair of verniers, or with the fame face of the circle uppermoft; fay alfo, that the final readings by this pair of verniers were refpectively 1° 10′ 20″, and 181° 10′ 0″, or rather 361° 10′ 20″, and 541° 10′ 0″, becaufe thefe verniers completed the entire circle; then if we diminifh the latter reading by 180°, its diftance before the other, we fhall have 361° 10′ 0″, and the average of the pair of oppofite verniers will be 361° 10′ 10″, which quantity divided by 9, the number of meafures taken by them, will give a quotient of 40° 7′ 8″.9 for the firft average of the diftance, refulting from the operation of the revolving verniers alone; again, let the final readings of the fixed verniers be refpectively 50° 57′ 20″ and 230° 57′ 30″; but if we increafe the firft reading by 360°, we fhall have 410° 57′ 20″, which muft be diminifhed by 90°, becaufe it ftarted from this number, and the remainder will be the correct reading, namely 320° 57′ 20′; alfo 230° 57′ 30″ increafed by 360° is 590° 57′ 39″, and this number diminifhed firft by 90°, as before, and then by 180°, the diftance by which it precedes its fellow-vernier, will be 320° 57′ 30″, and confequently the average of the two final readings of the fixed verniers will be 320° 57′ 25″, which fum divided by 8, the number of repeated

peated meafures in the inverted pofition, will give a quotient of $40° 7' 10''.6$ for the diftance averaged by the fixed verniers; and laftly $\frac{40° 7' 8''.9 + 40° 7' 10''.6}{2} = 40° 7' 9''.75$, the exact *apparent* diftance, which may be converted into the *true* diftance by any of the methods ufed for clearing it of the joint effect of *parallax* and *refraction*. See Longitude, and Lunar *Obfervations*.

Repeating *Mechanifm*, in *Horology*, is a mechanical contrivance that, when acted on by a pull or pufh, will make the ftriking part of a clock or watch repeat the hours and quarters of exifting time, fo that a perfon in the dark, or even in bed, may know within a quarter of an hour what it is o'clock, as well by night as by day. The firft contriver of the repeating mechanifm of a clock was Barlow, a London clock-maker, who in the year 1676 produced to the world his fpecimen of ingenuity, which aftonifhed all the admirers of the mechanical arts, and excited in others a defire to vary the conftruction, with a view to the improvement of the original contrivance; and the confequence has been, that Quare, Tompion, and others in London, as well as after them Julien le Roy, Thiout, Collier, Larçay, Berthoud, &c. on the continent, have given fo many different kinds of repetition, for both clocks and watches, that a particular defcription of each conftruction would require feveral plates, and a whole volume to give the details. Under our article Clock we have already explained at confiderable length the particulars of the repeating mechanifm of two feveral clocks, as it is conftructed at this time, from which the reader will fee how the acting parts may be varied in many ways to anfwer the fame purpofe; but in moft of the modern contrivances the *rack* and the *fnail* conftitute the bafis of the plan, and regulate the action of all the metallic parts employed. For the repeating mechanifm of a watch, fee our article Watch.

REPELLENT Medicines, are thofe which prevent fuch an afflux of fluids to any part as would excite tumour or inflammation, or which tend to diminifh fuch an afflux, when it is already produced. Medicines of this quality are principally refrigerants and aftringents, efpecially the former. The moft effectual repellent is cold; and thofe applications, therefore, which moft effectually obftruct the heat, are the moft efficacious repellents; and many of the drugs, which are applied in combination with cold liquids, are of little value; the cold menftruum, that is the water, being the principal agent in the curative procefs.

REPELLING Power, *vis repellens*, in *Phyfics*, is a certain power or faculty refiding in or exerted by the minute particles of natural bodies, by which, under certain circumftances, they mutually fly from each other.

This power is the reverfe of the attractive power.

Sir Ifaac Newton having eftablifhed the attractive power of matter from obfervation and experiment, argues, that, as in algebra, where pofitive quantities ceafe, there negative ones commence; fo in phyfics, where the attractive force ceafes, there a repelling force muft begin; and adds, that there is fuch a force, does likewife appear from obfervation.

As the repelling power feems to arife from the fame principle as the attractive, only exercifed under different circumftances, it is governed by the fame laws: now the attractive, we find, is ftronger in fmall bodies than in great ones, in proportion to the maffes; therefore the repelling is fo too. But the rays of light are of all others the moft minute bodies we know of; therefore, of all others, their repelling force muft be the greateft.

Sir Ifaac Newton computes, that the attractive force of the rays of light is above 1000000000000000 times as ftrong as the force of gravity on the furface of the earth: hence arifes that inconceivable velocity with which light (if it confift of real particles) muft move, to reach from the fun to our earth in feven minutes. For the rays emitted from the body of the fun by the vibrating motion of its parts are no fooner got without the fphere of attraction of the fun than they come within the action of the repelling power.

The elafticity or fpringinefs of bodies, or that property by which, after having their figure altered by an external force, they return to their former figure, follows from the repelling power. See Repulsion.

REPENTANCE, in *Theology*, is a change of fentiments followed by a change of conduct: or repentance denotes fuch a conviction of the evil and danger of a finful courfe, as is fufficient to produce fhame and forrow in the review of it, and effectual refolutions of amendment. This definition expreffes the fenfe of the two words μεταμελεια and μετανοια, which are commonly ufed by the evangelical writers to fignify repentance.

REPENTIGNY, in *Geography*, a town of Canada, on the river St. Laurence. N. lat. 45° 48'. W. long. 73° 15'.

REPERCUSSION, in *Mechanics*. See Reflection.

Repercussion, in *Mufic*, iteration, a repetition of the fame note or found.

This often happens in the modulation, where the effential chords of each mode, or of the harmonical triad, are to be ftruck oftener than the reft; and of thefe three chords, the two extremes, *i. e.* the final and the predominant one, (which are properly the repercuffions of each mode) oftener than the middle one.

REPERNDORF, in *Geography*, a town of the duchy of Wurzburg; 7 miles S.E. of Wurzburg.

REPERTORY, Repertorium, a place in which things are orderly difpofed, fo as to be eafily found when wanted.

The indices of books are repertories, fhewing where the matters fought for are treated of. Common-places are a kind of repertories, very ufeful to the learned.

Repertorium *Anatomicum*, denotes a large hall near an amphitheatre of diffections, where fkeletons, both human and brutal, are orderly preferved. Such is the repertory in the French king's garden at Paris.

REPETEND, in *Arithmetic*, is ufed for that part of an indetermininate or infinite decimal fraction, which is continually repeated ad infinitum.

Thus, in the indeterminate decimal fraction 317.45 316 316,316, &c. the figures 316 are called the repetend.

Thefe repetends often arife in the reduction of vulgar fractions to decimals, thus $\frac{1}{3} = 0.3333$, &c. $\frac{1}{7} = 0.142857$, 142857, &c. $\frac{1}{11} = 0.09\,09, 09$, &c.

Decimals of this kind are called repeating or circulating *decimals*, (which fee,) on account of this continual repetition or circulation of the fame figures. Infinite decimals are of two kinds, which may be diftinguifhed by the general denominations of certain and uncertain. A general infinite decimal is fuch whofe numerator runs into infinity by a continual repetition of one or more figures, as 44, &c. 033, &c. Uncertain decimals are fuch, whofe numerator goes on for ever without a conftant circulation of figures. The effential difference between thefe two kinds is this; that the certain infinite decimals have a determinate, finite, and certain value, in that there is a certain determinate vulgar fraction, which expreffes the true and complete value of that infinite decimal, whereas the uncertain have no fuch finite and affignable value: and hence the reafon of the names.

Repetend, *Single*, is that where only one figure is repeated, as in 0. 3 3 3, &c.

Repetend, *Compound*, is that where two or more figures are repeated, as in 0. 09 09, &c. or in 0. 142857 142857, &c.

Decimals with repetends may always be reduced to vulgar fractions; for either the repetend begins with the decimal, or not.

If the repetend begins with the first place of decimals, or if the decimal is a pure circulate, make it the numerator of a vulgar fraction, and make the denominator consist of as many 9's as the repetend has figures; or if there be cyphers between the point and repetend, with as many cyphers to the right hand of the denominator, then will this vulgar fraction be equal to the decimal.

Thus, if the repetend be single, as in 0. 3 3 3 3, the vulgar fraction equal to it will be $= \frac{3}{9} = \frac{1}{3}$. So if the repetend be compound, as in 0. 09 09, &c. the equivalent vulgar fraction will $= \frac{09}{99} = \frac{9}{99} = \frac{1}{11}$.

And in like manner 0. 142857 142857, &c. $= \frac{142857}{999999} = \frac{1}{7}$.

The reason is obvious from this consideration, that the decimal 0. 3 3 3, &c. is $= \frac{3}{10} + \frac{3}{100} + \frac{3}{1000}$, &c. the sum of which will be equal to $\frac{3}{10}$ divided by $1 - \frac{1}{10} = \frac{3}{9} = \frac{1}{3}$; and so of the rest.

If the repetend does not begin with the first place of decimals, but at some place farther on towards the right, or if it be a mixed circulate, as in the decimal 0. 8 3 3 3, &c. where the repetend does not begin till the second place of decimals, observe, that 0. 8 3 3 3 + &c. $= \frac{8}{10} + \frac{3}{100} + \frac{3}{1000} +$ &c. $= \frac{8}{10} + \frac{1}{10} \times \frac{3}{10} + \frac{3}{10^2} +$ &c. But $\frac{3}{10} + \frac{3}{10^2} +$ &c. $= \frac{3}{9} = \frac{1}{3}$, as before: therefore the proposed decimal is $= \frac{8}{10} + \frac{1}{10} \times \frac{1}{3} = \frac{8}{10} + \frac{1}{30} = \frac{24+1}{30} = \frac{25}{30} = \frac{5}{6}$.

Thus also if the decimal 0. 2 27 27, &c. were proposed, we shall find it $= \frac{2}{10} + \frac{1}{10} \times \frac{27}{100} + \frac{27}{100^2} +$ &c. And $\frac{27}{100} + \frac{27}{100^2} +$ &c. being $\frac{27}{99} = \frac{3}{11}$, the decimal will be $= \frac{2}{10} + \frac{1}{10} \times \frac{3}{11} = \frac{2}{10} + \frac{3}{110} = \frac{22+3}{110} = \frac{5}{22}$. The reason of which is obvious from what has been said.

It may, perhaps, be worth while to observe, that if the numerator of a vulgar fraction be unity, and the denominator any prime number, except 2 and 5, the decimal equal to the proposed fraction will always be a repetend, beginning at the first place of decimals; and this repetend must necessarily be a submultiple, or an aliquot part of a number expressed by as many nines as the repetend has figures; that is, if the repetend have six figures, it will be a submultiple of 999999; if four figures, it will be a submultiple of 9999, &c. From whence it follows, that if any prime number be called p, the series 9999, &c. produced as far as is necessary, will always be divisible by p, and the quotient will be the repetend of the decimal fraction $= \frac{1}{p}$. For the management of decimals of this kind, see Malcolm's Arithmetic, book v. chap. 4.

REPETITION, Repetitio, the reiterating of an action. See Reiteration.

Habits are acquired by the frequent repetition of actions.

School-philosophers call the repetition of the same numerical effect, in another place, the replication of that effect.

Repetition. The French make use of this word for a *rehearsal*, which the Italians call a *prova*. "Rehearsals (says Rousseau) are necessary for compositions that are to be performed in public, in order to prove whether the several parts are correctly copied, and for ascertaining the entrances and the exits of the several characters, as well as to see that they seize the spirit of their parts, and of the entire drama. Rehearsals are likewise of use even to the composer himself, to enable him to judge of effects, and to make such changes as may seem necessary."

Repetition, in *Music*, denotes a reiteration or playing over again the same part of a composition, whether it be a whole strain, or part of a strain, or a double strain. The repetition is denoted by a character called a *repeat;* which is varied so as to express the various circumstances of the repetition.

Repetition, *Reply*, is also used when, after a little silence, one part repeats or runs over the same notes, the same intervals, the same motions; in a word, the same song, which a first part had already gone over during the silence of this.

Repetition, *Reply*, is also a doubling or trebling, &c. of an interval, or reiteration of some concord or discord.

Thus, a fifteenth is a repetition of the octave, *i. e.* a double octave, or second octave.

Repetition *of Passages*. See Rosalia.

Repetition, in *Rhetoric*, is a figure by which the orator rehearses the same words or phrases over again.

Of this there are two kinds. In the first, the word is repeated precisely in the same sense: as, *Oh, Jerusalem, Jerusalem, who killest the prophets*, &c. *My God, my God, why hast thou forsaken me?*

Such repetitions have the same effect in discourse, with second strokes of the pencil in painting; they render the colours more strong and lively.

Sometimes the orator begins again and again with the same word, of which we have an instance in the beginning of Cicero's first oration against Catiline: *Nihilne nocturnum præsidium palatii, nihil urbis vigiliæ, nihil timor populi, nihil consensus bonorum omnium, nihil hic munitissimus habendi senatus locus, nihil horum ora vultusque moverunt?* Where the word *nihil* so often reiterated gives an admirable force and vehemence to the discourse. Again, the same author: *Quem senatus damnârit, quem populus R. damnârit, quem omnium existimatio damnârit, cum vos sententiis vestris absolvetis?* Again, *Non feram, non patiar, non sinam.*

The second kind of repetition, called πλοκη, *place,* (which see,) is a repetition of the same word in the same phrase; but in such a manner, as that some new idea or character is added to the word in the second, which it had not in the first.

As, *Corydon is always Corydon: Ex illo Corydon Corydon est tempore nobis;* by which we signify, that Corydon is no ordinary person; and that nothing can distinguish him but the repetition of his own name: as if we should say, *he is Corydon, that is enough.* By the same figure our Saviour speaks, when he says: *Let your language be yea, yea; and nay, nay.* See Recapitulation.

REPETITUM, or *Vetitum Namium*, in *Law*. See Namium.

REPHAM, or Reepham, in *Geography*, a market-town and parish in the hundred of Eynsford, and county of Norfolk, England, is situated at the distance of 13 miles N.W. by N. from Norwich, and 112 N.E. by N. from London. The charter for its market, which is held on Saturday weekly, was obtained by sir John de Vaux, in the fifth year of the reign of king Edward V. An annual fair, on the 29th of June, was granted at the same time. At one period this parish was remarkable for having three churches situated within one sepulchral inclosure; *viz.* Reepham, Whitwell, and Hackford; but only two of these are now standing. The

The church of Reepham serves also for the village of Kerdeston, which belongs to the same lords. In this edifice was formerly a "famous image of the Virgin Mary," which, like the shrine of Diana at Ephesus, was productive of no small gains to its possessors; numerous pilgrimages having been made to it by persons of rank and affluence. Here are several monuments to the memory of different branches of the Kerdeston family. One of them, placed against the north wall of the chancel, bears the figure of a knight templar in armour, with his hands and legs crossed. It has no inscription, but is traditionally said to have been raised in honour of sir Fulk de Kerdeston, who died in 1270. Blomefield's History, &c. of Norfolk. Beauties of England and Wales, vol. xi. by John Britton, F.S.A.

REPIN, a river of Poland, which runs into the Dnieper, near Kiev.

REPITZ, or Ropitz, a town of Saxony, in the margravate of Meissen: 2 miles N. of Torgau.

REPLANTING, in *Gardening*, the act of planting a second time.

The gardeners used to displant their tulips every year, and replant them. Lettuces must be displanted and replanted yearly, to make them head and knit. If strawberries, &c. be not displanted and replanted once in a few years, they degenerate.

REPLEADER, Replacitare, in *Law*, is to plead over again what was once pleaded before.

If, by the misconduct or inadvertence of the pleaders, the issue be joined on a fact totally immaterial, or insufficient to determine the right, so that the court upon the finding cannot know for whom judgment ought to be given, the court will after verdict award a repleader, *quod partes replacitent;* unless it appears from the whole record that nothing material can possibly be pleaded in any shape whatsoever, and then a repleader would be fruitless. (4 Bur. 301, 302.) And whenever a repleader is granted, the pleadings must begin *de novo* at that stage of them, whether it be the plea, replication, or rejoinder, &c. in which there appears to have been the first defect, or deviation, from the regular course. Raym. 453. Salk. 579.

REPLEGIANDO *Homine, Writ de.* See Homine.

REPLEGIARE *de Averiis*, a writ brought by one whose cattle are distrained, and put in a pound, by another; upon security given the sheriff to pursue, or answer the action at law against the distrainer.

REPLETION, in the *Canon Law*, is where the revenue of a benefice or benefices is sufficient to fill or occupy the whole right or title of the graduate who holds them.

When there is a repletion, the party can demand no more by virtue of his degrees. In England, where benefices are not appropriated to degrees, repletion, strictly speaking, has no place.

In France, by the old constitution, 600 livres, or 45*l.* sterling *per annum*, made a repletion, when the benefice was obtained otherwise than by a degree; and 30*l.* *per annum*, when it was obtained by virtue of a degree.

Repletion, in *Medicine*, sometimes signifies the general fulness of the habit, which is called *plethora;* and sometimes the temporary overloading of the stomach with food and drink, which occasions particular attacks of disease, such as a fit of apoplexy, or of the gout, or a diarrhœa.

REPLEVIN, Plevina, in *Law*, a remedy granted on a distress; being a re-deliverance of the goods distrained to the first possessor, on security or pledges given by him to try the right with the distrainer, and answer him in the course of law.

If a person distrain another's goods or cattle for rent, or damage feasant, &c. the owner, upon giving security to the sheriff, that he will prosecute his action against the party distraining, and return the goods or cattle again if the seizure shall be adjudged good, may have a writ of *replevin*, or *replegiari facias*. See Distress and Replevy, *infra*.

REPLEVISH, is to let one to mainprise upon surety. See Mainprise.

REPLEVY, Replevie, (from the Latin *replegiare*, to re-deliver to the owner upon pledges of surety,) is the bringing of a writ of *replevin*, or *replegiari facias*, issuing out of chancery, by him whose cattle or goods are distrained by another upon any cause; having first given security to the sheriff, that, on the delivery of the thing distrained, he will prosecute the action against the person who made the distress.

In the stat. 24 Henry VIII. we read of *canes replegiati*, or *hounds replevied*, in a case between the abbot of St. Alban's and Geoffery Childwic.

Goods may be replevied two ways; *viz. by writ*, which is that used by the common law; and *by plaint*, which is that by statute law, for the more speedy having again the cattle and goods; and is brought in the sheriff's court.

Accordingly, the statute of Marlbridge (52 Hen. III. cap. 21.) directs, that (without suing a writ out of chancery) the sheriff, immediately upon complaint made to him, shall proceed to replevy the goods. And, for the greater ease of the parties, it is farther provided by statute 1 P. & M. cap. 12. that the sheriff shall make at least four deputies in each county, for the sole purpose of making replevins. Upon application, therefore, either to the sheriff, or one of his said deputies, security is to be given, in pursuance of the statute of Westm. 2. 13 Edw. I. cap. 2. 1. That the party replevying will pursue his action against the distreinor; for which purpose he puts in *plegios de prosequendo*, or pledges to prosecute: and, 2. That if the right be determined against him, he will return the distress again; for which purpose he is also bound to find *plegios de retorno habendo*. Besides these pledges, which are merely discretionary in the sheriff, the statute 11 Geo. II. cap. 19. requires that the officer, granting a replevin on a distress for rent, shall take a bond with two sureties, in a sum of double the value of the goods distrained; which bond shall be assigned to the avowant or person making cognizance, on request made to the sheriff; and, if forfeited, may be sued in the name of the assignee. The sheriff, on receiving such security, is immediately, by his officers, to cause the chattels taken in distress to be restored into the possession of the party distrained upon; unless the distreinor claims a property in the goods so taken. If this be the case, the party replevying must sue out a writ *de proprietate probanda*. But, if no claim of property be put in, or if (upon trial) the sheriff's inquest determines it against the distreinor, then the sheriff is to replevy the goods, if they be found within his county. When the goods are delivered back to the party replevying, he is then bound to bring the action of replevin, which may be prosecuted in the county-court; but either party may remove it to the superior courts. Blackst. Comm. book iii.

REPLICATION, Replicatio, in *Logic*, the assuming or using the same term twice in the same proposition; otherwise called *reduplication*.

Some philosophers use the phrase *replicatio mundi*, replication of the world, for its conversion, or turning round. The human soul is said to be in a place *replicatively*, *replicative*, when conceived to be all in the whole, and all in every part of it.

Replication, in *Law*, is an exception of the second degree,

gree, made by the plaintiff to the plea or firſt anſwer of the defendant.

The replication is particularly that which the plaintiff replies to the defendant's anſwer in chancery; and which is either *general* or *ſpecial*. The ſpecial is grounded upon matter ariſing out of the defendant's anſwer, &c. The general is ſo called from the general words uſed in it. See REJOINDER, and CONFESS *and avoid*.

REPLIQUE, Fr. in *Muſic*. This term, which implies an octave, has been, not very happily, rendered into Engliſh by *replicate*, in the wretched tranſlation of Rameau's treatiſe; but though it has been generally adopted, it has never ſeemed properly naturalized to our language. Sir Francis Bacon has uſed the word *recurrence* for the ſame purpoſe, which is much more congenial with our idiom. There is neceſſarily a repetition of the ſame ſound, or its octave, in every compoſition of four parts.

REPLOT, in *Geography*, one of the Quarken iſlands, in the gulf of Bothnia. N. lat. 63° 15′. E. long. 21° 7′.

REPOLON, in the *Manege*, is a demivolte, the croupe in, cloſed at five times. The Italians are extremely fond of this ſort of manege. In making a demivolte, they ride their horſes ſhort, ſo as to embrace or take in leſs ground, and do not make way enough every time of the demivolte.

REPOLOVSKOI, in *Geography*, a town of Ruſſia, in the government of Tobolſk, on the Irtiſch; 171 miles N. of Tobolſk.

REPONSE, Fr. in *Muſic*, the anſwer to a ſubject of fugue. The anſwer to a fugue, and the time when it is to be introduced, are difficulties in the art of regular fugue, concerning which young contrapuntiſts are long doubtful. See FUGUE and COUNTER-SUBJECT.

REPORT, the relation made upon oath, by officers or perſons appointed to viſit, examine, ſtate, or eſtimate any thing.

Damages, repairs, &c. are judged from the reports of experienced perſons. Proviſions for perſons wounded are only granted on the reports of ſurgeons, &c.: in caſes of rapes, a report of matrons is to be had.

REPORT, in *Law*, is a public relation, or bringing to memory, of caſes judicially argued, debated, reſolved, or adjudged, in any of the king's courts of juſtice, with the cauſe and reaſon of the ſame delivered by the judges. They are hiſtories of the ſeveral caſes, with a ſhort ſummary of the proceedings, which are preſerved at large in the record, the arguments on both ſides, and the reaſons the court gave for its judgment: taken down in ſhort notes by perſons preſent at the determination: theſe ſerve as indexes to, and alſo to explain, the records.

Theſe reports, which in matters of conſequence and nicety the judges direct to be ſearched, are extant in a regular ſeries from the reign of king Edward II. incluſive; and from his time to that of Henry VIII. were taken by the prothonotaries, or chief ſcribes of the court, at the expence of the crown, and publiſhed annually; whence they are known under the denomination of the "Year-books." And it is much to be wiſhed (ſays judge Blackſtone) that this beneficial cuſtom had, under proper regulations, been continued to this day; for though king James I., at the inſtance of lord Bacon, appointed two reporters, with a handſome ſtipend, for this purpoſe, yet that wiſe inſtitution was ſoon neglected; and from the reign of Henry VIII. to the preſent time, this taſk has been executed by many private and contemporary hands; who ſometimes through haſte and inaccuracy, ſometimes through miſtake and want of ſkill, have publiſhed very crude and imperfect (perhaps contradictory) accounts of one and the ſame determination. Some of the moſt valuable ancient reports are thoſe publiſhed by lord chief juſtice Coke, which are ſo highly eſteemed, that they are generally cited without the author's name; and are ſtiled κατ' ἐξοχὴν, *the reports*. The reports of judge Croke are alſo cited in a particular manner, by the name of thoſe princes in whoſe reigns the caſes reported in his three volumes were determined, *viz.* queen Elizabeth, king James, and Charles I., as well as by the number of each volume. Blackſt. Com. book i. &c.

When the chancery, or any other court, refers the ſtating of ſome caſe, or comparing an account, &c. to a maſter in chancery, or other referee, his certificate therein is alſo called a report.

REPORTS, in *Military Matters*, are daily, weekly, and monthly reports of the ſtate of the companies or regiments, relative to their being preſent or abſent, on duty, ſick, confined, &c.

General officers report to the commander-in-chief only. The commander-in-chief's guard reports to himſelf by one of his aid-de-camps. Reports of cavalry are given in to the ſenior generals of cavalry; and reports of infantry to the ſenior general officers of infantry. On a march the field officer of the piquet reports to the general of the day who leads the column; and in camp to the next ſuperior officer to himſelf. A provoſt martial gives in his return of priſoners, and reports to the general of the day.

Deputy judge advocates, acting in diſtricts or garriſons, &c. ſend in the minutes of courts martial, and report to the judge advocate general, without going through any general officers. Regimental ſurgeons report to their commanding officers, and ſurgeons in diſtricts, &c. to the medical board.

The life-guards report, through the Gold Stick, to the king direct, from whom they receive the parole.

The foot-guards report, through the field officer of the day, to the king direct.

All other troops belonging to the Britiſh ſervice, the marines excepted, who report to the admiralty, report through their ſeveral commanding officers, &c. to the adjutant-general and ſecretary at war, and to the commander-in-chief.

A *ſpecial* report is ſaid to be made when the name of an officer is tranſmitted by his commander to the general of a diſtrict, independent of the regular returns; and ſome ſpecific inſtance of miſconduct is laid before him. It muſt be generally remembered, that every officer, on his arrival from abroad with a regiment or detachment of troops, muſt report himſelf to the governor or commanding officer of the ſeaport at which he arrives; and every officer who takes his paſſage for foreign ſervice, muſt do the ſame previous to his departure.

The ſenior officer in each recruiting quarter reports weekly to the field officer of the diſtrict, the number and ſtrength of the parties therein. The field officers commanding recruiting parties in diſtricts, report to the inſpector-general, to whom all returns and reports are to be tranſmitted by them, and not direct from the recruiting officers.

The various ſubordinate reports are thoſe of a rear-guard, of a barrack-guard, of a quarter-guard, of a main-guard and its dependencies, &c. &c.

In the column of remarks which muſt accompany each of theſe reports, it is neceſſary, for the perſon who ſigns, to ſpecify all caſualties and extraordinary occurrences according to the particular nature of each report. The different hours at which the grand rounds, viſiting rounds, and patroles went, muſt likewiſe be put down.

REPORT, *Pinion of*. See PINION.

REPOS, Fr. in *Muſic*, a repoſe, or pauſe. It is the termi-

termination of a phrafe or period. The repofe here meant refembles a hyatus in verfification ; it is a cadence more or lefs perfect as the bafe falls a third, a fifth, or rifes to the fixth of the key. It is a kind of refting place, determined by the fenfe of the paffage, and by feeling. See CADENCE and CADENZA.

REPOSE, in *Poetry*, &c. See REST, PAUSE, &c.

REPOSE, in *Painting*, is applied to certain maffes, or large fyftems of affemblages of light and fhade ; which, being well conducted, prevent the confufion of objects and figures ; by engaging and taking up the eye fo as it cannot attend to the other parts of the painting for fome time ; and thus leading it to confider the feveral groupes gradually, and, as it were, to proceed from ftage to ftage.

REPOSE, *In*, in *Military Language*, is a phrafe that applies to troops which are allowed to be ftationary for any given period, during an active campaign, either through ficknefs, or from fome other caufe.

REPOSITION *of the Foreft* (formed from *re*, and *ponere to lay again*), an act by which certain grounds, before made purlieu, are, upon a fecond view, laid to the foreft again.

REPOSITION, in *Surgery*, the reduction of a bone.

REPOSITORY, REPOSITORIUM, a ftore-houfe or place where things are laid up and kept. In which fenfe we fay, the repofitory of the royal fociety, the royal repofitory at Woolwich, containing models of every fort of warlike ftores, &c. See MUSEUM.

REPOSITORY *of Farm Manure*, in *Rural Economy*, the place where it is put or laid up. See RECEPTACLE *of Stall Manure*.

REPOSO, in *Geography*, a fmall ifland near the coaft of Brafil ; S. lat. 19° 36′.

REPPELE, a town of Hinder Pomerania ; 7 miles W.S.W. of Zachau.

REPPIN, a town of Brandenburg, in the New Mark, on the Eylang ; fix miles S.S.W. of Droffen, N. lat. 52° 25′. E. long. 15° 2′.

REPREHENSION, in *Rhetoric*. See PARRHESIA.

REPRESENTATION, REPRÆSENTATIO, in the *Drama*, the exhibition of a theatrical piece ; including the fcenes, machines, recitation, &c.

Sir Richard Steele's principle is, that the defign of a play is not to be read but reprefented ; fo that it is on the ftage, not in the prefs, it is to be judged of ; and that the pit, not the public, are the proper judges.

REPRESENTATION, in *Law*. See DESCENT, *Right of* CROWN, INTESTATE, ADMINISTRATION, and PARLIAMENT.

REPRESENTATION, in *Infurance*, is underftood to mean a collateral ftatement, either by parol or in writing, of fuch facts or circumftances relating to the propofed adventure, and not inferted in the policy, as are neceffary for the information of the infurer, to enable him to form a juft eftimate of the rifk. Such reprefentations are often the principal inducement to the contract, and afford the beft ground upon which the premium can be calculated. A reprefentation may be untrue, either wilfully and fraudulently ; or inadvertently and innocently.

A wilful mifreprefentation, or *allegatio falfi*, in any fact or circumftance *material to the rifk*, is a fraud that will always avoid the contract. As if an agent, knowing that a fhip had failed from Jamaica for London on the 24th of November, effect an infurance on the voyage, and tell the underwriter that the fhip failed in December : this is a fraud, and the policy is void.

And fuch mifreprefentation fo completely vitiates the policy, that the infured cannot recover upon it, even for a lofs arifing from a caufe unconnected with the fact or circumftance mifreprefented. As if the infured reprefent that the fhip or goods infured are neutral property, when in fact they are enemy's property ; he fhall not recover even for a lofs occafioned by fhipwreck.

So it would be if the broker or agent were to affert that a fhip or goods were neutral property, without knowing whether this were true or falfe, and they are, in fact, enemy's property : for, though it may not, perhaps, be equally criminal *in foro confcientiæ* for a man to aver that to be true which he knows nothing of, as to aver that to be true which he knows to be falfe ; ftill it is unqueftionably a fraud, and in the cafe of an infurance, equally injurious to the underwriter ; becaufe he is induced by the deception, however occafioned, to compute the rifk upon falfe principles. The fame reafoning holds even in the cafe where the perfon himfelf making the reprefentation *believes* it to be true.

But if he were only to fay that he *believes* the fhip to be neutral property, knowing nothing on the fubject, and having no reafon to believe the contrary ; there, though the fhip be not neutral, the reprefentation will not avoid the policy ; becaufe the under-writer may inform himfelf of the grounds of this belief, before he enters into the contract ; and if he neglect to do fo, he takes upon himfelf the rifk of its being unfounded.

For the fame reafon, if the word *expected* be ufed, this will not amount to a reprefentation : as when a broker in getting infurances effected on feveral fhips, belonging to the fame owner, and fpeaking of them all, faid,—'Which veffels are *expected* to leave the coaft of Africa in November or December,' when, in fact, they had all failed in the May preceding : this does not amount to a reprefentation, being only an *expectation*, the ground of which the under-writer might have enquired into.

There is a material difference between a reprefentation and a warranty. A warranty, being a condition upon which the contract is to take effect, is always a part of the written policy, and muft appear on the face of it : whereas a reprefentation is only matter of collateral information or intelligence on the fubject of the voyage infured, and makes no part of the policy. A warranty, being in nature of a condition precedent, muft be *ftrictly and literally* complied with; but it is fufficient if a reprefentation be true in *fubftance*. By a warranty, whether material to the rifk or not, the infured ftakes his claim of indemnity upon the precife truth of it, if it be affirmative, or upon the exact performance of it, if executory ; but it is fufficient if a reprefentation be made without fraud, and be not falfe in any material point ; or if it be *fubftantially*, though not *literally*, fulfilled. A falfe warranty avoids the policy, as being a breach of a condition upon which the contract is to take effect, and the infurer is not liable for any lofs though it do not happen in confequence of the breach of the warranty. A falfe reprefentation is no breach of the contract, but if material, avoids the policy on the ground of *fraud*, or at leaft becaufe the infurer has been mifled by it.

It has already been fhewn that a warranty muft appear upon the face of the policy, and make a part of the written contract ; and therefore a written paper, wrapped up in the policy, or even wafered to it, is only a reprefentation. For the fame reafon, the written inftructions for effecting the policy, unlefs inferted in it, cannot be deemed a warranty, but only a reprefentation ; for the under-writer, by not infifting on having thefe inftructions inferted in the policy, fhews that he is content to take them as a reprefentation.

But

but it behoves all agents and brokers concerned in the effecting of policies, to keep correct entries of theſe inſtructions, and indeed of all repreſentations made to the under-writers: for the whole queſtion between the inſured and the under-writers often turns upon theſe inſtructions. Beſides, they are anſwerable to the inſured for the conſequences of any repreſentation made by them without authority, as well as for thoſe of omitting to make ſuch repreſentations as they have been inſtructed to make.

By an extenſion of equitable relief in caſes of fraud, it ſeems to be now ſettled that if a falſe repreſentation be made to the firſt under-writer on the policy, in a material point, this ſhall be conſidered as a miſrepreſentation made to every under-writer, ſo as to infect the whole policy, otherwiſe it might be a contrivance to deceive many; for when a reſpectable under-writer ſtands firſt on the policy, the reſt ſubſcribe the policy without aſking a queſtion; and if the firſt under-writer be impoſed upon, the reſt are entrapped by the ſame fraud.

But the inſurer muſt avail himſelf of this ſort of objection in the firſt inſtance; for after a verdict has been obtained, the court will not ſet it aſide upon an affidavit of the firſt under-writer, that a material miſrepreſentation had been made to him. The defendant, in ſuch caſe, knows what has been repreſented to himſelf, and might have known what had been repreſented to the firſt under-writer; and he ſhall not lie by till after a trial, in order to make the objection, if the verdict ſhould be againſt him.

If the inſured ſtate his computation as *fact*, inſtead of the information on which he founds his computation, and it prove untrue, it is a miſrepreſentation; and if material, it will avoid the policy.

A miſrepreſentation in a material point equally vitiates the contract, whether it be the miſrepreſentation of the inſured himſelf or of his agent, and whether it proceed from fraud, miſtake or negligence; for the inſurer is thereby led into an error, and computes the riſk upon falſe grounds.

As a repreſentation is only matter of collateral information, it is ſufficient if it be true in *ſubſtance;* and its not being inſerted in the policy in the form of a warranty, is looked upon as a proof that the inſurer does not require it to be ſtrictly and literally true. Although the voyage be repreſented as being leſs than the voyage deſcribed in the policy, yet, if there be no fraud, and the voyage actually performed be within the policy, it will be protected by the policy. Even if a repreſentation as to the courſe of the voyage be literally untrue, yet if it be made in conformity to an eſtabliſhed uſage of trade, and no perſon be deceived by it, and the voyage meant to be performed be within the policy, it will not avoid the contract.

Every repreſentation reſpecting the ſtate of the ſhip, and the time of her ſailing, is material; and therefore if it be ſtated that a ſhip was *ready to ſail* on a certain day, when, in fact, ſhe had ſailed the day before, this is both a miſrepreſentation and a concealment, and will avoid the policy.

Concealment, or "ſuppreſſio veri," is nearly allied to miſrepreſentation, or "allegatio falſi," and conſiſts in the fraudulent ſuppreſſion of any fact or circumſtance material to the riſk; and this, like every other fraud, avoids the contract *ab initio,* upon principles of natural juſtice. But it is not merely on the ground of *fraud* that a concealment avoids the contract; for even a concealment which is only the effect of accident, negligence, inadvertence, or miſtake, will be equally fatal to the contract, as if it were intentional and fraudulent. Whatever reſpects the ſtate of the ſhip, the time of her ſailing, the nature of the employ in which ſhe is to be engaged, &c. ought to be fully diſcloſed; and the keeping back of any part of this fact will be fatal to the contract. In ſuch caſe, the concealment ſo vitiates the policy that it will afford the inſured no remedy, even for a loſs ariſing from a cauſe unconnected with the fact or circumſtance concealed; for a concealment is to be conſidered, not with reference to the event but to its effect, at the time of making the contract. A well-founded ſuſpicion of concealment will amount in the courts to proof of fraud. As it is in ſome caſes neceſſary to ſtate to the under-writers the nature of the ſervice in which the ſhip is to be employed; if this be attended with any extraordinary danger, the concealment of it will avoid the policy. A material concealment is fatal, though the fact concealed was not diſcloſed, becauſe the broker thought it immaterial. Doubtful rumours reſpecting the ſafety of a ſhip which it is intended to inſure "loſt or not loſt," ought to be faithfully diſcloſed to every under-writer; and the withholding of ſuch information will avoid the contract. The obligation of a ſtrict obſervance of good faith is equally binding on both parties in all contracts; and in that of inſurance, the under-writer, as well as the inſured, is bound to diſcloſe all circumſtances within his knowledge affecting the riſk. If, therefore, it ſhould appear, that at the time when he underwrote the policy, he knew that the ſhip was arrived ſafe, the contract will be void as to him, and an action will lie againſt him to recover back the premium.

There are, however, many matters, which are open to both parties, and upon which they may both exerciſe their judgments, with regard to which they may be innocently ſilent. The inſured need not diſcloſe what the under-writer knows, or what he ought to know. The under-writer needs not be told what leſſens the riſk agreed upon, and is underſtood to be compriſed within the terms of the policy. He is bound to know every cauſe which may occaſion natural perils, as the difficulty of the voyage, the variation of ſeaſons, the probability of lightning, hurricanes, &c. He is alſo bound to know every cauſe which may occaſion political perils, from the rupture of ſtates, from war, and its various operations; and he is bound to know the probability of ſafety from the continuance and return of peace, from the imbecility of the enemy, the weakneſs of their counſels, or their want of ſtrength. There are other circumſtances which the under-writer ought to know; and, particularly, it is not neceſſary to communicate to him, that the ſhip is foreign built, though this enabled her to ſail without convoy, and without a licence to do ſo, being within the exception in the ſtat. 38 Geo. III. c. 76. § 6; it being the buſineſs of the under-writer to obtain this information for himſelf. In caſes of concealment, the queſtion muſt always be, whether there was, under all the circumſtances, at the time when the policy was underwritten, a full and fair ſtatement, or a concealment: fraudulent, if deſigned; or, though not deſigned, varying materially the object of the policy, and changing the riſk underſtood to be run; and in both caſes avoiding the contract. It is not neceſſary that there ſhould be any previous repreſentation as to the ſtate of the ſhip, that being covered by the implied warranty that ſhe is ſea-worthy. For a variety of other particular facts and documents, relating to the ſubjects of repreſentation and concealment, we refer to Marſhall's Treatiſe on the Law of Inſurance, vol. i. b. 1. ch. 9 and 10. See WARRANTY.

REPRESENTATIVE, one that perſonates, or ſupplies the place of another; and is inveſted with his right and authority.

The word repreſentative is equivalent to procurator or proxy.

The

The commons are the people's reprefentatives in *parliament;* which fee.

There is this defect in the conftitution of our parliament; that whereas all Englifhmen who have confiderable eftates ought not to be taxed without their own confent in parliament, by themfelves, or their reprefentatives; copyholders, of whom fome have a thoufand pounds a-year, have no voice in the election of knights of the fhire. See PARLIAMENT.

REPRESENTATIVE *Character*, in *Political Economy*, thus denominated by way of excellence, or in contradiftinction to other kinds of reprefentation, conftitutes the ambaffador, or minifter of the firft rank, who reprefents his mafter in his very perfon and dignity. It places him above all other minifters, who are not invefted with the fame character, and precludes their entering into competition with the ambaffador. (See EMBASSADOR.) Envoys are minifters of the fecond rank, and are not invefted with the reprefentative character, properly fo called, or in the firft degree. See ENVOY.

REPRESENTATIVE *Power*, in *Metaphyfics*, a term introduced by Leibnitz, to fignify that power of the human foul, by which it reprefents to itfelf the univerfe, according to the fituation of the body in the univerfe.

Wolfius calls this power *vis reprefentativa*, to denote its being an active power, or rather a force actually exerting itfelf. For he exprefsly fays, *quod vis confiftat in continuo agendi conatu*. And he thinks that from this principle of a *vis reprefentativa*, every phenomenon of the human mind may be accounted for. See his Pfycholog. Ration. art. 529.

But it may be prefumed, that many will find this principle too obfcure to be admitted.

When it is faid, that our ideas are reprefentative of things without us, or of the univerfe; it may be afked in what fenfe this is to be underftood? Do they reprefent it, 1. As a picture does its original? Or, 2. As an effect of a caufe? Or, 3. As a fign reprefents the thing fignified? The firft opinion is exploded in part by Locke and the Cartefians, and totally by Dr. Berkeley, late bifhop of Cloyne. The fecond is admitted by Hobbes, but denied by Leibnitz himfelf and the idealifts. The third fhould feem to be the opinion of Leibnitz, but he is not fufficiently explicit.

Dr. Berkeley admits ideas to be figns; but according to him they are arbitrary figns, depending on the immediate will of the Deity: hence the vifual language; and ideas only fignify or fuggeft each other, and fpirits; but not bodies, the exiftence of which is totally unknown.

REPRIEVE, or REPRIVE, from *reprendre, to take back*, in *Law*, a fufpending or deferring the execution of the law upon the prifoner for the prefent time.

A reprieve is properly a warrant from the king, for fufpending the execution of a perfon condemned.

This may be, firft, *ex arbitrio judicis*, either before or after judgment; as, where the judge is not fatisfied with the verdict, or the evidence is fufpicious, or the indictment infufficient, or he is doubtful, whether the offence be within clergy; or fometimes, if it be a fmall felony, or any favourable circumftances appear in the criminal's character, in order to give room to apply to the crown for either an abfolute or conditional pardon. Thefe arbitrary reprieves may be granted or taken off by the juftices of gaol-delivery, although their feffion be finifhed, and their commiffion expired; but this rather by common ufage than by ftrict right. (2 Hal. P. C. 412.) Reprieves may alfo be *ex neceffitate legis*, as where a woman is capitally convicted, and pleads her pregnancy; which is referred to a *jury of matrons*. Another caufe of regular reprieve is, if the offender become *non compos* between the judgment and the award of execution. See LUNATIC.

REPRIMAND, a fharp authoritative reproof. Such a perfon was reprimanded in court by the bench, &c.

REPRIMAND, a military punifhment at the head of a regiment, is fometimes ordered by a court-martial, and fometimes only in the prefence of the officers of the corps: it is generally given by one of the field-officers, and ufually in fuch terms as thefe: "Captain, or lieutenant A. B., you have been tried for ——, and are, by the fentence of a general court-martial, found guilty thereof, and fentenced to be reprimanded at the head of the regiment: the difagreeable tafk of doing it is affigned to me: I therefore do hereby reprimand you, and hope, that it may prevent your falling again into the like error." Non-commiffion officers are fometimes, though not frequently, ordered to be reprimanded.

REPRISALS, or REPRIZALS, *Reprifalia*, in the *Civil Law*, a right which princes have to retake from their enemies fuch things as they unjuftly detain from them; or other things equivalent to them.

The word is formed from the Italian *reprefaglia*, which fignifies the fame thing.

When a place is taken or held from a prince, he feizes another by way of reprifal. Sometimes he takes men of the oppofite party, by right of reprifals.

The Romans called this *clarigatio;* and the Greeks had fomething like it under the name of *androlepfia*.

Reprifals are ufed between nation and nation, to do juftice to themfelves, when they cannot otherwife obtain it. If a nation has taken poffeffion of what belongs to another; if it refufes to pay a debt, to repair an injury, or to make a juft fatisfaction; the other may feize what belongs to it, and apply it to its own advantage, till it has obtained what is due for intereft and damage, or keep it as a pledge till full fatisfaction has been made. The law of nations permits reprifals only upon a caufe that is evidently juft, as for a debt that is extremely clear. For he who forms a doubtful pretenfion, can at firft demand only an equitable examination of his right. In the fecond place, he fhould, before he proceeds fo far, have in vain demanded juftice, or, at leaft, have the utmoft reafon to believe that it would be in vain for him to demand it. Then alone he may right himfelf. It would be too contrary to the peace, to the repofe, and fafety of nations, to their mutual commerce, and to the duties which bind them to each other, for any prince fuddenly to apply to force, without knowing whether the other is difpofed to do him juftice, or to refufe it. It muft be obferved, in order perfectly to underftand this article, that if, in a litigious affair, our adverfary refufes the means of bringing the right to proof, or artfully eludes it; if he does not, with good faith, apply to pacific meafures for terminating the difference; and, above all, if he is the firft who begins acts of hoftility, he renders the caufe juft, which was before doubtful: we may then make ufe of reprifals, or feize his effects, to oblige him to embrace the methods of reconciliation, which the law of nature prefcribes. This is the laft attempt before coming to an open war. As the wealth of the citizens forms a part of the total wealth of a nation, and between ftate and ftate, whatever is the property of the members is confidered as belonging to the body, and is anfwerable for the debts of the body; it follows, that in reprifals they feize the goods of the fubject, in the fame manner as thofe of the ftate, or fovereign. Every thing that belongs to the nation is fubject to reprifals, as foon as it can be feized, provided it be not a depofit trufted to the public faith. This depofit is found in our hands, only

only in consequence of that confidence which the proprietor has put in our good faith; and it ought to be respected, even in cases of open war. Thus it has been usual to behave in France, England, and elsewhere, with respect to the money which foreigners have placed in the public funds. He, however, who makes use of reprisals against a nation, on the goods of its members indiscriminately, cannot be taxed with seizing the wealth of an innocent person for the debt of another; for, in this case, the sovereign is to recompense those of his subjects on whom the reprisals fall: this is a debt of the state or nation, of which each citizen ought only to support his quota. It belongs only to sovereigns to use and order reprisals, in the manner now stated. This is a measure of too great consequence to be abandoned to private persons. In all civilized states, a subject who thinks himself injured by a foreign nation has recourse to his sovereign, in order to obtain the permission of making reprisals. This is what is called desiring "letters of marque." See the next article.

We may use reprisals against a nation, not only for the actions of the sovereign, but also for those of his subjects. Accordingly the sovereign demands justice, or makes reprisals, not only for his own affairs, but also for those of his subjects, whom he ought to protect, and whose cause is that of the nation. But to grant reprisals against a nation, in favour of foreigners, is to set himself up as a judge between that nation and these foreigners, which no sovereign has a right to do.

As we may seize the things which belong to a nation, to oblige it to do justice, we may, for the same reason, arrest some of the citizens, and not release them till we have received entire satisfaction; the subjects thus detained being only regarded as a security to oblige a nation to do justice, if their sovereign is obstinate in refusing it. We cannot take away their lives, nor inflict any corporal pain upon them, for a refusal of which they are not guilty. But the sovereign may make use of force against those who resist the execution of this right, and use as much as is necessary to surmount their unjust resistance. In this case, the true and just welfare of the state is the grand rule: moderation is always laudable in itself; but the conductors of nations ought to exercise it only so far as it is consistent with the happiness and safety of their people. A sovereign, however, has no right to oppose force, or to make war against him, who, in such a case, by ordering the making of reprisals, only exercises his just right. Whenever a sovereign can, by the way of reprisals, procure a just recompence, or a proper satisfaction, he ought to make use of this method, which is less violent and less fatal than war. Those who run to arms, says the excellent Vattel, without necessity, are the scourges of the human race, barbarians, enemies to society, and rebels to the law of nature, or rather to the common father of mankind. There are cases, however, in which reprisals would be justly condemned, even when a declaration of war would not be so; and these are precisely those in which nations may with justice take up arms. When it relates to differences, not on an act of violence, or of an injury received, but of a contested right; after having in vain attempted ways of reconciliation, or pacific measures of obtaining justice, it is a declaration of war which ought to follow, and not pretended reprisals, which, in such a case, would only be real acts of hostility, without a declaration of war, and would be contrary to the public faith as well as to the mutual duties of nations.

There is one kind of retortion sometimes practised in war, under the name of reprisals, which we must here mention. If a general of the enemy has, without any just reason, caused some prisoners to be hanged, a like number of his men, and of the same rank, will be hung up; signifying to him, that this retaliation will be continued for obliging him to observe the laws of war. It is a sad extremity thus to put a prisoner to death for his general's fault; and if this prisoner was before promised his life, reprisals cannot be made on him with any colour of justice. Yet as a prince, or his general, has a right of sacrificing the life of his enemies to his safety, and that of his men, if he is engaged with an inhuman enemy, who frequently commits such enormities, he appears to have a right of refusing life to some of the prisoners he may take, and of treating them as his were treated. But Scipio's generosity is rather to be imitated. That great man, having reduced some Spanish princes, who had revolted against the Romans, declared to them, that on a breach of their faith, he would not call the innocent hostages to an account, but themselves; and that he would not revenge it on a disarmed enemy, but on those who should be found in arms. (Liv. l. 28.) Alexander the Great, having cause of complaint against Darius for some malpractices, sent him word, that if he continued to make war in such a manner, he would pursue him to the utmost, and give no quarter. (Quint. Curt. l. iv. c. 1, and 11.) It is thus an enemy, violating the laws of war, is to be punished, and not by causing the penalty due to his crimes to fall on innocent victims. Vattel's Law of Nations, b. ii. ch. 18. b. iii. ch. 8.

Reprisals is also used for a letter or permission, which a prince sometimes gives a subject, upon a full cognizance of the cause; authorizing him to retake from the first persons he meets of the opposite party, as many effects as make an equivalent to what have been violently forced from him, and for which the opposite prince has refused to do him justice.

These permissions are also called *letters of marque*, or *mart;* and in the stat. 27 Edw. III. *law of marque;* in regard a person denied justice in another man's territory, redresses himself by goods belonging to men of that territory. See *Letters of* Marque.

Reprisals is also used in the same sense with recaption.

REPRISE, or Reprize, in the *Commerce by Sea*, a merchant-ship, which, having been taken by a corsair, privateer, or other enemy, is retaken or recovered by a vessel of the contrary party.

The word is French, and signifies a *resumption* or *retaking*.

When a vessel, thus retaken, has been twenty-four hours in the hands of the enemy, it is deemed a lawful prize. If the reprize has been made within twenty-four hours, the vessel is to be restored to the proprietor, with every thing in it, upon his allowing one-third to the vessel who made the reprize.

If the reprize has been abandoned by the enemy, either in a tempest, or from any other cause, before it have been led into any port, it is to be restored to the proprietor. See Recapture.

Reprise, in the *Manege*, is a lesson repeated, or a manege recommenced. Thus we say, to give breath to a horse upon the four corners of the volte with only one reprise, that is, all with one breath.

Reprise, Fr., in *Music*. Every part of an air or strain that is to be repeated, without being written or printed twice over, is called by the French a reprise. There are various ways of marking repetitions in music: first by a double bar dotted; if on both sides, both parts or strains are

are to be repeated; if only one ſide of the double bar is dotted, that ſide only is to be repeated. This ſign 𝄋, and ſometimes *da capo al ſegno* 𝄋, imply a repetition of particular portions of a melody; as do, likewiſe, dots in the ſpaces of the ſtaff. (See Renvoi and Reference.) Gretry, in his Memoires, ſays that the repeating of the firſt and ſecond parts or ſtrains of a movement is a barbarous cuſtom.

Reprises, in *Law*, are deductions, drawbacks, or duties, paid yearly out of a manor, or lands. Such are rent-charges, penſions, fees of ſtewards or bailiffs, &c. The manor of Doll yields 40*l. per annum, ultra reprizas*, beſides all reprizes.

REPROBATION, Reprobatio, in *Theology*, a decree or reſolve, which God has taken from all eternity to puniſh ſinners, who ſhall die in impenitence.

Reprobation ſtands in direct oppoſition to *election.*

Divines hold it a ſymptom of reprobation, when a ſinner is hardened ſo as not to feel any farther remorſe or miſgivings of conſcience.

The caſuiſts diſtinguiſh two kinds of reprobation, *poſitive* and *negative*. *Poſitive* is that by which God is ſuppoſed to create men with a poſitive and abſolute reſolution to damn them eternally. This opinion of reprobation is countenanced by St. Auguſtine, and others of the fathers; and is ſtrongly maintained by Calvin, and moſt of his followers. Something like it is alſo found in the thirty-nine articles of the church of England; but it is now generally exploded, as injurious to the juſtice of God. *Negative* or *conditional* reprobation is that by which God, though he creates all men with a ſincere deſire to ſave them, and furniſhes them with the neceſſary means thereto, ſo that all may be ſaved, if they will; yet ſees there are ſeveral who will not do it, with the aids he ſhall afford them, how powerful ſoever; and ſees, at the ſame time, they would do it with certain other aids, which he ſees, but will not give them. *O altitudo!* &c.

By comparing one part of ſcripture with the other, ſays Dr. Doddridge in his "Lectures," (Prop. 142, ſchol. 1.) there ſeems to be this remarkable difference between the predeſtination to life and that to death (here called reprobation), that, in the former caſe, God determines by the influence of his grace to work ſuch a change in the hearts of his elect, as that their ſalvation ſhould on the whole be aſcribed to him, and not unto themſelves; whereas he determines to bring others into ſuch circumſtances, that though their ruin ſhould in fact happen, yet they themſelves ſhould be the authors of it, and the blame lie as entirely upon themſelves, as if it had not been ſo much as foreknown. (See Rom. ix. 22, 23. Matth. xxv. 34, 41.) But the oppoſers of this doctrine allege, that this kind of reaſoning is an evaſion and not a ſolution of the difficulty. This learned divine, adverting to the objection, that the above-ſtated doctrine tends to make the perſons whom it concerns deſperate, obſerves, that if it be granted, that *ſufficient* aſſiſtances are given to *all*, none will have reaſon to deſpair, nor will any have an excuſe to plead before God, in conſequence of his ſecret purpoſes, which will not be made a rule of his final judgment. If it be ſaid, that nevertheleſs thoſe who are not predeſtinated to life are left under a neceſſity of periſhing, and an impoſſibility of ſalvation; it muſt be owned, that it is difficult to ſay, how the doctrine, as explained by ſome, can be freed from this objection; but that this conſequence does not neceſſarily follow from it, according to his ſtatement. See Election and Predestination. See alſo Sublapsarian and Supralapsarian.

REPRODUCTION, in *Phyſiology*. In ſpeaking of the growth of organic bodies, we muſt notice their power of reproduction; that wonderful property of reſtoring or renewing parts that have been mutilated or entirely loſt. This is one of the moſt important proviſions of nature, inaſmuch as it guards animals and plants againſt the multiplied dangers to which their bodies are expoſed. Hence, when viewed in connection with the ſyſtem of nutrition altogether, it forms one of thoſe deciſive and grand characters, which diſtinguiſh at once the machines that proceed from the hand of the Creator, from all, even the moſt ingenious and boaſted, productions of human ſkill. The difference is recogniſed at the firſt glance; the diſtance is immeaſurable. The ſprings and wheels of mechanical inſtruments have no power of repairing themſelves, when they are bent, broken, worn, or ſpoiled; but ſuch a faculty is enjoyed in various degrees by every animal and by every plant.

At different periods of the year, ſeveral organiſed beings loſe, by a ſpontaneous and natural proceſs, certain parts of their body, which are ſubſequently renewed. Examples of this occur in the fall of the ſtag's horns; in the moulting of birds; in the renewal of the cuticle of ſerpents, and other amphibia, of the larvæ of inſects, and of the ſhell of the cruſtacea; the fall of the leaves of trees, &c. This may be called ordinary or natural reproduction. The ſtag's horn, or antler, as it ſhould be more properly called, is a maſs of true bone, poſſeſſing the ſtructure and characters of oſſeous ſubſtances. In its early ſtate, it is ſoft, and traverſed by large veſſels, which muſt be reproduced every time the new horn is formed. This annual reproduction conſtitutes, in many points of view, one of the moſt remarkable phenomena of animal phyſiology. It affords a moſt ſtriking proof, 1ſt, of the power of the nutritive proceſs, and of the rapid growth, which is dependant on this in warm-blooded animals. For the horn of a ſtag, which may weigh a quarter of a hundred, is completely formed in ten weeks. 2dly. Of a limited duration of life in a part of an animal, entirely independent on the life of the whole animal, which in the ſtag extends to about thirty years. 3dly. Of change of calibre in particular veſſels. For the branches of the external carotid, which ſupply the horn, are ſurpriſingly dilated during its growth; and recover their former area, when that proceſs has ceaſed. 4thly. Of a peculiar ſympathy, which is manifeſted between the growth of the horns, and the generative functions. For caſtration, or any eſſential injury of the organs of generation, impedes the growth, alters the form, or interrupts the renewal of the horns. See the articles Cervus, and Horn, in *Comparative Anatomy*.

The cuticle of the ſnake is ſeparated every year, and comes off as a complete ſheath, excepting the aperture, through which the animal eſcapes: the covering of the cornea is ſhed with the reſt of the external integument.

Cruſtaceous animals (the crab, lobſter, &c.) have a ſkeleton, which ſurrounds and contains their ſoft parts, and which ſerves, at the ſame time, the purpoſes of a ſkin. When it has attained its perfect conſiſtence, it grows no more; but, as the ſoft parts ſtill increaſe, the ſhell ſeparates, and is detached, being ſucceeded by a larger one. The calcareous bodies in the ſtomachs of theſe animals, performing the office of teeth, are ſhed with the ſhell. See the article Cancer, in the account of the ſpecies *ruricola*, and *gammarus*.

The larvæ of inſects caſt their cuticular covering ſeveral times before their transformation. An intereſting account of the

the particulars may be feen in the article ENTOMOLOGY, in the divifion "*of the larva ftate,*" under the fubdivifion "*lepidoptera.*"

The fecond, or *extraordinary* kind of reproductive power, is that by which wounds, fractures, or any accidental mutilation or lofs of parts of an organifed body, are remedied or reftored. This exifts in very different degrees in different departments of the animal kingdom. In man, and fuch animals as are nearly allied to him, the property is very limited, although fufficiently active to be capable of remedying the effects of great injuries. If a bone be broken, a mufcle or tendon divided, or a piece of fkin deftroyed, proceffes are fet up in the parts by which reftoration is accomplifhed. The ends of the bone are joined by an offeous fubftance, which gives to the part its original folidity; the tendon regains its firmnefs and power of refiftance; the mufcle can contract again and move the points of its attachment; and the furface of the body is covered by a new piece of integument. The functions of the parts are reftored; but the newly formed matter can be always diftinguifhed from the original compofition of the body, and poffeffes a weaker vitality. For, in fome cafes, old ulcers have broken out afrefh, and even fractures have been difunited in ftates of great general debility. A divided nerve is reunited, even if a fmall portion be removed: and the function of the part, fufpended for a time, is thus reftored. The cafe is different in the blood-veffels: the proceffes confequent on wounds of thefe tend to ftop the hemorrhage, which in general can be effected only by the obliteration of the tube.

The power of repairing the effects of injury is modified by various circumftances. The health and ftrength of the individual, the age, the air, and other circumftances, which the furgeon muft attend to, have great influence.

In the cafes which have been juft mentioned, the reftorative power repairs injuries; but it goes no further. Neither in man, nor in any warm-blooded animals, are entire organs ever reproduced. If a limb be cut off, or a piece of flefh taken away, the wound is healed, the chafm is filled up; but the loft parts are never formed again.

In the lower orders of the animal kingdom, on the contrary, fuch are the ftrength and perfection of the reproductive energy, that confiderable members are formed again, and we can hardly affign a limit to the power in fome inftances. The lower we defcend in the fcale of beings, the more furprifing are the manifeftations of this reproductive faculty. It is familiarly known, that the claws of the crab and lobfter, and the entire limbs or tail of the newt, can be reftored: the fame holds good of the rays of the ftar-fifh (afterias), and the arms or tentacula of the cuttlefifh. It was afferted by Bonnet and Spallanzani, that the entire head of the fnail can be reproduced; but the affertion was fufpected, becaufe other experimentalifts did not fucceed in repeating the trials. Hence Blumenbach was led to obferve, "that fome experiments on this reproductive power require a hand exercifed in fuch employments, together with various precautions, and a favourable combination of circumftances, for their fuccefs. Hence perfons muft be cautious in concluding againft the truth of any ftatement, becaufe their own experiments do not fucceed. After feveral fruitlefs attempts on this fubject, I have lately fucceeded in obferving the reproduction of the whole head of the fnail (helix pomatia) with its four horns, which occupied about fix months." Comparative Anatomy, tranflated by Lawrence, p. 219.

The fame phyfiologift has given us a remarkable inftance of reproduction in an animal of more complicated ftructure. "I preferve," fays he, "in fpirits a large water newt (lacerta paluftris), from which I extirpated nearly the whole eye feveral years ago: all the humours were difcharged, and then four-fifths of the emptied coats were cut away. In the courfe of ten months an entirely new eye-ball was formed, with cornea, iris, cryftalline lens, &c.; and this is only diftinguifhed from the fame organ on the oppofite fide by being fmaller." Ibid.

Not only are amputated tentacula fpeedily replaced in the actiniæ (fea anemones), but, if the animal be divided by a vertical or horizontal fection into two halves, each of thefe becomes an entire actinia. See the article ANEMONE.

The frefh water polype exhibits very furprifing powers in this way. If it be cut into two or more pieces, thefe become perfect animals. If it be flit half way down, the two halves are rendered perfect, remaining united below: thefe may be flit again with the fame refults. The oppofite ends of two polypes may be made to grow together, &c. See POLYPE.

See the memoirs on animal re-productions in Spallanzani's tracts: alfo the works of Bonnet.

REPROOF, OBJURGATIO, in *Rhetoric*, is diftinguifhed from *invective*; which fee.

REPS, in *Geography*, a town of Tranfilvania; 16 miles N. of Fogaras.

REP-SILVER, money anciently paid by fervile tenants to their lord, to be quit of the duty of reaping his corn.

REPTILES, in *Comparative Anatomy* and *Phyfiology*. Although the animals, whofe ftructure we are about to explain, are perfectly fimilar to each other in their principal characters, and ought therefore to be united in one clafs, naturalifts have experienced a real difficulty in difcovering an appropriate name for the clafs. That of *amphibia*, employed by Linnæus and his difciples, although deduced from a ftriking circumftance in the economy of the more generally known reptiles, namely, the power of exifting for a long time in water, as well as in air, is vague and uncertain in its fignification. If we regard as amphibia thofe aquatic animals, which are able to live for fome time on land, or thofe land animals, which can remain for a certain time under water, all animals are amphibious; for even the human fubject and the mammalia can dive. If, on the other hand, the word amphibious be taken etymologically, and underftood to denote an equal power of fubfifting in air and water, it is applicable to no animals. Although reptiles can remain much longer under water than the mammalia, or birds, they are obliged, as their refpiratory organs are only calculated for breathing air, to come fooner or later to the furface for this purpofe; and they are drowned, like any warm-blooded animal, if detained in the water beyond that time. To enable an animal to exift equally in air and water, it fhould have lungs and gills; that is, it fhould have the power of breathing air, like the mammalia and birds, and of breathing water, like fifhes; and it fhould be able to ufe either of thefe methods, to the exclufion of the other. But we know of no fuch animals. The larvæ of frogs and falamanders, the proteus anguinus, and the firen lacertina (fee the latter part of this article), have indeed branchiæ and lungs; but as far as our knowledge hitherto goes, none of thefe could live out of the water. The lungs of the tadpole, and of the larvæ of falamanders, are defigned for the fervice of thofe animals in their fubfequent ftage of exiftence; but do not give them the power of living in air: and the lungs, either of the proteus or firen, do not feem fufficient to enable them to difpenfe with the office of the branchial appendages. In its etymological fenfe, then, the term amphibious is not applicable to any animals we know of.

Linnæus

Linnæus places among his amphibia reptiles who never go into the water, and fome fifhes which never quit it. He could not fail to experience great difficulties in naming a clafs fo ill conceived as that of his amphibia; confequently, this appellation is objectionable, as being vague and obfcure; the genera comprehended in the Linnæan clafs amphibia, are too ill afforted to admit of their having a common name fuitable to all. Daubenton divided them into two claffes, naming one oviparous quadrupeds, and the other ferpents. Lacépéde adopted thefe two claffes, and placed between them a third, that of oviparous bipeds. Hermann of Strafbourg, in his "Tabulæ affinitatum Animalium," propofed to fubftitute, for the term amphibia, that of cryerozoa. "Si in novorum nominum impofitione gloriam more multorum quæreremus, et ea re fcientia promoveretur, cryerozoa apte vocari poffe putaremus, quia omnem fere naturam eorum animalium vox ifta exhaurire videatur. Κρυερος enim non modo frigidum, fed et horridum luridumque fignificat." Hermann, Tab. affin. Anim. p. 218.

Without entering further into the objections againft the appellations juft enumerated, we adopt that of reptiles, already employed by many modern naturalifts, and particularly by Cuvier, in his "Tableau Elémentaire d'Hiftoire Naturelle." In fact, in the progreffion of the oviparous quadrupeds, as well as in that of ferpents, the belly moves againft the furface of bodies, over which they pafs.

General Obfervations.—Referring to the article CLASSIFICATION for a view of the genera comprehended under thefe divifions, we prefix to the more detailed furvey of the anatomy of reptiles, a fhort fummary of the principal anatomical characters of the four orders into which the clafs is divided.

1. The CHELONIAN order; Teftudines. Body inclofed in a bony fhell. They refemble birds in having the mafticating furfaces of their maxillary bones covered by ftrong cutting horny plates. Body fupported on four limbs, terminated by a tail, and covered in almoft all by fcales. They copulate; fecundation takes place internally: the female lays eggs, covered by a firm calcareous fhell: the young animals come out without incubation, merely by the heat of the atmofphere; and they undergo no metamorphofis. Stomach larger than in the other reptiles, and inteftinal canal furnifhed with a cæcum. The heart has two auricles.

2. SAURIAN order, or Lizard kind. They refemble the former very nearly in the ftructure of their principal internal organs. They have firm bones, like thofe of the mammalia: curved and long ribs, and a fternum. Teeth fet in the jaw. The two branches of the lower jaw confolidated. A trachea compofed of cartilaginous rings, an os hyoides and larynx, capable of producing founds, at leaft in fome individuals. Heart with two auricles. A fimple penis in the male. There is a real internal copulation; the female lays feparate eggs, generally covered with a firm fhell, depofiting them on dry ground, or in holes. The young ones come out of them, and undergo no metamorphofis. The fkin is furnifhed with numerous plates or fcales. Body elongated, and ending with a tail. Feet, often high, and ftrong enough to fuftain the body above the ground in progreffion. Some are quadruped; others biped, having either fore or hind feet. Toes furnifhed with nails: generally five in number; but there may be four, three, two, and even one.

3. OPHIDIAN order; Serpents. They agree with the two former orders, in having firm bones, curved and long ribs, a larynx and trachea, capable of producing a flight hiffing in moft. An external organ of generation in the male. A real internal copulation: the female lays eggs covered with a calcareous fhell, which fhe depofits in holes filled with leaves, under the roots of trees, in warm and rather moift fituations. The young ones, when they quit the egg, are like their parents. They differ from the preceding orders, in having a long, eel-fhaped, flexible body, covered with a fkin, either furnifhed with fcales or plates, or naked, unprovided with feet, and terminated by a tail, often very long. Numerous long curved ribs, not united together, as there is no fternum. The branches of the lower jaw not united in front. Upper jaw confifting of four branches. Simple, fharp, and numerous teeth; and long, curved, tubulated fangs, in addition to thefe, in the venomous kinds. They creep along the ground by undulations of their body. Excepting the ophifauri, they have no external auditory openings. Heart with a fingle auricle. Double penis. Eggs covered with foft calcareous fhells.

4. BATRACIAN order; Frog kind. They refemble the preceding orders in having a tail; excepting the frogs and toads in their perfect ftate: a trachea and larynx, capable of producing found. Like the chelonian and faurian reptiles, they have feet, and fimple jaws, *i. e.* not formed of two branches, moveable on each other. In common with the faurian and ophidian orders, they poffefs teeth fixed in the jaws; and with the ophidian, a heart with a fingle auricle.

Many characters diftinguifh them from thefe three orders. Their naked fkin, which is warty or tubercular, more or lefs moift, and nearly fimilar to that of the cecilia, the laft genus of the ophidian order. Softnefs of the bones; a fternum without ribs in the frogs and toads: rudiments of ribs and no proper fternum in the falamanders: true curved ribs furrounding the body in the proteus and firen. Four feet, or two only. They all fwim; thofe with long hind legs and no tail leap; the tree-frogs attach themfelves to leaves by the round tubercles of their toes: thofe with four equal limbs, or two only, crawl and fwim, but do not leap. An external tympanum in the tree-frogs, frogs, and moft toads; no external ears in the others. No external organ of generation in the males, nor any internal real copulation. The female lays eggs in the water, or humid earth, and the male fecundates them as they pafs out; or in the ovo-viviparous fpecies, as the land falamander, the feminal liquor of the male is abforbed by the fexual organ of the female. The ova are without fhells; from them proceed fmall animals, called tadpoles, which undergo various changes, before reaching their perfect ftate. They have branchiæ in their tadpole condition, and thus approach to fifhes.

Notwithftanding the obvious differences of organization in the different reptiles, as the turtle, lizard, ferpent, frog, and falamander, we may remark that their ftructure does not deviate effentially in its general plan from that of the human fubject. They have a bony vertebral column, and all the principal organs found in man, but with more or lefs ftriking modifications.

Reptiles have fome relations, in their organization and habits, with other vertebral animals, particularly with fifhes. This is feen in the true branchiæ of the batracian larvæ and firen; in the fcales of the fkin in lizards and ferpents; in the polygonal horny plates of the teftudines, correfponding to thofe of fome cartilaginous fifhes; in the elongated form and habits of the firen, like thofe of the eel-fhaped fifhes.

The form of the body prefents great differences in the reptiles; nearly all the chelonians, faurians, and batracians have four feet; and there are only two faurians with two feet. In the chelonians, the body is orbicular, more or lefs convex, inclofed in a bony cafe, and terminated by a fmall tail; the toes are feparate and diftinct in fome, palmated and fin-like in others. All the faurians have an elongated body, covered with various kinds of fcales, and terminated

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by a very flexible tail, often compofed of articulated rings. In the very elongated form of their body, the chalcides refemble ferpents, though, in other refpects, they are true faurians. The fkin is quite naked in all the batracians; they have four feet; fome have no tail, a ftout, thick body, and the hind legs longer than the front; others have the fhape of a lizard, being furnifhed with a tail, and having feet of equal length. Laftly, ferpents have a very long, cylindrical body, covered with fcales, and without limbs. Thefe variations of figure muft neceffarily be attended with modifications in the form and pofition of organs; the internal arrangements will correfpond with thefe outward figns.

Although the animals of this clafs differ very confiderably in outward form, as well as in the general bulk of their bodies, they agree very nearly in the effential points of their organization, and more particularly in the functions of their animal economy. We may inftance the mode of taking their food; the long abftinence of which they are capable; their oviparous generation; the length of time, for which they can bear an interruption of refpiration; their tenacity of life and extraordinary power of reproduction; and the low temperature of their bodies. The laft points, of animal heat and reproduction, two exceedingly interefting fubjects of inquiry, which have been inveftigated of late years with great induftry, form the moft ftriking differences between cold and warm-blooded animals; the latter alone poffeffing that remarkable property of maintaining in themfelves a temperature confiderably exceeding that of the medium in which they live, while the former are diftinguifhed by the wonderful extent of their power of extending or reproducing injured or loft parts.

An accurate knowledge of the ftructure of reptiles is not only important from its fubferviency to the claffific arrangements of natural hiftory, and highly interefting from expofing to us new and rich fcenes in the vaft domains of nature, new forms of life, and frefh modifications of organization, accompanied with fingular changes of functions already familiar to us in other fhapes; but it acquires additional intereft from the great ufe which phyfiologifts have made of different reptiles in their experimental elucidations of the human economy. We muft furvey in a general view the ftructure and economy of thefe animals, and compare them with thofe of the warm-blooded claffes, before we can determine how far the conclufions, drawn from experiments on reptiles, concerning the heart's motion, irritability, the action of the nerves, the effects of opium, &c. &c. can be transferred to the human body.

Organs concerned in the Vital Functions.—The *mouth* is fituated at the extremity of the fnout, and directed tranfverfely. If we fancy the head to be divided by a horizontal cut, extending from before backwards, to its very pofterior part, we fhall have a juft idea of the mouth of a reptile. The cranium is very fmall in this clafs, and the head confifts almoft entirely of the two jaws. The lower is articulated towards the back of the head, and thus allows the opening between the two mandibles, conftituting the mouth, to be very confiderable. Almoft all reptiles fwallow entire animals, and thus require this extenfive opening. The margins of the aperture confift fimply of the maxillary arches, which are not covered or enclofed by any thing deferving the name of lips. In no cafe is there any maftication; and the food or prey is taken by the teeth or tongue, fo that a moveable covering of the jaws, fimilar to the lips and cheeks of the mammalia, is not neceffary either for confining fubftances fubjected to the action of teeth as organs of maftication, or for the purpofe of reaching or feizing food.

The horny coverings of the mandibles, completely naked, and not concealed even by the fmalleft fold of fkin, form the fides of the entrance into the mouth in the chelonian reptiles. Their food confifts of marine vegetable productions, teftacea, infects, &c. and does not require fo large an opening for its introduction, as when confiderable animals are fwallowed whole. The mouth is confequently fmaller in this than in either of the other orders; and does not extend completely to the back of the head.

The family of tortoifes, which Geoffroy has called trionyx, offers a remarkable exception to what we have ftated about the abfence of lips: they have thefe folds, and a moveable probofcis at the end of the fnout. "The exiftence of lips in thefe tortoifes is an anomaly, the more likely to furprife us, inafmuch as the affinity of thefe reptiles to birds feems to affign a motive for the abfence of lips, and alfo for the exiftence of the horny coverings of the mandibles." Geoffroy St. Hilaire, Mem. fur les Tortues molles; Annales du Mufeum, v. 14. pl. 1. p. 9.

In the faurians, the flit of the mouth goes to the very back of the head, far behind the ear. Its appearance is very formidable in the crocodile, where the hard ftrong jaws project into a large fnout, and are armed with fharp powerful teeth, deftitute even of gums: thefe jaws open to the very back of the head, and difclofe a tremendous throat. The mouth is as large proportionally in the other faurians; but their fize is too infignificant and their habits too harmlefs to allow of their infpiring that terror, which the formidable weapons of the crocodile fo juftly caufe. The ophidians have not only a mouth equal in its tranfverfe meafurement to the diameter of their body; but they poffefs alfo the means of enlarging this aperture, fo that they can fwallow creatures whofe diameter exceeds their own. The batracians have an opening as large as the fize of the head will allow. In the latter, as well as in the ophidian, and moft of the faurian reptiles, the integuments make a fmall fold at the edge of each jaw; thefe folds meet when the mouth is clofed, fo as to hide the edge of the jaws, but they poffefs no power of motion.

In the tadpole, in the proteus and firen, the mouth is much fmaller than in the other reptiles; and they poffefs folds more deferving the name of lips. In the former there is a kind of horny apparatus within thefe lips, forming fomething like a beak. In the fmallnefs of its mouth, and in thefe horny jaws, the tadpole is remarkably diffimilar to the perfect animal.

The Jaws.—In confidering the jaws and their mufcles, the teeth, and the tongue, we muft bear in mind that thefe organs are calculated merely for feizing their food, and conveying it to the throat; in no cafe does the food undergo any maftication, as in the mammalia.

No reptiles have an upper jaw moveable on the head, like that of birds: the fuperior maxillary bones are in truth articulated moveably with the head in ferpents, and may be extended and retracted, or moved laterally, as we fhall defcribe prefently; but, in general, the cranium and upper jaw are united into one piece, fo far as their motions are concerned.

The moft oppofite opinions have prevailed refpecting the crocodile, even down to the prefent time. Herodotus firft obferved, that it is the only animal poffeffing an upper jaw moveable on the lower, which remains fixed. The fame opinion was generally held by the ancients, as Ariftotle, Pliny, &c.; and feveral moderns fpeak in the fame way, as Maregrave, Marmol, Jacobæus, Vefalius, and the Jefuit Miffionaries at Siam, who had opportunities of obferving the living animal. But the anatomifts of the Academy of Sciences

Sciences (Perrault and Duverney) undertook to demonſtrate the falſehood of the opinion of Herodotus. Geoffroy, one of the French ſavans, who attended the Egyptian army, has given us an account of the matter, which ſettles all theſe diſputes, by proving that the ſtatement of Herodotus is almoſt rigorouſly true; and that the crocodile is the only known animal, whoſe upper jaw, including within its branches the cranium, is moveable on the lower jaw, which poſſeſſes only an almoſt inſenſible degree of motion. "Nothing can be more paradoxical than the head of the crocodile: every thing which is placed laterally in other animals, as the moving powers of the jaw, &c. is thrown behind. The temporal bone itſelf extends backwards far behind the cranium, is elongated, and transformed into a double condyle. We have in fact nearly deſcribed the crocodile's head, when we ſay that it conſiſts of two mandibles; for the cranium is ſo ſmall, and out of place, that it eſcapes notice at firſt. We find it below, and a little in front of the occipital criſta. The brain is ſo far forwards, that the eye and ear are above and a little behind it.

"The lower jaw is one-ſixth longer than the upper, with the cranium: it preſents a cavity with a double ſurface, in which the condyle of the temporal bone is articulated by ginglymus. The occipital condyle is in the ſame line as the temporal condyles: thus the head is really held at its articulations, like the lid of a box by the hinge, and is confined entirely to motions upwards and downwards. When a living or ſtuffed animal is examined, it is difficult to believe that the head ends at the extremities of the jaws. There is a regular fullneſs of the front of the neck, which might be regarded as the frontal part of the head: this ariſes from the enormous temporal muſcles, which lie between the recti and obliqui. The latter, ariſing from the cervical vertebræ, and inſerted in the occipital criſta, elevate the head upon the neck, making it deſcribe an arc of 45°. The ſkin behind the occiput being thin, yields to the motions of the head; while the lower jaw, on the contrary, is incloſed in a kind of ſheath of hard, rugous ſkin. If there were a muſcular force capable of drawing it down, this covering would impede its deſcent, while it is ſtill further confined behind: the long proceſs ſituated beyond its articular ſurface, deſcribing a curve, approaches the ſkin exactly at the point where it is armed with a long ſcale, which offers an almoſt invincible reſiſtance to the elevation of the condyle, and conſequently to the depreſſion of the jaw. Yet it is not entirely fixed, as Marmol imagined, who ſtated that it forms a ſingle bone with the ſternum. Two ſmall muſcles have the power of moving it ſlightly." (Annales du Muſeum, tom. ii. p. 38, et ſeq.) This deſcription is accompanied with an excellent figure of the ſkull, in the elevated ſtate of the upper mandible. An analogous figure of the whole head is given by Humboldt, Recueil d'Obſ. de Zool. & d'Anat. comparée, tom. i. pl. 4. From the figures of the Nilotic crocodile, in Blumenbach's Abbildungen Natur Hiſtoriſcher gegenſtände, N° 26; and of the St. Domingo crocodile, in the Annales du Muſ. tom. ii. it appears, that the animal moſt frequently exhibits this elevation of the upper jaw. It cannot be neceſſary to point out how the raiſing of the entire cranium and ſuperior mandible, juſt deſcribed, differs from the motion of the upper jaw upon the cranium: this has been already done by Blumenbach. See Syſtem of Comparative Anatomy, p. 111, note 8.

The length of the lower jaw is much more conſiderable in compariſon to that of the upper in reptiles, where it is articulated far back, and is even prolonged beyond its articulation, than in mammalia and fiſhes, where this articulation is placed more forwards. Its compoſition is more complicated in the reptiles, than in any other order. In the green turtle (teſtudo mydas) it conſiſts of ſeven diſtinct pieces, a middle one forming the arch, and three others on each ſide, forming a continuation of its branches. The fartheſt of the three penetrates like a wedge between the two others, and forms a great part of the articular cavity. In many of the ſaurians the number is ſtill greater: the lower jaw of the Nilotic crocodile, and of the caïman (croc. americanus), has no fewer than twelve pieces, arranged as follows. As the two branches are diſtinct, and united by a ſuture, each of them muſt be compoſed of ſix pieces; 1, one, in which all the teeth are implanted; 2, another, lying along the internal ſurface of the former, without reaching to its anterior extremity; 3 and 4, two others articulated with the preceding; *viz.* an inferior one prolonged to the poſterior extremity of each branch, a ſuperior extending as far back as the other in the Nilotic crocodile, but not ſo far in the caiman. 5. The greateſt part of the articular cavity is excavated in a fifth piece within the two former, and conſtituting the inner and ſuperior part of the portion beyond that cavity. 6. Laſtly, a ſixth piece forms the front and inner part of the orifice of the dental canal. The lower jaw of the tupinambis (lacerta monitor) is alſo compoſed of twelve pieces, two of which form the coronoid proceſſes, while the other ten are analogous to thoſe deſcribed as entering into the formation of the lower jaw of crocodiles, excepting the laſt. There are eight or ten in moſt of the other ſaurians. We find four in each branch in the genus anguis; an anterior one united to its correſponding piece in front, and three poſterior ones joined to the former. There are only four altogether in the amphiſbæna. The two laſt mentioned genera are the only ophidian reptiles, in which the jaws are not ſeparated in front. In all the others there is a ſeparation, and each branch has only two diſtinct pieces; an anterior, in which the teeth are implanted, and a poſterior: they are united by ſuture, and vary in relative length, according to the number of teeth. The very open arch, compoſing the lower jaw of the batracian order, is made up of ſix pieces; the middle of which are the moſt ſlender.

The anterior angle, formed by the union of the two branches, depends on the form of the ſnout in general, on the figure of the two branches, the preſence or abſence, number and ſize of the teeth, &c. It is rounded and very open in the chelonian reptiles, and more ſo in the batracian. In the ophidian order, which have the branches of the jaws moveable, it is ſuſceptible of change, according as their extremities are approximated or drawn aſunder; indeed in the former caſe only can it be properly ſaid to exiſt at all. It is rounded in the amphiſbæna; more angular in the anguis; ſtill very obtuſe in the geckos (lacerta gecko), which have wide jaws, with the branches of the lower curved only in the horizontal direction; it is leſs ſo in the cameleon and ſtellio (lacerta ſtellio), the ſcinks (lacerta ſcincus), and the lizards, although in all theſe the two branches are only joined by their extremities. It is acute in the tupinambis and iguana, in which the branches, ſomewhat curved in the vertical direction, are approximated for a longer ſpace. The Nilotic and Gangetic crocodiles differ very much in this reſpect. The two branches are united in the latter in the greateſt part of their extent, as in the cachalot, and conſequently form a long bill, in the edges of which the two rows of teeth are implanted. In the former, on the contrary, the branches remain ſeparate, and only approximate towards their extremity, increaſing a little in thickneſs at the ſymphyſis.

The portion of the bone, which is incurvated towards the cranium in moſt of the mammalia, and conſtitutes

 the

the afcending branch of the jaw, does not exift in reptiles.

Motions of the Jaws.—Reptiles may be divided into two orders, according to the conformation of their maxillary bones, and the kind of motion of which they are fufceptible. In the firft would be placed thofe which have the lower jaw only moveable, as the lizards, the teftudines (tortoife and turtle), the frogs, the falamanders, and the genera anguis and amphifbæna among the ferpents. The fecond would include the colubres, and the venomous ferpents, which can move both jaws.

The general difpofition of the articulation is nearly the fame in reptiles as in birds (fee BIRDS, in *Comparative Anatomy*). Inftead of a condyle at the pofterior extremity of the jaw, an articular furface is excavated to receive an eminence bearing confiderable analogy to the os quadratum of birds, and differing from it only in not being fo moveable; often, indeed, it is only a fimple prolongation of the temporal bone. To this moft inferior point of the cranium, and to an articular furface nearly tranfverfe in its direction, and fhaped like a condyle, the lower jaw is articulated by a glenoid cavity, of which the middle part fometimes prefents a rifing line, converting it into a kind of pulley. Behind this articular cavity there is often a more or lefs confiderable bony procefs, affording attachment to a mufcle analogous to the digaftric.

The moft remarkable differences requiring our notice here are, the form of this prominence or condyle of the temporal bone; the greater or lefs prolongation of the procefs behind the articulation; the fituation and extent of the temporal foffa; and, laftly, the exiftence or abfence of the eminence occupying the fituation of the coronoid procefs.

In proportion as the temporal eminence is carried backwards, the jaws approach more nearly to each other in their longitudinal direction. We fee this in the crocodile, falamander, frog, turtle, and tortoife. When, on the contrary, it defcends vertically, or very obliquely, and is very elongated, as in the cameleon and iguana, it forms a kind of pedicle to the lower jaw, which, by feparating it from the cranium, produces a much more confiderable interval between the jaws. Several kinds of lizards, as the lacerta agilis, draco, &c. occupy the intermediate fpace between thefe two extremes.

The crocodile has the largeft procefs for the attachment of the digaftricus. It is fenfibly diminifhed in the cameleon, the gecko, the tupinambis, and the teftudines; and we fee nothing of it in the pipa, the toad, frog, and falamander.

All four-footed reptiles have very deep temporal foffæ; they are united to the cavity of the orbit. In fome fpecies, the two cavities are feparated in front by a bony circle, as in the teftudines, the crocodile, the dragon, and the other lizards; but in the pipa, the frogs, and falamanders, there is no orbital circle.

There is, in the crocodile, a confiderable excavation on each fide of the cranium, behind the orbit, terminating below in the temporal foffa, and wanting in the crocodile with bony eyelid (Crocod. palpebrofus, Cuvier). It is bounded externally by a bone correfponding to the fquamous portion of the temporal, which joins the lateral frontal bone, and thus forms a fecond kind of zygomatic arch. The fize of this excavation differs much in the different fpecies. No doubt it contains mufcles. But we find no exprefs and fatisfactory defcription of it and its mufcles, nor of the mufcles of the jaw in the writings of the French naturalifts already quoted, on the fubject of the crocodiles.

The coronoid procefs of the lower jaw is not prominent in reptiles. There is a mere rudiment of it in the teftudines, the cameleon, and fome lizards, as the iguana, but there is no trace of it in the crocodile, the frogs, and falamanders.

The mufcles of the jaw, in the oviparous quadrupeds, are analogous to thofe of the mammalia, and refemble them in number.

The mafleter is large and diftinct in the tupinambis, occupying all the fpace comprifed between the pofterior edge of the orbit and the meatus auditorius. It is directed obliquely from behind forwards, fo that it raifes and carries the jaw backwards. This mufcle is fmall in the agame marbré (lacerta marmorata), and the turtle. It is fo flender, that it can fcarcely be diftinguifhed from the lower part of the temporal.

The temporal mufcle is very large in the turtle, occupying all the temporal foffa, and forming the back of the orbit. It is much fmaller in the tupinambis and common lizard, in which it is almoft entirely concealed by the mafleter.

The pterygoidei are, in general, but imperfectly diftinguifhed from each other. They envelope the whole branch of the jaw towards its extremity in the tupinambis; their fibres are in a manner twifted. They elevate the jaw and carry it forwards; thus they act in an oppofite direction to the two preceding mufcles. The fame mufcles are flat and thin in the turtle; their fibres are nearly tranfverfe, fo that they can move the lower jaw more directly from fide to fide.

In all thefe reptiles the mufcle analogous to the digaftric is flat and triangular; the broad portion is fixed to the cervical ligament behind the occiput, and the point terminates at the extremity of the jaw, behind its articulation, and near the pterygoid mufcles.

After defcribing the mufcles employed in moving the jaws of the turtle, Perrault afferts, in his "Mémoires fur les Animaux," that it has more power in its jaws than moft other animals, that it can cut very hard and ftrong fubftances, and that the head of a fmall turtle has been feen, half an hour after it was cut off, to ftrike its jaws together with a noife like that of caftagnettes. Daudin relates the following circumftance, communicated to him by a Dutch naturalift, who refided feveral years in India. "When we landed in Table bay, we took feveral hawk's-bill turtles (teftudo imbricata), whofe ftomachs were filled with marine plants, and thick fhells, which they eafily break down with their horny gums. Three, which could not be brought on board, were tied to the trunk of a tree, with a thick cable, but when the failors returned on the following morning, they found that thefe turtles had contrived to turn over on their bellies, and had then cut, with their gums, the cables with which they had been faftened." Hift. Nat. des Réptiles, in the edition of Buffon, by Sonnini, t. i. introduction, p. 38.

The two jaws are not moveable in all the ferpents. They may be divided into three orders. 1. Thofe with the branches of the lower jaw confolidated, and confequently not poffeffing any power of thrufting forward the upper jaw, or moving it laterally. 2. Thofe with the branches diftinct, and united in the recent ftate by an elaftic ligament. There are two modifications of the latter; they may either have merely the power of feparating the two jaws; or they may, at the fame time, feparate the jaws, and carry forwards a part, or the whole of the upper. We fhall fpeak of the motions of the jaws according to this divifion, firft defcribing the bones, and then the mufcles.

The Bones.—In the ferpents, with the lower jaw confolidated, the head is fhaped nearly as in the lizards. This is the cafe in the anguis and amphifbæna, the cæcilia, acrochordus, and hydrophis. In the genus anguis the head very clofely refembles that of the iguana. The arch of the upper jaw

jaw is uninterrupted, and correfponds to the curve of the lower; the concavity of the palate is nearly complete in front. The palatine arches are directed backwards, and united to the condyloid pedicle of the temporal bone. This pedicle is fhort, and nearly vertical, and excavated behind for the attachment of the digaftric mufcle. The lower jaw has a fmall procefs behind its articulation for the attachment of the mufcles, which deprefs it; and another towards its pofterior third portion, analogous to the coronoid, for the elevating mufcles.

In the amphifbæna, although the general configuration is a little changed, nearly the fame arrangement is met with. The whole upper jaw is lefs feparated from the cranium; the concavity of the palate is nearly complete. The palatine arches are much larger. The condyloid pedicle of the temporal bone, inftead of being vertical, is continued nearly horizontally forwards. In proportion to the cranium, the lower jaw is much fhorter; and it is articulated to the condyle by its pofterior extremity. It is very wide behind, to produce the coronoid procefs. The orbit and temporal foffa are completely confounded; they are bounded by prominent bony criftæ, as in the carnivorous mammalia; hence, on firft view, the head of an amphifbæna might be fuppofed to belong to one of the cheiroptera.

The ferpents of the fecond kind, whofe lower jaw is formed of two diftinct branches, and in which the upper is capable of being feparated, but not carried forwards, are all the non-venomous colubres, and the boas. The conformation of the upper jaw, in the latter, is very different from that of the lizards, although the bones are nearly the fame, as we fhall explain in the ofteology of the head. The offa incifiva are not always furnifhed with teeth; fometimes even, as in the boas, they do not unite the fuperior maxillary bones. All the other bones of the jaw are moveable on the cranium, which ferves merely as a point of fupport.

The fuperior maxillary bones are two long branches, in which the teeth are implanted; they form the outer edge of the palate. They are articulated by two points; firft towards their middle, as a lever of the firft kind, on a fmall bone analogous to the os malæ, and forming the anterior edge of the orbit: nearly at the fame point, but towards the inner fide, the fuperior maxillary bone has a procefs, which flides in a groove, and refts on the palatine arch. It moves on thefe two furfaces, playing backwards and forwards. The anterior extremity of this upper maxillary bone is free: the pofterior receives the end of a particular bone, ferving to unite it to the palatine arches.

The palatine arches are the two internal bony branches themfelves, formed of two parts. An anterior, which is free in front, and articulated by three points; behind, with a bony branch, which proceeds towards the extremity of the lower jaw within its articulation, and appears to form a continuation of it; on the outfide, with a particular bone, uniting it to the maxillary arch; and above, with the bafis of the cranium, in front of the orbits. The pofterior portion of the palatine arch is analogous to the pterygoid alæ or laminæ. It is articulated by three points; 1ft, in front, with the pofterior extremity of the firft portion; 2d, behind, with the lower jaw towards the infide; 3d, on the outfide, and towards its anterior part, with the bone uniting it to the maxillary arch. Laftly, the third palato-maxillary is a piece nearly cylindrical in its middle, flattened and widened at its two extremities, by which it is fupported, being articulated, on the outfide, to the pofterior extremity of the maxillary arch, on the infide, towards the middle and outfide of the pterygoid portion of the palatine arch.

In confequence of this fingular formation, the whole upper jaw is, as it were, fufpended and diftinct from the cranium, and influenced by the motions of the lower jaw. When the pofterior extremities of the latter are feparated, the pterygoid arches are moved apart. They carry with them the pofterior extremities of the palatine and maxillary arches, while at the fame time the anterior extremity is moved inwards. On the contrary, when the two internal edges of the pterygoid laminæ are brought together, or, what is the fame, when the articular extremities of the lower jaw tend to approximate, the anterior ends of the palatine and maxillary arches are carried outwards, and feparate from each other.

The ferpents of the third order, which have jaws fufceptible of feparation, and which at the fame time can carry forwards the fuperior maxillary bones, properly fo called, exhibit but a flight modification of the ftructure defcribed as belonging to the preceding divifion. Their pterygoid arches are articulated with the lower jaw, towards its extremity, on the guttural afpect. They alfo receive the bone which is to join them to the palatine arches; but the latter are very fhort, directed forwards, and only containing venomous teeth. This intermediate bone, therefore, goes above the fuperior maxillary, which is itfelf articulated in the front of the orbit, or the fhort and moveable cheek-bone. When the lower jaw is moved forwards, the palatine arch, carried in the fame direction, drives before it the bone which joins it to the maxillary. The latter, extremely moveable, is immediately turned up, or carried forwards, by moving on the cheek-bone, which caufes a complicated feries of motions.

The articulation of the lower jaw is the fame in the whole family. The temporal proceffes are prolonged pofteriorly: they receive an intermediate bone; analogous to that defignated by the name quadratum in birds. This bone is very fhort, and poffeffes little motion, in the fpecies which have the upper jaw fixed, and the inferior confolidated.

It is directed forwards in the amphifbæna towards the lower jaw, which is fhorter than the cranium by nearly one-third;—a circumftance which belongs only to this fpecies. In the anguis, the os quadratum defcends much more obliquely forwards.

In all the other fpecies the bone laft-mentioned is much longer. It fometimes defcends perpendicularly, as in the boas; but it is commonly directed backwards, as in moft of the colubres. The temporal extremity is generally widened and excavated by a fmall depreffion. The inferior extremity is rounded like a condyle, and received into an excavation of the pofterior extremity of the correfponding branch of the inferior maxillary bone.

From the nature of its articulation, the lower jaw of either fide is not only fufceptible of elevation and depreffion, fo as to open and fhut the mouth, by playing on the os quadratum, as is the cafe only in the genera amphifbæna and anguis; but it may alfo be carried outwards, and take with it the os quadratum, as is the cafe in the colubres and venomous ferpents, whenever the pterygoid arch is moved outwards. That is to fay, whenever the upper jaw is widened, the inferior muft follow its dilatation, becaufe the pofterior extremities of the pterygoid arches, being articulated with the internal part of the lower jaw, it muft move together with them. The arrangement of the mufcles accords very well with this formation, as we fhall proceed to defcribe.

Mufcles of the Jaws.—The maxillary mufcles of the genera anguis and amphifbæna, and probably of all the ferpents with a confolidated under jaw, refemble thofe of the common

common lizard: but they are very different in thoſe whoſe lower jaw conſiſts of two diſtinct pieces: we ſhall deſcribe them in the rattleſnake.

Here the muſcles of the lower jaw are concealed in the lips, and go round the mouth on each ſide. That which forms the anterior edge of the commiſſure of the lips is the ſtrongeſt, and ſeems to hold the place of the maſſeter. It ariſes by firm aponeuroſes from the tendinous ſheath, which contains the venomous gland. Its fibres form a conſiderable cord, which conſtitutes the whole thickneſs of the lower lip, and are inſerted in the upper edge of the inferior maxillary branch for almoſt two-thirds of its length.

The muſcle immediately behind is analogous to the temporal, and is much ſlenderer than the preceding. It is a muſcular faſciculus, of which the ſuperior extremity is fixed to the temporal excavation behind the orbit, and the inferior, after going backwards behind the commiſſure, is confounded with the inſertion of the laſt muſcle. It is obvious that the contraction of theſe two muſcles muſt approximate the jaws, and thus cloſe the mouth.

In the commiſſure of the lips, and behind the two laſt muſcles, we ſee another reſembling them in form, but much ſhorter. It occupies the inferior part of the os quadratum, and about the poſterior third of the jaw, at the outer edge of the dental canal. It is an acceſſory muſcle to the temporal and maſſeter.

The muſcle correſponding to the digaſtricus occupies the whole length of the back of the os quadratum, and terminates at the poſterior apophyſis of the maxillary branch beyond and behind its articulation.

The muſcles moving the upper jaw are more numerous. One ariſes, by aponeurotic fibres, from the capſule of the joint, between the maxillary branch and the os quadratum, and paſſes forwards and upwards towards the ſheath of the venomous teeth, being partly expended on that ſheath, and on the poſterior apophyſis of the ſuperior maxillary bone. Its uſe is evidently to draw down the venomous teeth, when they have been elevated.

Two other muſcles act on the pterygoid and palatine branches. Both are ſituated between the middle line of the baſis cranii and the palatine arches. The lower, ſituated immediately under the ſkin in the palatine foſſa, is a plane of elongated fibres, occupying the whole middle line of the cranium, and going backwards to the internal ſurface of the bony pterygoid plate, which it will carry inwards and forwards, ſo as to protrude the ſuperior maxillary bone, and elevate the venomous fangs, at the ſame time contracting the mouth by the approximation of the two internal arches.

The other muſcle, ſlenderer, and placed above the preceding, towards the baſis of the ſkull, extends from the anterior portion of the palatine arch, and the whole length of this arch, to the middle of the baſis cranii, croſſing the direction of the laſt muſcle, on which it is placed. When it contracts, it carries backwards the whole maſs of the upper jaw, at the ſame time approximating its two branches.

By means of this mechaniſm, ſerpents can twiſt their mouths in ſeizing objects, and dilate them extraordinarily, ſo as to ſwallow animals larger than themſelves. Their teeth ſerve merely for holding their prey; and the muſcles moving the bones, in which theſe teeth are implanted, cannot move them in ſuch a way as would be neceſſary for maſtication, but merely depreſs, elevate, approximate, ſeparate, protract, and retract them.

Lacépéde thus deſcribes the motions of the jaws in ſerpents. "While the teeth of one ſide are fixed in the prey which the animal has ſeized, and are therefore motionleſs, thoſe of the other ſide are carried forwards, penetrate the animal, drag it towards the throat, and there fix it in their turn; when the oppoſite ones are again advanced to repeat the ſame proceſs on their ſide. By theſe repeated alternate motions of the two ſides of the jaws, combined with their lateral expanſion, ſerpents are enabled gradually to ſwallow animals of a diameter exceeding their own." Hiſt. Nat. des Serpens.

The Teeth.—Their ſtructure has nothing peculiar in reptiles. The bone is compact and hard; the enamel thin; and, as they are always thin, there is none of the third ſubſtance called by Cuvier the cement. We are not acquainted with any facts concerning the ſucceſſion of the teeth in reptiles;—whether they have two ſets, or that the firſt grow conſtantly, or that the jaws are elongated anteriorly, &c. The crocodile forms an exception to this remark: we are indebted to Cuvier for a very intereſting account of the ſucceſſion of their teeth, which we ſhall ſtate preſently.

The chelonian reptiles, like birds, have no teeth, properly ſo called: the horny ſubſtance encaſing their jaws, and ſupplying the place of teeth, will be deſcribed at the end of this account of the teeth of reptiles.

The ſaurian, ophidian, and batracian reptiles may be compared to the cetacea; as they do not maſticate their prey, the teeth are calculated merely to hold, and not to divide it: hence they have much leſs influence on their economy than thoſe of viviparous quadrupeds. They accord, however, tolerably with the natural genera and ſubgenera.

They are almoſt always the ſame in all parts of the jaw, ſo that they admit of diviſion into different claſſes, according to their configuration, only in very few ſpecies.

Sometimes they are attached to the two jaws only, as in the mammalia: this is the caſe with the ſaurians (excepting only the iguana, which has palatine as well as maxillary teeth); ſometimes they are implanted alſo in the palate, as in the ophidians, with the ſingle exception of the amphiſbæna. Their number is of leſs importance; firſt, becauſe it is conſiderable, and not accurately determined; ſecondly, becauſe they fall out without any hitherto aſcertained regularity, either in ſituation or time.

Teeth of the Saurians.—In the crocodile the enamel is more or leſs ſtriated longitudinally. The upper and lower teeth croſs when the jaws are ſhut. They are all conical, hollow, generally a little curved, and marked with two longitudinal projecting lines; an anterior and a poſterior one. The five or ſix poſterior teeth on each ſide are more obtuſe and compreſſed than the others.

In a living crocodile, which Perrault obſerved at Verſailles in 1681, he found that all the teeth were ſlightly bent towards the throat, and that this curvature was the moſt conſpicuous in thoſe near the end of the ſnout. When the jaws were drawn together, the teeth of each jaw paſſed into the intervals between thoſe of the other, ſo that an uninterrupted ſeries was viſible, as there are no lips to hide them. He ſays further, that the points of the upper teeth entered into excavations of the lower jaw.

The following account is derived from Cuvier's Obſ. ſur l'Oſteologie des Crocodiles vivans, in the 10th volume of the Ann. du Muſ. "The number of the teeth does not change with the age of the animal: a crocodile quitting the egg has the ſame number as one twenty feet long. I have aſcertained this fact in a ſeries of heads from an inch to two feet long. The back teeth may be a little concealed by the ſkin of the gums. The interior is always hollow, although

although the teeth, as in all other cafes, are formed by fucceffive ftrata.

" The capfule containing the new tooth is not enclofed in a feparate cell of the maxillary bone, as in the mammalia, but it lies in the bottom of the focket of the tooth which it is defigned to fucceed. This little fhell is firft on the internal furface of the root of the tooth in place; it occafions a groove in this part, by which, as it increafes in length, it penetrates into the hollow of the latter, and then deftroys by its preffure the pulp that filled its cavity, and furnifhed the materials of its increafe. Hence, at whatever age we may remove a crocodile's teeth, we fhall find, either in the alveolus, or in the cavity of the tooth itfelf, a fmall tooth, either in the form of a thin and fhort fhell, or more advanced and ready to occupy its place, when the old and enveloping tooth fhall have been difcharged. This fucceffion feems to be repeated as long as the animal lives: hence the teeth always appear fharp and frefh, and although larger, they are not much more worn in old than in young crocodiles. I have afcertained all thefe facts in a recent head, and in others preferved in fpirits of wine: and I could diftinguifh very clearly pulps and capfules fimilar to thofe of quadrupeds.

" This procefs was tolerably well underftood by Perrault and Duverney; Mem. pour fervir à l'Hiftoire des Animaux, v. iii. p. 167.

" As the teeth of the crocodiles are generally nearly perfect cones, and enlarge to their very bafis, how can they come out of the alveoli, of which the entrance is much narrower than their bafe? The new tooth, as it is developed and fills the cavity of the old, compreffes its fubftance againft the focket, deftroys its confiftence, makes it crack, and thus difpofes it to be feparated on the flighteft fhock at the level of the gum. The fragments are eafily thruft out of the fockets. We often find in the fockets of crocodiles, when changing their teeth, rings formed by the relics of the old teeth left behind, through which the new are making their way: and fuch are alfo found in the foffil jaws of true crocodiles.

" The bafe of the cone is generally not entire, but exhibits a more or lefs deep fiffure on its internal fide: it has been already mentioned that this is caufed by the preffure of the germ of the new tooth. While the germ is very fmall, this fiffure does not exift, and the germ itfelf never exhibits it.

" Although the teeth may be faid to be all alike, and arranged in an uniform feries, fome are rather larger than the reft; and the greater this inequality, the more irregular is the line of the jaws.

" Thefe larger teeth are either received into grooves of the oppofite jaw, or into holes, or they perforate it completely.

" In the caimans or alligators, the firft of Cuvier's fubgenera, (containing the American fpecies,) there are from nineteen to twenty-two teeth on each fide below, and nineteen or twenty above. The two firft of the lower jaw penetrate at a certain age the front of the upper jaw, and go completely through it. The fourth of the fame jaw are the longeft, and go into the holes of the upper jaw, in which they are entirely concealed when the mouth is fhut. The five front in the upper jaw are intermaxillary teeth.

" The firft and fourth of the lower jaw are long in all the three fubgenera; next to thefe come the eighth and ninth of the upper, the eleventh of the lower jaw in the true crocodiles and caimans. The caiman with bony eye-lids (crocodilus palpebrofus) has the twelfth below and the tenth above the longeft. After the fourth in the gavials (longiroftres) they are all nearly equal, fo that the jaws in thefe have not fo waving a line as in the other fubgenera.

" The fourth tooth below might be called canine, from its fuperior length, and becaufe it correfponds to the future between the maxillary and intermaxillary portion of the upper jaw.

" In the fecond fub-genus, or proper crocodiles, there are fifteen teeth on each fide below, and nineteen above. The firft of the lower jaw penetrate the upper; the fourth pafs into grooves, and are not lodged in cavities of the upper jaw.

" The gavials (longiroftres) have 25–27 on each fide below, and 27–28 above. The two firft and the two fourth of the lower pafs into grooves, not into perforations or cavities of the upper."

In the tupinambis of the Nile we find fixteen above, of which five are intermaxillary, thirteen below; all conical, and flightly bent backwards: the pofterior are the largeft and moft obtufe. In a tupinambis from the Moluccas there were fix above, and feven below, all compreffed and pointed.

The teeth of the common lizard, the iguana, and agame, are cutting, and more or lefs ferrated on the edges; they are all fo in the iguana, where feveral have fix or eight denticulations, and there are twenty or twenty-one teeth on each fide. The common lizard has twenty-one or twenty-two, but the anterior are not fenfibly denticulated, and the others have merely a groove. The agame has nineteen or twenty, all with three denticulations. In thefe three genera they increafe in fize from before backwards.

They are triangular, with a little groove before and behind, in the ftellio: there are fixteen or feventeen fuch on each fide, and two large conical canine teeth. There are, moreover, two fmall conical intermaxillary teeth above, to which nothing correfponds below.

The dragon correfponds to the ftellio in its teeth, except that the canine are proportionally longer than the incifors: the number is the fame. There is a good reprefentation of them in Blumenbach, Abbildungen Natur-Hiftorifcher gegenftände, No. 98.

The gecko has thirty-five or thirty-fix teeth on each fide, all of equal fize, clofe, fimple, flender, and pointed. The flat-headed gecko has feventy or feventy-four on each fide. There are twenty-two on each fide, above and below, in the fcink, all conical, fhort, clofely fet, and of equal fize.

The cameleon has, on each fide, eighteen above and nineteen below; of which the anterior are very fine, the pofterior much larger, and furnifhed with three points.

Teeth of the Batracians.—All thefe have teeth in the palate; as to the jaws, the falamanders have them in both, the frogs in the fuperior only, and the toads in neither.

The palatine teeth form, in the toads and frogs, a tranfverfe line, interrupted in the middle. They are implanted in the palate bones. They form two long parallel lines in the falamander.

The maxillary teeth are fmall, pointed, and clofely fet. The frog has about forty on each fide above, eight of which are intermaxillary; the falamander fixty, both above and below, and thirty on each fide of the palate.

Teeth of the Ophidians.—The ferpents are divided firft into two families, thofe which can, and thofe which cannot, feparate the two halves of the upper jaw. The former have no incifor teeth; but they have palatine, maxillary, and

 mandibular,

mandibular, or teeth of the lower jaw. The latter, having all the edge of the upper jaw furnifhed with teeth, poffefs, confequently, a kind of incifors.

The fecond family includes only the angues and amphifbænæ. The former, befides the conical flightly curved teeth of uniform fize, which they have in both jaws (eighteen or twenty above, and fifteen or fixteen below on each fide), poffefs others, very fmall and fhort, arranged in two rows, on the pofterior half of each palatine arch.

The other family is fubdivided into two tribes, the venomous and the non-venomous. In the latter there are conical, curved, and very pointed teeth, directed backwards along each maxillary, palatine, and mandibular arch; confequently there are four rows in the upper, and two in the lower jaw, all nearly longitudinal.

On the maxillary branch of the venomous ferpents there are only the hollow fangs, attached to the anterior extremity only; confequently, with the exception of thefe fangs, there are only the two palatine rows above, and the two rows of the lower jaw below.

The following is a table of the numbers of teeth on each fide in fome fpecies.

Names.	Incifor Teeth.	Maxillary.	Palatine.	Mandibular.
Boa conftrictor.	2	18	14	
Coluber molurus.	0	18	24	20
Coluber nafica.	0	16 of which the anterior are the largeft.	25 of uniform fize; very fmall.	18 the anterior largeft.
Coluber natrix (common fnake).	0	18 the pofterior largeft.	28	24
Rattlefnake (crotalus horridus).	0	1 and feveral rudiments not fixed.	14	5 or 6
Coluber haje.	0	the fame.	25 and a parallel row of fmall ones.	12—14
Coluber naja.	0	the fame.	the fame.	
Anguis fragilis (blindworm).				
Amphifbæna fuliginofa.	3 on each fide, and a middle one.	5	0	8

To this table, which is derived from the Leçons d'Anat. comp. of Cuvier, we add a fecond, drawn up by Palifot Beauvois, a French naturalift, who fpent many years in America, and whofe obfervations on ferpents are inferted by Daudin in the fifth volume of his Natural Hiftory of Reptiles.

Comparative

Comparative Table of the Teeth of feveral Serpents of North America, by Palifot Beauvois.

Names of the Species.	Upper Jaw. External Branch. Fangs on each Side.	Upper Jaw. External Branch. Common Teeth on each Side.	Upper Jaw. Internal Branch on each Side.	Lower Jaw on each Side.	Total Number of Teeth.	Food.
Crotalus duriffus.	1	0	6	5	24	Squirrels, various birds, rats, mice.
Cr. rhombifer.	1	0				Hares, fquirrels, birds, rats, mice.
Cr. miliaris.	1	0				Grafshoppers and other infects, worms.
Vipera berus.	1	0	10	10—12	44—48	
Coluber hetorodon (hognofe-fnake).	0	13 the two lower ones three times larger.	14	12—15	80—86	Infects, worms, field-mice, fhrews.
Col. erytrogrammus.	0	10	15—16	10—12	70—76	Birds, young turtles, frogs, falamanders, the amphibious rat.
Col. conftrictor.	0	12	28—30	16—18	112—120	As the laft; alfo fquirrels, lizards, tree-frogs.
Col. getulus (chain fnake).	0	8	18—20	10—12	72—80	Lizards, a ferpent with red and black bands, col. fulvius?
Col. fafciatus.	0	8	20—24	12—15	80—94	Small fifhes, frogs, infects, worms.
Col. fulvius.		the teeth not afcertained.				Grafshoppers and other infects.
Col. faurita.		the fame.				Tree-frogs, infects, worms.

Venomous Teeth and Gland.—We have ftated that the innocent ferpents have teeth along the maxillary edge of the upper jaw, and in the palate; that is, four parallel rows, two external or maxillary, two internal or palatine. The venomous kinds, inftead of the maxillary rows, have the venomous fangs at the anterior end of each fuperior maxillary branch; and they poffefs the palatine rows, as well as the innocent ferpents. There is no difference in the teeth of the lower jaw. The venomous fangs are much longer and thicker than the other teeth: they are conical, fharp-pointed, and perforated by a fine tube. They are moveable at the will of the animal, and can be drawn up from the jaw, or laid down at pleafure. They are contained in a kind of cavity formed in the gums, from which their point projects.

At the end of his account of Indian ferpents, Ruffel has given two finely engraved plates, reprefenting the appearances of the teeth in the venomous and innocent fpecies. In the coluber catenularis (tar-tuttah), an innocent ferpent, there are two marginal or maxillary rows of fimple teeth, and two palatine rows. The vipera elegans (katukah-rekula-podah) has alfo two palatine, but no marginal or maxillary rows. The teeth are furrounded by a fringed membranous covering, which almoft conceals them. The points alone appear, when the membrane is not entirely deprefled. At the anterior end of the maxillary bone, on each fide, is a large membranous fac, wrinkled, and containing the fangs. The vipera naja, or fpectacle fnake, has the palatine teeth, and two venomous fangs, like the laft; but the teeth are fmaller, the fangs fhorter, and the membranous fac lefs apparent. The bungarum-pamah, a fpecies of bungarus, has the palatine teeth, two fangs ftill fmaller than in the fpectacle fnake, and at the edge of the mouth, behind the orifice of the bag inclofing the fangs, three fmall teeth on each fide, which may be confidered as an imperfect maxillary row.

In the vipera elegans, the fang is fixed to a bony bafis, which is attached to the fuperior maxillary bone: this bafis is much longer in the fpectacle fnake, and has attached to it the three fmall fimple teeth already mentioned.

Behind the venomous fangs in the vipers and other ferpents, are other fmaller fangs, faid to be defigned to replace the former when they are loft.

Blumenbach has given an excellent delineation of the mouths

mouths of the boa conftrictor and the crotalus horridus, in his Abbildungen Natur-Hiftorifcher gegenftände, No. 37, to fhew the difference between the venomous and innocent kinds; an object of the greateft importance, both with regard to the fewer fpecies of the former, and the much more numerous of the latter kind, in order to warn mankind againft real danger, and preferve them from groundlefs terrors. "All ferpents (fays Blumenbach), whether venomous or not, have the double internal row of palatine teeth, and the inferior maxillary teeth, in common. But the innocent fpecies have moreover the whole outer edge of the upper jaw furnifhed with teeth: in the venomous kinds, this is toothlefs. But the latter have, at each anterior corner of the mouth, attached to the upper jaw, the long hollow fangs with a flit at their point. Thefe are connected with the venomous glands, of which they may be regarded as bony excretory ducts, to convey venom into the wound made by the bite.

"When, therefore, we fee in any fnake four rows of teeth in the upper jaw, *viz.* befides the two internal palatine rows, an external row on each fide running to the corner of the mouth; we may be fure that the fpecies is poifonlefs, and fo far innocent."

The *poifonous gland*, peculiar to the ferpents with fangs, and faid to be of the conglomerate kind, like the falivary glands of the mammalia, is fituated on each fide, behind the orbit, clofe to the branch of the fuperior maxilla, and almoft immediately under the fkin. It is covered by a membranous or aponeurotic femitranfparent fheath, fixed to the bones of the head in front of the gland. The excretory duct extends from the anterior part of the gland, immediately under the orbit, to the bony bafis of the fang, and opens into a canal excavated in the fang, running through it from above downwards, and terminating by an oblique aperture on its anterior furface. Two mufcles deftined to elevate the fangs, to deprefs the fuperior maxillary bones, and confequently to clofe the mouth, pafs along thefe bones from before backwards; one on the outer, and the other on the inferior fide of the gland. Thefe cannot act without compreffing the gland, and expelling its fecretion into the excretory duct. See a reprefentation of the gland and the furrounding mufcles in the coluber naja, Phil. Tranf. 1804, pt. 2. pl. 8.

In the article Poison of this work, there is an account of the appearance and fenfible properties of the fluid fecreted by the venomous gland of the viper, and of its effects on animals. We have a few additional points to mention on this fubject, as well as concerning the poifonous properties of fome other ferpents.

Fontana afferts, that the noxious qualities of the fecretion are retained for a long time, even in a dry ftate; and that perfons have fuffered from wounds inflicted by the fangs of vipers, and other venomous ferpents, preferved in fpirits or dried, even years after the death of the animal. The venom retains its colour and tranfparency in the dead tooth, and is ftill active enough to kill animals, if it be rendered fluid by immerfion in warm water. He alfo found it active after many months, when dried and powdered.

Leeches, fnails, and flugs, were not injured by the venom of the viper. The blindworm and common fnake were not affected. Of tortoifes, fome were infenfible to the bite, others died at the end of fome hours, when bitten by feveral vipers.

The bites of the vipers of thefe climates produce more or lefs alarming fymptoms in the human fubject, but are not attended with danger. A peafant, bitten by a viper in the little toe, had the foot, leg, and thigh fwoln in fix hours; the pulfe fmall and intermittent; there was head-ache, pain in the abdomen, laffitude, and oppreffion; he cried frequently and had no appetite. He gradually recovered in two days, under the ufe of vegetable decoctions and poultices, which probably did not contribute much to his reftoration. Daudin, Hift. Nat. des Reptiles, 8vo. introd. p. 138.

Lepechin mentions the circumftance of a young Bafchkir, ten years old, being bitten by a black viper (coluber prefter, L.) in the foot. "Son pied enfla extremement en moins d'une demi-heure, et il eprouvoit tant de douleur dans la partie bleffée, qu'il ne pouvoit pas remuer le pied fans être forcé de crier: la paleur extrême de fon vifage, fes yeux troublés, et fa refpiration génée, annonçoient trés-fortement le danger que couroit ce jeune homme, fi l'on n'y apportoit un prompt remède." Olive oil externally, and volatile alkali by the mouth, were the fuccefsful remedies. Daudin, v. 6. p. 168; (quoted from Lepéchin, Tagebuch einer Reife, &c. t. 2. p. 105).

While Charas was engaged in refearches for his work on the viper, he was bitten in the fore-finger. He immediately fucked the wound, made a ligature on the root of the finger, and another on the wrift. The bite gave him but little pain. He took fome fudorifics, which operated in a few hours, and he was cured.

Boyle fays that he cured a man bitten by a viper, by holding a red-hot iron near the wound for a quarter of an hour. The truth feems to be, that the effects of the bite are not confiderable in the human fubject; and this accounts better for the recovery of perfons bitten, than any virtues in the remedies employed.

The wounds inflicted by thefe animals are not. however, always fo free from danger. The viper cherfea (coluber cherfea, L.), fays Daudin, is very venomous, and its bite is often mortal. Linnæus employed olive oil in the cafe of a woman who had been bitten; but fhe died, although the remedy had been fuccefsfully employed in the bite of the black viper (vipera prefter). Daudin. v. 6. p. 148.

The wounds of many Indian, African, and American ferpents, are, however, fatal to the human fubject. The vipera cornuta of fouthern Africa, is defcribed by Paterfon as very virulent, infomuch, that the Bosjefmen and Namaquaws employ its venom for poifoning their arrows. Daudin, ibid. p. 189.

A captain Hall made fome experiments on the poifonous powers of the rattlefnake, of which he has recorded the refults in the Philofophical Tranfactions. The firft dog bitten by this animal died in fifteen feconds; the fecond at the end of two hours; and the third of three hours. He recommenced his experiments with the fame ferpent on the following day: the firft dog died in thirty feconds; another in four minutes. Three days after, a frog died in two minutes, a chicken in three minutes. A little time after, an amphifbæna was bitten, and died in eight minutes; and the ferpent, having fubfequently bitten himfelf, died in twelve minutes.

Sir Everard Hume has defcribed at full length the cafe of a man, who was bitten on the thumb and fore-finger by a rattle-fnake between four and five feet long in this country. He died eighteen days after the accident. Great fwelling of the whole limb up to the axilla enfued; the tumefaction did not extend to the neck, but there was a fullnefs down the fide, and blood was extravafated as low as the loins, producing a mottled appearance. A full trial was given to the volatile alkali, both externally and internally, and to other medicines of the like nature, as ether, brandy, &c. alfo to opium. The cellular fubftance had floughed over the whole fwelled part of the limb, fo that the fkin was feparated univerfally from the mufcles. For a further account of this cafe, and

and of some other cases of bites of East and West Indian serpents, see the Phil. Trans. for 1810, p. 75.

Russel, in his account of Indian serpents, has furnished us with the most ample and interesting details concerning the Indian poisonous serpents. Of these the cobra de capello, or spectacle snake (coluber naja), and the katuka-rekula-poda (vipera elegans), are the most dangerous. It appears, from a comparison of the effects of the venom of the Indian serpents, the rattlesnakes, and the viper in the mammalia, that the symptoms are nearly the same in all, but that the term of their duration differs. The bite of a rattlesnake destroyed a dog in England in two minutes; while that of the most venomous Indian snake has never been fatal to this animal in less than thirty-seven minutes. A chicken bitten by the gedi paragoodoo (bungarus cæruleus) was immediately affected with stupor; in ten minutes, it was incapable of remaining upright; a quarter of an hour after it was stretched on the ground, as if asleep; it made some efforts to rise, turning the head to one side and the other, became convulsed, and perished in half an hour.

A stout dog was bitten in the thigh by a serpent of the same species: he howled much from the bite, but walked about freely. He lay down in a quarter of an hour, and howled: when an attempt was made to make him stand by raising him up, it was found that the hind limbs were paralysed. He grew worse, ceased to howl, and vomited abundantly: he became benumbed, and remained lying on the side. He died in two hours, having had very bad convulsions.

A lean bitch, having been bitten near the groin, remained fifteen minutes without exhibiting any symptoms of suffering. In fifty minutes she lay down, and appeared much affected: on attempting to make her stand, it was discovered that the limbs were paralysed. She vomited a little, and was convulsed till death, which occurred seventy minutes after the bite.

Wounds inflicted by the spectacle snake, or coluber naja, had the same effects; also those of the katuka rekula poda. Death did not always follow in the latter case, particularly in a dog, who was bitten six times, and once inoculated with the poison. A horse was bitten by the last-mentioned snake on each side of the nose. Prodigious swelling ensued, and extended to the throat; the animal refused his food, vomited, and appeared greatly affected. He had an emollient fomentation, and recovered on the third day.

Experiments with the bodrou pam had the same results: swelling, numbness, paralysis, convulsions, and death.

Russel tried inoculation of the venom with needles, thread, &c. Of six trials on dogs, none proved mortal. Eight out of twenty-four were fatal in chickens and pigeons.

Several venomous and innocent serpents were exposed to the spectacle snake: it would not bite them until instigated to do it, and they died without attempting to retaliate. But Russel found, in repeated trials, that two of these animals did not hurt each other; they would fight, and wound each other, but these wounds were not mortal.

Many circumstances modify the results of wounds inflicted by venomous serpents: *viz.* the quantity of venom, the condition of the serpent as to vigour or weakness, the number of bites he has inflicted, the situation and nature of the part bitten, the size of the animal, &c.

There are many facts to prove, that the secretion of the venomous gland, which is so active a poison, when introduced into a fresh wound, is quite innocent, and probably inoperative, if taken into the stomach. The psylli, or serpent charmers, so celebrated among the ancients for curing persons who had been bitten by vipers, sucked the wound strongly and repeatedly. Recent wounds made by the fer de lance (vipera lanceolata) of Martinique, the venom of which is very active, are also sucked with impunity. Fontana swallowed the poison of the viper, both mixed with water, and pure; it had even a mild taste, instead of producing a caustic and burning sensation, as some have stated. The heads of vipers, with their fangs and glands entire, have been eaten by dogs without any ill effects; and even the head of the terrible rattlesnake, with all its venomous apparatus, has been employed, with the rest of the body, in making soup, which has been drunk with perfect impunity.

Having thus described the instruments with which nature has furnished the venomous serpents, for the purpose of attacking, killing, seizing, and swallowing their prey, we cannot be at much loss to understand how these objects are effected; yet the prevailing notions on the subject are calculated, instead of elucidating, to involve a plain matter in obscurity and mystery. These will be most effectually dispelled by the following statement of Palisot Beauvois, who had considerable opportunities of observing the habits of serpents in America. "Much has been written on the manner in which serpents seize their prey: some ascribe to them a kind of magical power, the effect of which is to charm and enchant the animals on whom they fix their looks; others, less fond of the marvellous, pretend that they inspire them with excessive alarm, that, not knowing what they do, they run from one side to the other, fly, return, and at last precipitate themselves into the jaws of the monster; a third opinion is, that serpents diffuse around a fetid odour, by the aid of which they suffocate birds, squirrels, rabbits, and the different animals on which they feed. It must be difficult to determine the means employed by these animals in a state of nature, for the purpose of seizing their prey; and it would probably be wrong if we were to suppose that the same means are adopted in all instances. Can we believe, for example, that the black serpent (coluber constrictor), which creeps with astonishing quickness, climbing shrubs, and not at all venomous, should employ the same means as the boiquira (crotalus durissus), a slow moving animal, never ascending the smallest plant, and furnished, like all the venomous serpents, with two fangs, the wound of which is so quickly fatal? Yet, if we may judge of these reptiles in a state of liberty, by what goes on when they are prisoners, they certainly create only a common alarm, such as any creature will feel, when endeavouring to escape from its enemy. The animals experience no enchantment, nor any attack of madness, when a serpent fixes his eyes on them. Serpents produce no bad smell, still less a fetid vapour, capable of suffocating animals. The boiquira eats indiscriminately all the dead birds brought to it. It will not eat frogs, which the black serpent, on the contrary, seems to prize highly. Fascination and charms are repugnant to reason: sorcerers and magicians exist no more among animals than men: cunning, address, and force, are in both cases a sufficient, as well as the only charm and power, to render the weak tributary and victim to the strong.

"I made, in conjunction with Peale, the following observations on a boiquira, which he had preserved alive for five years, and on a black serpent.

"A living bird (icterus pheniceus) was put into the cage with the rattlesnake, and remained there two days, without any offensive proceeding on the part of the serpent. The bird did not seem at all uneasy. As far as we could judge from the countenance, the air which it breathed was the same as it would be in an ordinary closed cage. During the two days, the reptile ate a dead bird of the same species as as that in the cage, which he never offered to touch. Another living bird, the loxia cardinalis, inftead of being frightened by finding himfelf in company with the boiquira, amufed himfelf with pecking at the cage, and eating millet-feed thrown into him; he changed his fituation frequently, and would even perch on the reptile's back; but he moved off at the found of the rattle. Several kinds of frogs, living and dead, were prefented to the fame ferpent; but he touched none. The black ferpent, on the contrary (coluber conftrictor), attacked the frogs immediately, and feemed to prefer the tree-frogs. He alfo fwallowed flies and other infects.

"A common rat was put into the cage with the boiquira, who immediately appeared animated; the rat, frightened, ran towards the fide oppofite to the reptile. The chafe lafted a few feconds, the animal ufing every effort to efcape, when the reptile, perceiving a favourable moment, flew at his prey, and bit it. The rat continued to run round the cage, but the ferpent remained quiet: the former, in about a minute, fwelled, became convulfed, died, and was fwallowed by his enemy. Thefe convulfions were probably confidered by old obfervers as the effect of the charming power of the ferpent, or of extraordinary fear; but they are a regular fymptom of the action of the poifon.

"Perhaps thefe experiments do not determine exactly the means which ferpents employ for feizing their prey, fo likely to efcape them by running or flying: but they feem fufficient to authorife us in rejecting all ideas of fafcination, or charm, of extraordinary terror or fuffocating vapour. On the latter point, I can ftate, that nine boiquiras were kept for three weeks in the fame box; when it was opened, at the end of this time, no particular odour was obferved." Daudin's Hift. Nat. des Reptiles, in the edition of Buffon, by Sonnini, v. 5. p. 55. et feq.

Thofe ferpents which have not this quick and effectual means of deftroying their prey by the poifonous apparatus, accomplifh their object in another manner. They throw themfelves on the animal which they attack, twine round his body and limbs, and exert, in this manner, a compreffive force capable of breaking the bones. When he is thus difabled from refiftance, they fmear him over with a mucous faliva, and fwallow him gradually in the way already defcribed. The enormous ferpents of Africa and America, thirty or forty feet long, are ftrong enough to attack and overcome the larger animals, and can then fwallow them entire. See the account of the boa aboma by Stedman, in his voyage to Surinam and Guiana; and of the boa conftrictor, in Adanfon's Voyage au Senegal, p. 152. et feq.

Proportion of the venomous to the harmlefs Serpents.—The number of ferpents poffeffing venomous fangs is more confiderable than has been generally fuppofed. "Ne telis horrentibus," fays Linnæus, "execrabili veneno nimium fævirent, decimam quamque tantum fpeciem armavit imperans, et verfipelles eos voluit, ut dubii omnes metuerentur ab omnibus." Yet Dr. Ruffel found feven venomous fpecies among forty-three, which he obferved; and the proportion of the venomous to the non-venomous kinds, among the ferpents defcribed by Daudin, in his Hiftory of Reptiles, is as 80 to 233. There are not more than 14 or 16 genera of ferpents indigenous in Europe, yet among thefe are five vipers. Of the fpecies defcribed by Daudin, 201 belonged to the ancient, and 112 to the new continent: the venomous kinds formed a fourth in the former, and a fifth in the latter.

Daudin gives the following lifts of the poifonous and harmlefs kinds.

Genera with poifonous fangs.	Genera without poifonous fangs.
1. Bungarus.	1. Boa.
2. Acanthurus?	2. Python.
3. Crotalus.	3. Corallus.
4. Scytale.	4. Hurriah.
5. Lachefis.	5. Coluber.
6. Cenchris.	6. Enhydrus.
7. Vipera.	7. Erpeton.
8. Platurus.	8. Eryx.
9. Langaha.	9. Anguis.
10. Clothonia.	10. Ophifaurus.
11. Hydrophis.	11. Pelamides.
	12. Acrochordus.
	13. Amphifbæna.
	14. Cæcilia.

See his Hift. Nat. des Reptiles, v. 5. p. 22.

The following is given by Humboldt as a comparative enumeration of the venomous fpecies in the old world, and in America.

In the old continent.	Species.	In the new continent.	Species.
Bungari	2	Bungarus	0
Crotalus	0	Crotali	7
Scytalæ	3	Scytalæ	2
Lachefis	0	Lachefes	2
Cenchris	0	Cenchris	1
Viperæ	44	Viperæ	10
Platuri	2	Platurus	0
Clothonia	1	Clothonia	0
Langaha	1	Langaha	0
Hydrophes	5	Hydrophis	0
	58		22

See the Recueil d'Obfervations de Zoologie et d'Anatomie comparée, v. 2. p. 5.

Horny Covering of the Jaws in the Chelonian Order.—This fubftance is fimilar in its nature to that which compofes the hollow horns of animals (fee HORN); and there is no effential difference between it and that of the bill in birds. (See BIRDS, in *Comparative Anatomy*.) As in birds, this horny covering is fpread over the oppofed furfaces of the two mandibles; but the organ fo covered is much lefs fufceptible of motion in the teftudines, as the upper mandible is always fixed in them. In general it is fenfibly fibrous in its texture, but fometimes it appears homogeneous. It is very hard, fo as to enable thefe animals to break fhells with facility. In this refpect, it is analogous to the horny bills of the birds of prey, and the refemblance is fo ftriking in one fpecies of turtle, that it has received the name of hawk's-bill. It is formed on a vafcular fubftance covering the bone, as is the cafe with the hollow horns and the bill of birds. The edges are fometimes fimple, fometimes ferrated, fometimes divided into large unequal teeth; the extremity is either entire and rounded, or grooved, or brought to a fharp point. The edge of the upper jaw is terminated by a thin fharp plate of horn, within which the lower paffes to fome height, being rather narrower in its tranfverfe meafurement: hence any fubftance may be cut by them as with fciffars, for the outer margin of the lower jaw is alfo brought to a fharp edge. Befides this fharp edge, there is a covering of fome breadth in the upper jaw, forming a ridge a ridge towards the anterior part, received into a correfponding concavity of the lower jaw.

Salivary Glands.—We have already obferved, that nothing deferving the name of maftication takes place in any reptile. They live on other animals, and almoft univerfally fwallow them whole. Some teitudines feed on fhell-fifh, and break the teftaceous coverings with their horny mandibles, but they do not *chew* the contained animals. The falivary apparatus muft, therefore, be very different from that of the mammalia.

Several reptiles, however, require the affiftance of fluids poured into the mouth for feizing and fwallowing their prey. Some, as the frog and cameleon, dart out the tongue, covered with a vifcid matter, upon infects, which are entangled in the flime, and thus captured. Serpents fpread a frothy flaver over the animals which they fwallow, to facilitate their paffage.

In fome reptiles the tongue is compofed, in great part, of a thick glandular mafs, formed of numerous fmall tubes united at their bafes, and feparating towards the furface of the tongue. They are fo many papillæ, giving a briftly appearance to the organ, or rendering it villous, when they are very fmall. The fides of the mafs are perforated by numerous pores, through which the fecreted fluid efcapes. This gland refts on the mufcles of the tongue, and follows the motions, which they communicate to the organ. The gland in queftion exifts in the chelonians; in the teftudo græca the ftructure juft defcribed is very evident. It exifts alfo in feveral faurians, as the flat-headed gecko (G. fimbriatus), the common iguana, and the Schneiderian fcink.

In the agame umbra (iguana umbra, Linn.) the gland is furmounted in front, inftead of papillæ, with tranfverfe plates clofely arranged. Thefe laminæ cover the whole furface in the cameleon.

The tongue feems to be covered by an analogous glandular fubftance in the batracians.

Where the tongue is fcaly, or fmooth, and covered with a fimple membrane, the place of this gland is fupplied by two others, elongated and glandular, fituated under the fkin, along the external furface of the branches of the lower jaw-bone, and pouring out their fluid at the outfide of the teeth of the fame jaw. In this direction they are in contact with the palatine membrane. Thefe glands are ftrongly marked in the tupinambes, the colubres, and the boas. In the amphifbænæ the glands are not fituated in the fame place, although they have the fame apparent ftructure. They lie immediately under the tongue, between the genio-gloffi and genio-hyoidei.

The conglomerate gland fecreting the poifonous fluid of the venomous ferpents is fpoken of in the defcription of the teeth.

The *os hyoides* varies in the different orders of reptiles, but it approximates in general very nearly to that of birds, from which it does not differ effentially in the faurian and ophidian orders. As in birds, its connections with the larynx are very inconfiderable: there is no mufcle paffing between them: a fimple membrane is the medium of union. They are, in fact, completely feparated in fome genera of faurians; as, for example, the cameleon: and the fame obfervation may be extended to all the ophidians which have a tongue included in a fheath. This circumftance completes the proof of what is rendered very probable by many other reafons, that the effential function of the os hyoides is to fupport the tongue, and affift its motions.

The form of the os hyoides varies much in the chelonians: fometimes the body is nearly fquare, thin, and flattened, then the pofterior cornua are ftraight, articulated to the pofterior angles of the body, feparating from each other as they pafs backwards, and having the larynx placed in their interval. The anterior cornua are confolidated to the body, a little behind the anterior angles, directed backwards, and curved upwards behind the occiput. In front the body is prolonged into a point, under the tongue, which it fupports. Such an os hyoides is feen in the teftudo græca. But in the matamata (teftudo fimbriata, Gmel.) the body is very folid, bony, and pyramidal, with the bafis turned forwards. The anterior cornua, forming angles towards the front, are articulated behind each angle terminating the bafis; while the pofterior, more flender, and bent like an arc, are fixed near each other to the apex of the pyramid.

Ufually the os hyoides confifts merely of cartilage in the faurians, as in moft other reptiles; its parts are generally flender, elongated, and confolidated with each other. Yet it preferves in the crocodile that flattened fhield-like figure, which we have defcribed it to poffefs in the chelonian order, and which we fhall difcover alfo in the batracians. There are only two cornua, articulated nearly in the middle of the fides of the cartilaginous plate. They feem formed of two portions united together, but diftinguifhed by a kind of angle projecting pofteriorly.

In the common iguana (I. delicatiffima, lacerta iguana, Linn.) the body may be confidered merely as the point of union of the feven cornua compofing the os hyoides An anterior one is continued under the tongue, without being fixed to it. The fix others are behind. The two loweft are the longeft; they are contiguous, flightly curved, and enter the goitre, without affording attachment to any mufcles or ligaments. The four others are true cornua of the hyoid cartilage. Two pafs firft forwards, but quickly bend backwards, and then upwards, to reach the occiput. The others are bent backwards and upwards, fo as to remain nearly parallel to thefe. They are analogous, in their form and ufe, to the correfponding parts in birds. The cornua belonging to the goitre are found alfo in the fcinks, agames, and dragons. In the dragon raye (draco lineatus) their extremity is attached to the large bag forming the goitre, and will draw it inwards, when the tongue paffes out of the mouth. Thefe cornua are not found in the other faurians. Sometimes there are only two hyoideal cornua, as in the gecko fimbriatus. They are always perfectly analogous to thofe of birds.

The os hyoides of the cameleon has four; of which two are ftraight and directed obliquely forwards. The two pofterior go behind the head. The body is prolonged to nearly the anterior third of the tongue, when that organ is in the ftate of repofe: it is cylindrical and flender in the whole of this part, which is between one and two inches long.

In the lizards and tupinambes, the number of cornua is alfo four. The anterior are formed of two pieces, confolidated, or moveable on each other, of which the firft is directed forwards, while the fecond turns backwards, and is curved towards the occiput.

In the ophidians, with a tongue inclofed in a fheath, the hyoid cartilage is compofed of two parallel threads, directed from before backwards, approximated to each other, feparated in their anterior half by the fheath of the tongue, and in the reft of their extent by the two hyogloffi. The two threads are united in front, nearly between the pofterior extremities of the branches of the jaw, being bent into a femicircle under the fheath of the tongue; from the convexity of their union a fhort point is continued under the fheath. In the other ophidians, as the amphifbænæ, &c. the

the hyoideal cartilage has a triangular figure: the two posterior angles are elongated to form the cornua.

The os hyoides forms a broad nearly square plate, immediately applied to the inferior parietes of the palate and back of the mouth, in all the batracians, except the salamanders. The anterior cornua go off towards the front from the anterior angles, separate more widely before they turn backwards, then are continued towards the angle of the jaw, and curved from below upwards, in front of this angle, to be fixed to the posterior part of the cranium. The posterior horns are straight, strong, bony, not consolidated with the square plate, but articulated to its posterior angles, and directed obliquely backwards and outwards. The larynx is placed between them. The hyoid cartilage of the salamanders has a triangular form: the cornua go off from the posterior angles, and ascend at the sides of the neck. Their posterior edge is consolidated to a thread of the same nature, bent in the form of a handle, and having its anterior extremity united to that of the opposite thread in the middle of the posterior concavity of the hyoid cartilage. On each side of the branches of this cartilage, towards the front, there is a broad cartilaginous plate, nearly parallel to them, and only joined by muscles which go from one to the other. It seems to hold the place of an anterior horn.

In the thirty-fourth plate of the fifth volume of the Leçons d'Anat. comparée, there are figures of the os hyoides of the iguana, the Nilotic crocodile, the Nilotic tupinambis, the lacerta agilis, the gecko fimbriatus, amphisbæna, another serpent, the testudo græca, the salamander and frog.

Muscles of the Os Hyoides. — In those saurians, which have a more or less protractile tongue, these muscles contribute greatly to its elongation, by carrying the bone forwards.

We find in reptiles; 1st, a muscle analogous to the mylohyoideus. It is composed, in the two first orders, of several portions; *viz.* an intermaxillary, fixed to the lower edge and internal surface of the branches of the lower jaw; a second very thick, ascending behind each angle of the jaw, upon the digastricus, and attached to the occiput; a third passing to different distances in the neck, fixed to the skin above, and embracing the neck like a girth. It is analogous to the cutaneus colli; and embraces the whole extent of the neck in the chelonians. In the common iguana the intermaxillary portion does not extend to the arch of the chin; and in the gecko there is only a thin aponeurosis reaching so far. But, in general, the mylo-hyoideus is fixed to the os hyoides in these two orders, which is not the case in the batracians; in which the muscle seems to exist merely for the purpose of filling the wide interval between the maxillary branches, and supporting and elevating the parts above it. Its fibres are directed transversely from one branch to the other; they are divided in several species by a median line, and attached to the internal surface of the maxillary branches, which enables them to elevate more advantageously the subjacent parts. In the rana ocellata the posterior edge is separated on each side, to ascend within the angle of the lower jaw as high as the palatine membrane.

2. The muscle analogous to the sterno-hyoideus is attached in the chelonians, between the two cornua of the same side, and to the posterior cornu; it descends along the neck, passes within the first bone of the shoulder, and is inserted on the inside of the neck of the second bone. It rests, in this course, against the sides of the œsophagus, and is strongly attached to the pharynx towards its anterior extremity.

The same muscle, in the saurians, is attached on the outside of the sternum, between the sterno-mastoidei, and is fixed to the posterior cornu of the hyoid cartilage. In the iguana, it is fixed to nearly the whole posterior edge of the first part of these cornua; in the gecko fimbriatus, to the middle of this edge. In the caïman, after touching the os hyoides, it is continued to the lower jaw, and inserted far back in its lower edge.

It is much elongated in the cameleon, and carried far backwards on the outside of the sternum, forming a point in the same direction. This muscle covers another, thinner and broader, but of the same length, equally contiguous to its fellow of the opposite side in the two posterior thirds, and inserted in the extremity of the posterior cornua of the os hyoides. It might be named sterno-ceratoïdeus. In the agame umbra (iguana umbra, Linn.), the same muscle extends equally backwards on the outside of the sternum. The sterno-hyoideus has two portions in the crocodiles, which are only separated beyond the sternum: the lower one is thinnest, and inserted in the edge of the hyoid plate; the outer, broader and thicker, reaches the posterior edge of the cornu, and after a slight tendinous intersection, which serves to attach it to this cornu, is continued in the same direction to the jaw, and forms the first layer of the cerato-maxillary muscle.

In the serpents, the place of the sterno-hyoideus is supplied by a costo-maxillary muscle, extending from the anterior ribs to the lower jaw. Its internal fibres go from the jaw and the ribs to the hyoid cartilage.

It is prolonged, in the batracians, except the salamanders, within the sternum, to the farthest end of this bone, where it is fixed; or it only reaches the middle of the sternum. Many of its fibres are expanded on the pleura. In front it is divided into several portions, inserted successively in the external edge of the hyoid plate. One of these goes as far as the anterior cornua, and is fixed to it by a slender tendon. In the salamanders, the sterno-hyoideus is continuous with the rectus abdominis, and partakes in its motions.

3. The omo-hyoideus does not exist in the ophidians.

In the chelonians it ends in the sheath of the mylo-hoideus, which incloses the extremities of the anterior cornua of the os hyoides. This muscle is very considerable in some saurians. In the gecko, for example, it is widened, to be inserted in the greatest part of the posterior cornua: it covers the greatest part of the sterno-hyoideus in front.

In the iguana it is contiguous to a muscle, which has the same direction: it is attached to the clavicle behind, and above the body of the hyoid cartilage in front. In the caïman it is also composed of two portions. The external, which is soon detached from the following, is fixed to the palatine membrane near the lower jaw. The internal is attached to the angle of the hyoideal cornu.

It is long and slender in the cameleon; it passes on the outside of the sterno-ceratoideus, and is fixed to the body of the os hyoides, on the outside of the sterno-hyoideus.

The omo-hyoideus of the frog is mentioned in the account of the muscles of the shoulder.

4. Muscle analogous to the stylo-hyoideus. This has only been noticed in the frogs and toads. It comes from the back of the head, behind the ear, where it is attached at the side of a muscle analogous to the sterno-mastoideus. It is divided into two portions in the rana ocellata, and into three in the common frog: they are all attached to the posterior cornu.

5. The genio-hyoideus. The chelonians have only one, the tendon of which is fixed to the arch of the chin: the two fleshy portions separate as they go backwards, and are fixed to the basis of the posterior hyoideal cornua. In several saurians the structure is nearly the same; as in the common iguana, and the caïman, for example. It consists of two portions

portions in the cameleon; an internal long and flender one, inferted in the body of the os hyoides; an external broader and ftronger, contiguous to the former, and attached to the pofterior cornua in their whole length: it has an attachment alfo to the anterior cornua.

In the ophidians the genio-hyoidei are continuous behind with the cofto-hyoidei. They are only obferved in thofe whofe tongue is not inclofed in a fheath.

The genio-hyoidei are divided behind into two portions, in the batracians. The external and fhorteft is inferted on the fide of the hyoideal plate above its edge; the internal is prolonged on the pofterior cornua, and furnifhes a fheath to the hyogloffus. The fterno-hyoideus penetrates between thefe two portions, to be fixed to the plate.

6. The cerato-maxillary mufcles. Thefe are analogous in their attachments and ufe to the conical mufcles of the os hyoides in birds: they only differ from them in not being turned round the cornua. They are found in the three firft orders, but do not exift in the batracians. They arife from the pofterior third of the internal furface of the branches of the lower jaw, and proceed backwards and inwards to the pofterior cornua of the os hyoides. There are two on each fide, attached to the four cornua, in the iguana. This animal has, moreover, a tranfverfe mufcle of the cornua, the fibres of which go obliquely outwards from the anterior to the pofterior cornu of the fame fide.

In the agame umbra the laft mufcle is long and flender, continued from the extremity of the pofterior cornu to the angle of the anterior.

In the chelonians, the cerato-maxillary are inferted into the extremities of the anterior cornua.

The *tongue* varies confiderably in this clafs of animals: it is employed, in many inftances, as the means of procuring their food, by thofe reptiles which feed on infects. But as none of this clafs mafticate their aliment, or fwallow it like the mammalia, the form of the organ is very different from that which it exhibits in the mammiferous animals.

The chelonians have a fmall pyramidal tongue, with the bafis turned backwards, the apex forwards.

A large part of the faurians and ophidians have a tongue capable of confiderable elongation. The moft remarkable example occurs in the cameleon, where it is not larger than a quill, but five or fix inches long: it is expanded at its extremity, which is covered with a vifcous fecretion. This weapon lies commonly in a fheath at the bottom of the mouth, contracted to the length of about an inch, or lefs. The animal can dart it out at pleafure, when the vifcous fluid at its end entangles the prey, which is taken into the mouth with great celerity. "Quand les caméléons veulent manger," fays Belon, "ils tirent leur langue, quafi d'un demipied, ronde comme la langue d'un oifeau nommé picvérd, femblable a un verre de terre; et a l'extremité d'icelle ont un gros nœud fpongieux, tenant comme glu, duquel ils attachent les infectes, favoir eft fauterelles, chenilles & mouches, et les attirent en la gueule. Ils pouffent hors leur langue, la dardant de roideur auffi vîtement qu'un arbalête ou un arc fait le traict." Pierre Belon, Obfervations, &c. liv. ii. ch. 34.

In the common lizards, the tupinambes, &c. the tongue is fmooth, extenfile, and terminated by two long flexible points, although femi-cartilaginous and nearly horny: it refembles perfectly that of the ophidians, excepting the anguis and amphifbæna, and perhaps alfo the cæcilia, which have it flat, and merely forked at the end, without the power of elongating it.

In moft of the ferpents, the tongue, when contracted, is contained almoft entirely in a membranous fheath. The mechanifm belonging to thefe projectile tongues partakes both of that which is found in fome mammalia, as the echidna and the ant-eaters, and of that of birds. (See MAMMALIA and BIRDS, in *Comparative Anatomy*.) It depends on mufcles acting on the os hyoides, and alfo on the mufcles of the tongue.

The ftellios and iguanas have a flefhy tongue, villous on its furface, and poffeffing about the fame mobility as that of the mammalia. In the fcinks and geckos it differs from the former only in being fiffured at the end; and it refembles, in this refpect, that of the angues, between which and the fcinks there is in all points much analogy.

The tongue of the batracians is not only different from that of other reptiles, but alfo from that of other animals. It is flefhy, of a flattened figure, fmooth, and covered, in all of the frog and toad kind, with a tenacious mucus. It is villous in the falamanders, and covered with very long papillæ in the horned frog (bufo cornutus, rana cornuta, Linn.). The great peculiarity of the tongue is its being attached by the bafis to the front of the mouth, to the fymphyfis of the lower jaw. This is its thickeft part: it is continued backwards in a thinner form, fo as to end in two loofe and flat portions, reprefenting the apex, and lying in the back of the mouth. This loofe part, ordinarily turned back towards the throat, is projected from the mouth, covered by its vifcous fecretion, upon the fmall infects which the animal feeds on, and which are thus entangled and fwallowed.

Mufcles of the Tongue.—They poffefs nothing peculiar in the chelonian reptiles, which have not an extenfile tongue: they confift merely of two pairs. The hyogloffi come from the anterior half of the pofterior cornua, and penetrate into the tongue at the fides of the bafis.

The genio-gloffi are very ftrong and broad in the vertical direction: they come from the front of the lower jaw, and enter the tongue more outwards and forwards than the preceding, with which their fibres are interwoven. The apex of the hyoid cartilage penetrates between them: they are alfo feparated by a fmall cylindrical cartilage, to which each mufcle is fixed; which is prolonged behind under the body of the hyoid cartilage, extending in front to the apex of the tongue.

The faurians have in general three pairs of mufcles going to the tongue from the os hyoides or the arch of the chin, and a proper mufcle attached to the organ only.

1. The hyogloffus comes from the cornua of the hyoid cartilage. In the common iguana it is attached to the pofterior cornua, oppofite the omohyoideus. In the gecko fimbriatus it is fixed to the middle of the cornua, at the fide and within the cerato-maxillaris: it forms, with the ftraight genio-gloffus, the bafis of the tongue, and mixes its fibres with thofe of the proper mufcle. The hyogloffus is long and cylindrical in the lizards and tupinambis: it comes from the extremity of the pofterior cornua, approaches the oppofite mufcle as it advances forwards, becomes contiguous to it at the bafis of the organ, towards the extremity of which it terminates in forming the two portions of cylinders, of which this tongue confifts. In the cameleon it is fixed to the whole anterior edge of the pofterior cornua, and is very thick at that part. Beyond the angle formed by the two cornua of the fame fide, it is curved and continued directly forwards. The fafciculi of fibres, of which it confifts, are inferted in the pofterior half of the fheath of the tongue, which it ferves to draw backwards.

2. The ftraight genio-gloffi come from the inferior edge of the arch of the chin, and are continued to the bafis of

of the tongue; where they meet the hyogloſſi, with which their fibres are interwoven.

3. The tranſverſe genio-gloſſi are attached to the arch of the chin, and to the anterior part of the inferior maxillary branches, on the outſide of the preceding. Inſtead of being narrow and elongated, they are broad and ſhort. Their fibres paſs obliquely from without, inwards and backwards upon the membrane of the mouth, as far as the ſides of the tongue; which they will draw outwards and forwards. The two laſt pairs of muſcles do not exiſt in the cameleon.

4. The proper muſcle is found in thoſe ſaurians only, whoſe tongue admits of elongation. It is compoſed, in general, of annular fibres. In the gecko fimbriatus, which has a broad tongue, this muſcle is divided in front into ſix or eight ſmall portions, which are united into two towards the middle third of the tongue, and then into one on each ſide, which form the two pieces of the baſis of the tongue.

In the cameleon the annular muſcle is very thick, and forms a fleſhy cylinder ſurrounding the anterior three-fourths of that part of the os hyoides which penetrates into the tongue. Towards the front it is divided on the ſides into two portions, a ſuperior and an inferior; the latter is folded back towards the ſheath of the tongue, to which it adheres. There is, moreover, a muſcle proper to this ſheath, which may be called the retractor muſcle. It comes from below the glandular part, and is continued, on each ſide, as far as the part that is puckered up. When the hyogloſſus throws this latter part into wrinkles, and ſhortens it, and the os hyoides is carried backwards by the ſterno-hyoidei and ceratoidei, the retractor muſcle cauſes the end of the ſheath to remain applied to the extremity of the annular muſcle which recedes, becauſe then its poſterior attachments are the moſt fixed: on the contrary, when the extremity of the os hyoides and the annular muſcle puſh the ſheath forwards, the anterior attachments have a point d'appui; the poſterior portions of the retractor draw forwards the ſheath, and unfold it.

By putting together what we have ſaid concerning the os hyoides and its muſcles in the cameleon, in a former part of this article, and what we have juſt ſaid of the muſcles of its tongue, it will be eaſy to underſtand how this organ can be elongated, and withdrawn into the mouth. The firſt office is performed by the annular muſcle, with the cerato-maxillary, and the genio-hyoidei. The ſterno-ceratoidei and hyoidei carry backwards the os hyoides, at the ſame time that the hyogloſſus ſhortens the ſheath and puckers it up.

In moſt of the ophidians the tongue is incloſed in a membranous ſheath, which opens behind the interval of the branches of the lower jaw, and is continued backwards between thoſe of the hyoid cartilage, under the trachea. It is lined internally by the membrane of the mouth. This ſheath is carried forwards by a pair of muſcles analogous to the genio-gloſſi. They derive their origin by two portions, one of which comes from between the two branches of the lower jaw, the other from their extremity; they come together and are fixed to the ſides of the ſheath to its moſt diſtant extremity. The hyogloſſi are two elongated muſcles, contiguous, and even united together by fine cellular laminæ. They exactly fill the interval of the cornua of the hyoid cartilage, and are even doubled backwards round their extremity. Theſe muſcles go to the baſis of the ſheath, and draw it backwards, when it has been carried forwards by the two firſt pairs.

The proper muſcle is formed of two cylinders, firſt lying together, and ſeparated towards the anterior third of the tongue, for the two portions of which its apex conſiſts; here they become conſiderably diminiſhed, and are reduced to a mere thread at the end.

This ſimple apparatus, combined with that of the os hyoides and its muſcles, gives to the tongue of the ſerpent that wonderfully quick power of extenſion and retraction. Carried forwards by the genio-vaginal muſcles, brandiſhed by its proper muſcles, it re-enters the ſheath in conſequence of the elaſticity of the hyoideal cornua, which tend to reſtore themſelves, and of the action of the hyogloſſi. One or other of theſe actions is aſſiſted by the coſto-maxillary muſcles, according as the portion analogous to the ſterno-hyoideus, or that which correſponds to the cerato-maxillary, contracts. The extenſion of the tongue out of the mouth is ſo much the greater, becauſe it is effected through an orifice near the extremity of the ſnout, and becauſe its baſis may be brought near to this part.

In the amphiſbænæ, which have a flattened tongue, not incloſed in a ſheath, nor ſuſceptible of extenſive motion, there are, 1ſt, two genio-gloſſi attached to the arch of the lower jaw, more internally than the genio-hyoidei; 2dly, two hyogloſſi; and 3dly, two cerato-gloſſi, which preſent nothing worthy of particular notice.

The tongue of the batracians, as we have already deſcribed, is fixed in front to the arch of the lower jaw, and free behind. In paſſing out of the mouth, and going back again, it turns upon the fixed point of its attachment to the jaw. Two pairs of muſcles, the genio-gloſſi, and the hyogloſſi, execute theſe motions. 1. The hyogloſſi form, in the rana ocellata, two cylindrical maſſes, lying on, and attached to, the poſterior cornua. They ſoon unite into a ſingle maſs, which reſts on the hyoideal plate, and penetrates the tongue in front of this plate, expanding into ſmall faſciculi, which reach to the looſe edge of the organ. 2. The genio-gloſſi form at firſt two ſmall ſpherical maſſes, placed at the arch of the chin on the ſmall tranſverſe muſcle; they are ſubſequently elongated into two contiguous cylinders, of which the fibrous faſciculi ſeparate from each other, decuſſate with thoſe of the preceding muſcle, and go to the looſe edge of the tongue. While the tongue is in the mouth, the hyogloſſus is folded on itſelf, and the genio-gloſſus is ſtraight. The latter muſcle is folded, and the former ſtraight, when the tongue has been projected. In the common frog, theſe two pairs of muſcles are not ſo minutely divided in the tongue, and the genio-gloſſi do not form ſpherical maſſes towards the arch of the chin: in other reſpects they are ſimilar.

Tongue of the Crocodile.—Humboldt has obſerved a peculiar mechaniſm in the tongue of this animal, bearing an evident relation to its wants and habits, of which the following is a deſcription in his own words.

"From the moſt ancient times diſputes have exiſted concerning the tongue of the crocodile; ſome naturaliſts pretended that it was entirely wanting, others affirmed that it was very ſhort, and placed at the entrance of the œſophagus. According as one or the other of theſe opinions prevailed, the ſculptors and antiquaries of Rome amuſed themſelves with deſtroying or reſtoring the tongues of their crocodiles. When we examine attentively the os hyoides of this animal, we find that it is in conſequence of its form and ſmall ſize that a part or rather a fold of the tongue has been confounded with the whole organ. There is in this animal a peculiar mechaniſm, by which a valve is formed, interrupting the communication between the mouth and throat. When the crocodile appears motionleſs on the bank of the river, with the jaws opened at an angle of

95°,

95°, the whole mouth appears yellow: the valve is elevated, and the opening of the fauces is not feen. If we furprife him, the valve is generally depreffed; and if a perfon runs the rifk of approaching fufficiently, a round body of a beautiful red colour, which is the opening of the glottis, may be perceived. This valve enables the crocodile to feize his prey under water without running the rifk of being inundated by the great quantity of fluid that would pafs into the œfophagus. When he fwallows, the valve muft be depreffed, and the animal on dry ground. The os hyoides of the crocodile of the Orinoco is a membranous fpatula, broad, concave, and terminated by two fhort horns. The os hyoides of the Egyptian crocodile, as delineated by Mr. Duverney, is altogether different from that of the South American animal; another proof of the diftinction between the crocodiles of the old and new continent. In an animal of eighteen feet, the tongue is twenty-five inches: it is yellow, flefhy, and covers the whole jaw; but it is attached on all fides, fo that the os hyoides cannot elevate it to the end. The anterior or fpatula-fhaped portion of this bone enters the membranous fubftance of the tongue, which it can elevate at a right angle. As the fides and extremity of the organ are fixed, this motion of the bone can only carry with it the membranous part of the tongue, which forms the fold prefenting itfelf like an elevated valve. The os hyoides is depreffed, and the valve immediately difappears. Three conditions are neceffary to the execution of this mechanifm, a tongue attached to the lower jaw; a ductile and flexible membrane covering it; and an os hyoides broad in front. The yellow fubftance in the anterior part of the mouth belongs to the tongue as well as the fold covering the entrance of the œfophagus. Humboldt found that the tongue fwelled very much, when fubjected to Galvanic influence, by means of zinc and filver. See Recueil d'Obfervations d'Anatomie comparée et Zoologie, faites dans le Voyage de Humboldt et Bonpland, t. 1. pag. 9. pl. 4.

Geoffroy gives a fimilar defcription of the tongue, os hyoides, and their mechanifm, in the Nilotic crocodile. He defcribes it as a yellowifh, fhagreened fkin, exactly like the fubftance of the palate, pierced by numerous fmall holes, the excretory ducts of the glands fituated on its upper furface, and adhering on all fides to the branches of the lower jaw. He fpeaks of the broad anterior part of the os hyoides forming, by its elevation, a veil, which covers all the back of the mouth. Thus, the animal can remain under water with the jaws open, and receive air through the noftrils, the only part above the furface, without the water entering the throat or trachea. Annales du Mufeum, vol. ii. p. 42, et feq.

Epiglottis.—In moft reptiles the opening of the glottis is neither covered by a valve, as in the mammalia, nor armed with papillæ, as in birds. Yet a kind of epiglottis may be obferved in the common iguana, and in the Schneiderian fcink. There is a rudiment in the crocodiles; it does not appear in feveral other animals of the fame order, nor in the chelonian, ophidian, and batracian reptiles. The cylindrical larynx of the dragon, and its fimple opening behind the root of the tongue, are very well reprefented in Blumenbach's Abbildungen Natur-Hiftorifcher gegenftände, N° 98. Is the abfence of the epiglottis connected with the peculiar modification which refpiration undergoes in this clafs? or with their deglutition? On the former point we may obferve, that, as they breathe only at confiderable intervals, there is no danger of the glottis being opened during fwallowing, and its edges may confequently be kept clofely approximated. Again, as they fwallow their food whole, it is not likely to pafs into the larynx.

Fauces.—The openings of the noftrils are fituated very forwards in reptiles, and are not clofed by any moveable curtain, as in the mammalia. A kind of immoveable valve, attached to the anterior edge of the opening, and leaving the orifice free behind, may be feen in the gecko fimbriatus.

There is fomething analogous to the velum palati in the crocodile. The noftrils open far back, contrary to what we have mentioned concerning other reptiles. They form a round aperture in the moft diftant part of the arch of the palate. The membrane lining this concavity forms a loofe production a little in front of the opening in queftion, which defcends on the fides, growing a little broader, until it meets another elevation behind the bafis of the tongue. Thefe form together, by their loofe edge, the ifthmus faucium, or entrance of the throat. The firft affords fome protection to the opening of the noftrils, but cannot entirely clofe it; the latter contributes, with the rudiment of the epiglottis already mentioned, to cover the glottis.

The entrance of the throat is large in all reptiles, and capable, in many, of ftill greater fize, by the expanfion of the lower jaws. There is nothing deferving the name of ifthmus. They fwallow entire animals, which cannot pafs into the noftrils, and hence do not require a velum palati.

Pharynx.—As the noftrils open forwards in reptiles, the pharynx has not the fame relation to the nafal cavity, as in the mammalia and birds. The mouth and larynx communicate with it, and there is ufually a large aperture correfponding to the Euftachian tube.

The pharynx can hardly be diftinguifhed from the commencement of the œfophagus in reptiles. Their diameter is ufually the fame; and there is abfolutely no difference in the afpect of the membrane forming their internal parietes. It prefents a great number of longitudinal folds, which are effaced when a prey of large fize is fwallowed. There is no exterior mufcle enveloping the entrance of the canal.

Deglutition may be affifted, in the chelonians, by the action of the fterno-thyroidei, which reft on the œfophagus in the whole length of the neck; and even adhere in front to its parietes, and to the part which may be regarded as belonging to the pharynx. The os hyoides may alfo contribute to deglutition, by means of the mufcles which elevate it.

This office is particularly evident in the batracians, and efpecially in the frogs and toads. The hyoideal plate, which fupports in thefe animals the extenfive parietes of the back of the mouth and palate, is put in motion by the mylohyoideus and the mufcles analogous to the ftylo-hyoidei, only for the purpofe of elevating thefe parietes, and applying them to the concavity of the palate. There is alfo another mufcle coming from the upper and back part of the head, in front of that which correfponds to the ftylo-hyoideus; it is narrow at its origin, but expands as it paffes forwards and downwards, and as it covers that part of the throat which is prominent behind. It is continued to the edge of the hyoideal plate, in which it is inferted, its fibres adhering alfo to the membrane of the throat, on which they lie. Their action will elevate the hyoideal plate, and apply the membrane which they cover to the oppofite furface of the cavity.

The longitudinal fibres, belonging both to the pharynx and œfophagus, are more or lefs ftrongly marked.

Œfophagus and Stomach.—The former tube does not prefent thofe dilatations which we notice in birds: it retains nearly an uniform diameter throughout, or the change, if any, is gradual. But this diameter is, in moft cafes, much more confiderable, in comparifon with that of the ftomach, than in the two preceding claffes. Under certain circumftances, indeed, the œfophagus is larger than the ftomach in in the ophidians; for example, when the latter is not diſtended with food, becauſe its parietes contract ſooner after enlargement than thoſe of the œſophagus. The membranes are the ſame in both, and, when the tube increaſes in ſize inſenſibly to the ſtomach, it is often very difficult to aſſign the limits of the two parts, and conſequently the ſituation of the cardia. The ſtomach is generally without any cul-de-ſac, oval and elongated: its parietes uſually thin. The muſcular coat is then hardly perceptible, at leaſt in ſome part of its extent, and the cellular is confounded with the mucous or internal. The pylorus is uſually without any valve; it is marked by a ſimple contraction, by the greater thickneſs of the parietes of the ſtomach, and by the different ſtructure of the inteſtinal membranes.

In the turtle, the internal ſurface of the œſophagus is beſet with long, hard, conical papillæ, of which the points are directed backwards, with the effect, apparently, of preventing the return towards the mouth of the matters ſwallowed by the animal. Such, at leaſt, is the notion generally entertained of the end or purpoſe of this ſtructure. But the abſence of ſuch proviſion in all other animals, where the neceſſity ſeems equally to exiſt, cannot but render us ſceptical on the ſubject, more particularly as we know no facts concerning the nature of the food, the mode of its deglutition, nor any peculiar modification of ſurrounding or connected organs, to which this ſingular ſtructure might be ſuppoſed to bear ſome relation. The ſtomach is gradually diminiſhed in ſize from the cardia to the pylorus: it is bent on itſelf, and the portion beyond the curvature is thicker than the reſt, in conſequence of the muſcular fibres being more copious. The internal coat has longitudinal folds in this part, but hardly any in the other. The ſituation of the cardia is well marked, and the œſophagus is diſtinguiſhed from the ſtomach by the ſudden dilatation of the latter. The pylorus has no valve.

Among the ſaurians, the crocodile has a peculiarly ſhaped ſtomach; it is very diſtinct from the œſophagus by its globular figure. Near the inſertion of this canal there is ſeparated from it below a ſmall cul-de-ſac, opening into the inteſtine by a very ſmall orifice, and having its cavity ſeparated from the great ſac of the ſtomach by a kind of ſtrait. Conſequently the general cavity of the ſtomach is a large cul-de-ſac, of which the parietes are very thick. The internal membrane forms conſiderable plaits arranged in a ſerpentine form, like the convolutions of the brain. The cellular coat, which is not very diſtinct from the mucous in the œſophagus, becomes more ſo in the ſtomach. The muſcular nearly equals the two others in thickneſs; the coats are altogether much thinner in the ſmall cul-de-ſac.

In the other ſaurians there is no cul-de-ſac. The ſtomach is oval and very elongated in the iguana, without curvature; the œſophagus dilates gradually to form it. The only mark that can guide us in determining the ſituation of the cardia is, the ceſſation of the longitudinal folds of the internal œſophageal membrane. The ſtomach is ſuddenly contracted, and bent a little before its termination at the pylorus. Its parietes become thick and opaque at ſome lines from this aperture, from an increaſe of the muſcular fibres, of which the tranſverſe are ſtrongly marked. The internal coat forms no fold; there is no valve at the pylorus, which is very ſmall.

In the tupinambis monitor the ſtomach forms a long tube, bent into almoſt a complete circle.

In the Schneiderian ſcink we again meet with the ſame elongated form, tranſparent parietes, and difficulty of diſtinguiſhing the ſtomach from the œſophagus, except by the longitudinal folds of its inner membrane, and the thickneſs of its muſcular coat. But the poſterior part of the ſtomach contracts ſuddenly, is bent towards the right, and a little elongated in this direction before it terminates. The parietes of the latter portion are more thick and opaque, and its internal membrane is folded longitudinally.

The ſtomach begins by a ſmall dilatation in the cameleon, then it aſſumes a cylindrical and elongated form, and is bent on itſelf; it is conſiderably contracted before it terminates, and forms a ſmall cylindrical canal, of which the internal membrane is folded longitudinally. The muſcular coat is thicker in this contracted part than elſewhere. It forms a prominent ring at the pylorus.

In the dragon the ſtomach is ſhaped like a pear, of which the large end correſponds to the cardia; it has no curvature; its parietes are tranſparent; they become thicker and opaque near the pylorus; and theſe characters are the only circumſtance, by which we can diſtinguiſh it from the beginning of the inteſtinal canal, which has thin and tranſparent coats.

The ſtomach is alſo pear-ſhaped in the gecko; the œſophagus makes a curve before it ends, and is inſerted at one ſide of the baſis. It is narrow, with thick coats, a ſtrong muſcular covering, and broad longitudinal folds of the internal or mucous coat. The ſides of the organ are thicker at its extremities; and the pyloric end is a little bent. The internal membrane is ſmooth.

In the ophidian order the ſtomach is ſhaped like an inteſtine, hardly larger than the œſophagus, and without curvature. The internal membrane is folded longitudinally. When the ſtomach is empty, theſe folds are thicker than thoſe of the œſophagus, which are not always obſerved.

The œſophagus of a ſnake, examined by Spallanzani, formed a cylindrical tube like an inteſtine, for about nine inches: it then became gradually narrower, ſo as to conſtitute a funnel of the length of four inches and a half. This funnel was the true ſtomach. The ſides of the ſtomach were thicker than thoſe of the œſophagus: no glands or follicles could be ſeen in the latter; but the ſtomach was abundantly ſupplied with them throughout its whole length; they diſcharge part of their liquor on being preſſed, and the internal coat is moiſtened with it. Diſſertations relative to the Natural Hiſtory of Animals and Vegetables, v. 1. p. 112 and 113.

In frogs and toads the ſtomach is ſhaped nearly as in the chelonian reptiles. At firſt conſiderably dilated in compariſon with the œſophagus, it is gradually contracted, then curved ſo as to form an inteſtine-like canal, with thick coats, ending at the pylorus.

It is ſlightly curved only near its poſterior extremity in the ſalamanders. Its figure is elongated and not much ſwoln; the parietes thick; and the internal membrane exhibits ſmall rugæ. There is a fold near the pylorus, in the ſituation of the curvature. Figures of the ſtomach and inteſtines of various reptiles are given in Cuvier's Leçons, pl. 41.

Inteſtinal Canal.—Its length, in proportion to that of the body, is greateſt in the mammalia, and diminiſhes ſucceſſively in birds, reptiles, and fiſhes. In reptiles it is often hardly twice the length of the body, taken from the extremity of the ſnout to the anus. But tadpoles exhibit in this reſpect a remarkable peculiarity. Their inteſtinal canal is nearly ten times as long as the ſpace between the ſnout and anus, while in the frog it is not more than twice the length of the correſponding ſpace. Other important differences, which will be noticed ſubſequently, exiſt in the two caſes. This ſhortneſs of the alimentary canal correſponds to the nature of the food in reptiles, which is derived from the animal kingdom.

The

The following table of the length of the inteſtinal canal in various reptiles, is taken from the third volume of Cuvier's Leçons d'Anatomie comparée, p. 457.

Names.	Length of the body.	Length of the ſmall inteſtine.	Length of the large inteſtine.	Length of the whole canal.	Proportion to the length of the body.
Teſtudo græca - - -	0.210	0.680	0.014	0.694	:: 1 : 3.3
Nilotic crocodile (adult) -	1.690	5.384	0.406	5.790	:: 1 : 3.4
Nilotic crocodile (young) -	0.240	0.710	0.036	0.986	:: 1 : 4.1
Gangetic crocodile (gavial) -	0.360	1.350	0.040	1.390	:: 1 : 1.1
Cameleon - - -	0.130	0.180	0.040	0.220	:: 1 : 1.7
Gecko à goutelettes (gecko guttatus)	0.125	0.120	0.053	0.173	:: 1 : 1.3
Schneiderian ſcink - -	0.150	0.230	0.171	0.401	:: 1 : 2.8
Iguane ardoiſé (iguana cærulea) -	0.180	0.175	0.062	0.237	:: 1 : 1.3
Common iguana - -	0.220	0.400	0.230	0.630	:: 1 : 3
Lacerta agilis - - -	0.088	0.050	0.017	0.067	:: 1.3 : 1
Common ſnake (coluber natrix) * -	0.500	0.530	0.050	0.580	:: 1 : 1.2
Toad - - - -	0.065	0.110	0.028	0.138	:: 1 : 2
Frog - - - -	0.070	0.100	0.034	0.134	:: 1 : 2
Tadpole of the frog - -	0.035	0.300	0.030	0.330	:: 1 : 9.7
Salamander - - -	0.040	0.080	0.022	0.102	:: 1 : 2.5

* In a common ſnake of four feet in length, Blumenbach found the inteſtinal canal about three feet, nearly ſtraight, or at leaſt very ſlightly undulated: its proportional length was therefore different from that expreſſed in the table. Specimen Phyſiol. Comp. p. 30.

The inteſtinal canal of reptiles has in general no appendix to mark its diviſion into large and ſmall inteſtines; this diviſion exiſts neverthelefs in moſt of them. All the chelonians, moſt of the ſaurians, the ophidians, and the batracians, with the exception of the ſiren lacertina, have a long and ſlender inteſtine, inſerted into a large and ſhort inteſtine, and commonly prolonged into the cavity, ſo as to form a circular margin of a valve-like form. The ſides of the large inteſtine are almoſt always thicker and ſtronger than thoſe of the ſmall. The membranes differ too; the muſcular in reſpect to its longitudinal fibres, and the internal in its folds. The iguana is the only animal of this claſs, in which a true cæcum has been noticed.

Of the Inteſtinal Canal.—All reptiles have the inteſtinal canal very ſhort, but not of the ſame diameter in its whole length. In the firſt and moſt conſiderable portion, the capacity is much inferior to that which it is found to poſſeſs near its termination; ſo that it may be divided, as in the mammalia, into ſmall and large inteſtines. A circular valve is moſt frequently found ſeparating the two diviſions; it is formed by a prolongation of the ſmall inteſtine, which becomes dilated, and ſometimes is extended into a kind of ſac, projecting more or leſs into the cavity of the large inteſtine, and rendering the parietes double at that part. It is thus found in the Schneiderian ſcink.

In tortoiſes, the diameter of the ſmall inteſtine gradually diminiſhes from the pylorus to the point of its inſertion into the large: the area of which is four times greater than that of the ſmall, and its parietes have the ſame ſtructure as in the other reptiles. The cavity is regular throughout, there being no partial dilatations or ſacculi. The internal membrane has folds, more or leſs broad, and of a membranous ſtructure, in different ſpecies, ſometimes connected in a reticular form at the commencement of the ſmall inteſtine, having a longitudinal and parallel direction in the reſt of its extent, and arranged more or leſs irregularly in the large. The large inteſtine proceeds in a ſtraight direction to the anus, whilſt the ſmall makes many irregular turns in its courſe.

Blumenbach found the inteſtinal canal of the hawk's-bill turtle (teſtudo caretta) five times as long as the whole animal. The ſmall inteſtine, as it is called, was larger than the ſhort portion of the large inteſtine; the whole internal ſurface was covered internally with an abundance of mucus. Syſt. of Compar. Anat. p. 173.

The internal coat of the inteſtine of the turtle is covered with innumerable thin longitudinal proceſſes, lying cloſe together, and increaſing the ſurface of the gut to a vaſt extent. They are moſt numerous in the upper part of the canal, and gradually diminiſh in number, until they ceaſe altogether, below. In the latter reſpect they reſemble the valvulæ conniventes of man, and the villi of all animals. For theſe ſtructures are always moſt diſtinct at the commencement of the canal, where abſorption goes on to the greateſt extent. The alimentary matter is deprived more and more of its nutritious parts, as it deſcends in the inteſtine; and hence a leſs extenſive abſorbing ſurface is ſufficient, in the lower part of the canal, for taking up the remains of really nutritious particles. Yet Blumenbach ſays that he found theſe folds ſo numerous in the rectum of the hawk's-bill turtle, that a ſection of the gut reſembled a broad radiated band. Lib. cit. p. 173, note.

In the crocodile of the Nile, the ſmall inteſtine may be diſtinguiſhed into two portions, the one more capacious, having thinner coats, and making four turns in ſuch a manner as to form four permanent angles; the other, more contracted and having thicker parietes, incloſes between its internal and muſcular coats a layer of glandular ſubſtance, ſemi-tranſparent, of a grey colour and pulpy conſiſtence. In the internal membrane lining the glandular ſubſtance, there are ſeen longitudinal folds arranged in a zigzag form, and connected together laterally, by ſmaller folds, ſo as to form a reticular ſurface. In the firſt portion of the ſmall inteſtine, where the glandular ſubſtance is not manifeſt, the folds arranged in a zigzag form are replaced by fine villous eminences. Near the termination of the ſmall inteſtine there are only ſeen ſome waving folds, connected by a few, proceeding tranſverſely. In the large inteſtine, the folds are arranged irregularly, forming a velvet-like ſurface.

The form of the rectum (under which term is included the large inteſtine of fiſhes and reptiles) is cylindrical in the crocodile of the Nile; and the ſmall inteſtine, where inſerted into it, is nearly of equal diameter. In the gavial

(Gangetic

(Gangetic crocodile), the large inteftine has a pyriform figure, the termination of the fmall being inferted into its broadeft part.

In the lizards, the rectum is cylindrical, and much broader than the fmall inteftine which is inferted into it; the latter, after having turned forwards from the pylorus, is folded backwards, and proceeds in a tortuous direction as far as the rectum, which purfues a ftraight courfe to the anus. The parietes of the inteftinal canal are thin and tranfparent; the internal membrane has folds arranged in a zigzag form.

In the cameleon, the coats of the inteftine have the fame ftructure; the capacity of the fmall is not much inferior to that of the ftomach and large inteftine, in the greateft part of its extent; but it becomes much contracted a little before its infertion into the latter. There is no valve indicating the feparation between the different portions; the internal membrane has waving folds, the loofe edges of which have a fringed appearance; they are directed longitudinally, and contracting as they approach the rectum, difappear at fome diftance from that inteftine, where the internal membrane becomes fmooth and without any folds. The mufcular coat is thicker in the rectum than in the fmall inteftine, where it is indiftinct. The cellular coat is not manifeft.

In the dragon, the inteftinal canal forms two turns and a half before it arrives at the anus; the commencement is diftinguifhed only by the different appearance of its coats, which are much thinner than thofe of the ftomach.

In the iguana, the parietes of the inteftinal canal are thin and tranfparent, gradually contracting from the pylorus to the infertion of the fmall inteftine into the rectum; the latter is of an elongated form, but contracted at one part, by which it becomes divided into two portions almoft of a cylindrical fhape. The internal membrane has fome folds directed longitudinally in the fmall inteftine. In the common iguana, which has the inteftinal canal long and very capacious, there is a true cæcum, diftinguifhable from the large inteftine by the greater thicknefs of its coats, and by a partition feparating their cavities, fo that it is through a very narrow orifice that the fecal matter paffes from the cæcum into the fucceeding part of the large inteftine. The infertion of the fmall into the former takes place near its middle. The coats of the cæcum have in fome degree a facculated form. The internal furface is fmooth and without folds. In the large inteftine the internal membrane has the fame ftructure, except at the commencement, where there are found about fix tranfverfe valves, which do not extend around the whole tube of the inteftine. In the fmall inteftine there are longitudinal folds. The pouch formed by the cæcum is about three-fourths of an inch in length, and twice as much in breadth.

In the gecko à gouttelettes the parietes of the inteftine are alfo tranfparent, the fmall has but little capacity, but is unequal at different parts; it is inferted into the centre of the firft portion of the large inteftine, which is of a globular form; and is feparated, by a contraction in its coats, from the fecond portion, which is elongated and oval, the fmall extremity correfponding to the anus. In the Schneiderian fcink the thin and tender coats of the inteftinal canal are much dilated at the commencement of the fmall inteftine, and contracted at the part where it is introduced into the large. We have already mentioned that it is dilated into the form of a bladder, and enveloped by the firft portion of the large inteftine, fimilarly dilated. The excrements, which pafs through the fmall aperture in the veficular dilatation of the fmall inteftine, find their way partly into the interval between the latter and the internal furface of the large. Beyond the firft portion the rectum becomes cylindrical. The fmall inteftine is divided into many pouches by contractions which pretty nearly correfpond to its different turns.

In the ophidian order the inteftinal canal purfues a ferpentine direction as far as the rectum, and preferves nearly the fame diameter throughout, dilating but little in the large inteftine. In the fmall, the internal membrane forms broad longitudinal layers, folded in the manner of ruffles; it is rugous, and in the rectum forms thick, irregular folds, which are continued to the anus. In the coluber natrix, according to Blumenbach, the whole length of the inteftinal canal does not equal that of the animal. The fmall inteftine forms a very confiderable valve at its entrance into the large. Lib. cit. p. 174.

In the falamanders, the fmall inteftine is very narrow in comparifon with the rectum, where the internal membrane forms thick and fimbriated folds. In toads and frogs, we find a nearly analogous conformation and ftructure, there being only a flight variation in the form of the rectum, which is more or lefs of a conical or pyriform fhape, as in many frogs, or cylindrical, as in toads. But in the tadpoles of both, the inteftinal canal is altogether very different from that of the fame animal in the perfect ftate. Long, narrow, and nearly of uniform diameter in the fmall inteftine, making irregular turns in its courfe, its volume augments at the rectum, which becomes of a facculated form, and makes two fpiral turns upon itfelf, before it proceeds to the anus. There is no valve feparating the two portions of the inteftine.

In the firen lacertina the inteftinal canal proceeds almoft in a ftraight courfe from the pylorus to the anus, making but one fmall turn near its middle, from which it proceeds ftraight to its termination. Its coats are tranfparent, and its diameter nearly equal throughout, not admitting of any divifion into fmall and large inteftines.

Phyfiology of the digeftive Organs.—Blumenbach afferts that moft reptiles are omnivorous, while fome are confined to one fpecies of food, as the bufo or rana calamita, which feeds on a few fpecies only of infects, and thofe alive. (Specimen Phyfiol. Comp. p. 29.) We cannot help doubting the accuracy of the firft part of this ftatement: the food feems to us almoft entirely animal. Serpents, frogs, and lizards, live on the fmaller animals or infects; and even the turtles, which eat particular kinds of marine plants, feed alfo on the mollufca. The fimple ftomachs, the fimple and fhort alimentary canals of the whole order, correfpond very clearly to what we underftand concerning their carnivorous habits. Newts feem to care for living infects and worms only, which they feize with their jaws, and fwallow whole.

Two apparently contradictory circumftances have been noticed in this order; great voracity in many inftances, but in all a wonderful power of abftinence. Salamanders fometimes devour their own excrement, and earth. Serpents often take in a quantity of food, which diftends their bodies inordinately, and leaves them inactive, and hardly capable of motion. The falamanders will fometimes ftuff themfelves to fuch a degree with worms, that they crawl up again out of their ftomachs. See Spallanzani's Differtations, vol. i. p. 110.

"A newt," fays Bonnet, "having devoured a large earthworm, I fupplied it with another above four inches long, and thick in proportion. It immediately fwallowed the whole, except a line or two that hung out of the mouth; but the worm was foon thrown up, and the fame repeated twice, but the worm ftill lived." Spallanzani's Tracts, vol. ii. p. 366.

The inftances which are recorded of the abftinence of reptiles feem at firft almoft incredible. Not to mention the toads,

toads which have been found inclofed in blocks of ftone, and which probably have been in a torpid ftate, nor the more common inftances (fee L. Th. Gronovius ad Plinium de Aquatilium Natura, p. 38.) we have the refpectable authority of Caldefi for the fact of tortoifes having remained without food, and not in a torpid ftate, for a year and a half. Blumenbach reports of a tortoife, which he kept for three quarters of a year, that the harmlefs creature never ate any thing the whole time, although every thing that the houfe and garden afforded was offered to him. For the laft three months (from November to February) he exhibited the loweft degree of vitality, manifefted, in addition to extremely flow locomotion, with almoft clofed eye-lids, merely by the fingle fenfe of touch or feeling, particularly of warmth and drafts of air. When he died, the mufcles were as flefhy and frefh-coloured as in the beft nourifhed tortoifes. Abbildungen, &c. No. 66.

Redi had a land tortoife live eighteen months, a cameleon eight, and vipers ten, without food. (Spallanzani's Tracts, Introduction, p. 42.) Toads were quite lively at the end of fourteen and eighteen months, inclofed in pots. Ibid.

Blafius mentions, in his "Anatomia Animalium," that a land tortoife which he kept ten months would take no food during the whole time.

Bonnet, fpeaking of newts, fays, "thefe animals can fupport the want of food very long. Some of mine have lived two months without it. Sign. Spallanzani had remarked the fame; and obferved, that although long deprived of nutriment, they reproduced their members equally well as thofe plentifully fupplied with fuftenance." (Spallanzani's Tracts, v. 2. p. 364.) Blumenbach has kept falamanders eight months without taking food, or appearing to fuffer from the want of it. (Handbuch der Natur gefchichte, p. 220.) Daudin afferts that fnakes and vipers may be kept for fix months without food, yet feem to lofe none of their activity: t. 1. Introd. p. 270.

Some protei, which Dr. Schreibers of Vienna had kept in his poffeffion for two years, had taken no food, and were quite well. (Cuvier, Rech. fur quelques Rept. douteux; l'Anat. du Proté.) Bruce ftated that he had kept the ceraftes in a bottle for two years without food, and Lacépéde reports, on the authority of Shaw, that a Venetian apothecary kept two of thefe fafting for five years. (See Daudin, vol. vi. p. 186.) This power of fafting belongs, in a greater or lefs degree, to the whole order. For a comparifon between the power of abftinence of warm-blooded animals and reptiles (the ftate of torpidity being excepted), fee Diff. Academ. Inftit. Bonon. ap Benedictum 14. Pont. Max. de fervor. Dei Beatificatione, lib. 4. p. 1. pag. 328.; alfo Beccarius in Comm. Inftit. Bonon. t. 2. p. 1. pag. 223.

No reptiles mafticate: the herbivorous amphibia gnaw off the vegetable productions on which they feed, but they do not chew them. The ftructure of their jaws, teeth, and tongue, gives them the power of fwallowing entire animals: this procefs of deglutition, being often exercifed on animals as broad as themfelves, and broader, is very flow, and occupies even hours. The œfophagus muft of courfe poffefs a great power of dilatation. In his account of the newt, Bonnet fays, "that worms are feized with a fudden motion of the animal's jaws, and fwallowed alive, with gentle fhocks of the whole body, and particularly of the anterior part. The prey is always fwallowed without maftication: the minute teeth, which are not employed in chewing, ferve to prevent the efcape of the animal, which twifts itfelf about moft actively. Long worms are devoured entire, notwithftanding all their exertions to efcape. They twine round the neck of the newt like a ferpent: every moment they become fhorter, and gradually difappear. Thus have I feen a newt fwallow a worm more than fix inches long in lefs than five minutes. A large worm, feized by the middle, is feldom fwallowed in the fame pofition, becaufe it is too large, if doubled in the mouth, and the newt gradually fhakes it out, until it can feize one of the extremities; which being accomplifhed, the worm is foon devoured. However, I have obferved a large one fwallow a worm taken by the middle, without feizing an extremity; but a quarter of an hour was occupied in the meal. The fucceffive motions of deglutition are very fenfible; it is performed by repeated fhocks. Though they have flexible jointed fingers, they make no ufe of the hand, either to feize their prey, convey it to the mouth, or retain it there." Spallanzani's Tracts, v. 2. p. 364.

The length and capacity of this tube, and its large communication with the ftomach, are well fuited to the nature of ferpents. The prey, always fwallowed without maftication, is often too long to pafs entirely into the ftomach: it remains in the œfophagus until room is made for it. Travellers have even afferted that one end of an animal fometimes hangs out of a ferpent's mouth, while the other is in the ftomach.

As there is no maftication in this clafs, nor any provifion like the gizzard of birds, for comminuting the food when fwallowed, the procefs of digeftion muft be effected by the action of the ftomach alone on the prey fwallowed entire. The juices of the organ are fully adequate to this effect; and the procefs has been demonftrated by experiment in feveral genera by Spallanzani. He inclofed food in tubes, and conveyed them into the ftomach of the frog, the newt, and different ferpents; and always found that it was diffolved in a longer or fhorter time: it thus appears that the effential nature of digeftion is the fame as in the warm-blooded animals: but the procefs exhibits fome modifications, as the different nature and habits of the animals would naturally lead us to expect. The chief difference is that the folution requires a confiderably longer time than in warm-blooded animals. The flefh in the tubes, conveyed into the ftomachs of frogs, was not completely diffolved until the third and even the fifth day. (Differtations, v. 1. p. 102.) Yet although the gaftric liquor of frogs acts fo flowly, it is capable in time of diffolving even bone: Spallanzani met with a moufe in the ftomach of a frog; all the foft parts of the limbs were gone, fo as to have only the naked bones, which were confiderably wafted, and converted into a femi-gelatinous fubftance. (Ibid. p. 102.) Earth-worms enclofed in tubes were converted into a whitifh pulp in thirty hours, in the ftomach of the water newt; p. 104. He found numerous fmall white worms in the ftomachs of three-fourths of all the newts he examined, from five or fix in number to a hundred and more. Thefe were fo delicate that they would not bear even flight preffure; and thus afford a proof that nothing like trituration can go on in the ftomach, but that digeftion is fimply folution by the gaftric liquor; p. 104—111. In ferpents the procefs occupied from two to five days. The tibiæ of frogs were almoft completely diffolved in five days; § 118—122. As the animals fwallowed by ferpents often lie in part in the œfophagus, a queftion arifes, whether they undergo any digeftion in that tube, or whether this function be the exclufive attribute of the ftomach. A viper, fays Charas (Defcrip. Anat. de la Vipère,) vomited a lizard, which had been fwallowed twelve days before. All the front of the body, which had been in the ftomach, had merely

merely the bones remaining, while the other parts were nearly as perfect as if they had been fwallowed the fame day. Spallanzani confirmed this want of digeftive power in the œfophagus, by direct experiment ; § 125. Naturalifts, fays this indefatigable inquirer, were already apprized of the tardinefs of digeftion in ferpents. Bomare, in his Dict. d'Hift. Naturelle, gives an account of a ferpent at Martinique, which retained a chicken in its ftomach for three months, and did not completely digeft it. "It is remarkable that flefh does not become fœtid from remaining long in the ftomachs of thefe cold animals, which I had occafion to obferve particularly in a viper. A lizard was retained in its ftomach for fixteen days, at the end of which time it had no odour but that of the gaftric juice. Yet fuch was the heat of the feafon, that another lizard, which I had placed in a clofe veffel, containing a little water, emitted an infupportable ftench before the expiration of the third day ; § 127. The gaftric liquor of a fnake approaches in colour to that of foot ; it had the fluidity of water, and evaporated very flowly ; it had both a falt and bitter tafte, and was not inflammable. It ftrongly refembled the gaftric fluid of other animals, and this refemblance extended to the odour, which was exactly like that of the correfponding juices of birds of prey ; § 123.

The idea of Blumenbach, that the venom of the poifonous ferpents fupplies the place of maftication, and promotes digeftion by fome feptic power, feems completely unfounded. It is a provifion calculated merely for purpofes of offence. Where is this feptic power, or what fupplies its place in the harmlefs ferpents, and in all other amphibia ?

The whole alimentary canal of the amphibia abounds with a vifcid tenacious mucus, the abode of feveral genera of worms.

Blumenbach failed completely in very numerous and diverfified attempts to cram frogs and lizards with madder root, and thus to produce in their bones that beautiful rofe colour, which is fo quickly produced in the mammalia of birds, when thus fed. Specimen Phyfiol. p. 31.

Abforbing Veffels. —This fyftem has been very little examined by anatomifts, probably on account of the minutenefs of the tubes, and the confequent difficulty of injecting them. We have nothing to add to the account given by Hewfon, who firft defcribed them in the Philofophical Tranfactions, 1769.

No lymphatic gland has been yet feen in a reptile : birds have none in their mefentery, but they are feen connected to the large lymphatics of the neck.

It has been afferted that the chyle is colourlefs, and hence anatomifts have explained why the veffels were fo long undifcovered. In animals which have white chyle, the appearance of this fluid through the tranfparent coats of the lacteals fupplies the place of injection, and affords an eafy method of demonftrating them. Mr. Hewfon ftates that he faw white chyle in a crocodile.

The diftribution of the lacteals (if that term may be employed where the chyle, inftead of being like milk, is tranfparent) on the inteftine of the turtle, forms one of the moft elegant preparations in comparative anatomy. By fixing the injecting tube in a veffel near the inteftine, and waiting with a little patience, the quickfilver will gradually find its way into the minute ramifications of the lacteals. The large trunks on the mefentery contain valves, fo that we cannot fucceed in filling the abforbents of the inteftine from them ; but the ramifications on the inteftine itfelf are deftitute of thefe folds, fo that when once the quickfilver has reached the furface of the gut, it will run forward without any obftacle. The peritoneal furface of the gut is completely covered with ftraight parallel branches, running according to the length of the inteftine. Its inner furface is no lefs thickly covered with lacteals of a different appearance. When dried it feems as if the quickfilver were contained in fmall cells, covering the whole internal furface of the inteftine fo completely, that the point of a pin could fcarcely be placed between them. Mr. Hewfon has particularly defcribed this appearance, and was doubtful whether it ought to be referred to extravafation or not. But we are convinced, from frequent examinations of this cellular ftructure, that it is a part of the natural organization ; becaufe the cells are regular and uniform in their fize and arrangement ; no force is ufed in the experiment ; and a real extravafation prefents an appearance altogether different. The extent of the abforbing fyftem, as demonftrated in this way, is beyond any thing we could form an idea of from injections in man or warm-blooded animals.

After leaving the inteftine, the lacteals accompany the blood-veffels on the mefentery, running at their fides, and communicating acrofs them. Each artery has two veins, and there is a lacteal or more at each fide of each of the three veffels ; fo that their number confiderably exceeds that of the blood-veffels. A coarfe reprefentation of them, on the mefentery, is exhibited in Monro's Phyfiology of Fifhes, tab. 30.

Near the root of the mefentery the large lacteals anaftomofe, fo as to form a net-work, from which feveral large branches go into fome confiderable lymphatics on the left fide of the fpine. Thefe laft can be traced downwards almoft to the anus, and belong to the parts fituated below the mefentery, and particularly to the kidnies. At the root of the mefentery, on the left fide of the fpine, the lymphatics of the fpleen join the lacteals, and immediately above this union a fort of plexus or net-work is formed, which lies upon the right aorta. Flom this plexus a large branch arifes, which paffes behind the right aorta to the left fide, and gets before the left aorta, where it affifts in forming a large receptaculum, lying in front of that artery. The thoracic ducts arife from this receptaculum. From its right fide goes one trunk, which is joined by that large branch which came from the plexus to the left fide of the right aorta, and then paffes over the fpine. This trunk is the thoracic duct of the right fide ; for having got to the right fide of the fpine, it runs upwards on the infide of the right aorta, towards the right fubclavian vein. And when it has advanced a little above the lungs, or within three or four inches of the fubclavian vein, it divides into branches, which, near the fame place, are joined by a large branch that comes up on the outfide of the aorta. From this part upwards, thofe veffels divide and fubdivide, and are afterwards joined by the lymphatics of the neck, which likewife divide into branches before they join thofe from below ; fo that between the thoracic duct and the lymphatics of the fame fide of the neck a very intricate net-work is formed. From this net-work a branch goes into the angle made by the jugular vein, and the lower part, or trunk, of the fubclavian : this branch, therefore, lies on the infide of the jugular, whilft another gets to the outfide of that vein, and feems to open into it a little above the angle between that vein and the fubclavian. Into the above-mentioned receptaculum the lymphatics of the ftomach and duodenum enter : they have numerous anaftomofes, forming a beautiful net-work round the artery which they accompany. From this receptaculum likewife, befides the trunk already mentioned, which goes to the right fide, arife two other trunks, nearly equal in fize ; one of which runs upon the left fide, and the other upon the right fide of the left aorta, till they come within two or three inches of the left

left ſubclavian vein; where they join behind the aorta, and form a number of branches, which are afterwards joined by the lymphatics of the left ſide of the neck: ſo that here a net-work or plexus is formed, as upon the right ſide. From this plexus a branch iſſues, which opens into the angle between the jugular and the lower part or trunk of the ſubclavian vein. In theſe net-works, formed by the lymphatics near their termination in the veins, this ſyſtem in the turtle differs remarkably from that in birds. Hewſon's Account of the Lymphatic Syſtem in Amphibious Animals, Philoſ. Tranſ. vol. 69. p. 198.

The Liver, which is divided in the mammalia into ſeveral lobes diſtinct from each other, and is more uniform in birds, is ſtill leſs divided in reptiles. Often it has no diviſion of lobes, but is merely irregularly fiſſured on its looſe and thin edge. Its proportionate ſize, however, is more conſiderable than in the two claſſes juſt mentioned. Occupying uſually the two hypochondria, it extends far backwards under the inteſtines, and is ſupported in its poſition by folds of the peritoneum, analogous to thoſe which exiſt in the mammalia. Its colour is no longer that reddiſh-brown which is ſeen in the mammalia and birds; but it partakes more of yellow.

In the chelonians the liver exhibits a peculiar arrangement, being divided into two rounded irregular maſſes, of which the right occupies the ſame hypochondrium, and the other is connected to the ſmall curvature of the ſtomach. They are united by two narrow productions of the ſame ſubſtance, in which the principal veſſels paſs. In the green lizard, the geckos, the dragons, the iguanas, it forms a ſingle maſs of various figure, flat or convex below, concave above. Its looſe edge has two fiſſures in the dragon, dividing it into three lobes, of which the right is prolonged into a ſort of tail. There is only one fiſſure in the geckos, and the right part is equally more extenſive than the left. In the common iguana it is lengthened into a long appendix. In the crocodile and cameleon the liver has two very diſtinct lobes; and moreover, in the latter, a long appendix. It has only one lobe in the ſerpents, in whom it is long and cylindrical. Like other organs, it aſſumes in this order a figure correſponding to the elongated form of their bodies. There is one lobe only in the ſalamanders, but two in the other batracians.

Hepatic Canals.—The common trunk of theſe canals is uſually ſeparate from the cyſtic duct, and not inſerted with the latter in the inteſtinal canal, in reptiles, as well as in birds. This has been obſerved in the chelonian and ſaurian orders, in ſeveral ophidians, and ſome batracians. Yet this arrangement is not conſtant. For, in the crocodile, where the hepatic is ſometimes ſeparate from the cyſtic duct, it ſends at other times a branch to the gall-bladder, which is inſerted a little above its neck, and is itſelf united to the cyſtic canal, not far from the inteſtine. The mouth of the common canal was diſtant from the pylorus, ſays Cuvier, 0.26 in a crocodile, whoſe whole inteſtinal canal was rather more than a metre (about 39½ inches) in length.

In the teſtudo græca the hepatic canal ſends a branch of communication to the cyſtic canal, not far from the gall-bladder; but theſe two canals open ſeparately into the inteſtine, though near each other; the former before the latter.

The Gall-Bladder has its fundus uſually directed backwards. Its proportional volume is leſs conſiderable than in mammalia and birds; and it is more intimately connected with the liver than in theſe claſſes. In the teſtudines it is almoſt entirely concealed in the right lobe of the viſcus; and is placed under the ſame lobe in the crocodile. Where the liver is not divided into lobes, the ſituation of this reſervoir is marked out by a fiſſure. In the ophidians the gall-bladder is abſolutely ſeparated from the liver, and ſituated at the ſide of the ſtomach, near the pylorus, a ſhort diſtance beyond the poſterior extremity of that viſcus. Its form is generally oval, but it approaches to the cylindrical figure in the iguana.

The connections of the cyſtic and hepatic canals have been already mentioned. The former remains generally diſtinct from the latter, by the ſide of which it is inſerted into the inteſtine. Sometimes it receives the branches of the latter in ſucceſſion.

The Pancreas is a conglomerate gland, as in mammalia and birds, and poſſeſſes the ſame ſtructure (with ſome unimportant modifications of colour, conſiſtence, lobular diviſions, &c.) as in man. Its poſition and figure vary in reptiles. In ſeveral chelonians it is triangular. That of the Nilotic crocodile is divided into lobes: it is irregular in the ophidians, and ſituated on the right of the origin of the inteſtinal canal. In the frog its figure is equally irregular, and it is ſituated in the arc formed by the ſtomach towards the front. It is placed in the firſt curve of the inteſtine in the ſalamander.

There is either a ſingle or double pancreatic canal. In the Nilotic crocodile, for example, there are two, inſerted in the inteſtine after the biliary canals, while there is only one in the land ſalamander, the inſertion of which precedes that of the biliary tubes.

The Spleen.—This is a viſcus, of which the uſe is not hitherto underſtood. It exiſts in all the vertebral animals; but its importance ſeems to diminiſh as we paſs from mammalia to birds, from the latter to reptiles, and from theſe again to fiſhes; at leaſt, if we may judge from the ſucceſſive diminution of its volume in theſe four claſſes.

Its figure varies conſiderably in this claſs. It is ſhaped like the kidney in the teſtudines; ſmall and ſpherical in the frogs and toads; elongated in the ſalamanders, as well as in the ſaurian and ophidian orders.

The abdominal Cavity, Peritoneum, and its Proceſſes.—The offices of this membrane, in covering and inſulating the various viſcera, confining them, by its continuations and folds, more or leſs cloſely to the ſides of the cavity, and facilitating, by its ſmooth ſurface, their motions with reſpect to each other, and to the containing cavity, will convince us of the importance of the membrane, and lead us to expect that it ſhould exiſt very generally. We, conſequently, find it in all the vertebral animals. Generally white, delicate, and tranſparent, it is ſometimes black in reptiles.

In this claſs, as in birds, there is no diaphragm, and conſequently no diſtinction of abdominal and thoracic cavities. All the viſcera are contained in one large cavity, and ſurrounded by one membrane. Geoffroy, however, deſcribes ſome muſcular fibres coming from the ſternum, and fixed to a membrane covering the convexity of the liver, which ſeem like the rudiment of a diaphragm. Annales du Muſeum, v. ii. p. 50.

In the chelonians, the membrane produces certain ſubdiviſions of the common cavity of the thorax and abdomen. We remark, 1ſt, the cavity of the lungs, which are continued far backwards, above the heart, liver, and inteſtines; 2dly, that of the heart, or pericardium, which touches the following behind; 3dly, that of the abdominal viſcera, containing the ſtomach, liver, inteſtines, ovaries, teſticles, and urinary bladder. In front it covers the liver, forming a ſort of membranous diaphragm, ſeparating it from the heart; and it cloſes the cavity of the pelvis behind. It alſo furniſhes the meſenteric folds. The texture of this membrane appears ſtronger in the teſtudines than in other reptiles.

 The

The mefentery exhibits, in the different orders of reptiles, fome varieties, which we fhall fhortly notice. The firft fold, which is attached to the fmall inteftine in the teftudines, does not come immediately from the vertebral column, and does not form the mefentery properly fo called, until after it has fixed the arch of the colon by means of a mefocolon. The duodenum is confined in the right hypochondrium, and loins, by laminæ of the common membrane, which cover it, and are then continued to the abdominal parietes. The mefentery of ferpents is a narrow fold, not coming immediately from the vertebral column: the blood-veffels form numerous anaftomofes between its laminæ, as in warm-blooded animals.

The faurians have a mefentery tolerably developed. The production, which goes to the large inteftine, like that which belongs to the fmall, comes from the vertebral column. There is no tranfverfe mefocolon.

Reptiles have no *omenta;* but ftructures apparently analogous to thefe fatty membranes occur in fome of them. The ferpents have membranous proceffes, containing much fat, and extending, like the great omentum of the mammalia, under the inteftinal canal. Many faurians have alfo two productions of peritoneum, loaded with fat, advancing from the front edge of the pelvis under the abdominal vifcera; there are fatty lobes attached to the tefticles and ovaries of frogs. The latter are not regarded by Blumenbach in the light of omenta. " The yellow appendices," fays he, (ductus adipofi, appendices luteæ,) " which are found in the frog, on either fide of the fpine, and fometimes form one mafs, fometimes are divided into feveral fmaller portions, were confidered by Malpighi as a kind of omentum. (De omento et adipofis ductibus, oper. t. 2. p. 35, &c.) That this refemblance is very remote, appears from feveral circumftances; and particularly from the conftant and remarkable variations of fize which occur in thefe parts at the pairing feafon." Comparative Anatomy, tranflated by Lawrence, p. 193.

Thefe bodies, being apparently connected to the tefticles and ovaries, are defcribed with the generative organs by Swammerdam and Roefel. They confift of a pedicle, attached more particularly to the emulgent vein on each fide, and of two, three, to feven or more pieces joined to it, varying in fize according to the age and feafon. They are proportionally large in the tadpole. They may be feen fmall in female frogs, which have not yet laid their ova, although Roefel afferts that they increafe in fize with the generative organs. In this fmall ftate, Cuvier obferves, that a veffel, filled with venous blood, and producing no branches, may be feen in the axis of each fringed portion. Thefe veffels all join to form a common trunk in the pedicle; and this trunk terminates in the emulgent vein.

The abfence of omentum in this clafs does not accord with its fuppofed ufe to keep the inteftines warm. Is there any proof that the inteftines are warmer with it, than they would be without it? And is there not as great a neceffity for preventing the efcape of heat in reptiles, or in birds, (which alfo have no omentum,) as in the mammalia? Cuvier obferves, that many of the hybernating mammalia have two lateral omental appendices, which, with the principal omentum, are abundantly furnifhed with fat in the winter, fo as to form " an adipous covering for the inteftines, which no doubt contributes powerfully to retain their natural heat, to prevent the accefs of cold, and to fupply the place of food." All reptiles are torpid in the winter, yet they have no omenta.

Urinary Organs.

The Kidnies.—Thefe are diftinguifhed from the fame glands in mammalia, and refemble thofe of birds and fifhes, in the impoffibility of diftinguifhing in them the two fubftances (fee KIDNEY), and in the abfence of infundibula and pelvis. Their fituation, form, and relative fize, vary in the different orders.

In the chelonians and faurians, they lie far back in the abdominal cavity. They adhere clofely to the pelvis in the lizards properly fo called, under the facrum, and penetrate even under the tail; they go as far back, but they advance farther in front, in the falamanders. They lie altogether farther forwards, and very near each other, in the other batracians. In thefe three orders both kidnies are fituated at the fame height, and covered by the peritoneum on their inferior furface only. In the ophidians, the right is placed further forwards than the left; and they are connected, on each fide of the vertebral column, merely by a prolongation of peritoneum, which furrounds and fufpends them, without fixing them to the fpine. There is a manifeft relation between the peculiar arrangement, and the great mobility of the column in thefe animals.

Their form is fhort and thick in the chelonians, more or lefs elongated and flattened oval in the faurians and batracians, and extremely elongated in the ophidians. They confift, in the latter, of numerous feparate lobes, placed in a chain one before the other. They are alfo minutely divided in the chelonians, at leaft on their two furfaces; for all the lobes are united in the centre. They form, on their furface, a kind of convolutions refembling thofe of the brain, and giving the glands a peculiar afpect.

Among the faurians, the crocodiles have them much divided, at leaft at a certain age. In a fmall crocodile, about a foot in length, Cuvier faw no divifion, while there were many in a larger individual of the fame fpecies. It would be fingular if this fhould turn out to be a conftant difference, as it is exactly the converfe of that which exifts in man. They are without lobes, or only flightly divided in other genera of the fame order. They have no divifions in the batracians.

The origin of the ureters is analogous to that of birds; and their length varies according to the fituation of the kidnies.

They end in the urethra in the chelonians, and the urine paffes from that canal into the bladder.

They are fhort, large, and thick-fided in the crocodile, and pierce the fuperior furface of the cloaca, at a confiderable diftance from each other.

The principal ramifications of the urinary canals are eafily feen in the ophidians, ending fucceffively, as they come out of each lobe, in a common trunk, which follows the internal edge of the kidney, and forms the ureter. Arriving near the cloaca, each is dilated into a fmall oval bag, and then terminates feparately.

In general they terminate in the cloaca or bladder, according as the latter refervoir exifts or not.

Urinary Bladder.—Reptiles vary much in refpect to the exiftence of this part. The chelonian and batracian orders have it: and it is found in the following genera of faurians; *viz.* the iguana, tupinambis, cameleon, dragon, ftellio: while it is wanting in the crocodile, lizard, agame, gecko, other genera of the fame order; and in the ophidians.

The bladder is very large, with thin fides and weak mufcular fibres in the chelonians; and it has a more or lefs marked divifion at its fundus into two portions. A very fhort urethra opens on the inferior furface of the cloaca: its cavity prefents two prominences on each fide, of which the anterior is pierced by the orifice of the vas deferens, the pofterior by that of the ureter.

The

The bladder always receives the urine by its neck, or by a beginning of an urethra, which opens immediately into the cloaca.

There are two large membranous bags in the frog and toad, occupying the situation of the urinary bladder, generally considered as such, and so described by Blumenbach and Cuvier. Townson doubts whether they ought to be considered as part of the urinary apparatus. (See his Tracts and Observations, p. 66. tab. 3.) They have no connection with the ureters. Indeed it is very clear, that the latter tubes open on the superior surface; while these two receptacles terminate on the inferior surface of that intestine. They contain a pure water. Their size, which exceeds all ordinary proportion to the bulk of the kidney, renders it likewise probable that they are not receptacles of urine.

Renal Capsules.—The parts to which this name has been given, and which are found in the three first orders of reptiles, are still smaller in proportion, than in mammalia and birds, and are completely separate from the kidnies. In the chelonians they are connected to the emulgent veins. In the saurians and ophidians they lie in the fold of the peritoneum, which unites the ovaries and oviducts.

For a description of the fringed fatty appendices, which are found in the batracian order near the testicles and ovaries, and the vessels of which join the emulgent veins, see the account of the omenta.

Organs of Circulation.—The whole of nutrition is effected at one operation in zoophytes: chyle passes into the parts in proportion as it is made; in insects also it bathes them as soon as it is formed, and they appropriate it. In the superior animals, there is an intermediate operation: a particular fluid only, always moving in a certain system of vessels, immediately nourishes the parts; and this fluid is renewed by the chyle. The motion of this peculiar fluid, of this blood, is called circulation;—a process confined to the superior classes, that is, to the vertebral animals, the mollusca, the worms, and the crustacea.

There are two principal points for our consideration in the circulation; its agents, and the routes of the blood.

That part of the latter is particularly interesting, which conducts the blood to the respiratory organ. One of the chief purposes of the circulation is to conduct the blood constantly, in greater or smaller quantity, into an organ, where it may undergo the mediate or immediate action of oxygen; and, as the qualities of the blood depend much on the degree of force of this action, and in the modification which the blood receives from it, while all parts of the body, being nourished by this blood, partake of its qualities, it follows that the whole nature of an animal will be in some sort determined by the distribution of its circulating organs, and by the route which this distribution marks out for the blood.

Hence arises the importance of the structure of the heart, in reference to natural history, and the correctness of the characters drawn from it for the formation of classes. Men of genius had foreseen, rather than demonstrated this importance; but it has been established on rational principles only in modern times.

The circulations through the body and the lung are called, respectively, the great and the minor. In the former, all the blood returning from the body by the *veins*, which joining together from all parts, ultimately end in one trunk, goes again to these parts by the *arteries*, of which a common trunk is gradually divided and sub-divided, until the last divisions, as well as their union with the roots of the veins, escape the eye.

If the common trunk of the veins communicated directly with the common arterial trunk, there would be a single circulation; the blood brought back to the centre, would be sent again immediately to the parts, to return again directly, and so on; but this never takes place entirely.

Before the blood, brought back to the common trunk of the veins, can again enter that of the arteries, it must be sent in part, or altogether, to the pulmonary organ, in order to undergo the action of the atmosphere.

If the circulating organs be so arranged that every drop of the blood goes through the lung, by the minor circulation, before it can enter the arterial trunk, the common trunk of the veins of the body sending all its blood into the pulmonary arterial trunk, whose ultimate ramifications communicate with veins united into a common trunk, sending all its blood into that of the arteries of the body, there is a *double circulation*.

If, on the contrary, the common trunk of the general veins, instead of being distributed entirely to the lung, should only send to it a branch, while the rest of its blood should go directly into the common trunk of the general arteries, the minor circulation would be only a fraction of the great, more or less considerable, according to the size of the branch devoted to it. In each circuit of the blood, respiration would be exercised on a part only of this fluid, and the rest would go again into the body by the arteries, without having passed through the lung. This blood, and the parts nourished by it, would participate less, ceteris paribus, in the qualities which respiration could impart to it. This is what takes place in reptiles; their pulmonary circulation is only a fraction of the great, more or less considerable in the different genera. The other classes, *viz.* the mammalia, birds, fishes, mollusca, and worms, have a double circulation, and no part of their blood can return into the great, until it has gone through the minor circulation.

Yet we are not to conclude that the ultimate effect of respiration is the same, because circulation is the same. The mode of respiration may be different, and, as this is one of the factors, the product will be affected by its alteration. All the animals last enumerated have an entire pulmonary circulation, while, in reptiles, it is only a fraction: let them be, for example, as 1 to $\frac{1}{2}$. Now fishes, mollusca, and worms, breathing in water, and that oxygen only, which is mixed and contained in this water, may be considered as having a half-respiration, while reptiles, breathing air itself, have an entire one. An entire respiration, multiplied by a half-circulation, and a half-circulation by an entire respiration, give the same product; which is, in both cases, a half-oxygenation of the blood, using this term merely to express the changes taking place from breathing.

Mammalia have an entire circulation and respiration; and consequently an entire oxygenation. The quantity of the latter is even greater in birds in consequence of the peculiar manner in which air is introduced into all parts of their body.

The fraction of $\frac{1}{2}$ is only adopted for the purpose of illustration; the quantity probably varies in the different genera of each class, and cannot be rigorously appreciated.

By these considerations we may estimate, and in a manner calculate, the nature of each animal. As respiration gives to the blood its heat and energy, and through its medium imparts excitability to the organs, its quantity will determine the degree of vigour in the animal functions. Hence we deduce the great force of the moving powers, the acuteness of the senses, the rapidity of digestion, and the heat of the passions in birds. Hence the more moderate degree of all these in the mammalia; hence the inertness, the inactivity, and apparent stupidity, of the other classes. Hence, too, the various modifications of vital temperature natural to each

each of thefe claffes, which are in an exact ratio to the degree of their other qualities.

The circulation is effected by means of mufcular powers, which are applied particularly to the arterial fyftem; the venous feeming to be merely paffive. A hollow mufcle, called a *ventricle*, poffeffing great and continued irritability, and contracting forcibly on the blood whenever it arrives, is placed at the union of the venous and the correfponding arterial trunk. Valves are placed at its two openings; one valve allows the blood to enter, and prevents it from going back again, while the other permits its exit, and cuts off the return. The ventricle then cannot contract without diftending the arteries, pufhing forwards the blood, which they contain already, and thus producing the *pulfe*. The ventricle, having expelled the blood which irritated it, is relaxed and dilated, and then immediately filled with a frefh quantity of blood from the veins. Before entering the ventricle, the vein is dilated into a mufcular fac, called the *auricle*, with much lefs confiderable mufcular fides. This is irritated by the blood received from the vein, contracts on it, and fends it into the ventricle. It is hardly neceffary to add, that the auricle and ventricle contract alternately.

Animals with a fimple circulation have a fingle ventricle; but they poffefs fometimes two auricles. When the circulation is double, there may be a ventricle at the origin of each artery, or at that of one only. Mammalia and birds have two, and the fepiæ among the mollufca.

All other animals have a ventricle at the origin of one only of the two arteries, but not of the fame in all. It is placed, in fifhes, at the origin of the pulmonary artery; in the mollufca at the origin of the artery of the body, or the *aorta*, which is the name of that artery.

The union of the auricle and ventricle conftitutes the *heart*. We find, therefore, in fifhes and mollufca, a fimple heart, *pulmonary* in the former, *aortic* in the latter. Reptiles, alfo, have a fimple heart, at once pulmonary and aortic. Mammalia, birds, and fepiæ, have a double heart, or rather two, a pulmonary and an aortic, hearts.

In mammalia and birds the two hearts are united, and form one mafs, which commonly bears the name of heart, as if it were a fingle organ. This is not the cafe in the fepiæ. See VERMES, in *Comparative Anatomy*.

We may now underftand what naturalifts mean, when they fay that mammalia and birds have a heart with two auricles and two ventricles; reptiles and fifhes a heart with a fingle auricle and ventricle. The latter phrafe, befides comprifing, in a common expreffion, two things really very different, contains alfo an error of fact; for many reptiles have two auricles.

Refpecting the hearts of mammalia, birds, fifhes, and mollufca, fee the articles MAMMALIA, BIRDS, FISHES, and VERMES, in *Comparative Anatomy*. For the phyfiology of the circulation, the powers and actions of the heart, and the other organs concerned in it, fee CIRCULATION and HEART.

The effential ftructure of the heart is the fame in all animals; there are only modifications of greater or lefs importance. It is covered externally by a fmooth membrane, the reflected portion of the pericardium; its cavities are lined by another fmooth membrane, continuous with the linings of the blood-veffels; and there is more or lefs mufcular fubftance interpofed between them. The exiftence of the pericardium is as general as that of the heart; its nature and difpofition are fo nearly alike in all animals, that it is not worth while to notice the modifications.

Of the Heart.—In the different orders of reptiles, the heart is found to vary in fome parts of its ftructure; there is, however, no effential difference, when viewed in relation to its functions. The three firft orders have a heart confifting of two auricles and a fingle ventricle, which is fometimes divided into many cavities, communicating with each other. On the other hand, in the batracians there is but a fingle auricle and ventricle, with its cavity of a fimple form. We fhall enumerate fucceffively the differences of ftructure in the four orders of this clafs of animals.

Firft in the chelonians. In the animals compofing this order, the heart has a form altogether peculiar. The length of the organ is much exceeded by its breadth; in fome inftances, it refembles the fegment of a fphere; in others, it is of a fquare but elongated form, and curved in its longitudinal direction. In its natural fituation, it is found beneath the lungs, in front of the liver, and partly between the two lobes of the latter. The pericardium, which is capacious and ftrong, is in contact with the membrane invefting thofe organs, and is as firmly adherent to it as the pericardium is to the diaphragm in man.

The magnitude of the two auricles is much greater in proportion, than in any animals of the claffes of mammalia or birds; the capacity of each is at leaft equal to that of the ventricle; they are fituated in part above the latter, projecting upon its lateral and anterior parts. They poffefs fomewhat of a rounded form, are without any appendix, and have their parietes thin, with fome flefhy fafciculi in their ftructure. The right auricle, which exceeds in a trifling degree the fize of the left, receives, by a fingle opening at its upper part, the blood returning from the body. Two valves are placed around the borders of the opening, giving it the appearance of a fimple fiffure. The pulmonary veins alone terminate in the oppofite auricle; their termination is provided in the fame manner with two valves. A fimple membranous partition feparates the cavities of the two auricles and their openings into the ventricle. It is on the ventricle that depends the form which we have defcribed as belonging to the heart. Its cavity is very fmall in comparifon to its fize, which is owing to the great thicknefs of the parietes. Thefe are found to be compofed exteriorly of a moderately thick layer of fibres, which have a direction parallel to the external furface of the ventricle. Beneath thefe, there are other numerous mufcular fafciculi, varying in their direction, but proceeding principally from the fuperior to the inferior furface; the greater number of them are only contiguous, or feparated from each other, allowing the blood to pafs through the intervals formed between them as through a fponge. It refults from this ftructure, that the cavity of the ventricle is diminifhed to one-third of its volume; it occupies the middle and right fide of its bafe. In its greater part, it is lined by a continuation of the membranous fold which covers the auricular orifices, performing to them the office of a valve; it is of a fquare form, attached at the middle of its external furface to the partition between the auricles, and by its fuperior and inferior fides to the correfponding parietes of the ventricle; it is only loofe and unconnected in its right and left borders. The firft is extended over the opening of the auricle on the fame fide, and the latter over that of the oppofite auricle; fo that thefe openings appear in the ventricle feparated by the breadth of the fold, while in the auricles there is but the thin feptum intervening between them. The blood returning from the lungs into the left auricle is directed into the ventricle by means of the valve belonging to the former, in a courfe directly contrary to that leading to the opening belonging to the arteries of the body. It muft, therefore, neceffarily pafs through the whole cavity of the ventricle, from the left to the right, and

and into the intervals of the mufcular fafciculi compofing the parietes. From this ftructure it refults, that there muft be an admixture in the ventricle between the blood returning from the lungs, and that portion which has not been fubmitted to the influence of the furrounding element in its paffage through thofe organs. The opening between the right auricle and the cavity of the ventricle is in a fituation immediately directed towards the two cavities leading to the pulmonary arteries and arteries of the body; they are both fituated completely to the right, in the cavity of the ventricle. The firft, which is not always of the fame magnitude, is placed inferiorly to the other, having a wide communication with it. In fome inftances the opening is extended very far towards the pofterior part of the heart; in others it is fo fmall, as in the land tortoifes, that it does not exceed the diameter of the cavity leading to it. It is only in the firft conformation, of which we find examples in many of the fea tortoifes, that the appellation of pulmonary cavity can be applied to it. The blood arriving from the right auricle purfues a direction more particularly towards that part, by a channel leading from the one to the other. There is but one opening leading from the pulmonary cavity, which is that of the pulmonary artery; it is provided with two valves, and penetrates the bafe of the heart more inwardly than the openings to be next mentioned. Thefe are the terminations of the two aortæ, which are found near to each other on the right fide of the fuperior cavity, the fame which receives the blood of the two auricles. The termination of the left aorta is fituated a little more inwardly than that of the right, and inferiorly to it. They are each provided with two femicircular valves. This is the ftructure found in the fea tortoife; but in the land fpecies the arteries of the body arife by a fingle opening from the ventricle. The heart of the turtle is beft delineated by Mery, in the Acad. des Sciences, 1703.

In the fecond order of reptiles, the faurians, we fhall commence with a defcription of the heart of the crocodile, which prefents an example of the moft complicated ftructure that we have found in the animals of this order, or even in the whole clafs of reptiles. The pericardium is found, as in the chelonians, adhering to the peritoneum invefting the convex furface of the liver. The apex of the heart is connected by a very ftrong tendinous chord to the loofe part of that bag, which is extremely thick, and has a fibrous ftructure externally. In its natural fituation the organ is found occupying the fpace between the two lobes of the liver and the lungs on each fide. The fize of the auricles is fomewhat lefs than in the chelonians; in other refpects they are fimilar. The parietes are ftrengthened by flefhy fafciculi proceeding in different directions. The ventricle prefents an oval form, and has its parietes of great thicknefs. Its cavity is divided into three compartments, communicating by numerous openings. One of thefe divifions is fituated inferiorly and to the right. The auricle of the fame fide projects into its anterior part the blood received from the veins of the body by a wide opening, which is provided with two valves. The termination of the left defcending aorta is found in the fame cavity, in its left and anterior fide. Behind this latter opening is feen an orifice, which leads into the fmalleft of the three divifions, at the middle of the bafe of the heart, and in which is found the common trunk of the pulmonary arteries. It refults from this conformation, that there are two channels offered to the blood which has paffed from the right auricle into the cavity of the fame fide; the one by the left defcending aorta; the other into the cavity leading to the pulmonary artery. It may even take a third route, and pafs through the numerous holes which penetrate the partition feparating the fuperior and left cavities. The left auricle projects into the latter the blood received from the pulmonary veins. A membranous valve is found attached to the border of the opening on its right fide. The trunk common to the right defcending aorta, carotids, and axillary arteries, is fituate to the right of the valve. The blood muft either pafs into the arterial trunk, and from thence be diftributed to the head and extremities, or penetrate into the intervals between the flefhy fafciculi of that cavity, and from thence into the two others. It refults from this ftructure, that the blood diftributed to the anterior parts by the carotids and axillary arteries, to the pofterior parts by the iliacs, and to the tail by the middle facral artery, is nearly all derived immediately from the lungs, whilft a portion of that which is diftributed to the other vifcera by the left aorta comes from the right cavity and from the auricle of the fame fide, and confequently has not been modified by its paffage through thofe organs. The pulmonary blood is not fo intimately admixed with that from the body, as in the chelonians. Such is the ftructure of the heart in the crocodile of the Nile, and the caiman or American alligator. For a view of the crocodile's heart, fee Cuvier Leçons, t. 5. pl. 45.

It is lefs complicated in the common iguana (iguana delicatiffima). In this animal, the fituation of the heart is very remote from the liver, beneath the origin of the lungs, and in the moft projecting part of the cheft. It is of a conical form, being very broad at its bafe, and acute at its fummit. The auricles prefent nothing remarkable. In the ventricle, there are but two cavities, the one fituate to the right, which forms the proper cavity of the ventricle, the other to the left and fuperiorly, appearing as a finus of the former. The openings of the pulmonary auricle and right defcending aorta are found in the latter, nearly in the fame manner as in the crocodiles. The opening of the right auricle is fituated towards the middle of the great cavity or that of the ventricle, and is provided with a femilunar membranous valve, in the fame way as that of the left auricle. The orifices of the pulmonary artery and left defcending aorta are placed lower down in the fame cavity; the firft on the left, the other on the right. There is no pulmonary cavity. The interior of the ventricle is furnifhed with fafciculi of flefhy fibres.

The ftructure of the heart in the third order of reptiles, the ophidians, differs but in a trifling degree from that of the faurians, poffeffing the moft fimple conformation of this organ. There is no diftinct pulmonary cavity. The auricles are of confiderable fize; that which receives the blood from the body is the largeft. Their parietes are thin and tranfparent in the intervals between the flefhy fafciculi, by which their ftrength is augmented, and which are irregularly interlaced together. Their cavities are feparated by a membranous partition. The figure of the ventricle is generally that of an elongated cone, irregularly formed in confequence of an appendix of the fame figure, which projects from the left fide beyond its bafe. The interior is divided into two cavities, the one fuperior, the other inferior, the former being extended into the appendix. An imperfect feptum intervenes between them, having a loofe unconnected edge on its right fide, and is extended horizontally from the bafe to the apex; it is compofed of flefhy fafciculi, allowing the blood to penetrate in their intervals. A confiderable opening, by which the two cavities communicate, is found towards the right fide of the bafe of the ventricle, at the part where the feptum terminates. The parietes of the ventricle, of themfelves moderately thick, afford attachment to a multitude of flefhy fibres, giving additional

additional ftrength, but greatly diminifhing the cavity of the ventricle. Thefe fafciculi are moftly feparate from each other, allowing the blood to permeate between them as through a fieve; thus effecting the more perfect admixture between the portion arriving from the lungs and that from the body. The openings of the auricles are found clofe to each other, at the middle of the bafe of the heart, above the feptum. Each orifice is clofed by a femicircular valve of a membranous ftructure, the loofe edge of which correfponds to the auricle of the fame fide. The termination of the arteries is found in the right fide of the bafe of the organ; that belonging to the pulmonary artery is fituate towards the left and in the lower part, correfponding to the inferior cavity. On the left of the latter is found the opening of the left aorta, correfponding to the fame cavity, and placed oppofite to the opening which forms the communication between the fuperior and inferior cavity. The opening of the right aorta is found immediately behind the laft, and correfponds more particularly to the fuperior cavity, in which is received both the blood from the lungs and that from the body; the two portions united are projected partly into the right aorta and partly into the inferior cavity, and from thence into the left aorta and pulmonary artery.

In the fourth order of reptiles, the batracians, the heart prefents a ftructure the leaft complicated of the whole clafs. It confifts of a fingle auricle of a rounded figure, broader than the bafe of the organ, with its parietes ftrengthened by flefhy fafciculi. At the bafe of the auricle is the orifice of communication with the ventricle, which is fingle, having a fimple cavity, with flefhy columns, not feparated from each other. At its bafe is found the common trunk of the arteries, arifing by a fingle orifice, fituate more to the right and lower down in the ventricles than the opening of the auricles. The heart of the frog has been delineated by Swammerdam, Bibl. Natur. tab. 49; and by Roefel, Hiftor. Ranar.

Of the Blood-Veffels.—The diftribution of the blood-veffels in the four orders of reptiles is varied according to the ftructure of the heart, and many other circumftances in their organization. In the batracians the arrangement differs in the greateft degree from that of mammalia and birds. All the arteries arife by a fingle trunk; confequently there is but one opening in the heart. In the three other orders, there are at leaft two openings, frequently three, which give origin to as many diftinct trunks, one of which is deftined exclufively to the lungs.

Of the Arteries in the Chelonians.—The arteries of the body arife from the heart by a fingle or double trunk in different fpecies; thofe of the lungs by a fingle trunk. They are firmly connected together for a fhort diftance from their origin. The trunk of the pulmonary artery arifes on the left, lower down than that of the body. It quickly feparates into two branches, one of which proceeding to the right lung, turns from the left to the right, then advances forwards to arrive at the anterior part of the organ, where the infertion of the bronchus takes place. The other proceeds in a contrary direction, paffing acrofs the œfophagus, it arrives at the fummit of the left lung.

The trunk of the arteries of the body takes its origin at the right extremity of the bafe of the heart, and divides almoft immediately into two great branches, the right and left pofterior aortæ. When the trunk is double at its origin, they feparate, forming thefe two branches. The right aorta furnifhes, near its origin, another confiderable artery, which may be denominated the anterior aorta. This foon divides into two branches, each of which is again fubdivided into two others, the internal of which, the fmalleft, is the common carotid, and the external, the fubclavian or axillary artery. The common carotid proceeds by the fide of the neck, concealed by the mufcles going to the os hyoides, fending branches to the œfophagus and adjacent mufcles. It arrives at the head, to the parts of which it is ultimately diftributed, without dividing previoufly into two principal branches analogous to the carotids of mammalia. The fubclavian or axillary artery furnifhes nearly the fame branches as the arteries bearing the fame name in mammalia, with the exception that there is no branch correfponding to the inferior thyroid. The continuation of the trunk forms the brachial artery. The two pofterior aortæ proceed on each fide upwards and outwards; then bending backwards, they approximate again, and are connected by a communicating branch, which the left aorta gives to the right; nearly oppofite to the fifth dorfal vertebra.

The right aorta, previoufly to communicating with the left, furnifhes many arteries to the back or upper fhell, correfponding to the intercoftals. The left aorta furnifhes confiderable arteries to the vifcera of the abdomen, which confume great part of its blood. When the trunk arrives beyond the cardia, it divides into three branches; the firft, which is the fmalleft, furnifhes a branch to the œfophagus, and then is diftributed to the ftomach. It is analogous to the coronary ftomachic of mammalia. The fecond, almoft as confiderable as the trunk from which it proceeds, diftributes arteries to the inteftines, fpleen, pancreas, and liver, in the following manner. The hepatic artery is the firft given off on the right fide; it turns backwards and downwards to arrive at the liver, and divides into two branches, near the bafe of the vifcus, from one of which proceeds a fmall branch to the pancreas, and numerous others to the duodenum. The fecond branch is one of fmall fize, and is diftributed to the fecond turn which the colon makes to the right. It is the colica dextra. The third branch paffes from the right to the left, and diftributes its branches to the tranfverfe colon. It is the colica media. After having given off thefe branches, the trunk purfues a fhort courfe between the layers of the peritoneum, in a direction downwards and backwards. It then diftributes the following branches. The pancreatic, which paffes from behind forwards upon the left border of the pancreas. The fplenic, a very fmall artery, diftributed exclufively to the fpleen. A very confiderable branch, belonging to all the right part of the colon and cæcum. It is a fecond colica dextra. A fmall artery, which, after having given a branch to the cæcum, proceeds to anaftomofe with the next, the proper mefenteric artery, which is larger than any of the preceding, and ramifies in the mefentery of the fmall inteftine, to which it is ultimately diftributed. Laftly, the third branch, refulting from the divifion of the pofterior left aorta, the fecond in magnitude, proceeds obliquely to the right and backwards, and anaftomofing, as has been mentioned, with the right aorta, without furnifhing any branch. The common trunk, formed by their union, appears rather as a continuation of the right aorta; it extends along the vertebral column to the pelvis, giving off the following branches in its courfe. Five or fix fmall branches on each fide, correfponding to the intercoftal or lumbar arteries. The fpermatics. One or two branches on each fide to the kidnies. A fmall artery correfponding to the pofterior mefenteric, which is diftributed to the cloaca.

The common pofterior aortic trunk terminates by four branches, in the individuals belonging to the teftudo græca, which we have diffected. The firft on the left was the external iliac of that fide, then came the internal iliac of the fame ſame ſide, and oppoſite to it the primitive iliac of the right ſide. Between the two latter aroſe the artery of the tail, correſponding to the middle ſacral artery. The branches of the internal iliacs are very analogous to the ſame arteries in mammalia. The trunk divides into two branches; one ſending branches to the bladder and cloaca; the other dipping into the pelvis, and correſponding to the iſchiatic and poſterior iliac arteries. The external iliac proceeds forwards upon the border of the pelvis, furniſhes an analogous branch to the epigaſtric, from which ariſes the anterior iliac. The firſt deſcends upon the internal and inferior parietes of the upper ſhell, and paſſes in a direction from behind, forwards. A ſecond branch, which ariſes from the external iliac, oppoſite to the epigaſtric, deſcends along the anterior border of the pelvis, as far as the ſymphiſis of the pubis, and is loſt in the muſcles of that part. After having furniſhed theſe two arteries, the external iliac paſſes out of the pelvis, takes the name of crural artery, giving off firſt, the circumflex arteries, then the profunda, and in the reſt of its courſe is analogous to what it is found in mammalia.

The diſtribution of the principal arterial trunks in the ſaurians differs but little from that which has been deſcribed in the preceding orders.

In the crocodile there are three arterial trunks, each having a diſtinct opening in the ventricle, provided with two ſemi-lunar valves. The pulmonary artery, which ariſes from the cavity bearing the ſame name, is ſituate to the left, and ſomewhat ſuperiorly; the poſterior left aorta, which ariſes from the right and inferior cavity, and is ſituate between the pulmonary trunk and the next to be mentioned; the poſterior right aorta, correſponding to the ſuperior cavity. Theſe three trunks are connected together for a ſhort diſtance from their origin. From the latter proceed, in the firſt place, the trunk common to the ſubclavian and left carotid, which remains attached for ſome extent to the poſterior left aorta, then advances obliquely forwards, paſſes beneath the bronchus, and divides beyond that canal. Secondly, a ſimilar trunk for the ſame arteries on the right ſide. The poſterior aorta, after having given off theſe branches, turns in a direction, firſt from below upwards, then from before backwards, and divides in a direction obliquely inwards beneath the ſpinal column, without furniſhing any remarkable branch until it receives the communicating branch from the left aorta. This latter turns around the bronchus on its own ſide, and paſſes backwards and inwards in the ſame way as the preceding. After having paſſed the cardia, it divides into many branches, which proceed to the ſtomach, ſpleen, pancreas, and duodenum. Theſe receive the greateſt part of the blood of the trunk. The latter has no communication with the right aorta, but by an artery, the diameter of which is ſcarcely equal to a fourth part of the trunk from which it proceeds.

We have already alluded to the conſequences reſulting from this arrangement of the arteries, in the deſcription of the heart. All the other arteries derived ordinarily from the abdominal aorta, with the exception of the cæliac trunk, here take their origin from the right poſterior aorta. It is remarkable that the anterior meſenteric takes its origin at a very conſiderable diſtance from the cæliac trunk, or from the arteries ordinarily compoſing it; while, in the chelonians, it moſt frequently ariſes very near, or is even a branch derived from it. The ſplenic is alſo given off by the cæliac. After having paſſed through the ſubſtance of the ſpleen, from its anterior to its poſterior part, and diſtributed to its ſubſtance many ſmall branches which ariſe at a right angle from the trunk, it paſſes out almoſt as large as at its entrance, and proceeds to be diſtributed to the rectum, and the termination of the ſmall inteſtine; that branch of the ſplenic having the latter diſtribution, forms a conſiderable communication with the anterior meſenteric.

The pulmonary artery, very ſoon after its origin, divides into two branches, which proceed to the lungs, in the ſame manner as in the chelonians. Their diameter is nearly equal to that of the trunks formed by the carotids and ſubclavians on each ſide.

In the common iguana, which has the heart placed very far forwards in the cheſt, the arteries of the body have, in the ſame manner, two diſtinct trunks ariſing from the two cavities of the heart, although they are united at their origin. The left poſterior aorta does not furniſh any branch before it becomes united to the right. The latter gives origin to the carotids and ſubclavians, as in the crocodiles; but with this difference, that the latter do not ariſe from the ſame part as the former, but much farther backwards, on account of the heart being placed ſo much anteriorly.

In the lizards properly ſo called, the two aortæ advance forwards out of the cheſt; the right having firſt divided into three branches, the left without forming any diviſion. The latter turns backwards upon the ſides of the neck, to proceed afterwards along the vertebral column; and at the point where it takes a direction from before backwards, it receives the left branch of the right aorta, which forms a curvature in front of it. From its convexity ariſes the left carotid. The two other branches of the right aorta turn backwards, and unite in the ſame manner on the right ſide of the neck, forming two arches in front of each other. The carotid of the ſame ſide ariſes in a ſimilar manner from the anterior arch, formed by the middle branch. The ſubclavians ariſe from each aorta a little before their junction. We have ſeen that in the crocodiles and the common iguana, they are produced both by the right aorta. The trunk formed by the union of the two arteries, which unite ſpeedily after their origin from the heart, produces the different pairs of intercoſtal arteries in ſucceſſion. It gives off, near its commencement, an artery to the œſophagus; farther on, a ſmall artery which proceeds to the liver; and ſtill farther, an artery which quickly divides into two branches; the anterior of which diſtributes its ramifications to the ſtomach, ſpleen, pancreas, and duodenum. The poſterior belonging to the inteſtinal canal is properly the anterior meſenteric. From the trunk the following arteries next proceed: the lumbar, the ſpermatics, the poſterior meſenteric, which proceeds immediately to the rectum, the renal, which are among the laſt given off, ſince the kidnies are ſituate very far back in the abdominal cavity. Laſtly, it produces the iliacs and middle ſacral artery. The latter is of ſo conſiderable a ſize, that it may be regarded as a continuation of the aortic trunk, of which the iliacs appear only as branches. This circumſtance evidently depends on the great ſize of the tail, in compariſon with the extremities.

The diſtribution of the principal arterial trunks in the third order of reptiles, the *Ophidians*, becomes much ſimplified from the deficiency of extremities, and there being but a ſingle lung. The number of the trunks is the ſame; the relations between their openings in the heart have been already mentioned in the deſcription of that organ. The pulmonary artery aſcends and turns backwards upon the baſe of the heart, and ſpeedily arrives at the inferior ſurface of the lung, where it paſſes from before, backwards to the left of the vein. The right aorta aſcends on the ſame ſide, bends backwards, paſſes above the œſophagus, and obliquely backwards and inwards, to join itſelf to the left aorta, ſome diſtance beyond the point of the heart. It gives off, near its origin, ſome ſmall arteries, which proceed to an

orbicular

orbicular gland, placed in front of the bafe of the heart, likewife to another gland of a more confiderable fize and elongated form, fituate beneath the jugular. The trunk then furnifhes the common carotid, the only one exifting in this order of reptiles. It paffes obliquely to the left, and advances, by the fide of the left jugular, between the trachea and the œfophagus, and laftly beneath the latter. It fends a great number of ramifications to thefe organs, and divides near the head into many branches diftributed to the adjacent parts. Near to the vertebral column, the right aorta produces a confiderable branch correfponding to the vertebrals and fuperior intercoftals which proceeds along the fpine, fending to it branches, and wholly penetrating into it near the head. When the communication takes place between the right and left aorta, the diameter of the former is become very fmall, fo that the greateft part of the blood which it has received from the heart is diftributed to the parts in front of that vifcus: it is properly the anterior aorta. The left aorta afcends and turns backwards to the left, paffes beneath the œfophagus; then by the fide of and always beneath the lung, receiving the right aorta beyond the heart; and continuing to pafs in a direction backwards, it gives off branches correfponding to the intercoftals, likewife arteries to the vifcera. Thofe branches proceeding to the ftomach, pulmonary bladder, and liver, are detached fucceffively from the aorta, as it proceeds backwards; thus there is no cæliac trunk. Nearly oppofite to the pylorus. the aorta furnifhes the anterior mefenteric, which proceeds parallel to the inteftinal canal one half of its extent, fending to it branches. Farther backwards the inteftinal canal receives three other fmall branches in fucceffion, from the fame artery: as it paffes backwards, it alfo fends fimilar branches to the kidnies, ovaries, &c.; arrived at the lower part of the abdomen, it penetrates beneath the vertebræ of the tail and is loft in that part.

In the laft order of reptiles, the Batracians, the aorta, which proceeds from the bafe of the ventricle, foon divides into two branches, which feparate and purfue a very oblique direction from within, outwards and a little forwards. Each branch gives off a pulmonary artery, a common carotid, an axillary, a vertebral, and arteries correfponding to the intercoftals; then turning backwards, and approaching its fellow, it fpeedily becomes united to it. The trunk formed by their junction gives off, firft, the cæliac trunk, then all the other arteries which arife ordinarily from the abdominal aorta, prefenting nothing worthy of remark.

Of the Veins.—In the *Chelonians* there are two pofterior venæ cavæ, which pafs through the liver on each fide, and receive in their courfe numerous fmall hepatic veins. Immediately after their exit from the liver, they are joined by two anterior venæ cavæ, one on each fide, or by the common trunk of the jugular and fubclavian. They all terminate in the right auricle by an opening in the form of a fiffure, provided with two valves; they do not terminate in the cavity of the auricle, but in a receptacle communicating with it. The pulmonary veins united in a fingle trunk terminate in an analogous receptacle, which opens into the left auricle; around the borders of the opening, there is placed a flefhy valve in the form of a half moon.

In the *Saurians* and *Ophidians*, there is but one pofterior vena cava, and two anterior, that belonging to the left fide paffes acrofs, and above the heart, in a direction from left to right, and terminates in the common receptacle by the fide of the pofterior vena cava. This receptacle, fimilar to that found in the chelonians, has in the fame manner its entrance into the right auricle, in the form of a fiffure, and provided with two valves. In this order, likewife, the anterior venæ cavæ are more properly confidered as the jugulars. They have alfo a double azygos, one formed by the intercoftal veins in front of the heart, the other pofterior to it. They both join the right auricle by the fide of the right jugular. It appears that they are rendered neceffary by the fituation of the venæ cavæ, which is very remote from the vertebral column, and more inferiorly.

The pulmonary veins in the faurians are fimilar to thofe of the chelonians.

In the ophidian order there is only one, which terminates in the fame manner in the left auricle. Its volume exceeds that of the artery, which we have not obferved in the other reptiles.

In the batracians the veins have a diftribution fimilar to that of the arteries which refults from their terminating in a fingle auricle, in the fame way as the latter arife from a fingle ventricle. There are two anterior venæ cavæ which receive the blood from the head, neck, anterior extremities, and from the veins analogous to the external mammary, which are very confiderable, extending beneath the fkin to the groins, and likewife a pofterior vena cava, which receives the veins from the other parts, prefenting nothing worthy obfervation.

The blood-veffels of the tadpole are defcribed in the account of that creature in the divifion concerning the generative functions; and thofe of the proteus and firen, in the feparate defcription of thofe animals at the end of this article.

Phyfiology of the Circulating Organs.—The nature of the blood in reptiles, the points in which it differs from the correfponding fluid in other claffes, its difference in the various orders and genera, its relations to the food and to the fecretions and excretions, are fo many interefting topics of inquiry, on which we have abfolutely no information to offer. Chemiftry does not yet appear to be fufficiently advanced for the fuccefsful inveftigation of thefe and fimilar matters.

We may obferve, in the firft place, that the reptiles of thefe climates at leaft, poffefs, in comparifon with warm-blooded animals, a much fmaller quantity of blood in proportion to their fize: hence their mufcles are whiter, and fome of their vifcera, particularly the lungs, which are loaded and gorged with fuch a profufion of blood in the warm animals, prefent in this refpect an appearance altogether contrary in reptiles.

"I made an experiment," fays Blumenbach, "on the water falamander, (lacerta lacuftris, L.) of which I diffected twenty-four, adult, lively, recently taken in the early fpring, and weighing together $1\frac{1}{2}$ ounce, in order to meafure the quantity of blood they contained: I could preferve from the whole of the bodies of all, only two fcruples and a half. This fmall quantity of blood is to the whole body as $2\frac{1}{2}$ to 36; while in an adult and healthy man the proportions are calculated at 1 to 5. Haffelquift obferved the fame circumftance of the fmall quantity of blood in proportion to the body, in the crocodile of the Nile." Voyage dans le Levant & en Paleftine.

It is alfo remarkable, that the arterial blood of our reptiles differs in external appearance in the fmalleft degree, if at all, from the venous, fo that one can be diftinguifhed from the other only by the fituation and courfe of the veffels; while, on the contrary, the bright fcarlet arterial blood of the mammalia offers fo remarkable a contraft to the dark livid or purple venous fluid; unlefs when they have been for fome time in a warm bath or other warm medium, when it appears from the elegant experiments of Dr. Crawford,

ford, that the venous blood, becoming gradually lefs and lefs dark coloured, approaches more nearly to the vivid rednefs of the arterial ftream. (See Philof. Tranfact. v. 71. p. 487.) Haller obferved that there is no difference between the arterial and venous blood in the frog. (Oper. minor. v. 1. p. 183.) And Spallanzani noticed the fame fact in the falamander or water newt: "avutafi egualità di diametro, il colore del fangue venofo e fomigliantiffimo al colore del fangue arteriofo." De' fenomeni della circolazione, pag. 100. And again, "il fangue arteriofo in nulla differifce dal venofo, fia nel colore, fia nella denfità." P. 193.

In this circumftance reptiles refemble the fœtus of warm-blooded animals; in which, fo long as it remains immerfed in its uterine bath, we know that the arterial and venous bloods are of the fame colour.

Yet all animals of this clafs are not alike in this refpect. Accurate obfervers have afferted, that in the tortoife the venous blood is black, and the arterial crimfon, as in the warm-blooded claffes. (Caldefi, Offervazioni Anatomiche intorno alle Tartarughe, p. 60. Mery, Hift. de l'Acad. des Sci. de Paris, 1669. v. 2. p. 210.) This difference probably correfponds with the diverfity of ftructure obfervable in the refpiratory organs, which are calculated, in the different orders of reptiles, to admit of a more or lefs intimate expofure of the blood to the air in refpiration.

The colour of the blood varies in our amphibia according to the ftate of their nutritive functions: it is paler when they have fafted, of a deeper red when they have been well fed. If, under the latter circumftance, it be drawn from a vein, and expofed to the air, it exhibits a bright florid rednefs as it forms the coagulum.

The component elements of the blood of amphibia, confidered in a general way, feem nearly to refemble thofe of the warm-blooded animals, except that in the former, when examined alive, there are almoft always feen bubbles of air mixed with their purple ftream, performing, like the blood itfelf, the circulation, and dividing that fluid in the veffels into intervals, as the mercury is interrupted in a badly made thermometer. Redi and Perrault obferved this fact in tortoifes; Jacobæus in ferpents; Daudin in the green lizard, frog, and falamander (Hift. Nat. des Reptiles, Introd. p. 184.); and Blumenbach in the amphibia of Germany. Now, although in certain ftates the veins may be very turgid, and elaftic air may be found in them after death, nothing of this kind is ever known to take place in a healthy and ftrong individual. The air indeed is fuppofed in the mammalia to conftitute one-thirtieth of the blood, but it is fo diffolved, and fo intimately mixed in the vital ftream, that it can only be extricated and exhibited in its elaftic aerial form by artificial means.

The phenomena of the circulation are common on the whole to the reptiles with the warm-blooded animals, and are very familiar in the former, fince the wonderful circulating motion of the blood was not only firft actually feen and defcribed in frogs by the great Malpighi, but is alfo ftill examined to the prefent time in thofe animals. The branchiæ of the tadpole are very favourable objects for inveftigations of this kind.

As the circulation can be actually feen in thefe animals, we may inquire on this fubject, whether the globules of the blood, entering the minute veffels, can be really obferved to change their figure, and become oval inftead of fpherical. "In warm-blooded animals," fays Blumenbach, "I have never heard or read that any one has feen fuch a change; and I certainly have never feen, either in the incubated chick, in which the circulation of *warm* blood may be moft clearly and beautifully obferved, particularly on the fifth and following days, or in the frog or lizard, any oval globules: yet Reichel afferts that he has feen globules changed from fpherical to oval in the mefentery of the frog, and has given an elegant plate in illuftration of the fact. See Experimenta de Sanguine ejufque motu, fig. 3." Blumenb. Specimen Phyfiol. p. 10. He doubts, however, whether this change can be confidered as a natural occurrence in the healthy circulation, or ought to be referred to the difturbance naturally following the fufferings of the animal.

The motions of the heart, confifting in our amphibia of a fingle auricle and ventricle, agree in the alternate contractions and relaxations of thofe parts, with the analogous fucceffion of fyftolic and diaftolic changes obfervable in the double auricles and ventricles of the warm-blooded claffes.

A queftion was formerly raifed, concerning this fyftole or contraction, whether the ventricles are really fhortened, or experience merely a diminution of diameter? The former, fays Blumenbach, has now been proved by the moft careful obfervations both in cold and warm-blooded animals; he adds, that he has never feen it demonftrated more clearly, and beyond every fufpicion of inaccuracy or miftake, than in the common fnake (coluber natrix), in fpecimens of which, two yards long, from the woods of Germany, he has obferved, and frequently demonftrated, a fhortening of the ventricle equal to two lines. Blumenbach ftates further, that the ventricle is completely emptied in its fyftole, not the leaft drop of blood flowing back into it from the aorta, in the fnake, frog, and toad, and alfo in the incubated chicken. But he does not venture to decide, whether the fame thing occurs in man and the other mammalia, or whether the femilunar valves may intercept fome drops of blood, which thus are made to flow back into the ventricle.

Reproduction.—As the nutrition and growth of parts, in the healthy ftate, are among the moft important functions of the blood-veffels, fo the reparation of injury, and the reftoration of what is mutilated, conftitute another very ftriking inftance of their powers, and a very impreffive example of thofe prerogatives, which belong exclufively to living organized beings. Although this power of reproduction, taken in its moft extenfive acceptation, cannot be faid to be withheld entirely from any animal, feveral genera of reptiles poffefs it in a more remarkable degree than any of the other vertebral claffes. There is an interefting account in the Memoirs de l'Acad. des Sciences de Paris, 1686, particularly of the reftoration of the tail of lizards. Spallanzani, Bonnet, and Blumenbach, have employed themfelves in refearches on this fubject. The former firft called the attention of the public to it in his "Prodromo di un' Opera da imprimerfi fopra le Riproduzioni Animali." Bonnet publifhed his memoir on the reproduction of the limbs of the water newt in the Journal de Phyfique, 1777. His enquiries were again publifhed in his "Œuvres d'Hiftoire Naturelle," t. 5. and there are three memoirs by him on the fubject, tranflated into Englifh, in Spallanzani's "Tracts on the Natural Hiftory of Animals and Vegetables," v. ii. The experiments of Blumenbach are contained in his "Specimen Phyfiologiæ comparatæ." The experiments have been made chiefly with the water newt; on the lacerta agilis of the terreftrial kind, fee P. T. Hartmann, dubia de generatione viviparorum ex ovo, p. 26; refpecting the lizards of the Antilles, fee Oldendorp Gefchichte der Caraibifchen Miffion, p. 97.

"It might be fuppofed," fays Bonnet, "that the amputation of the limbs is moft painful, and that the animals would fuffer long and feverely from it; however, one of my obfervations apparently infers the reverfe. I cut the left hand

hand and the right foot off a large newt ; and a ſtream of blood, as thick as a hog's briſtle, continued ſpouting out nearly two minutes without intermiſſion. Not only did the animal ſeem not in the leaſt enfeebled by the loſs of blood, but, in ſcarcely a quarter of an hour, to my great ſurpriſe, it ſwallowed two earth-worms." Spallanzani's Tracts, v. ii. p. 367.

The following narrative is extracted as a ſpecimen of Bonnet's experiments. "On the 6th of June I cut off the right arm and left leg of a large newt cloſe to the body. (It ſeems from the accompanying figure that the ſections paſſed through the femur and humerus reſpectively.) A ſtream of florid blood ſpouted a minute and a half from each wound ; however, the veſſels ſoon cloſed, and the newt was apparently as well as thoſe unmutilated. But it will eaſily occur, that it did not ſwim with equal facility. When about a month had elapſed, I began to perceive a papilla, of a violet grey colour, near the edge of the trunk or ſection. This was the origin of a new arm and leg, which gradually increaſed, and were quite perceptible, although ſtill very ſmall, on the 14th of July. The two papillæ grew more in length than in thickneſs : they became minute ſtumps, and on the 1ſt of Auguſt were two lines long. A kind of cleft hardly perceptible announces the appearance of two toes : no cleft appears on the originating arm. The new parts were very diſtinguiſhable from the old by their lighter colour. The two toes were eaſily recogniſed on the ſeventh : they were real miniatures, and truly moſt minute. The ſtump of the arm had increaſed, but there was no indication of fingers.

"It is pleaſing to obſerve the little hand fully unfolding, while only three fingers of unequal length are viſible : the middle one is the longeſt. The arm has made no ſenſible progreſs. The new foot had four toes alſo of unequal length ; the firſt and ſecond of which are longeſt ; the other two only begin to appear ; the fourth is ſcarcely perceptible. Evolution advanced every day. The regenerated members began to deepen in colour, ſo that the line, diſcriminating the old parts from the new, was no longer ſo conſpicuous ; but the black ſpecks on the toes of unmutilated newts were ſtill imperceptible. On the 22d of Auguſt four well-ſhaped fingers were already on the hand ; but only four toes out of the five which the foot regenerates ; and they all have to acquire more ſize, conſiſtence, and colour. I continued my obſervations on the daily evolutions of the members ; and the following were their dimenſions in length on the 30th of September.

Old Members.			New Members.		
Arm	-	4 lines.	Arm	-	2½ lines.
Cubit	-	3½	Cubit	-	2½
Thigh	-	3	Thigh	-	2⅔
Leg	-	4	Leg	-	2¼
Longeſt finger		3⅔	Longeſt finger		1½
Longeſt toe	-	4½	Longeſt toe	-	1⅓

Even in the beginning of October, the fifth toe of the new foot was not viſible." Lib. cit. 372, et ſeq.

There is a kind of ſemi-tranſparency in the reproduced parts, which the original members have not. This continues long, and changes ſlowly as the reproductions colour. The tranſparency is evidently greater on the edges of the fingers than elſewhere ; if examined with a magnifier they ſeem incloſed in a fine diaphanous envelope : but nothing of this is evident in the old fingers. (P. 376.) "It is incredible how long the new fingers require to attain the ſize of the old. I have had newts, whoſe fingers, in thirteen months and more, were not as large as thoſe of unmutilated members." (P. 393.) "When the tails of large newts were amputated near their origin, the whole died in a certain time. If the part be cut off about its middle, reproduction will follow. A tail was cut on the 11th of July, and on the 14th of Auguſt, the reproduced part was about three lines and a half long, and four and a half in diameter at the baſe. The new portion was ten lines in length on the 20th of September, and ſhaped exactly like the tail of a newt. I could obſerve no difference between the motions of this regenerated tail, and thoſe of tails unmutilated. On the 8th of October the regenerated part had a peculiar tranſparency, wanting in the reſt of the tail." P. 381, et ſeq.

"The fingers and toes are not evolved in the ſame proportion as the arm and leg. Now, when I write this, on the 10th of October, the new arm and leg of the newt, mutilated on the 6th of June, have nearly attained the ſize of the original members, while the regenerated fingers and toes have not acquired half their natural ſize ; yet they are perfectly well formed, and execute all their functions." P. 390.

Blumenbach found that the true ſalamander (lacerta ſalamandra) poſſeſſes the ſame reproductive power as the water newt (lacerta lacuſtris) : that a third part of the tail, or a toe, would be perfectly but very ſlowly reproduced, and remained even at the end of a year conſiderably inferior in ſize to that of the original parts. Specimen, p. 32.

Bonnet made other experiments to determine whether reproduced members poſſeſs the ſame powers of reproduction as thoſe amputated. He cut off an arm and a thigh of a large newt on the 2d of June : as ſoon as the hand and foot were viſible, he cut them off, and they were renewed : he repeated this four times, the laſt operation being on the 13th of October, and the parts were each time reſtored. P. 394, et ſeq.

He diſlocated the arms of one and the thighs of another newt, ſo that the members immediately after were pendent, as if dead, the animal having no power over them. On the following evening each newt moved the disjointed limbs with a liberty and facility which announced that nature had already repaired the diſorder. P. 431.

The moſt ſurpriſing fact in Bonnet's Memoir is the reproduction of the entire eye. "With a ſcalpel," ſays he, "I extracted the right eye of a large newt on the 13th of September, 1779 ; but I did not obtain the globe without much injury to the tunics. A deep bloody wound in the ſocket of the eye was the conſequence of this cruel operation. And the reader will not be ſurpriſed if I hardly expected any thing from it, and that the newt would probably remain blind for ever. How great was my aſtoniſhment, therefore, when, on the 31ſt of May, 1780, I ſaw a new eye formed by nature. The iris and cornea were already well ſhaped, but the latter wanted its peculiar tranſparency, which is very conſiderable in theſe animals. The reſtoration was complete on the 1ſt of September ; the cornea being tranſparent, and the iris having acquired its yellow gilded colour. On the 8th of November 1780, it differed from the other eye only in being a little ſmaller, and in the iris, or golden circle, going only half round the ball." P. 432, et ſeq.

"I repeated," ſays Blumenbach, "the experiments of the celebrated Bonnet, concerning the reproduction of the eye in the water newt. I cut out the whole globe, at the inſertion of the optic nerve, in three inſtances, in neither of which was the organ reproduced : but a white and firm fungus, ſhooting from the cut end of the nerve, gradually filled the orbit, the animals themſelves becoming affected with a kind of dropſical ſwelling, and dying in a few

few months. Inftructed by thefe failures, I proceeded to operate in a different way on a fourth animal, in May 1784. I firft divided the cornea, to let out the lens and other humours, and then cut away the remaining empty and collapfed coats, leaving a fmall portion of the common coverings of the bulb, which, from a careful examination in water with a glafs of the parts removed, I judge to have been fcarcely equal to one-fifth of the whole globe. In the following months the whole orbit feemed clofed by the approximated eye-lids, which, however, began to feparate in the fixth month after the operation, and thus difclofed a new little bulb fpringing up from the bottom of the orbit. This new globe was ftill much fmaller than the other in April 1785, when the animal died accidentally, though in other refpects it was moft perfect, exhibiting the golden iris with its regular pupillar aperture behind the cornea, all which points are clearly diftinguifhable in the preparation which I preferve." Specimen, p. 31.

"On comparing," fays the author laft quoted, "the facts juft detailed with the very limited and much lefs perfect reproduction obfervable in warm-blooded animals, we fhall become fenfible of the wide difference between them and the amphibia. I am daily more and more convinced, that no parts are reproduced in man and the other mammalia, except fuch as are compofed merely of cellular fubftance, and enjoy no other kind of vital power except common contractility; and I cannot find fufficient proof that the irritable mufcular fibre, the fenfible nervous medulla, or thofe parenchymata which are endowed with a peculiar modification of vitality, have ever been truly reproduced in a warm-blooded animal." Ibid. p. 32.

Tenacity of Life.—This fubject is fo far analogous to that which we have juft confidered, that we pafs naturally from the view of the facts, in which the furprifing reproductive powers of the clafs is evidenced, to the no lefs aftonifhing examples of their very hardy vitality; of the energy and permanence of their vital forces, both in individual parts, and in the body at large.

The amputated tails of water newts, and the divided fragments of the blind-worm (anguis fragilis), exhibit very lively motions for ten hours and more. The heart of a frog or ferpent continues to palpitate on irritation many hours after its feparation from the body; and the limbs of frogs are excitable by the Galvanic influence for a long time. Some reptiles, as the ferpents and teftudines, can open and fhut the mouth long after the head has been fevered from the trunk. General Gage informed Blumenbach that he had feen the amputated head of a rattlefnake bite long after its feparation: and another Britifh officer ftated to him that when he put a ftick between the jaws of an American turtle, the fecond day after decapitation, it was firmly held.

The fame energy of the vital force in the parts, and the independence of one clafs of functions on another, in the amphibia, are further evinced by many well known facts; the limbs of turtles have moved for eleven days, nay, on the thirteenth day after decapitation (Güldenftaedt, Theoria virium corp. hum. primitivarum, p. 74.); and a rattlefnake lived fome days after the fkin had been removed, and moft of the vifcera taken away. Tyfon, in Philofophical Tranfactions, N° 144.

In the beginning of November, Redi opened the fkull of a land tortoife, and removed the whole brain. The animal did not feem to fuffer, it moved about as before, but groping its way; for the eyes foon fhut after lofing the brain, and never opened again, a flefhy integument formed, which covered the opening of the fkull, and in this ftate the animal lived till May. Spallanzani deprived four frogs of the brain; two lived till the fifth day. He alfo deprived three newts of the brain; they fuffered violent convulfions; their eyes clofed, they hardly moved from one place to another; and expired about the middle of the third day. He cut the heart out of three newts; they took to flight, leapt, fwam, and executed the fame functions as before; however, all died in forty-eight hours. Four frogs, deprived of the heart, kept their eyes open, and preferved the ufe of their limbs. They furvived thirty-fix hours. Spallanzani's Tracts, Introduction, p. 45.

Captain Cook met with a turtle, in which there was a wooden harpoon about fifteen inches long, and barbed, between the fhoulders. The opening by which it had entered was quite healed.

Redi and Boyle faw fome figns of life in ferpents after they had been twenty-four hours in vacuo. And they will live more than four hours in fpirits of wine. See Daudin, v. 6. p. 100; and v. 1. p. 270.

In our account of the phyfiology of the digeftive organs, we have already noticed the fingular power which reptiles poffefs of remaining for fuch long periods without food. They are equally remarkable for being able to bear, permanently, confiderable degrees of heat and cold. Not only are moft of the Clafs inhabitants of the warmeft regions, but fome of them, like fome fifhes, are known to live in warm fprings, inhabiting them fpontaneoufly, and appearing to be healthy. (See Cocchi in Spallanzani, Opufcoli di fifica animale e vegetabile, v. 1. p. 46.) They live in the warm fprings of Pifa, which rife to 37° of Reaumur, 115° of Fahr.

"Befides a hoft of fufpicious narratives," fays Blumenbach, "of newts, and other amphibia, which have lived for a confiderable time in the human body, there are many unexceptionable and indubitable examples of this remarkable phenomenon." See the narrative of Th. Reinefius, a moft refpectable authority, concerning a girl of Altenburg, in Bartholin, Act. Havnienf. v. 2. p. 110; Harder, Apiar. obfervat. p. 89; I. R. Zwinger in Act. Helvet. v. 1. p. 22; Hift. de l'Acad. des Sciences de Berlin, 1770, p. 40; a mafs of citations in Jacobæus de ranis et lacertis, p. 12; Paulini de Bufone, p. 38; I. Helwig Obferv. p. 249 and 272; Kundmann Promptuarium, p. 108; alfo Act. Natur. Curiof.; Collectan. Vratiflavienf. et Commerc. Literar. Noric. &c. Thefe facts are not fo remarkable on account of the degree of heat to which the animal is expofed, as from the other concomitant circumftances. We muft obferve, however, that thefe animals inhabited the ftomach fo long as they continued alive, while the individuals troubled by thefe unufual guefts were led, by their fuffering, to drink copioufly of water, and thus in a manner fupplied the newts with their natural element.

"Reptiles have the power of bearing intenfe cold as well as great heat. I one morning found a tree-frog, which I had kept for fome time, in confequence of a froft fuddenly fet in the preceding night fo as to reduce the thermometer to 30° Fahr., completely inclofed in a cake of ice, like infects in amber; of courfe it was motionlefs, the eye-lids fhut, &c. As the ice melted, the animal recovered, firft moving its hind legs, when they were difengaged; the head and trunk ftill being moft firmly detained; when the folution was complete, the whole animal was reftored, feemed as well as before, and furvived a long time. Du Fay attefts the fame circumftance concerning water newts; Mém. de l'Acad. des Sciences de Paris, 1729, p. 144. The amphibia are expofed to be frozen in their winter fleep; but we are the lefs

 furprifed

furprifed at the occurrence, becaufe all the functions are either entirely fufpended, or moft languidly performed." Specimen, p. 10.

Organs of Refpiration.—After defcribing the heart, and viewing the phenomena of the circulation, we proceed to the lungs, which are not only moft important parts in the economy of all animals that poffefs blood, but conftitute, in the peculiarity of their ftructure and functions, the moft ftriking marks of diftinction between reptiles and warm-blooded animals.

All reptiles breathe by means of lungs, which in their bulk confiderably exceed thofe of the mammalia, while the latter are as far fuperior in the abundance of their vafcular ramifications, and the wonderful minutenefs of their internal fubdivifions. Thefe large, but loofe and rare veficular lungs, are contained, not in a particular cavity, feparated from the abdomen by a diaphragm, but, with the other vifcera, in a general cavity of the body. Hence the mode of refpiration is as different from that of the mammalia, as the texture of the organ.

To the general pofition, that reptiles breathe by means of lungs, there is an exception in the batracian order; in fome of which (the proteus and firen) there are branchial appendages or gills, as well as lungs; while in the firft ftate (the tadpole) of others, there is a fimilar conjunction of thefe two modifications of refpiratory apparatus. See the anatomy of the tadpole, in the account of the generative organs, and that of the firen and proteus, at the end of this article.

The Air-tubes.—The trachea is not divided into bronchi in the ophidian order, which have a fingle lung; neither does this divifion take place in the green lizard (lacerta agilis), whofe trachea, having reached the united anterior extremities of the two lungs, opens into each by a large orifice: but it is found in almoft all the other animals of this clafs. The divifion is effected very early in the chelonians, which have confequently a very fhort trachea, and long bronchi; more particularly becaufe the latter, inftead of entering the lungs directly, firft make a turn in the cheft. The trachea is divided much later in the crocodile, where the tube is bent from behind forwards, divided into bronchi, which alfo run forwards, and then turn from before backwards, remaining for fome time joined to each other. The bronchi are extremely fhort in moft other reptiles: they begin, in the batracians, immediately below the larynx.

Reaching the lungs, the bronchi generally terminate abruptly by one or more large orifices, which open into the cavities of thefe vifcera. This is what occurs in the ophidians; but in the chelonians and the crocodile, each bronchus is continued into the interior of its lung, before it terminates. They are continued, in the teftudo græca, into the moft remote part of the lung, without undergoing any fenfible change of diameter; and they communicate with the large cells compofing thefe vifcera, by ten or twelve wide orifices, of which the outlines are circular, like the commencement of canals. In the turtles, each bronchus penetrates in like manner to the fartheft part of the lung, but gradually diminifhing in diameter. Their fides are pierced with numerous holes, opening into the pulmonary cells.

The relative fize of the trachea and bronchi does not exceed what we obferve in the mammalia and birds, except in the ophidians, where the diameter of the former is very confiderable. Thefe air-tubes never exhibit any inequalities, fuch as are feen in birds.

They are generally compofed of complete cartilaginous rings, and confequently are little fufceptible of changes in fize. We muft, however, except the crocodile, in which animal the front end of the trachea prefents, on its upper furface, a membranous interval, which is wider the nearer we come to the larynx; (fee Humboldt Recueil d'Obfervations, &c. tom. i. p. 11. of the crocodile of the Orinoco; and Geoffroy in Annales du Mufeum, tom. ii. of the Nilotic fpecies); the cameleon, where the annuli are incomplete in the laft portion of the trachea, and at its bifurcation; and the ophidians, in whom the trachea poffeffes cartilages only in one third of its circumference. Thefe cartilages are alfo vifible for a fhort fpace along the front end of the lung, in a groove of its inferior furface, containing alfo the pulmonary vein. The trachea, however, ceafes fuddenly on touching the lung, and dilates immediately to form its fac.

In thofe reptiles which have bronchi running throughout the length of the lungs, the portion of the tube, contained in thefe vifcera, has only imperfect and irregular pieces of cartilage, which neverthelefs furround its circumference. They are more thinly fcattered in the turtles, in proportion as we obferve them farther back in the lung.

This cartilaginous ftructure of the air-tubes (the trachea and bronchi) of reptiles, renders them very incapable of changing their diameter. They feem entirely deftitute of tranfverfe mufcular fibres; nor do we perceive any longitudinal ones to diminifh their length. The membranous trachea of the ophidians, poffeffing cartilages only in the inferior third of its circumference, feems equally deftitute of mufcular fibres. On this membrane we difcover a fine white and opaque net-work, which is continued into the interior of the lung, where its mefhes, as we fhall fee, border the cells, and are formed of ftronger threads, apparently of a tendinous ftructure, and perhaps capable of contraction.

Veficular Structure of the Lungs.—We have mentioned that the lungs of reptiles are very large: they are immenfe in the teftudines and cameleon, and are even confiderable in the native amphibia of thefe climates, if you compare their relative bulk to that which they poffefs in warm-blooded animals. We have juft feen that the bronchi do not divide, that they do not ufually enter the lungs, but terminate abruptly by one or more large orifices, as foon as they have reached thefe vifcera. In the batracians and faurians, the lungs form two facs, varying confiderably in their form and relative fize, and having their internal furface divided by membranous plates into polygonal cells, in which other fmaller plates form more minute divifions. They have been juftly enough compared by Blumenbach to the reticulated ftructure, in the fecond ftomach of ruminating animals. Thefe cells are more numerous, fmaller, and deeper in the anterior part of the fac: they become more open towards the pofterior part; and when the latter terminates in one or more appendages, we fee only a net-work, with loofe and extremely fine mefhes. Afterwards the parietes of the pulmonary fac are quite fimple, and without any divifion. Such is the ftructure in the appendices which terminate pofteriorly the lungs of the cameleon, and the agame or lacerta marmorata; and of the great bladder in which the fingle lung of the ophidian order ends.

The lungs of the falamander, the proteus, and firen, form alfo fimple facs without any divifion.

"In frogs and toads," fays Blumenbach, "the lungs are made up of polyhedric and large cells: the fame ftructure is obferved in the lacerta agilis and falamander. They form an oblong bladder in the aquatic lacerta (water newts). The lung of the coluber natrix forms a fingle bag of large fize, hollow throughout; and the fame ftructure feems, from the reports of anatomifts, to exift in other ferpents. (See Coiter Obf. Anat. Chir. p. 126. Charas Nouvelles

Nouvelles Obf. fur la Vipère, p. 39. Tyfon in Phil. Tranf. N° 144. p. 30. tab. 1. fig. 1. tab. 2. fig. 4. Seba Thefaur. vol. ii. tab. 109. fig. 1—5.) The pulmonary bag of this coluber exceeds a Paris foot in length. Rather more than the anterior half has thick fides, with an elegantly reticulated internal furface, refembling in its general habit that of the internal furface of the fecond ftomach of the ruminating mammalia. The remaining pofterior portion is a fimple thin membranous bladder." Specimen, p. 12.

The ftructure is rather more complicated in the chelonian order. Each of the openings of the bronchus, which we have ftated to be about ten or twelve in the teftudo græca, is the entrance of a particular fac, the fides of which are compofed of polygonal cells, in which there are ftill fmaller ones. Each of thefe cells is bordered by whitifh and as it were tendinous chords, which appear defigned to fupport their fides, and fix the facs to the orifices of the bronchus. The facs or principal cells are much fmaller, and more numerous, in the turtles, and correfpond to the numerous orifices with which the bronchus is pierced. We fee alfo the cords forming and fupporting the cells, and giving to the lungs of thofe animals the appearance of a cavernous tiffue.

The form and fize of the pulmonary cells may be fomewhat different in the crocodile, but their effential ftructure is the fame. In this refpect the crocodiles depart from the lizards, and approach the turtle and tortoife. Geoffroy in Annales du Mufeum, vol. ii. p. 46.

How different a notion do thefe details convey to us, of the ftructure of the lungs in reptiles, from that which they poffefs in the warm-blooded claffes! Although they may be defcribed in the latter as cellular, fpongy, and light, yet, when compared to the fame organs in the former clafs, they are vaftly more compact, made up throughout of an infinite number of ramified air-tubes, and of countlefs moft minute bronchial cells connected to them, united and interwoven with common cellular tiffue. Hence, if we compare any mammiferous animal with a reptile of the fame fize, as the vefpertilio murinus with the rana bombina, the lungs of the latter are indeed the largeft, but are beyond all comparifon inferior to thofe of the former in the very inconfiderable number of their cells.

As the lungs of warm-blooded animals fo wonderfully furpafs thofe of reptiles, in the minutenefs and number of their cells; fo they ftill farther excel them in the aftonifhing abundance of their blood-veffels. The fimple appearance of the organs, without any anatomical preparation, is fufficient to fhew this fact; and microfcopical examination, after fuccefsful injection, fully confirms it. For, although the lungs of the amphibia exhibit their denfe vafcular networks, beautifully painting the fides of the cells, thefe are not to be compared to the number and fubtilty of the ramifications, eluding even the affifted eye, which every where fill up the lungs of warm-blooded animals.

Since, in the mammalia and birds, all the blood of the body muft pafs through the lungs, before it can return again to the organs, it was neceffary to have a large number of veffels for its conveyance, and a furface for their expanfion, both extenfive on account of their number, and the neceffity of expofing the blood in minute portions to the air, and yet confined as much as poffible to one fpot, that its bulk might not be inconvenient. Thus we explain that inextricable tiffue of blood and air-veffels, and fmall veficles or cells, which compofe the lungs of mammalia and birds. All thefe circumftances are different in reptiles. If we may judge from the diameter of the pulmonary arteries, they receive at moft a third of the circulating mafs, and fometimes much lefs. It is not neceffary that this blood fhould pafs back again through the lungs to return to the body: it may proceed by another route, as we have explained in the account of the circulating organs; becaufe it does not require to be fo frequently fubmitted to the action of the air, as in the two claffes mentioned above. Hence have refulted the two great differences already pointed out between the lungs of the warm-blooded claffes and of reptiles; differences which are obvioufly related to each other, the numerous vafcular ramifications requiring numerous cells and vifcera.

The pulmonary ferve alfo as bronchial veffels in reptiles; at leaft we find no arteries or veins of the latter defcription. The arterial and venous bloods are mixed in the heart; and the fame that goes to the lungs is conveyed to all other parts of the body for their fupply.

Yet the pulmonary are not the only arteries conveying blood to the lungs in reptiles: the ferpents, at leaft, offer an exception. The ramifications of the pulmonary artery are confined to that part of the lung, which has a reticulated internal furface. The pofterior part of the organ, compofing the fimple membranous bag, receives blood only from the arteries of the body. A part of the twigs that fupply it comes from the branches of the pofterior aorta, which are alfo diftributed on the ftomach. Other very minute ones are detached fucceffively from the vertebral column. The veins correfponding to thefe arteries pour their blood into the vena cava. In this fingular ftructure, we find a part of the lung executing the office of the cells of birds: and a portion of the blood, very fmall indeed, contained in the arteries of the body, is again fubmitted to the action of the air.

That portion of the general ferous membrane which covers the lung has nothing peculiar in reptiles.

The form and bulk of the organs vary much more in this clafs, than in the mammalia and birds. Both are determined in the mammalia by the cavity of the thorax; in birds, by the peritoneal cells, which limit them on one fide, and by the ribs, which cover them on the other. In reptiles, on the contrary, nothing feems to limit their developement, nor to give them a peculiar figure. Commonly they form oval bags, which extend in the chelonians along the back to the pelvis, above all the vifcera; they are lefs extenfive in the faurians and batracians. The ferpents have a fingle very long lung, prolonged over the œfophagus, ftomach, and liver, beyond the latter parts. In this fituation it is expofed to preffure every time the animal fwallows a large prey. Does this check the pulmonary circulation, and contribute to the torpor which ferpents experience at thefe times?

In the cameleon, and the agame marmorata, each pulmonary fac is very extenfive. They are divided into large conical appendices, prolonged as far as the pelvis, placed among the vifcera, and capable of holding fo much air, as to increafe the animals' bulk confiderably when they are diftended. The lungs of the firen lacertina are two long cylindrical facs, continued to the end of the abdominal cavity. In the larvæ of the falamander, there is a fmall oval cavity, opening by a narrow canal in the fauces.

Branchiæ or Gills.—The firft orders of reptiles (the chelonians, faurians, and ophidians) never poffefs this kind of refpiratory organ: they have only lungs. The batracians in their firft ftate, and the proteus and firen during life, have both lungs and branchiæ, or rather branchial appendages (appendices fimbriati). See the anatomy of the tadpole, and that of the proteus and firen, at the end of this article.

Expanfive Power of the Lungs.—" A fingular power," fays Blumenbach, " characterifes thefe vifcera in reptiles, and is is a point, in which they exceed those of the human subject, and of the other mammalia; namely, a particular kind of tone, or energy, by virtue of which, even when the chest is opened, and they are exposed to the external air, they are still distended and support themselves, while those of the mammalia, when the sternum is removed, and the thoracic cavities exposed, allow the air to rush out, and collapse. (See Morgagni Adversar. Anat. 5, 29, and the elegant experiments on the tortoise by the Parisian academicians; Hist. des Animaux, part ii. p. 194.) It is even asserted, that when the lung is compressed in a tortoise opened alive, it has the power of distending itself again. (Coiter Obs. Anat. Chir. p. 127.) A tortoise, from whom the lower shell had been removed, the thorax consequently being opened, and the lungs exposed to the air, survived for seven days. (Hist. des Animaux, just quoted.) The cause of these phenomena can only be found in the peculiar vital properties of the lungs; as it cannot be referred to contractility, irritability, or nervous influence. I have never been able to detect, in the lungs of amphibia, any more appearance of truly muscular texture, than in those of the mammalia, to which a modern author has too liberally assigned irritability. (Varnier in Hist. de la Soc. de Médécine, 1779.) The design of this peculiar vitality in the lungs of amphibia will appear very obvious, when we consider that it exists in animals who have a very imperfect bony thorax, or none at all, or one in great measure incapable of motion. Such is the case with frogs and toads, who are entirely destitute of ribs; with nearly all the tortoises and turtles (excepting, perhaps, a few of the soft species), in whom the whole coverings of the trunk are immoveable, so that neither the thorax, nor the abdominal muscles, can execute those motions in respiration, which they perform in warm-blooded animals."

Mechanism of Respiration.—In this, as well as in other points, the several orders of reptiles differ from each other. The chelonians, whose ribs are in the form of large osseous plates, consolidated to each other, and motionless, are, in effect, like the batracians, some of which have no ribs at all, while in others these bones are too short, and too little susceptible of motion, to be capable of assisting in the process of respiration. In all these animals, then, we can no longer regard these bones as the principal agents of the respiratory function. They also want the diaphragm, like all other reptiles. Consequently the mechanism of respiration differs in them, in its essential points, from that described in the article Lungs, which belongs to the whole class of mammalia, where the respiratory organs, inclosed in a peculiar cavity, follow all the motions of that cavity.

In fact, it is now well ascertained, that the batracian reptiles *swallow* air into their lungs. They close the mouth, and dilate the throat, when the external air, rushing through the nostrils, fills the empty space. The sterno-hyoidei, carrying the os hyoides downwards and backwards, are the great agents in this dilatation of the throat: the coraco-hyoidei assist them. When the former muscles are cut, respiration ceases. The elevation of the os hyoides, principally by the stylo-hyoidei, contracts the cavity of the throat, and drives the air into the lungs. The escape of this air from the throat by the nose is, no doubt, says Cuvier, prevented by a valve; but no such structure has been demonstrated. The action of the abdominal muscles, and perhaps a contractile power of the lungs themselves, expel the air from these viscera in expiration. Townson, who has investigated this subject most attentively (see his Observationes Physiologicæ de Respiratione Amphibiorum, 8vo. Vienna, 1798, with figures; also translated into English in his "Tracts,") observes, that he does not know whether the muscles extending from the glottis to the pubes should be called oblique or not. They surround the lungs in their whole extent, and have a considerable compressive force. They probably consist of different muscles; their fibres extend more or less transversely, and are therefore well calculated to produce the effect he has assigned to them. He states that he has always seen the frog's lungs collapse when the glottis was opened, whether the animal was dead or alive.

If the muscles and the membrane of the throat are removed, leaving only the sterno-hyoidei, the motions of the os hyoides, which take place in respiration, are continued, although respiration itself is destroyed. The latter effect is a consequence of the destruction of the throat; no cavity can now be formed to receive the air, which the animal swallows in breathing. The os hyoides, however, is alternately depressed and elevated, and the glottis continues to open and shut, but the lungs are permanently collapsed. If all the muscles employed in moving the os hyoides are cut, the glottis, whose muscles are entire, is opened and closed. In the same way, when warm-blooded animals have received a large wound in the chest, they make vain efforts to breathe, and to get rid of the painful sensation of suffocation.

It will appear, from the preceding description, that the frog's mouth must be shut when he breathes: and this is so strictly necessary, that the animal perishes from suffocation, if his mouth be kept open. Herholdt and Rafn asserted this in a communication to the Academy of Sciences at Copenhagen, and the point has been verified by Cuvier and Duméril. See Bulletin de la Société Philomatique, N° 30, an. 7. p. 43.

The same mechanism is employed in the chelonians. Deglutition is the only means they can employ for introducing air into their lungs. Having the mouth closed, they alternately contract and dilate the throat, like the batracians, and by the same powers. The air is expelled from the lungs by two pairs of muscles, analogous to the abdominal muscles. These fill the posterior interval between the sternum and the back shell, in which the posterior extremities are folded when at rest. We perceive, at this part, in the chelonians, those motions of contraction and dilatation, which are observed over the whole abdomen in the mammalia.

The first, or outer pair, correspond to the external oblique muscles: it is attached to the whole anterior edge of the pelvis, to the back and front shell, and is extended in the whole posterior interval of these parts. The internal muscle consists of transverse fibres, attached above to the posterior half of the back shell, near the vertebræ, descending on the outside of the viscera, inclosing them, and terminating below in a middle aponeurosis. The latter passes partly under the bladder, and will serve to evacuate that organ when the muscles contract. They compress immediately only a small portion of the lungs; but they press strongly on the abdominal viscera, and through the latter on the lungs, so as to expel the air. Perhaps, too, the lungs may contract by some powers of their own.

The mechanism of respiration, in the saurians and ophidians, is very analogous to that of birds, inasmuch as this function is particularly executed by the motions of the ribs and of the abdominal muscles. In most of the saurians, the ribs are perfectly similar to those of birds, consisting of two portions, united by a moveable articulation, and forming an angle, which is opened in inspiration, and closed in expiration. The muscles which put them in motion are analogous to those employed for the same purpose in birds.

The ribs of serpents, forming simple arcs, composed merely

merely of an offeous portion, are inclined backwards, and brought near the vertebral column in expiration, and are extended in infpiration. Elevators of the ribs, fimilar to thofe of man, but larger in proportion, produce the latter effect, in which they are affifted by intercoftal mufcles. The mufcles carrying the ribs backwards, and thus producing expiration, lie within the cheft. They are fixed to the fides of the vertebral column, and correfpond in number with the ribs. They are narrow and flattened, forming a kind of mufcular ribbons, paffing from the vertebral column, over one rib, to be fixed in the next. Other mufcular ribbons are attached to the infide of the ribs, defcend to be joined together, and then extend acrofs, ending in a thin aponeurofis, which unites the ribbons of each fide. Thefe compofe the abdominal mufcles, and comprefs the vifcera of the great cavity.

Refpiration, which confifts in warm-blooded animals of a conftant regular fucceffion of alternate infpirations and expirations, hardly admitting even a very fhort interruption, is performed in reptiles at irregular and long intervals, admitting of very long fufpenfion, and capable, therefore, in a much greater degree than in the former claffes, of modification by the will of the animal. Hence Linnæus affigned a "pulmo arbitrarius," or voluntary power over the refpiratory function, as a diftinguifhing attribute of the clafs. The difference, however, between the reptiles and warm-blooded animals is in the length of time for which they can do without refpiration: after a longer or fhorter interval, its renewal is equally neceffary to both.

All reptiles continue breathing conftantly as long as they are awake; and the turtles moft frequently of all. It is well known that they cannot remain long under water; but are obliged, at fhort intervals, to come to the furface for a frefh fupply of air. Blumenbach obferved water newts, when placed in a deep veffel of water, fwim up to the top frequently for the purpofe of drawing breath.

"On the whole, however," continues Blumenbach, "reptiles cannot only go much longer without breathing than warm-blooded animals, but they can alfo continue unhurt in vitiated air for a much more confiderable time.

"Tortoifes have been known to live more than a month with their jaws tightly tied, and their noftrils clofed with fealing-wax, (Mery, in Mem. de l'Acad. des Sciences, avant 1699, v. 2.) On the fame point we may mention the puzzling, but fufficiently authenticated inftances, of toads found alive in the middle of folid trunks of trees, and even in maffes of marble and other ftones. (See Luidius in Lithophylac. Britann. p. 112. Le Cat in Allion du Lac, Melanges d'Hiftoire Naturelle, v. 3. p. 95. Gentleman's Magazine, v. 26. 1756, p. 74. Guettard in Mem. fur differ. part. des Sciences et Arts, v. 4. p. 615. Hift. de l'Acad. des Sciences de Berlin, 1782.) There are numerous citations in Haller, de Corp. Hum. Fabrica et Function. v. 7. p. 151, and Kaeftner, in the Preface to the German verfion of the Stockholm Tranfactions, v. 3.

"Reptiles can alfo bear to breathe fixed and phlogifticated air much longer than warm-blooded animals. In my experiments at the celebrated cavern of Pyrmont, I conftantly found that pigeons could hardly be reftored to life if their immerfion in that bath of carbonic acid gas was protracted into the fecond minute. Frogs, however, recovered after ftaying in it five, fix, feven, and even nine minutes. The event of fimilar trials, made in the famous grotto del Cane, near Naples, correfponds to thefe. (See Nollet, in the Mem. de l'Acad. des Sciences de Paris, 1750, p. 72. Murray, in the Swedifh Tranfactions, 1775, v. 36. p. 249.) Della Torre found that a toad lived for half an hour in that grotto, and that a newt was ftill alive, after having been immerfed in this pernicious atmofphere an hour and a quarter.

"Carminati has already fhewn how much fooner confined air proves fatal to warm-blooded animals, than to the amphibia. (De animalium ex mephitibus et noxiis halitibus interitu, p. 96.) When I have enclofed two fparrows under one bell-glafs, and two frogs under another of the fame fize, the former have perifhed in convulfions from the vitiated ftate of their air, while the atmofphere of the other glafs had experienced fo little change, that a candle or burning coals were not extinguifhed by it." Specimen, p. 1.

The experiments of Boyle (Philof. Tranf. 1670, N° 62.), and the Florentine academicians, which have been fince moft frequently repeated, have fhewn that ferpents, frogs, &c. can remain very long (from two or three to ten or twelve hours) under an exhaufted receiver.

The nature of the changes produced in the air by the refpiration of reptiles, has been examined by Spallanzani (Rapports de l'air avec les etres organifés, publies par Senebier, 3 tom. 8vo. Geneve, 1807); Mr. Ellis (Inquiry into the Changes produced on Atmofpheric Air, &c. 1807, and Further Inquiry, &c. 1811,) and others. The latter author prefents us with a fummary of all that has been afcertained, as well as with experiments of his own; we, therefore, extract them in his own words from the works juft quoted.

"To obtain a knowledge of the fpecific changes which the air fuffers by the refpiration of the amphibia, the following experiments were inftituted. A toad, fupported on a fmall hoop, was inclofed in one hundred and eight cubic inches of atmofpheric air contained in a jar inverted over water, and ftanding in a room varying from 55° to 60° Fahrenheit. He died on the fifth day. The water had rifen confiderably in the jar, and the refidual air was ftill farther diminifhed by agitation with lime-water, which it rendered turbid. Fifty parts, after being wafhed in lime-water, were next fhaken in the eudiometer with the liquid fulphuret of potaffa, and loft only one part of its bulk. The experiment was repeated by confining another toad, in the fame manner, in another jar containing forty cubic inches of atmofpheric air, inverted over mercury. Under the hoop which fupported the animal, was placed a fmall cup, containing 1.5 cubic inch of the water of potaffa, which floated on the mercury. The whole was then fet afide in a room, of the temperature of 64°. By the twelfth hour, the mercury had rifen nearly half an inch into the jar, which was thickly moiftened with vapour, and the breathing of the animal feemed rather languid: by the twenty-firft hour, he breathed very faintly; and, by the twenty-fourth hour, he had ceafed to breath. The jar was allowed to ftand fome hours, at the end of which time the mercury ftood about eight-tenths of an inch high, and one-tenth of an inch of fluid was depofited on its furface. The jar was now raifed, and diluted fulphuric acid being poured into the alkaline folution, excited in it a very brifk effervefcence. It is inferred, therefore, from thefe experiments, that the oxygenous portion of the air almoft entirely difappears during the refpiration of thefe animals, after which they ceafe to breathe; and that a large portion of carbonic acid is at the fame period produced.

"Proceeding on the fuppofition, that the lofs in the bulk of air, evinced by the afcent of the mercury, in the laft of the foregoing experiments, arofe from the attraction of the carbonic acid by the alkaline folution, we endeavoured to afcertain the proportion which this lofs of bulk bore to that of the whole air originally employed. With this view a frog was procured, and placed in a jar of the capacity of forty cubic inches. Under the hoop which fupported

ported him, about half way up the jar, was placed a fmall cup, containing one cubic inch of the water of potaffa; and the jar being then filled with atmofpheric air, was inverted into a difh of mercury, and kept fteady by a weight preffing upon it. In the room in which the animal was placed, the barometer ftood at 29.2 inches, and the thermometer at 61°. At the end of twenty-nine hours, the animal was refting quietly on the hoop, with no appearance of diftrefs, and the mercury in the jar, when that in the difh was brought to a level with it, had rifen fix-tenths of an inch. In twenty-four hours more, the frog was ftill alive: his refpiration feemed now to labour, and he rofe often to the top of the jar, as if defirous of efcaping, or of obtaining frefh air: the mercury had now rifen to 1.15 of an inch. From this time, the difficulty of breathing continued to increafe, and, at the clofe of the fifty-ninth hour, from the commencement of the experiment, after having lain quiet for a confiderable time, he gave a convulfive ftruggle, and moved no more. The mercury in the difh was now brought to a level with that in the jar, and its height was 1.2 of an inch. The barometer, at this period, was 29.8, and the thermometer 65°.

"In order to examine the refidual air, we plunged the difh under water, which rifing into the jar, difplaced the mercury, and the cup, with its folution, was then withdrawn under water. The refidual air fuffered no diminution by being fhaken with lime-water, nor by contact with phofphorus, but it loft rather more than $\frac{1}{100}$ by agitation with the liquid fulphuret of potaffa. The jar originally held forty cubic inches, but the animal, with the hoop, cup, and folution, occupied a fhare equal to four, fo that the actual bulk of air employed was 36 cubic inches. Having placed the jar on its bottom, water, to the quantity of 27 cubic inches, was poured in till it reached the point to which the mercury, during the experiment, had rifen; and this, therefore, indicated the volume of refidual air: it then required nine cubic inches more of water to fill the jar completely, which, confequently, was the bulk of air that had difappeared. Hence, therefore, we have $\frac{27 \times 29.8}{29.2} = 27.5547$, but $\frac{4 \times 27.554}{483} = 22819$ and $27.554 - .22819 = 27.32651$, the corrected volume of air at the clofe of the experiment. But farther, $36 - 27.32651 = 8.67349$, and $\frac{8.67349}{36} = \frac{1}{4.15}$, fo that the diminution of bulk which the air fuffered in this experiment is rather greater than $\frac{1}{4.54}$, the proportion of oxygen gas which the atmofphere contains. In a fecond experiment, another frog lived in the fame volume of air about 60 hours, and the diminution which it fuffered, after making the neceffary reductions, amounted to $\frac{1}{4.868}$ of the whole. Where the carbonic acid, formed by the refpiration of another frog, was fuffered to remain, the jar, after the death of the animal, adhered firmly to the faucer in which it was inverted, and, when cautioufly elevated, the furrounding mercury rufhed in; and occupied only about one-tenth of the fpace which it filled in the above-mentioned cafes: the inferences deducible from thefe facts, inftruct us, that the diminution which atmofpheric air fuffers by the refpiration of thefe animals, bears a near proportion to the oxygen gas which it contains, when all the carbonic acid is removed: and as a fmall lofs of bulk likewife takes place when this acid is allowed to remain, we muft afcribe a part of the obferved diminution to the neceffary lofs which always accompanies the converfion of oxygen gas into carbonic acid.

"It follows from the preceding feries of experiments, that the oxygenous portion of the air is changed by the refpiration of amphibious animals in the fame manner as by that of the other claffes, carbonic acid, in proportion thereto, being, in all cafes, produced; and that when the whole, or nearly the whole, of that gas is fo changed, the animal no longer furvives. But, if the animal die when all the oxygen gas is changed, and all the air that has difappeared when the carbonic acid is removed, he oxygen gas, then the bulk of air that remains, and is unchanged, muft confift wholly of nitrogen gas; and as this nitrogen gas, joined with the oxygen gas that has difappeared, makes up the whole bulk of air originally employed, it follows alfo, that, while the oxygen gas of the air has diminifhed and fuffered change, the nitrogenous portion has continued undiminifhed and unaltered.

"During all thefe changes operated on the air contained in water, by the refpiratory functions of aquatic animals, the water itfelf feems to fuffer little or no alteration. Mr. Carlifle took feparate glaffes, each containing one pound of diftilled water, which was previoufly boiled to expel all its air, and then inverting them over mercury, he put into them one gold fifh, one frog, two leeches, and one frefh-water mufcle. The animals were confined feveral days in thefe fituations, and expofed to the fun during January, in temperature 43° and 48° Fahrenheit; but no air-bubbles were produced in the veffels, nor was there any fenfible diminution of the water. The frog died on the third day, the fifh on the fifth, the leeches on the eighth, and the mufcle on the thirteenth day. This experiment was made to afcertain the changes produced in water by the refpiration of aquatic animals; but the water had not undergone any chemical alteration. See Croonian Lecture in the Philof. Tranf. 1805." Inquiry, p. 83—88.

Mr. Ellis adduces fome additional evidence in his Further Inquiry. "The experiments already detailed in the former work clearly prove, that frogs and toads which belong to this clafs, entirely convert, by refpiration, the oxygen gas of the air into nearly an equal bulk of carbonic acid, without producing any change in its nitrogenous portion. Dr. Carradori alfo difcovered, that thefe animals lived much longer when they were immerfed in water that had a free communication with the atmofphere, than when the air was excluded. (Phil. Mag. vol. 16. p. 245). According to Spallanzani, frogs die fooner in boiled, than in common water. In their refpiration, they confume oxygen, and form carbonic acid. Thofe which have been recently fed, confume more of this gas than thofe which have fuffered a long abftinence. Under great cold they become lethargic, but their heart ftill continues to beat, and they ftill, in a fmaller degree, continue to change the air; but the confumption of oxygen increafes with the increafe of temperature. Thefe animals alfo change the air by their fkin, as well as by their lungs; and act upon it after death, and under putrefaction. (Rapports, &c. tom. i. p. 468.) The ova of frogs were likewife found to require air to carry on their evolution. Small tadpoles, while yet attached to the egg, were confined in veffels half filled with water, while the other half contained air, or oxygen or nitrogen gas. Thofe in the two former veffels were perfectly developed, and became large enough to fwim about; but thofe confined with nitrogen perifhed. Rapports, &c. tom. i. p. 466.

"Spallanzani extended his experiments to many other ani-

mals

mals of this clafs, and obtained fimilar refults. Different fpecies of ferpents he found to die in hydrogen gas, or when confined under water, but to live in common air, and convert its oxygenous portion into carbonic acid. They became lethargic from cold, and the heart then beat very flowly, or not at all, the refpiration was then alfo fufpended, and little or no effect was produced in the air. The fkin of thefe animals acted upon the air, as well as the lungs (Rapports, &c. tom. i. p. 249.); and when the blood was reddened by expofure to the air, its oxygen alfo difappeared, and carbonic acid was produced. (Rapports, &c. tom. i. p. 239. 263.) Similar refults were obtained in experiments on the refpiration of vipers, tortoifes, lizards, and falamanders. Rapports, &c. tom. i. p. 275. 287. 295. 353.

"The preceding facts fufficiently fhew, that various animals in all the foregoing claffes, and in every ftage and form of their exiftence, require the prefence of oxygen gas to maintain the functions of life; that this gas, by the exercife of thefe functions, is converted into carbonic acid; and that the degree in which this converfion proceeds, depends much on the healthy condition of the animal, and the vigour of its circulating fyftem. Since, alfo, in every inftance where the experiments have been made with the requifite accuracy, the bulk of carbonic acid produced, nearly or exactly equalled that of the oxygen which difappeared, we may conclude, from analogy, that fuch is univerfally the extent to which this change in the air takes place in animal refpiration; and fince, farther, the nitrogen gas of the air appears to fuffer no neceffary change in the exercife of this function, we may alfo conclude, that as far as regards the air, the fubftitution of an equal bulk of carbonic acid for the oxygen gas that is loft, comprifes the only effential change which the atmofphere experiences during the performance of this animal procefs." P. 269—272.

Vital Temperature.—"Since the refpiratory organs," fays Blumenbach, "may, with great probability, from the numerous inveftigations and difcoveries of the moderns, be regarded as the principal fource of animal temperature, we follow a natural arrangement in paffing from the confideration of their ftructure and functions, to a fhort view of the differences between the natural heat of reptiles and warm-blooded animals.

"Animals, whofe lungs are moft compact, receiving the greateft fupply of blood, and furnifhed with all the apparatus neceffary for fending the whole circulating mafs through the minor circulation, are obliged to keep up the refpiratory procefs uninterruptedly from the time of birth, expelling, inftead of the pure aerial fluid which they infpire, a noxious air, which corrupts the furrounding atmofphere if confined, poffefs a high natural temperature, about the 98th degree of Fahrenheit's fcale in man, rather higher in fome mammalia, and particularly in birds. In reptiles, on the contrary, poffeffing lungs of a rare and loofe texture, with comparatively flender fupply of blood, refpiration is irregular, interrupted, and in fome meafure arbitrary; they very flowly vitiate confined air; and exhibit a temperature exceeding, by a few degrees only, that of the furrounding atmofphere. One or two degrees, I fay, according to the refults of accurate obfervation on tortoifes (Walbaum Chelonograph. p. 26.): for my own experiments on amphibia have not exhibited refults fufficiently conftant to allow me to draw any certain inference from them." (Specimen, &c. p. 18.) Braun, indeed, has afferted, in the Nov. Comment. Acad. Petrop. t. 13. p. 427, that frogs poffefs only the temperature of the furrounding medium; but the facts which we fhall advance prefently, completely difprove this affertion.

The power which modern inveftigations have proved warm-blooded animals, and more particularly the human fubject, to poffefs in fo high a degree, of being able to endure expofure to heat much above the natural temperature of the body, without having their own heat increafed; and, on the contrary, of bearing, with equal facility, the moft intenfe cold, is not withheld from the amphibia, as is proved by the facts which we have related, in order to fhew the tenacity of life in this clafs. It is not, indeed, clear in thefe cafes, as in the experiments, of which man and different mammalia have been the fubjects, that the reptiles, when expofed to a degree of heat greater or lefs than their own, have maintained their own temperature at an uniform ftandard; on the contrary, indeed, it feems that in a great cold their heat is abftracted, and they become frozen; and it will alfo be feen, from facts to be brought forward prefently, that their heat is varioufly changed under different circumftances. Now we know that the temperature of the mammalia is not raifed beyond its natural level by expofure in an atmofpheric medium of 280° Fahr. (fee Tillet in Mém. de l'Acad. des Sciences, 1764); and that its ftandard is equally undifturbed, when the atmofphere is below the freezing point of mercury. (See HEAT, *Animal*, and MAN.) We may therefore fafely affert that man and the mammalia very far exceed reptiles in the power of refifting either great heat or cold; that is, of maintaining a ftandard temperature under the action of a furrounding atmofphere, confiderably exceeding or falling fhort of their own temperature. The following fummary of facts, concerning the temperature of reptiles, is taken from Mr. Ellis's Inquiry.

"Amphibious animals exhibit a great variety in the ftructure of the refpiratory organs, and, confequently, in the degrees of animal heat. Frogs and land tortoifes poffefs a temperature about five degrees higher than that of the medium they inhabit, according to Dr. Martine. The fame may be faid of fea tortoifes, toads, vipers, and all the ferpent kind, all of whom have lungs of the fame fabric and the fame cold conftitution of body. (Effay on Thermometers, p. 142.) Mr. Hunter obferved that the frog and toad were about four or five degrees warmer than the atmofphere when it was at 35° or 36°; and that, fome hours after death, they gradually fell down to the temperature of the furrounding air. (Treatife on the Blood, p. 298.) The difference of temperature appears to increafe in a warmer atmofphere; for Mr. Carlifle kept three frogs for many days in an equable atmofphere of 54°, and their ftomachs preferved a temperature of 62°. (Philof. Tranfact. 1805, pt. 1.) In an atmofphere of 58°, Mr. Hunter found the thermometer, introduced into the ftomach of a healthy viper, to ftand at 68°; but, after the animal was put into a pan, and the pan into a cold mixture of 10°, where it remained about ten minutes, the heat was reduced to 37°, and, in twenty minutes more, to 31°, nor did it fink lower; its tail now began to freeze, and the animal was very weak. A frog alfo, whofe temperature was 44°, when put into a cold mixture, foon fell down to 31°; and beyond this point it was not poffible to leffen the heat without deftroying the animal. (Obf. on the Animal Economy, p. 104.) A toad being placed in cold water, juft deep enough not to cover his mouth, the whole was put into a cold mixture between 10° and 15°. The water froze around the toad, and, as it were, clofed him in, but he did not die, and therefore was not frozen. Why the animals, mentioned in thefe experiments, died before they were frozen, while thofe which are expofed

expofed to the atmofphere, in very cold climates, do not die, is a point which Mr. Hunter does not pretend to determine; not knowing the difference, he fays, between the effects of a natural and artificial cold. Ibid. p. 89, 90.

"The experiments of Mr. Hunter farther prove that the temperature of moft of the foregoing animals not only falls rapidly in a colder medium, but that it rifes more quickly in a warmer one than that of thofe which poffefs a higher ftandard temperature. In the ftomach of a frog, the thermometer rofe from 45° to 49°; the animal was then placed in an atmofphere made warm by heated water, where it remained for 20 minutes, and upon introducing the thermometer again into the ftomach, the mercury rofe to 64°. (Ibid. p. 90.) A healthy viper was put into an atmofphere of 108°, and, in feven minutes, the heat of the animal, both in the ftomach and anus, was found to be 92°.5, beyond which it could not be raifed in the above heat. An eel, very weak, whofe heat was 44°, which was nearly that of the atmofphere, was put into water heated to 65°, for fifteen minutes; and, upon examination, it was of the fame degree of heat with the water. The heat of a tench was, in ten minutes, raifed from 41° to 55°, both in the ftomach and rectum, by being put into water at 65°.

"He found alfo, that a living and dead tench, and a living and dead eel, put together into warm water, received heat equally faft; and when they were expofed to cold, both the living and the dead admitted the cold likewife with equal quicknefs. (Ibid. 104, 105.) Hence, therefore, the animal heat, in all the claffes of animals hitherto mentioned, whether they inhabit the air or the water, feems to follow nearly that of the medium in which they are placed; and their ftandard temperature cannot, in confequence, be reftricted to any fixed point, but muft be confidered always in relation to that of their furrounding medium.

"Notwithftanding, however, the low degree of heat which thefe feveral claffes of animals poffefs, hardly, in fome inftances, exceeding that of the medium in which they live, yet this fmall excefs is a proof that they poffefs, within themfelves, a power of producing heat. The lofs of heat which infects fuffer under cold, the fall of temperature which many of the vermes clafs undergo from the fame caufe, the melting of fnow by the heat of fifhes, and the decline of animal heat which the amphibia, when expofed to great cold, experience, all demonftrate that the furrounding medium, whether it be air or water, is conftantly drawing off their heat, which renders neceffary as conftant a re-production of it." P. 218—221.

The great fize and beautiful ftructure of the lungs of reptiles lead us to conclude that they are very important organs in the economy of thefe animals, although their ufes and relations are not yet all fatisfactorily afcertained. It feems tolerably certain, that befides their office as refpiratory organs, they render the body lighter for fwimming in many inftances: in this point of view they may be compared to the fwimming bladder of fifh. It is by the inflation of its large lungs, that the cameleon can diftend its body fo remarkably.

"The lungs, too," fays Blumenbach, "are fubfervient in many reptiles to the production of found; — I fay in many, becaufe fome fpecies, even of our reptiles, are, fo far as I know, completely dumb: *viz.* the falamander, lacerta agilis (green lizard), and anguis fragilis (blind-worm); and others utter found very rarely, and only when in great danger, as the water newts; refembling, in that refpect, the mole and hare, which do not cry out until great violence is offered them.

"It has been reported that fome mammalia lofe their voice in particular fituations, as dogs in certain parts of America: the fame thing has been reported of reptiles, for example frogs, which G. F. Müller found to be dumb in many regions of Afiatic Ruffia. Sammlung Ruffifcher Gefchichten, vii. p. 123." Blumenbach, Specimen, &c. p. 15.

Organs of Voice.—The larynx, varying in different genera, as in the other claffes, has thefe characters in common; *viz.* that it has no epiglottis, and is compofed of pieces analogous to thofe of the upper larynx of birds. This is the only vocal organ; there is never an inferior larynx, as in birds. The voice cannot be modified by lips or velum palati, fince they do not exift. The degree of aperture of the mouth, and the motions of the tongue, are alone capable of modifying the action of the larynx.

The cartilaginous fkeleton of the crocodile's larynx contains five pieces: a nearly fquare plate, compofing all the under furface of the cavity. Two circular pieces or handles, fixed near together at one end, in the middle of the front edge of the plate, and at the other, in the middle of the fide. Their body is a little evelated above the fquare plate, and leaves on each fide, between it and that plate, a membranous hollow. The anterior extremity of each piece forms a lateral and vertical prominence, conftituting a kind of pillar under the glottis. To the pofterior external angle of this plate, a branch is fixed on each fide; thefe join together above, and form, with the back edge of the plate, a complete ring, which is the beginning of the trachea.

The glottis is merely membranous, extending from the junction of the two laft-mentioned branches to the middle of the os hyoides, where the membranes compofing it are attached. There are neither ventricles nor chordæ vocales. Two mufcles act on this apparatus. One comes from below the great plate, furrounds the larynx, afcending obliquely backwards, and joins the correfponding mufcle of the other fide behind the glottis, which it has the power of clofing. The other comes from below the back edge of the fame plate; decuffates the former, afcending obliquely forwards, and is fixed to the edge of the glottis, which it opens. The firft half of the glottis correfponds then to the broad and flat cavity of the larynx; the fecond, beginning from the two pillars in front, is merely a long and narrow flit. It is only in ftriking againft the two pillars, that the air can produce a whiftling noife, if indeed any fuch be produced at all.

The glottis of the crocodile of the Orinoco, fays Humboldt, is furrounded by a thick flefhy ring with circular fibres, which the animal can contract to fuch a degree, that the flit or opening of the trachea cannot be diftinguifhed. The glottis refts on a round and flat cartilage, analogous to the thyroid of mammalia. The upper part of the trachea prefents a fingular ftructure, which we mention here, becaufe it feems fubfervient to the production of found. The firft nine cartilages are not complete rings, but are joined together above by a tranfparent, very fine and tenfe membrane. (See Humboldt Recueil d'Obfervations de Zoologie et d'Anatomie comparée, t. 1. pag. 11. pl. 4.) Geoffroy obferved ten annuli thus united in the Nilotic crocodile; Duverney fixteen, in a crocodile diffected at the Academy of Sciences, and the Jefuit Miffionaries in Siam a larger number. To this membrane, ftretched like the parchment of a drum, and thrown into vibrations by the air, the deep and terrific howlings or bellowings of thefe dangerous reptiles are afcribed; the glottis being at the fame time clofed by its mufcular ring. Annales du Mufeum, t. 2. p. 46.

In the iguana, the pillars are fcarcely more prominent within than the reft of the parietes; the glottis is very fhort, ſhort, and the inferior plate goes forwards and becomes broader, being turned up to form the rudiment of an epiglottis.

The ſame ſimplicity of ſtructure prevails in the tupinambis, the common lizard, the tortoiſes, and ſerpents; an inferior plate, and two lateral pieces narrowing a little the edges of the glottis. Theſe animals can only be capable of producing hiſſing ſounds.

The mud tortoiſe has, at the bottom of its organ, a rounded depreſſion, which is not ſo well marked in the turtle; but it has not any vocal chords. In a great land tortoiſe of Madagaſcar, there is a triangular membranous criſta, attached to the lower part of the larynx, and aſcending in the glottis, which it divides into two. This is analogous to a ſtructure very common in the upper larynx of birds. The edges of the glottis are flat, ſharp on the outſide, and touch completely.

In the ſcink, the edge of the glottis is turned a little inwards to form a tenſe membrane, directed backwards.

In the cameleon there are pillars, nearly as in the crocodile, but they are each furniſhed with a tenſe membrane directed backwards, and very fit for vibration. In front of them, on each ſide, a fleſhy protuberance is obſerved, contracting the glottis, which is very ſhort, and terminating in front by a tranſverſe ſlit. But the moſt remarkable circumſtance about the larynx of the cameleon, is a ſmall membranous ſac opening below, between the inferior plate of the larynx, and the firſt ring of the trachea.

Neither the iguanas nor the dragons poſſeſs a ſimilar ſac, although we obſerve in them goitres on the outſide: theſe prominences have no relation to the vocal organs.

The frogs, which are ſo noiſy, have a larynx ſuitable to this character in the ſize and prominence of its vocal chords. The inferior plate of the larynx is a ſlender tranſverſe branch, bearing on each ſide a large ring, which is the origin of the bronchus; for, in theſe animals there is no tracheal tube. On the front of the tranſverſe branch, two oval pieces are articulated, convex externally, and concave internally, ſo as to reſemble kettle-drums. On the lower edge of each a membrane is ſtretched internally, which oppoſes at right angles the courſe of the air. The edge of this membrane forms the chorda vocalis, which is conſequently more iſolated than the cartilages, and freer than in any other animal. Above it is the opening of the ventricle of the glottis, occupying all the concavity of the kettledrum cartilage. The upper edge of this cartilage forms the margin of the glottis properly ſo called. Vicq' d'Azyr conceived that the ventricles communicate by their bottom with the bronchi, and thus aſcribed three openings to the larynx of frogs: but this is a miſtake.

Beſides this apparatus, which is extremely ſonorous, male frogs have two bags, each of which opens by a ſmall hole, not in the larynx, but in the bottom of the mouth, at its ſides. They paſs under the arch of the lower jaw, to make a prominence under the ſkin on each ſide under the ear. Theſe bags are diſtended when the frogs are croaking. They are covered by a muſcular tiſſue capable of compreſſing them. The female frogs, and toads of both ſexes, and the tree-frogs, are deſtitute of the bags; but the latter have a ſimple ſac under the throat. In this larynx there is a muſcle on each ſide to ſeparate the oval cartilages; and a tranſverſe one in front, paſſing between them, and calculated to approximate them. For repreſentations of theſe laryngeal ſacs in the frog, ſee the German collection of Camper's ſmaller writings, vol. 1. pt. 1. pag. 144. tab. 3. fig. 1—4. Vicq d'Azyr has repreſented the rima glottidis of the tortoiſe, frog, and ſerpents, in the Memoires de l'Acad. des Sciences. 1779, tab. 13; and Tyſon that of the rattleſnake, in the Philoſ. Tranſ. vol. 13. The chordæ vocales, too, are larger in the male than in the female frog.

Voice of Reptiles.—The tortoiſes and turtles are ſaid to have the power of producing a more or leſs ſtrong hiſſing, when affected by any lively feeling; but we do not know of any very clear and ſatisfactory teſtimony on the ſubject. Pliny's obſervation about the ſnoring of turtles when floating aſleep on the water, has not been confirmed. The large iguanas utter ſharp whiſtling or hiſſing ſounds as they run about the tops of trees. Several ſerpents hiſs, and the large ſpecies very loudly. The noiſe made by the tail of the rattleſnake is not a vocal ſound, but produced by a peculiar organ, which we ſhall deſcribe.

Daudin aſſerts, that ſalamanders produce two kinds of feeble ſound out of the water; the firſt is a low ſound, produced in the throat, which they ſwell for that purpoſe; the ſecond conſiſts in a ſlight ſtriking of the two lips together, without any motion of the throat.

According to the traveller Bartram, crocodiles produce moſt prodigious noiſes. The ſound is terrific, particularly in the ſpring, when theſe dangerous animals copulate. The noiſe reſembles diſtant thunder, ſhaking the country and making it re-echo far and wide. When they are thus bellowing by hundreds and thouſands at a time, we might ſuppoſe, ſays Bartram, that ſome violent ſhock agitates the globe, and ſhakes it to its very foundations. He alſo ſtates, that when they ſtrike their jaws together they make a ſurpriſing noiſe, like that of a heavy plank forcibly beaten againſt the ground.

Humboldt ſays that the young crocodiles make a noiſe like cats; and that they utter very piercing cries, juſt after eſcaping from the egg, if attacked by a dog. He never heard any vocal ſound produced by the old crocodiles; although he lived among them five years, and the fire often attracted them within a few paces of the tents at night. The Indians aſſerted that the crocodile makes a noiſe like that of a cow; that its voice is very terrific, but ſeldom heard, and ſometimes juſt before an earthquake, the approach of which they are ſaid to diſcern. Recueil d'Obſ. de Zool. et d'Anat. Comp. p. 11.

Organs of the Generative Functions.—There is a very cloſe analogy in the ſtructure of theſe parts between reptiles and birds: in both claſſes there is a cloaca, that is, a cavity common to the generative organs, the feces, and the urine; in both the male has teſticles incloſed in the abdomen, while the female organs conſiſt of ovaries and oviducts. The young being leaves the mother in the form of a ſmall egg, which is generally developed out of the body. The generative proceſs, however, in many inſtances, exhibits in this claſs very ſtriking peculiarities.

Male Organs.—The teſticles: the ſituation and ſtructure of theſe glands in the three firſt orders are very analogous to thoſe which they have in birds. They are conſtantly found in the abdominal cavity, united to the inferior ſurface of the kidnies (in the chelonians), in front of the latter viſcera on each ſide of the vertebral column (in the ſaurians and ophidians), or immediately under their anterior portion (in the batracians). Their form varies in the different genera; they are ſeparated, in the ſalamanders, into two ſpherical bodies, placed one before the other.

The kidney, teſtis, and epididymis, lie cloſe together in the teſtudines, according to Blumenbach; but each of the three organs may be diſtinguiſhed by its peculiar colour and ſtructure on the firſt view. There is much obſcurity in the different deſcriptions of the male organs in the turtle and tortoiſe. Schneider has collected the various obſervations on this ſubject in his natural hiſtory of the genus teſtudo.

Their ſubſtance exhibits, in the tortoiſes, large faſciculi, of which the diviſions paſs in various directions, united by cellular tiſſue: theſe faſciculi are fine, cylindrical, and eaſily ſeparable in the lizards. In the crocodile, according to Geoffroy, the teſtes are like thoſe of fiſh, narrow and elongated, and lying above and in front of the kidnies (probably more correctly in front of and below theſe glands). In the batracians we can diſtinguiſh merely an agglomeration of ſmall white grains interſperſed with blood-veſſels. No corpus Highmori can be diſcerned.

Yellow appendages, conſiſting of a fatty ſubſtance ſurrounded by a membrane, and floating in the abdomen, are connected to the front end of the teſtes in the frogs and toads.

The *epididymis* of the chelonians is a packet made up by the convolutions of a large canal (the vas deferens), which is tortuous in its whole courſe, and ends in the cloaca at the part correſponding to the baſis of the penis and its canal. It forms, in the lizards, a detached body, large and pyramidal, larger than the teſticle, adhering to it only by a ſmall thread, and evidently made up entirely of the convolutions of the vas deferens. The latter paſſes along the outer edge of the kidney to the cloaca, in which it opens.

In the crocodile the ſemen is conveyed into two veſiculæ of conſiderable ſize, contiguous to each other, placed at the back of the common cloaca, and partly included in a cartilaginous ſac. They open into the cloaca by ſix or ſeven holes on each ſide, arranged in a circular form round the meatus urinarius. Geoffroy. If theſe are veſiculæ ſeminales, it is the only example we know among reptiles of ſuch organs.

The teſtis is long and ſlender, and the relative bulk of the epididymis is leſs in the ophidians; it ſoon changes into a vas deferens, alſo very tortuous, opening in this, as in the preceding orders, into the cloaca. In the latter only the canals are inſerted in a papilla, which has been incorrectly deſcribed as a penis. A more minute account of theſe organs in the viper, may be ſeen in Charas, Deſcription Anatomique de la Vipère.

Veſiculæ Seminales.—There is no reſervoir analogous to the veſiculæ ſeminales properly ſo called, nor to the acceſſory veſiculæ of ſome mammalia in any of the other claſſes of vertebral animals. They have been ſpoken of in the viper and the batracians, as well as in ſome birds; but it ſeems that a ſimple dilatation of the vas deferens has been miſtaken for them. Poſſibly future reſearches may ſhew that the arrangement mentioned above in the crocodile conſtitutes an exception to this remark. This is the ſtatement of Cuvier. Blumenbach ſpeaks of large veſiculæ ſeminales in the frog, which are wanting in the toad. § 324. (See Roeſel Hiſtor. Ran. Noſtr. tab. 5, 6, and 21.) Charas, in his deſcription of the viper, ſpeaks of two reſervoirs connected with the vaſa deferentia, and always full of a fluid, like that of the teſticles, under the name of veſiculæ ſeminales.

The ſecretion of the teſticles, as obſerved by Spallanzani in the frog and toad, was a tranſparent fluid like water. From the parts, which he calls veſiculæ ſeminales, of the frog, he could procure at the time of copulation from two to three grains of this fluid. In the water newt it was, in colour and conſiſtence, like thick milk. He could not diſcover in it any remarkable ſenſible property—nothing pungent—nothing acid or alkaline. (Diſſertations, v. 2.) He alſo found the ſeminal fluid, both of the frog and newt, to abound with the living vermiculi. Tracts, v. 1. p. 300 and 301.

Organs of Copulation.—There are two ſpecies of union between the male and female. In the greater number there is a male organ introduced into the body of the female, and conveying the fecundating liquor: but in the batracians, which have no male organ, there is merely a conjunction of their bodies, it is a prehenſion by the male rather than a true copulation.

In the males of thoſe batracians which copulate thus, there is a peculiar organiſation of the ſkin of the hand. Firm tubercles, compoſed of hard, blackiſh or brown papillæ, cover not only the thumb, but alſo the palm of the hand. Theſe being preſſed into the ſkin of the female, give the male a very firm hold. They diſappear after the ſeaſon of copulation, and are not ſeen again until that ſeaſon recurs. The copulation of the frog kind is effected in the following way: the male aſcends the back of the female, paſſes his front limbs under her axillæ, and carries them round the cheſt, until the fingers croſs in front. He continues graſping her firmly in this way until the laying is finiſhed. The poſterior part of his body paſſes beyond that of the female, ſo that he can fecundate the eggs as they are expelled, and he is ſaid to aſſiſt in that operation. They remain joined for ſeveral days, and the graſp of the male is ſo firm, that great force is neceſſary to ſeparate him. Contuſion and laceration of the breaſt, and even the death of the female, ſometimes follow the violent ſtraining of the male. (See Spallanzani's Diſſertations, vol. i. p. 17.) The males are more brilliant at the ſeaſon of copulation, which takes place only once a-year, in the early ſpring; they inflate their vocal bladder more frequently, and indulge in their croaking noiſe. In the ſalamanders a creſt, with divided edge, appears on the back and tail, and is afterwards, in great meaſure, loſt.

The duration of copulation in the frogs is inverſely proportional to the warmth of the atmoſphere. When this is conſiderable, the female will be free in five or ſix days; but, in a cold ſeaſon, the embraces of the male continue for eight or nine days. The ſeaſon of re-production is the beginning of ſpring: in the very firſt days, the frogs begin to ſtir themſelves in our marſhes and ponds: they copulate, lay and fecundate their eggs very ſoon. At the ſame ſeaſon, the tortoiſes, lizards, and ſerpents, accompliſh the ſame proceſs. Sometimes frogs are found united even before the froſts have ended. Daudin found two frogs in copulation in the middle of February, the thermometer of Reaumur at 3° above zero; it deſcended in the night to 4° below 0; and the pond was frozen for two days; at the end of which time the female began to lay. Hiſt. Nat. des Reptiles, vol. i. p. 207, 208.

One of the toads, on which Spallanzani made his experiments, copulates in the beginning of March or end of February, before all the ſnow is melted; the proceſs laſts ten, twelve, fourteen, or even twenty days, if the ſeaſon be cold. Spallanzani, ch. 3.

The abdomen ſwells greatly in both ſexes during copulation; in the female, from the enlargement of the ova; in the male, from the depoſition under the ſkin of a very limpid water, which diſappears after the laying.

The tree-frogs, at leaſt that of Europe (hyla viridis) do not copulate like the frog and toad. The male fixes himſelf on the female, by merely applying his anterior paws under her axillæ, and employing the tubercles of the fingers. He remains in this ſituation for twelve or fifteen hours, or even, according to Roeſel, three days.

The ſalamanders do not copulate at all; the male places his head on that of the female, and diſcharges the ſeminal fluid, which is received by the female organs. See Spallanzani,

zani, Diff. vol. 2; and Latreille, Hiftoire Naturelle des Salamandres de France.

Penis.—The chelonians have one; moft of the faurians, and the ophidians, have two; and the batracians none. There is a papilla in the cloaca, in place of the penis, but none in the toad.

The relative fize of the organ is more confiderable in the chelonians than in the mammalia and birds. It is long, nearly cylindrical, and expanded at the end, which terminates in an obtufe hook-like point, fomewhat refembling the end of the elephant's trunk. A deep groove runs along the whole upper furface of the member, and is even deeper near the glans. It terminates on the broad expanded end of the latter, by an orifice divided into two by a papilla. The approximation of its edges converts this groove into a canal: it fupplies the place of the urethra. This penis is compofed of two corpora cavernofa, confounded together in a part of its extent. They begin by two vafcular fwellings analogous to the bulb of the urethra: their tiffue is continued into two canals, of which the fibrous parietes, at firft thin, foon become very thick, while their cavities diminifh, and are united near the glans into one. The whole large fwelling compofing the glans is merely a developement of the vafcular tiffue of the latter, covered by a loofe and plaited fkin, and fupported by a prolongation of the fibrous fide of the corpus cavernofum.

The fkin of the groove is covered by a cavernous texture, analogous to that of the oftrich; and there is, on each fide of this groove, a canal, the orifice of which is in the cavity of the peritoneum, on each fide of the bladder, while the canal itfelf is prolonged in the fubftance of the penis, as far as the glans, where it ends in a cul-de-fac, without its fides appearing perforated in any part.

This penis has two retractor mufcles, arifing in the pelvis, and reaching as far as the glans. They fold back the penis in the cloaca, fo that, like the penis of the oftrich, it fhuts the orifice of the rectum, and that of the bladder. Erection, and the action of the fphincter, bring it out of the cavity.

The penifes of the lizards and ferpents are fhort, cylindrical, commonly befet with white, hard, and pointed papillæ, which have been tolerably well compared to the prickles of the hedge-hog. Thefe organs, in their collapfed ftate, are drawn within the fkin of the tail: when erect they are protruded, and appear at each angle of the external flit of the cloaca. They have two retractor mufcles, arifing under the firft caudal vertebræ. Tyfon has figured the penis of the rattlefnake and viper in the Philof. Tranf. v. 13, tab. 1; and the latter is minutely defcribed by Charas.

The penis of the crocodile is fingle, and lodged in a fold of the anterior part of the cloaca. It is compofed of a firm cartilaginous fubftance, terminated by a glans of fofter texture. It is excavated in its whole length by a deep groove. It has a very large retractor mufcle, which is fo confiderable as even to caufe a fwelling of the tail.

In the faurian reptiles, as in the frog and falamanders, the male fixes himfelf on the female, and obliges her to turn towards him the pofterior part of her body, and a real copulation enfues.

The act is differently accomplifhed in the ferpents: the male and female twine round each other, are clofely connected by feveral turns, and remain thus adherent for one or two hours. Is the fmall horny fpur, fituated on each fide of the anus in the boæ, and retractile under the fkin, employed at all by the ferpent as an organ of prehenfion, like the cutaneous tubercles of the hand of the ranæ? The faurians and ferpents conceal themfelves carefully for this purpofe.

Although the chelonian reptiles feem fo little calculated for copulation, this procefs takes place in them, the male fixing himfelf to the female by attaching the nails of his front limbs to the foft fkin of her neck. Naturalifts are ftill uncertain, whether turtles are joined plaftron to plaftron, as Lacépède has afferted in his Natural Hiftory of Oviparous Quadrupeds, or whether the male mounts on the back of the female, as Bomare has reprefented it in his Dictionnaire d'Hiftoire Naturelle. From the word *cavalage*, employed by the French mariners to denote this union, we may infer that they copulate like the frogs: the expreffion denotes clearly that the male is mounted on the female as the ftallion is on the mare (cavale). Catefby, in his Natural Hiftory of Carolina, afferts that they remain united for many days.

Female Organs of Generation.—Reptiles have two ovaries, ufually much more confiderable than the fingle ovary of birds. For moft of the year thefe bodies are fmall: but they acquire, at the propagating feafon, an extraordinary development, and thus diftend the abdomen very remarkably. This is particularly obfervable in the frog kind.

In autumn and winter, fays Spallanzani, the immature eggs lie all in the ovarium, which is divided into two lobes: thefe lobes confift of leffer lobes, each of which is invefted with a peculiar membrane. The eggs are of two fizes; fome very fmall, fo as to be fcarcely vifible with the naked eye; others feven or eight times larger; both kinds are globular. The fmaller are of a livid grey colour: of the larger one hemifphere is white, the other black. The flighteft touch is fufficient to burft them, after which they are refolved into a cineritious vifcid liquor. (Differtations, v. 1. § 4.) The black fpots of the furface, fuppofed by Valifneri and others to be the rudiments of the tadpole, are attached to the internal membrane, and have no connection with the eggs. In the fpring the eggs of the largeft kind are ftill larger, and they are mature when copulation takes place. In the firft periods of copulation, they are found in the fac of the ovarium; during the fucceeding times, partly in the ovarium and partly in the oviducts, where they become enveloped by their covering of vifcid tranfparent mucilage.

The ovaria of the falamander contain a multitude of little eggs of a yellowifh-white colour, fmaller than hufked millet, and not floating loofe in the cavity of the ovaria, but adhering to their fides. Thefe increafe in fize at the approach of fpring.

The ovaria are connected to two long productions of peritoneum, which are fixed on each fide of the fpine down to the pelvis. The ova are ranged along the loofe edge of this fold, either in a fingle row, as in the chelonians, or agglomerated in a much larger number, as in the batracians. Their blood-veffels extend between the laminæ of thefe membranous productions. In the batracians there are yellow fatty appendages to the ovaries, like thofe of the tefticles.

In the ferpents, like all their other vifcera, they partake of the elongated figure of the body. The ova, confifting of yellow veficles, refemble rows of beads.

Oviducts.—There are two in all reptiles, like their ovaries. They are membranous canals, fixed on each fide of the vertebral column by a production of peritoneum. They commence by an expanded orifice (fimbriated opening of the Fallopian tube in mammalia), at which the ova enter. The tube is firft conical, diminifhing a little in fize; then it is cylindrical in the reft of its courfe, which has a much greater propor-

tional

tional length than in birds. In confequence of this length of the canal it is plaited on the production of the peritoneum in the chelonian, faurian, and ophidian orders, or extremely finnous and folded on itfelf in the batracians. When the curvatures are deftroyed, and the duct is ftretched in a ftraight line, it is four times the length of the animal in the falamander. Its parietes confift at firft of a thin membrane, they become afterwards thicker, and affume the appearance of a glandular ftructure. The oviducts end in the frogs by a dilatation, which opens into the cloaca.

The thick flefhy part of the oviduct in the tortoifes has been frequently called the uterus: the two oviducts open feparately. Caldefi offervaz. intorno alle Tartarughe, tab. 6, fig. 9, 10.

An uterus is alfo fpoken of by fome in the frogs, although the generation of thefe animals has nothing in it like utero-geftation, and the ova are fimply tranfmitted through the tubes, without being retained in them to undergo any part of their developement. "The frogs of this country," fays Blumenbach, "have a large uterus divided by an internal partition into two cavities, from which two long convoluted oviducts arife, and terminate by open orifices at the fides of the heart. As the ovaria lie under the liver, it is difficult to underftand how the ova get into the above-mentioned openings. The uterus opens into the cloaca." (Comparative Anatomy, tranflated by Lawrence, p. 446.) "The toads have not the large uterus, but their oviducts terminate by a common tube in the cloaca." (Ibid.) For delineations of thefe parts in the frog and toad, fee Roefel, tab. 6, 7, 8, and 21. The rana pipa (Surinam toad) has the fame ftructure. See Camper in the 9th vol. of Commentat. Soc. Reg. Scient. Gotting. p. 129. Alfo in his Kleinere Schriften, v. 1. pt. 1. tab. 3. fig. 1.

Female Organs of Copulation.—The male penis in copulation paffes into the female cloaca. Does it go into the oviducts?

The chelonian reptiles have a clitoris very analogous to the penis of the male, from which it differs only in its fmaller fize. It is long, grooved lengthwife, and terminated by a rounded glans. Retractor mufcles, analogous to thofe of the penis, draw back the clitoris into the cloaca, when it has been extended.

No clitoris has been difcovered in the other reptiles.

Dorfal Cells of the Rana Pipa (Surinam toad, bufo dorfiger).—It is fingular enough to meet with in a toad a ftructure analogous to that of the abdominal pouch of the marfupial mammalia. The fkin of the bulk is excavated in the female pipa by a large number of cells, (of which, Cuvier fays, eighty have been counted,) in which the ova are placed, and changed into tadpoles, and the latter grow and are metamorphofed. As far as an examination of individuals, preferved for a long time in fpirits of wine, will enable us to judge, the parietes of thefe cells do not feem to have any thing in their organization diftinct from the reft of the fkin.

Naturalifts fuppofed at firft, that the ova grew on the back of the female, and that the male fecundated them in that fituation: but obfervation of the living animal, and anatomical inveftigations, have fhewn the incorrectnefs of this notion; have proved, that the generative organs refemble thofe of other female toads; that the pipa lays her ova like the other toads; and that the male faftened on her, as in the ordinary mode belonging to this order, covers her with the eggs after they have been fecundated. The eggs are then enveloped in a fluid, which caufes the fkin of the back to fwell round them: thus they are contained in rounded cavities. The tadpoles are produced there, with their membranous tails, and are developed in this fituation, which they do not quit until they have reached their perfect ftate. The female then caufes the cells to difappear from her back, by rubbing it againft hard fubftances. Befides the works of Camper already referred to, concerning the anatomy of this extraordinary creature, fee Blumenbach's Abbildungen, N° 36, for excellent figures of the animal, and of its young in three ftates: 1ft, as a long-tailed tadpole, with fmall proceffes of hind legs, and no trace of fore limbs; 2dly, as a four-footed creature, with the tail reduced to an infignificant fize; and 3dly, with the tail entirely removed. The fkeleton is figured by Schneider, in his Hift. Amphib. Fafcic. 1.

Phyfiology of the Generative Organs.—In the whole clafs it is quite obvious, that the germ or rudiment of the new being is produced by the female in the ovarium, a point which does not admit of direct proof in the mammalia. This "pre-exiftence of the germ" to the act of copulation, and its formation in a peculiar organ of the female, demonftrated fo clearly in reptiles, illuftrate one of the moft curious points in the theory of the natural reproduction of organized beings, or generation, and overturn many of the fpeculations on that fubject. Thefe germs acquire confiderable fize in the ovaries, and are therefore diftinctly vifible before the approach of the male. They pafs from the parts juft mentioned into the oviducts, and thence out of the body through the cloaca, having received in their paffage through the ducts fome external coverings. An application of the fecundating liquor fecreted by the male is neceffary to the evolution of thefe germs; they may be ejected from the body without the embraces of the male, as in the frog, toad, or newt, if they are forcibly feparated from the male after copulation has begun, but then they are not evolved.

Swammerdam and Roefel were of opinion, that the eggs were loofe in the abdominal cavity, and taken up thence by the oviduct. Spallanzani found them in the abdomen only thrice in more than two thoufand diffections; and hence fuppofes that the circumftance muft have been a deviation from the accuftomed courfe in thefe inftances.

Although the motions and vital functions of reptiles feem very languid in comparifon to thofe of the warm-blooded claffes, they exhibit confiderable ardour and manifeftations of lively feeling in their amours. "As foon," fays Spallanzani, "as the eggs begin to be difcharged, the agitation of the female is extreme; fhe darts backwards and forwards, rifes towards the furface of the water, and then finks, keeping the hind legs conftantly ftretched out, and croaking in a low voice. The male, keeping his hind legs clofe to his body, throws himfelf into ftrange contortions, and accompanies the croaking of the female with a kind of interrupted noife, which I cannot exprefs by words." Differtations, v. 2. § 11.

In the work juft quoted, which contains the moft original and interefting collection of facts concerning the whole affair of generation, Spallanzani gives the following account of the amours of the water newt, which are the more curious, inafmuch as there is not only no real copulation by the introduction of a male member into the female organs, but not even any conjunction of the bodies, as in frogs and toads. "The male purfues the female, which at firft makes a fhow of flying, but then ftops of her own accord. He then approaches her in fuch a manner, that the lower part of his head comes in contact with the upper part of the head of the female; and this is done while the animals are in fuch a pofture, that their bodies form an angle,

angle, of which the point is made by the union of the two heads; or they may only join muzzle to muzzle. The bodies are always very near together, fo that the angle formed by the two heads or muzzles is always very acute. Then the male erects that dentated prominence, which is placed on his back, and agitates it in a curious manner: he alfo moves his tail brifkly, bending it about, and ftriking very gently the fides of the female. During this time he emits from the aperture of the anus, now unufually tumid and dilated, a copious jet of femen, which mixes with the water, and thus diluted arrives at the anus of the female, alfo more enlarged than ufual. In this important operation, then, the anus of the male is never in contact with that of the female, which maintains a greater or fmaller diftance, and never fhews any part characteriftic of her fex. After the male has difcharged this jet of femen, he refts for a while, on fome occafions quitting the female; he then returns to his employment, and repeats the contortions of his tail, and the emiffion of femen." § 80.

In the land newts there is a momentary copulation: "in the cleareft days, and in the places moft expofed to the fun, the male runs after the female, and when he has overtaken her, he twines himfelf about her, and unites his genitals to her's, but this union may be termed momentary, after which they part." § 81.

The vehemence of the propenfity in amphibia is fo remarkable, that they actually will copulate with other fpecies, as frogs with toads, &c. No example of hybrid offfpring, from fuch a conjunction, has been recorded. It has alfo been known, that frogs, in want of a female, have copulated with other males, or with dead females.

That the animals are entirely abforbed by the powerful emotions accompanying this act is evinced by a feries of difgufting experiments of Spallanzani, purfued and multiplied with an unrelenting and unneceffary cruelty, and related quite coolly, without evidence of remorfe or the flighteft apology. He pricked, cut, and hacked the male frog and toads, without making them loofe their hold; amputation of the limbs, and of the head, was equally ineffectual.

Males, after fuffering amputation of the fore or hind limbs, renewed their fituation, and completed the generative act. "Nay, even the decapitation of a frog did not ftop the embraces or fecundation. It is well known, that thefe animals are fo tenacious of life, that that operation does not take it away immediately. That of which I am fpeaking was thrown into convulfions; but neither the fore-feet nor legs quitted the breaft of the female, which brought forth her fetufes in an hour and three quarters, and I was an eye-witnefs to the male's befprinkling them with femen; that they were fecundated there can be no doubt, fince they came to life at the ufual time. As foon as he had performed this operation, he deferted his fituation, and died in four hours afterwards." Differtations, v. 2. § 90 and 100.

All reptiles may be faid to be oviparous; an egg, containing the germ, and as much nourifhment as is neceffary to fupport it until it is fufficiently developed to leave this abode, is formed in the body of the mother, and enters the oviduct in all. But there is a fubdivifion, according to the fubfequent progrefs of the egg thus produced. In the greateft number of reptiles, the ova or eggs are laid by the female in that ftate, and the young reptiles are developed afterwards: but in fome, as the venomous ferpents, and the true falamander, the ovum may be faid to be hatched in the oviduct, although the animals ftill come into the world fo far enveloped by the membranes, that the character of an oviparous generation is preferved. The reptiles of the latter kind are called ovoviviparous.

In both thefe cafes, a real egg, like that of birds, is produced, and has no connection with the body of the mother; it is a very different thing from the ovum of the mammiferous animals, in which there is no fupply of nourifhment for the fœtus; and the latter is connected by the umbilical chord with the veffels of the mother, and derives from this fource the materials of its growth. Here, as no true egg is produced in any part of the procefs, and as the young are always brought into the world alive, they may be juftly termed viviparous. See Lacépéde, Hift. Naturelle des Serpens, t. i. p. 31.

In ufing the common term ovum, we do not mean to reprefent that the thing produced is the fame in all; nor that it is like the egg of birds in all. There are varieties in the different orders, and, in the batracians at leaft, there is not a very clofe analogy to the ova of birds.

The eggs of reptiles are covered with a membranous, rather than calcareous fhell; but there is fome earthy matter in it. In the green turtle this fhell is flexible, but contains earthy particles. It is compofed of a foft membrane, containing albumen, which heat does not harden, and a yolk which it does. The eggs of lizards have a more or lefs hard fhell: it is flexible in the grey lizard, hard in the fcink mabouya, and the crocodile. It has been afferted, that the eggs of the iguana are not hardened by boiling. The covering of the egg is foft and calcareous in ferpents. The batracians lay gelatinous and femitranfparent eggs, without any covering.

A part, correfponding more or lefs clofely to the yolk of a bird's egg, is produced in the ovary, efcapes from its membranous covering, and enters the oviduct, where it receives its external inveftment, as the yolk of the bird's egg receives its fhell and albumen. In the turtle, the procefs feems very fimilar to what we fee in birds. There are numerous large yolks obferved in the ovarium, contained in calyces; and thefe, when boiled, are very fimilar to the yolks of birds. In the crocodile and ferpents, it is nearly the fame. But in frogs, toads, and newts, the egg in the ovary does not feem to be a yolk, but the rudiment of the tadpole; and it comes forth, furrounded by a quantity of tranfparent glutinous matter. In the toad and newt, thefe rudiments are formed into long cords by the glutinous medium, which cords are double in the toad. In the frog they come out feparately in fo many fpheres of the gelatinous matter, about the fize of large peas.

In all the reptiles which have a penis, fecundation is effected within the body; but in the batracians, which have no male organ of copulation, it occurs externally. When frogs are joined, it may be feen, that an obtufe, tumid point, occupying the place of the penis, is elongated, and brought towards the eggs neareft the vent. By taking them out of water while this laying is going on, an actual difcharge of feminal fluid upon the eggs may be feen from this point. In the fame way the male of the water newt difcharges his fluid into the water near the anus of the female, and thus fecundation takes place. Spallanzani has inftituted an immenfe number of experiments on this fubject; they prove, that if breeches be put on the frog, fo as to receive the feminal fluid, no fecundation occurs; while, on the contrary, the feminal fluid from the epididymis, or the juice of the tefticles, will produce artificial fecundation of eggs laid by the female after the male has been removed, and otherwife unproductive, or of eggs taken out of the lower part of the oviduct immediately after death. Dilution of the feminal fluid, although it diminifhed the effect of its application, did

did not altogether prevent it. When three grains of feed were added to twenty-two pounds of water, fome tadpoles were evolved in it, but much fewer than in a ftronger mixture.

As fecundation is effected in thefe animals by the feminal fluid difcharged in water, it probably is always produced by an extremely fmall proportion. Spallanzani has made fome calculations, in order to find out the expreffion in numbers of the quantity of femen that was efficacious in fome of his experiments. He mixed three grains of feminal fluid with eighteen ounces of water, and found that a globule, $\frac{1}{50}$th of a line in diameter, taken out of this mixture, was often fufficient to fecundate a tadpole. The ratio of the tadpole to the particles of feed diffufed in this drop of water, is found to be as 106,477,777,7 to one. The weight of the feed is $\frac{1}{199,468,750,0}$ of a grain, and its bulk $\frac{1}{300,212,042,0}$ of a cubic line. Differtations, v. i. § 655.

He found, however, that although fo minute a quantity of feminal fluid is fufficient to produce the effect, there muft be contact of the grofs and vifible part of the fluid; that no vapour or effluvium, no *aura fpermatica* will fuffice. Diff. ch. 5. § 161—170.

The feed of one fpecies will not fecundate another; that of the water newt has no effect on the embryos of frogs and toads; nor reciprocally: neither is there any action of the feeds of frogs on toads, nor *vice verfâ*. § 171—172.

The number of eggs is fubject to much variety: it is inconfiderable in the ferpents; from ten to twenty in the vipers and lizards; one or two hundred in the crocodile, according to Bartram, Travels in America; two or three hundred in the turtle; but the moft numerous in the frog kind. In the toad, where the eggs are laid in a double row, forming a cord of a glutinous nature, thefe rows meafured 43 Paris feet, and contained 1207 eggs. Spallanzani Diff. v. ii. § 45.

In the teftudines, ferpents, and lizards, which have a true yolk, this is to be regarded as a fupply of nourifhment for the young animal, whofe evolution probably goes on in a manner analogous to what is obferved in birds; although the procefs has not been actually watched, nor the order and fucceffion of the changes obferved, as in that clafs. Blumenbach has delineated the egg of the crocodile, with the young one coming forth; the fhell is flexible, as in the other amphibia, and confifts of a thick, leathery, and tough, external ftratum, marked throughout with extremely fine undulated lines, and lined by a more delicate fmooth membrane. The recent eggs, and the young crocodiles which they contain after evolution has commenced, are eaten by various African tribes. The relation in fize between the egg (about equal to that of the goofe), and the full grown animal (the Nilotic fpecies), which reaches to thirty feet in length, or even more, is at firft view remarkable; and Herodotus has called the crocodile the largeft animal from the fmalleft egg. (Blumenbach's Abbildungen, N° 27.) Seba has alfo figured a young crocodile, with the membrane of the yolk adhering to the abdomen, as in birds. Thefaurus, t. i. pl. 104, fig. 7.

In the animals juft enumerated, the eggs, whether depofited in the fand of the fea-fhore, or of the banks of rivers, in the holes of trees, the chinks of walls and rocks, &c. undergo no procefs of incubation like thofe of birds, but are developed in the ordinary temperature of the atmofphere, and the young animals come forth from their confinement, differing only in fize and proportions from their parents.

In the venomous ferpents, and the falamanders, the cafe is different. The egg containing, as in the preceding inftances, the young animal, and a fufficient fupply of nutriment for its growth, until it is of fize to quit its original abode, is hatched in the oviduct of the mother, and the young come forth from the cloaca alive, but furrounded by their membranous coverings. The young vipers and other venomous ferpents, when they are born, are freed by the mother from this kind of after-birth.

A very curious circumftance has been obferved in fome of thefe, recalling to our minds the abdominal pouches of the marfupial mammalia, and the mode in which they ferve as a fhelter for the young, while yet too fmall to fhift for themfelves. Palifot Beauvois thus relates the fact we allude to. "Having perceived a rattlefnake at fome diftance, I approached as gently as poffible, when, on lifting my hand to ftrike him, he founded his rattle, opened his mouth, and received into it five fmall ferpents, about the fize of a quill. I retreated and concealed myfelf, when the animal, thinking the danger at an end, opened his mouth, and let out his progeny. When I appeared again, they immediately took to their fame retreat." He had heard this fact from American planters, and it has been fince confirmed by other travellers. Daudin, Hift. Nat. des Reptiles, v. 5. p. 68.

The young of the falamander, like thofe of the viper, are born alive. The female brings forth very delicate oval vefícles, which may be compared to hydatids, each of which contains a perfect young falamander, an inch in length, moving its tail, and lacerating its coverings at the time of birth, and emerging in the form of a four-footed tadpole.

"In this fame ftrange animal," fays Blumenbach, "I have obferved a curious fact, already noticed by Wurffbain in his Salamandrologia, p. 83. *viz.* that a female, kept by herfelf, and abfolutely without intercourfe with any other of her kind, has produced young ones. I have kept in a glafs at home, for five months, a female falamander, whofe tail I had cut off, and in the mean time have had no other in the houfe, nor even feen one. Yet this folitary female, which, to my furprife, fuftained fo long a faft without growing thin, has begun within a few days to bring forth young, of which thirty-four are now before me, not only living, but very lively. This obfervation will lead us to two conclufions; 1ft, that falamanders really copulate, and that the male does not fecundate the ova as they are difcharged, like what we have defcribed in the cafe of the water newts: 2dly, that falamanders have the fame nature in this refpect as hens; which, when they have been once impregnated by the cock, will lay fruitful eggs, not for a whole year, as Fabricius ab Aquapendente afferted, but, according to the moft accurate refearches of Reaumur (art de faire eclorre les oifeaux domeftiques, t. 2, § 327), for five weeks after feparation from the male.

Thefe young falamanders have a two-edged tail, broadly pinnated on each edge, excellently adapted for fwimming, and furnifhed on each fide of the neck with fimbriated branchial appendages like thofe of the tadpole, which however foon difappear, the two-edged tail being at the fame time converted into a cylindrical pointed one." Specimen, &c. 34.

All the reptiles of the frog and toad kind, and the aquatic falamanders, have this remarkable peculiarity, to which nothing at all analogous has been obferved in the economy of the warm-blooded claffes or the fifhes: *viz.* that they undergo a metamorphofis; and have, in their two ftates, not only an altogether different external form, but alfo important differences in many of the great internal organs. In their firft ftate, they are little aquatic animals with tails and

and large heads; from their twifting movements of the former, and the great fize of the latter, they have been called in Latin gyrini, in French têtards: the Englifh name is tadpoles, and the German kaulquappen.

Developement of the Frog.—As the fpawn of frogs is depofited in ponds, ditches, or other ftagnant water, the contained ova are evolved in the ordinary temperature of the atmofphere. In one fpecies of toad, Spallanzani fays, that it proceeds at 6° above freezing of Reaumur. He found that a temperature of 111° Fahrenheit, did not interfere with the fubfequent evolution; that the number of tadpoles produced was much diminifhed after expofure to 122°; and that very few were evolved after the eggs had been immerfed in water of 132°. A heat of 111° was fatal to tadpoles and frogs; although the latter bear 111° in the warm fprings of Pifa. (Tracts, vol. i. p. 32.) Each egg lies in the centre of a tranfparent fpherical mafs of mucilage; many of which, aggregated together, form what is called frog's fpawn. Round the eggs are two concentrical membranes, of which the innermoft, when pierced with a needle, difcharges a fluid as limpid as water. The egg is round, and has a fmooth furface, of which one hemifphere is black, and the other white. When the hot feafon is far advanced, the obferver foon perceives the lineaments of the tadpole. The egg grows for fome hours without lofing its round fhape: it is next elongated; the white hemifphere becomes darker, and the black changes into a longitudinal furrow, terminated by two perpendicular proceffes. And, as it increafes in bulk as well as length, the internal circular membrane is dilated, and contains more fluid. By tracing thus the progrefs of the evolution, we come to perceive that thefe bodies are not eggs, as naturalifts fuppofe, but real tadpoles. The furrow and the proceffes become longer; the fuppofed egg affumes a pointed figure, the whitifh hemifphere dilates, and the black is incurvated. The pointed part appears to be the tail of the tadpole, and the other the body. Further, the oppofite end takes on the appearance of the head, in the fore part of which the form of the eyes is vifible, though they are yet clofed. The two proceffes alfo, by which the animal faftens itfelf to bodies, when it is tired of fwimming, become evident, as likewife the veftige of the aperture of the mouth, and the rudiments of the gills. As the organs are further unfolded, the tadpole, which has not moved hitherto, begins to ftir, and loofen its fetters; at this time it appears clearly, that the internal circular membrane is the amnios, in the liquor of which the tadpole floats; the umbilical chord at laft is feen, and becomes ftill more vifible the firft day after the animal has quitted his confinement.' The cord is not, as in other animals, attached to the belly, but to the region of the head. (Spallanzani's Differtations, v. 2. § 14—16.) We take the liberty to note what is here faid about the umbilical cord as a fubject for further refearch.

The branchiæ are vifible towards the end of the fixth day: in the courfe of the feventh and eighth all the tadpoles quit the vifcid fubftance, which had been floating on the water, and which had hitherto ferved them for food. By the fourteenth and fifteenth days they are fo much grown, that two fmall but prominent eyes, an open mouth, noftrils, &c. can be diftinguifhed. About the nineteenth and twentieth days the branchial appendages are withdrawn within the fkin, and no longer vifible. The heart can be feen to move, and the caudal vertebræ are recognifable. On the twenty-fourth day the front limbs, which had already exifted under the integuments, appear in the place of the branchiæ, or rather near where they had been. In ten or twelve days more the hind limbs come out. In this ftate they fwim about in the water, and grow. The tail gradually difappears, and in about two months after they have been hatched, they are metamorphofed into frogs. Thefe at firft are fmall, and then become gradually larger. Except in the cafe of the rana paradoxa, and the bufo fufcus, in which the tadpoles become fo large, that the animal, when it has changed, is of the adult fize.

Anatomy of the Tadpole.—The points in which the animal differs from the organic arrangements of its perfect ftate, are the large tail, which bears a very confiderable proportion to the body, and is afterwards entirely loft; comparative fmallnefs of the mouth, to the under lip of which a fmall organ is attached for fixing the tadpole to other objects; a kind of horny plate for jaws; two tuberofities under the neck, which the animal can diftend at pleafure; the rudiments of the lungs; the inteftines convoluted in a fpiral mafs, which fwells the abdomen, and far exceeds, in its ratio to the length of the body, the inteftinal canal of the perfect animal; the branchial appendages, and the veffels connected with them; the fore limbs, fituated at firft under the fkin. For the feries of changes, and the anatomy of the young animal, fee the plates of Roefel, Hift. Ranar. Noftrat.

Further particulars of the anatomy of tadpoles, and particularly of the circulating and refpiratory organs. In his "Recherches fur les Reptiles douteux," Cuvier has entered at fome length into a confideration of the anatomy of the tadpole. The following account, which is tranflated from his memoir, as publifhed in the "Recueil d'Obfervations de Zoologie et d'Anatomie comparée, faites dans le Voyage de Humboldt et Bonpand," v. 1. p. 195, is to be underftood as applying to the full grown tadpole.

The tadpoles of frogs, tree-frogs, and toads, differ from thofe of falamanders, principally in having their branchiæ concealed: we have already obferved, that in their earlier ftages the branchiæ of the former are alfo external: the only way by which the water can efcape from them is through two holes, formed in different fituations, according to the fpecies: there are even feveral which have only one hole, on the left fide. Such are the tadpoles of the jackie (rana paradoxa), and of the brown toad (buco fufcus); but the tadpole of the common frog has two, both placed below.

We find, on opening the fkin of a tadpole longitudinally, that the internal organs are divided into two parts, or contained in two membranous facs.

The firft extends from the horny and falfe jaws, which form the mouth of the tadpole, to behind the branchiæ, enveloping the latter entirely. The other contains the abdominal vifcera; it is the peritoneum, on which veftiges of the abdominal mufcles are already vifible.

The firft fac is very thin and tranfparent, and penetrated, like the fkin, by holes for the exit of the water from the branchiæ.

The latter form on each fide four tranfverfe rows of fmall tufts or fringes, fupported by the fame number of fmall cartilaginous arches, which are marked on the fide next to the mouth by fmall rounded tubercles. Thefe cartilaginous arcs are articulated on one fide behind the cranium, on the other to a fpecies of os hyoides, and have the fame motions as in fifhes. In their intervals the water can pafs freely from the mouth to the branchiæ, to be difcharged fubfequently through the fmall external apertures.

The organization of the branchiæ in the tadpoles of frogs is, therefore, the fame as in certain fifhes, for example the callionymi and others, where the water can only pafs out by narrow apertures; there is, however, this difference, that

that they are not covered, either by a branchial operculum, or by radiated bones.

The branchiæ, or gills, properly fo called, that is, the immediate organ in which the pulmonary veffels are diftributed, are fmall tufts formed like feathers, that is to fay, fringed on the two fides. Each cartilaginous arc fupports about thirty fuch; and in the middle of each tuft are its two principal veffels derived from the two great blood-veffels of the arc.

It may be obferved here, that the fifhes called fyngnathi have alfo their branchiæ in the form of tufts.

The heart, placed in front of this apparatus, and receiving the blood from the body by the vena cava, which comes, as in moft cafes, in great part through the liver, has only one auricle and ventricle, as in fifhes, and in adult frogs and falamanders, without any of thofe divifions which are obferved in the chelonian and faurian orders. The ventricle gives origin to a fingle artery, which is completely diftributed on the eight branchiæ, fo that no drop of blood can go to the reft of the body, without having paffed through the refpiratory organs. All the blood which has circulated through the gills, is collected in the branchial veins, which go towards the back, and are united into a fingle trunk, which becomes the defcending artery: but, before uniting, they furnifh arteries to the head, fore feet, lung, and liver; fo that in the tadpole, the lung receives blood which has been already expofed to the action of water; and this fmall portion of the animal's blood undergoes refpiration twice, while, with refpect to the great mafs of the fluid, there is only one refpiration, and that of an aquatic nature, or fimilar to the refpiration of fifhes.

Great changes take place when the tadpole becomes a frog; but they are produced by very fimple means. As the arms and head increafe in fize, their arteries are enlarged; the branchiæ, on the contrary, are obliterated, and their arteries are gradually reduced: but, as it is always neceffary that blood fhould go to the head and other parts, one of the four principal branchial arteries on each fide is enlarged, and ferves to convey it. Then the artery, which goes out of the heart, and was formerly divided into eight branches, is now fimply bifurcated, and its two branches fupply the arterial trunks of the head, arms, lungs, &c.; and laftly, are united to form the defcending aorta. Now this is precifely the circulation of the frog, in order to produce which it has been merely neceffary to obliterate fix of the branchial arteries of the tadpole, and to enlarge the two others. Henceforward the lungs are the exclufive feat of refpiration, receiving, however, at each pulfation, only a fmall portion of the whole mafs: the frog, therefore, is now an aërial animal in refpect to its breathing.

While thefe changes are going on in the refpiratory organs, feveral others are taking place in different parts of the body. The narrow horny bill, preceded by fmall flefhy lips, falls off, and its mufcles difappear; the jaws grow hard, and form a much more ample mouth.

The eyes, difengaged from that fkin, which only allowed them to appear through a tranfparent difk, are now feen with their complicated apparatus of three eye-lids.

The fore-feet, which had been concealed between the bag enclofing the branchiæ and the peritoneum, appear externally; the hind-legs grow every day larger; and the long tail, formed by fo many mufcular ftrata, and fupplied by fuch numerous veffels and nerves, begins to difappear. The inteftines, formerly of nearly uniform fize throughout, exceffively long and arranged in a fpiral mafs, become fhort, and are dilated at proper parts to form a ftomach and colon.

Among thefe changes, which convert the tadpole into a frog, we cannot enumerate the appearance of the generative organs. The tadpole already poffeffes tefticles, ovaries, and their fatty appendages; and if thefe parts are not fo large as in the frog at the feafon of reproduction, they approach nearly to their fize at other times of the year.

What we have juft faid concerning the tadpole of the frog is equally applicable to that of the toad; but the different fpecies exhibit confiderable varieties in the epocha and the fize at which the change occurs, as well as in the rapidity of the change. The jackie (rana paradoxa) lofes its tail very late, and long after its branchiæ; while the latter do not entirely difappear until it has reached the full fize of its perfect ftate: the pipa, on the contrary, lofes both very early, and while it is ftill very fmall. The fpecies which lofe their branchiæ late, are larger in the tadpole than in the perfect ftate, becaufe thefe fupernumerary organs fwell out the front of the body, while the tail prolongs it behind. They feem, therefore, to become fmaller under their metamorphofis, and grow no more when they have become frogs. On the other hand, thofe which lofe their tail and branchiæ early, have ftill a long time to grow, and may be feen of all fizes in the perfect ftate. This has given rife to the miftaken notion that the jackie is changed into a fifh; the tadpoles being larger than the adult frogs, it was not thought poffible that the latter could be the fecond ftate.

We might reftore to the larvæ of the falamanders the name of cordyli, which they bore among the Greeks, according to the remark of Schneider. They ought not at leaft to have that of tadpole (têtard), becaufe they have not a large head, their branchiæ not being concealed under confiderable coverings, but floating loofely on the exterior of the body. They are tufts arranged like the teeth of combs, fimply flefhy or membranous, and attached by pedicles, which allow them to float loofely in the water. The cartilaginous arcs of the fides merely ferve to limit the fmall apertures through which the water paffes out of the mouth; for, although the form and arrangement of the tufts feem to expofe them fufficiently to the action of water, there are ftill openings from the mouth, enabling the animal to eftablifh a current of the fluid. In other refpects, the circulation is carried on as in the branchiæ of the tadpoles of frogs, and it undergoes the fame changes when the branchiæ are obliterated.

The larvæ of falamanders, obferved by Cuvier, had the fame vifcera as the adult animals, and poffeffed no horny bill, although their branchiæ were ftill very complete. He therefore concludes, that in this refpect, as well as in their feet, and in the organization and permanence of their tail, there is a much more clofe refemblance between thefe larvæ and the adult falamanders, than between tadpoles and frogs.

Thefe remarks on the anatomy of the tadpole, and of the larvæ of falamanders, are illuftrated by four figures in the 13th plate of the work quoted above. Figs. 1, 2, and 3 reprefent the anatomy of the tadpole of the bufo fufcus; and fig. 4. that of the larva of the falamandra aquatica.

The co-exiftence in the fame animal of branchiæ and lungs, that is, of organs calculated for breathing air, and of thofe which are fitted to extract air from the water, is not peculiar to the larvæ of frogs and falamanders; it is obferved alfo in the firen lacertina and the proteus anguinus, two animals whofe conftruction is in many refpects fo fingular, that the opinions of naturalifts concerning them have been long extremely unfettled. Many have fuppofed them to be the larvæ of fome large reptiles, for which opinion, other

other circumſtances in their organization and habits, beſides the poſſeſſion of branchiæ and lungs, have been adduced as arguments. Others have contended that they are perfect animals; and the more exact reſearches of modern naturaliſts and anatomiſts ſeem to have finally proved that this is the caſe. The anatomical details, by which this concluſion is ſupported, will be found towards the end of the article.

As the ſiren and proteus, truly perfect animals, have been ſometimes conſidered as larvæ or imperfect ſtates of unknown reptiles, ſo the contrary error has been committed, of deſcribing the larvæ of known ſpecies as perfect animals allied to the ſiren and proteus. Laurenti, one of the firſt naturaliſts who endeavoured to reduce the claſs of reptiles to regular order, eſtabliſhed a genus (proteus) for ſuch batracian reptiles as, according to him, poſſeſſed both branchiæ and lungs. To this genus he has aſſigned the tadpole of the rana paradoxa, under the name of proteus raninus; and another, which he himſelf inſpected, and which has ſince been aſcertained to be the larva of an aquatic ſalamander, under that of proteus tritonius. (See his Specimen medicum exhibens ſynopſin reptilium.) The ſiren operculata of M. de Beauvois (Tranſactions of the Philoſophical Society of Philadelphia, vol. iv.) is conſidered by Cuvier as a ſimilar inſtance, and perhaps as the very axolotl or Mexican animal, which will be deſcribed preſently. He regards, in the ſame light, an animal deſcribed by the very learned writer on amphibia, Mr. Schneider, as found in the lake Champlain: ſee Hiſt. Amphib. Nat. et Litter. Faſcic. 1. p. 50. He ſays it may be objected that we cannot eaſily conceive that ſo complicated an apparatus as that of the branchiæ, their cartilaginous arches, and the muſcles moving them, ſhould diſappear and leave no trace behind; but, as the larvæ of our ſalamanders experience ſuch a change, the ſingularity of the phenomenon cannot be pleaded as an objection to it. Recherches, &c. p. 117.

Anatomy of the Axolotl, or large Mexican Salamandrine Tadpole.—Another animal of this kind is one found very commonly in the lake ſurrounding the city of Mexico, and noticed by the early writers in their accounts of thoſe countries, and of the intereſting objects they produce, although not methodically deſcribed or ſcientifically inveſtigated until very lately. Hernandez ſpeaks of it in two places; in one, under the name of the eatable tadpole (gyrinus edulis), or atolocatl (Hiſt. Anim. Miner. Nov. Hiſp. lib. unic. Tract. 5. cap. 4. p. 77: this book is placed at the end of the abridgement by Recchi); in the other, under that of luſus aquarum, piſcis ludicrus, or axolotl (ibid. cap. 2. p. 76, and in the large abridgement by Recchi of the whole work of Hernandez, lib. 60. cap. 4. p. 316.) This account, accompanied by a figure of ſome other animal, was copied into other works with various errors.

Dr. Shaw deſcribed an individual ſent immediately from Mexico to the Britiſh Muſeum, and gave two good figures of it; in the Naturaliſt's Miſcellany, N° 343, under the name of gyrinus mexicanus; and in the General Zoology, vol. 3. pt. 2. pag. 612. pl. 140, under that of ſiren piſciformis, conſidering it as allied to the genus ſiren.

Mr. de Humboldt met with it in Mexico, and recogniſed it as the axolotl of the Mexicans and firſt Spaniards, under which name it is ſtill known. He brought ſpecimens of it to Europe, and entruſted their anatomical inveſtigation to the experienced hand and profound judgment of Cuvier, whoſe deſcription we extract from the Recherches ſur les Reptiles douteux, already quoted, pag. 109. et ſeq. pl. 12.

Anatomy of the Axolotl.—In its ſize and general configuration it very cloſely reſembles the ſalamander terreſtris (lacerta ſalamandra) of Europe. No one would heſitate in calling it a ſalamander, were it not for the branchiæ, which latter reſemble very narrowly thoſe of the larvæ of ſalamanders, and float looſely at the ſides of the neck.

The openings communicating with the mouth are four in number, and much larger than in the ſiren. A fold of the ſkin of the head forms a ſpecies of operculum for the four. There are four arches, as in fiſhes, and we ſhould hence expect five openings, but the fourth is immediately united to the trunk. The two intermediate arches have, towards the mouth, two rows of pointed denticuli; but the firſt and fourth poſſeſs, each, only a ſingle row. None of theſe denticuli exiſt towards the operculum, ſo that the firſt of the four openings is not denticulated in any direction. Each of the four arches has, towards the outſide, a ſharp membranous criſta, which might deceive ſuperficial obſervation by cauſing a reſemblance to the gills of a fiſh; but there is no vaſcular net-work for reſpiration, and the arterial trunks follow, without any diviſion, the three firſt arches to arrive at the branchial tufts, which are the only true gills. There are three of theſe tufts on each ſide, attached to the three firſt arches, where the ſkin joins them together; the operculum and the fourth arch have none. Theſe tufts are much more ramified than thoſe of the ſiren, but their ramifications reſemble a lock of hair, and are not arranged with ſo much regularity.

Oſteology.—The head is the ſame as in the ſalamanders, except that the cranium is rather broader. The teeth are placed in the ſame way on the edges of the jaws; there are moreover two plates immediately behind the edge of the upper jaw; but the two longitudinal ſeries, which are obſerved along the palate of the European ſalamanders, could not be perceived. The head is articulated in the atlas by two condyles, as in the ſiren and ſalamanders.

The apparatus for ſupporting the branchiæ is very ſimilar to that of the ſiren; and, at the time of the metamorphoſis, a part of it probably remains to form the os hyoides of the ſalamander. The middle piece is cylindrical, ſhort, and terminated behind by a forked extremity. The front end ſupports two cartilages, the ends of which, ſuſpended to the angles of the jaw, correſpond to the hyoideal branches of fiſh: they are immediately under the membranous operculum. From the poſterior end of this middle piece proceed two other branches on each ſide; a broad one ſupporting the firſt cartilaginous arch, and a more ſlender one trifurcated to ſupport the three other arches. The four branchial arches are ſuſpended, by their outer extremities, to the firſt vertebra.

There are ſeventeen vertebræ from the head to the pelvis; and twenty-three from the latter to the end of the tail. The ſpinous proceſſes of both are longer than thoſe of the ſalamander; and they exiſt on both aſpects of the caudal vertebræ, which makes the vertical meaſurement of this part exceed that of the European aquatic ſalamanders.

There are thirteen ſmall ribs on each ſide, ſimilar to thoſe of the ſalamander.

The oſteology of the limbs reſembles in all reſpects that of the ſalamander, excepting the more pointed form of the laſt phalanges, which has occaſioned them to be taken for nails.

Organs of Senſe.—The eye is ſmaller in proportion than in European ſalamanders; but not ſmaller than that of the ſpecies brought from the Alleghany mountains by Michaux.

Organs of Circulation.—The vena cava receives the termination of the veins of the head; of the branchiæ, and their arches; of the lungs; of the fore-feet; laſtly, of the inferior vena cava, which has traverſed the liver, and received, as

 uſual,

ufual, the blood of the vena portarum. It enters a large and fingle auricle ; there is alfo a fingle ventricle, giving origin to a large mufcular artery, fimilar in all points to that of fifhes, of the firen, and of tadpoles. It produces for the branchiæ three arteries on each fide, which proceed, as we have already mentioned, along the three firft arches. The branchial veins are quickly united behind into a fingle trunk, under the back of the head, and this veffel, following the direction of the fpine, becomes the great artery of the body. This is exactly the circulation of the batracian larvæ ; and the axolotl, being larger than any of the European fpecies, affords a convenient opportunity of examining this kind of arrangement in the circulating organ.

Organs of Refpiration.—The branchiæ of the axolotl, exhibiting on a larger fcale the fame motions as thofe of the falamandrine larvæ, the mechanifm can be better underftood ; and the following defcription of the mufcles will, therefore, be received with intereft.

Each of the cartilages analogous to the hyoideal branches has a very ftrong mufcle, defcending from the bafis of the fkull along their convex fides to their inferior extremities. Thefe mufcles open the branchial arches, by feparating their inferior extremities from the palate.

The arches are approximated by a mufcle fixed behind to the inferior extremity of the laft, advancing under that of the three others, and giving a flip to each. Its antagonift is a fmall mufcle, fixed, on one fide, to the inferior extremity of the hyoideal branches ; and proceeding backwards as far as under the firft branchial arch, to which it is attached, oppofite to the flip of the preceding.

The os hyoides is carried forwards by two genio-hyoidei, and backwards by two pubio-hyoidei : which latter fupply the place, as in the falamanders, both of the fterno-hyoidei and recti abdominis. It is elevated by a mufcle fimilar to the mylo-hyoideus of the fame animals.

Laftly, the three tufts are themfelves elevated and depreffed by as many pairs of mufcles, which are attached above and below to the convexities of the branchial arches, and have their other fixed points in the bafes of the tufts.

The lungs are two large bags, on the internal furface of which the blood-veffels form a loofe but very confpicuous net-work. There are no cells. They open into a common, membranous, opaque, and tolerably wide canal, fupplying the place of trachea, but unfurnifhed with cartilaginous rings, and contracted to form a fmall larynx with two membranous lips. The glottis is fmall, formed by two membranous projections, behind each of which is a fmall hollow or ventricle, which may be fuppofed to produce a more powerful voice than that of the firen.

Organs of Digeftion.—The tongue poffeffes but little power of motion ; it is free in front, but fixed behind to the anterior extremity of the os hyoides.

The œfophagus is fhort, folded longitudinally, and continuous with the ftomach, which is large and membranous, but confiderably narrowed, and more mufcular towards the pylorus. It was filled, in the two individuals from which this defcription was drawn up, with frefh-water cray-fifh, like the European, which had been fwallowed without maftication, fo that entire limbs were found even in the rectum.

The inteftinal canal is tolerably large, particularly behind, and of moderate length. It makes two principal folds, and has neither cæcum nor any internal valve. The liver is rectangular, without any deep notches ; no gall-bladder was obferved. There is a fmall fpleen in the centre of the mefentery, which is fimple, as ufual.

All thefe inteftines are like thofe of the falamander.

Generative Organs.—The ovaries, fmall, flaccid, and hardly containing vifible ova, refemble, in their fituation and fatty appendices, thofe of the falamander. The oviducts were fo delicate, that they could fcarcely be feen.

From all the circumftances juft detailed, and from the clofe refemblance of all its organs to thofe of falamanders, and their larvæ, we may conclude, that the Mexican axolotl, or firen pifciformis of Shaw, is the larva of fome large falamander.

Growth.—The age of puberty feems to be the limit of growth in many of this clafs, as in birds, and we may almoft fay, in all mammalia. But others, particularly the crocodiles, turtles, and ferpents, grow conftantly ; of which continual increafe the whales feem to afford an example among mammalia ; at leaft, no limits can at prefent be affigned to their ftature. We know little about the length of life of the amphibia. Many, particularly the tortoifes, ferpents, and crocodiles, are prodigioufly long-lived ; coming forth originally from an egg, which is very fmall in comparifon to their future ftature, growing very flowly, and reaching an immenfe fize. Niebuhr faw at Surat a tortoife 125 years old.

Organs of the Animal Functions.

Organs of Motion. Defcription of the Bones.—We know of nothing peculiar in the organifation of the bony fubftance of reptiles. In the larger fpecies, the bones poffefs as much firmnefs as in the mammalia ; but in the fmaller, as the frogs for example, they are more cartilaginous. Cuvier ftates, in general, that the bones of reptiles contain more gelatine than thofe of the mammalia. Caldefi afferts, that there are no medullary cavities in the tortoife ; according to Cuvier, there are confiderable ones in the crocodiles. Leçons d'Anat. Comp. tom. i. p. 110. They have never been feen tinged with madder.

The Head.—A very diminutive cranium, and enormous jaw, make up the head in this clafs.

As the brain of reptiles and fifhes occupies only a fmall part of the cavity of this cranium, no important confequences can be deduced from its fhape and fize. In the tortoife, this cavity is large, narrow from right to left, elevated anteriorly and depreffed pofteriorly. Its lateral parietes are almoft vertical, and its bafe is parallel to the palate. The external form of the head, and its apparent magnitude, are occafioned by the acceffory bones, between which and the cranium there is a large fpace occupied by mufcles and glands. The greateft part of the fkull is occupied by the large lateral hollows, holding the eye, and the powerful mufcles, that move the lower jaw.

The fmall fize of the cavity of the cranium, with refpect to the external bulk of the head, is ftill more extraordinary in the crocodile. In an individual four metres long (between thirteen and fourteen feet), that cavity will hardly admit the thumb, and the area of the fection of the cranium is not one-twentieth part of that of the whole head. (See a fection of the fkull of a crocodile in the Annales du Mufeum, tom. x. pl. 4. fig. 5.) The length of the cranium is not one-fifth of the length of the head in the gavials (longiroftres, Cuvier) ; and it is lefs than one-fourth in the alligators or caimans (alligatores, Cuv.), and in the true crocodile (crocodili, Cuv.) The figure of the fection is oblong, rather larger anteriorly, and defcending pofteriorly. There is a confiderable depreffion for the pituitary gland. Its breadth is equal to its height ; and the lateral parts of the head, as in the tortoife, cover only the temporal foffæ.

The relative fize of the cranium and jaws undergoes a very remarkable change, in proportion to the gradual developement of the crocodile. The head, when it comes out of the fhell, is thick and rounded, and the forehead prominent ; fee Seba.

Seba, Thefaurus, tom. i. pl. 104, figs. 3 and 6; and Blumenbach's Abbildungen, N° 27. The eyes are now equidiftant from the end of the fnout, and the pofterior extremity of the head; of which the cranium forms nearly one-third. When we look at the adult animal, we are aftonifhed to find the frontal prominence gone, leaving the head quite flat, and the jaws fo elongated, that the eyes are three times farther from the end of the fnout than from the back of the head; and the proportion of the face to the cranium is 20 inftead of 3 to 1. Geoffroy St. Hilaire in the Ann. du Muf. vol. x. p. 77.

The cameleon exhibits alfo a great difproportion between the cranium and the reft of the head. Its brain, according to the defcription of the Parifian diffectors, does not feem larger than a pea; and the remainder of the head, which is of confiderable fize, confifts of the large maxillary bones, the orbits, and immenfe temporal foffæ, which, not being feparated by any partition, give the cranium a very fingular appearance. Defcription Anat. d'un Cameleon, &c.; or Blafii Anat. Anim. vol. i. p. 14.

The cranium of frogs and falamanders is almoft prifmatic.

The French naturalifts have furnifhed excellent defcriptions and engravings of the heads of various crocodiles. It will be as well for us to enumerate here the fources of information concerning the ofteology of this animal altogether, and to give a few references to good figures of the fkeletons of other reptiles.

There are tolerably good reprefentations of the crocodile's fkeleton (the Eaft Indian) in Grew's Mufeum Societatis Regiæ, and in Faujas St. Fond, Hiftoire de la Montagne de St. Pierre de Maeftricht, pl. 44. The head of the crocodile of the Nile (croc. vulgaris, Cuvier), is figured by Geoffroy in the Annales du Mufeum, vol. ii. pl. 37, fig. 2. In pl. 4. vol. 10. of the fame work are four figures of the fkull to illuftrate a paper of Geoffroy St. Hilaire, entitled "Determination des Pièces qui compofent le Crane des Crocodiles;" and pl. 1, of the fame volume, contains nineteen figures of the heads of various crocodiles in different views, to illuftrate Cuvier's paper "Sur les differentes Efpèces de Crocodiles vivans & fur leurs Caractères diftinctifs." In the 12th volume of the Annals, Cuvier has given his "Obfervations fur l'Ofteologie des Crocodiles vivans," with two plates, in which moft of the bones are carefully figured. For the fkeleton of the tupinambis, fee Cuvier, Leçons, v. 5. pl. 3; of frogs, Roefel, Hiftoria Ranarum Noftratium; of the falamander, Latreille, Hift. des Salamandres de France; of the tortoife, falamander, frog, cameleon, lizard, and a ferpent, Daudin, Hift. Nat. des Reptiles, vol. 1; of the proteus, firen, and Mexican axolotl, Humboldt, Recueil d'Obferv. de Zool. &c. t. 1; of the tortoife, Blafii Anatomia Animalium; Cuvier, fur les offemens foffiles; and Geoffroy St. Hilaire, fur les tortues molles, in the Annales du Mufeum, vol. 14. The fkeleton of the tortoife is alfo figured in Chefelden's Ofteology; in Coiter's Lectiones Fallopii de Partibus fimilaribus, fol. Norib. 1575; and in J. D. Meyer's Zeitvertreib mit Betrachtung curiofer Vorftellungen allerhand Thiere. t. 1. tab 29, 31; t. 2. tab. 62; and the feparate parts in Caldefi offervazioni anatomiche intorno alle Tartarughe. Firenze, 1687. The fkeleton of the common green lizard may be feen in Coiter, pl. 4; in Meyer, t. 1. pl. 56; that of the falamander and water newt, and of feveral fnakes in Meyer: that of the cameleon is prefixed to Chefelden's 6th ch. Schneider has figured that of the rana pipa in his Hiftor. Amphib. fafcic. 1.

For the form of the head in the different fpecies, a point belonging rather to natural hiftory than comparative anatomy, we muft refer to the figures already quoted. The furface is more or lefs rugous in different fpecimens; and in many very confiderably fo; thefe differences are fpecific, only where individuals of the fame age are compared, for the rugofities increafe in fize and prominence in each fpecies with the increafe of years. The bony fubftance is often perforated by many fmall holes, as if it were carious or worm-eaten. The futures are conftant; they are not effaced in the oldeft heads obferved by Cuvier.

The Cranium.—The cranium of the crocodile, viewed from behind, has the form of a very irregular truncated pyramid; of which the point or narroweft portion is downwards, and the bafe excavated to lodge the brain, is upwards. This pyramid has three furfaces, one pofterior, which forms the occiput, and two lateral. The occipital furface is almoft triangular; one of the angles (the apex of the pyramid) is inferior, the other two are fuperior, and greatly prolonged backwards and to the fide, in order to form the enormous articular proceffes, which receive the lower jaw. Their pofition is almoft horizontal. The foramen magnum is fituated in the middle of this furface, and under it the fingle condyle for articulating the head with the vertebral column.

The futures depart from the foramen magnum, which divide the occiput into particular bones. The fuperior part of the cranium is formed by a fingle parietal bone. Anterior to it there is an os frontis, alfo fingle, which forms the roof of the orbits.

The offa temporum are fituated on each fide of the parietal bone, and are partly fupported by that articular procefs for the lower jaw, already mentioned.

A fmall arch on each fide, different from the zygoma, leaves between it and the parietal bone a large round hole, which perforates the temporal foffa. The arch is partly formed by a procefs of the os temporum, and partly by a particular bone articulated to the junction of the parietal and frontal. The particular bone occupies the place of the poft-orbitar procefs of the os frontis in the mammalia; for it defcends behind the orbit to join the cheek-bone; and with it finifhes the frame of the orbits.

The unufual configuration of the whole head in the crocodile neceffarily involves very extraordinary modifications of the individual bones, which it is in many cafes exceedingly difficult to refer to their correfponding ones in the crania of the mammalia. For a more minute account of this matter, which could not be eafily underftood without plates, we refer to the memoirs and engravings, already quoted, of Geoffroy and Cuvier.

A cranium fimilar to this of the crocodile, is found in the other lizards, notwithftanding the great differences in the form, proportion, and the direction of the parts. In the cameleon, therefore, the foramina, by which the temporal foffa communicate with the cranium, are fo large, and the bony edges which form them fo thin, that the latter reprefent three flender branches rifing to fupport the kind of helmet which diftinguifhes this animal. The articular proceffes are not directed backwards, but downwards.

The laft peculiarity is alfo obferved in the other lizards, but they have not the crefts of the cameleon, and the upper part of their cranium is broad, like the crocodile.

In frogs and falamanders the cranium is nearly of a cylindrical form, flat fuperiorly, and enlarged pofteriorly; the frontal bones have the fhape of an elongated rectangle, and occupy the interval of the orbits. The Surinam toad has the cranium much flatter than the other genera.

The eminences intended to affift in the articulation of the jaw are turned directly towards the fides.

The

The ftructure of the cranium of tortoifes bears more refemblance to that of crocodiles than of frogs. The frontal bones form only the roof of the orbits, and the cranium does not pafs between thefe cavities. They are very fhort, and the parietalia are three times longer. The latter are not confined to covering the cranium. They extend on each fide, and form an arch over the temporal foffa. In the fea tortoifes this arch is completed by two peculiar bones, which extend from the os parietale to the zygoma, and the anterior of which bounds the orbit behind.

The articular proceffes are directed downward, as in the cameleon. Above thefe and the meatus auditorius, we find confiderable maftoid proceffes, which are pointed fuperiorly in land tortoifes, but are rounded and marked by a longitudinal furrow in the fea tortoifes.

Serpents have two frontal bones almoft fquare, and a fingle parietal bone. Their cranium advances forward between the orbits, as in frogs. The occipital bone has a procefs directed backward, and connected with a particular moveable bone, analogous to the fquare bones of birds, to which the lower jaw, and the arches which form the upper, are articulated.

The general form of the cavity of the cranium of reptiles is oblong, and almoft of an equal breadth, being merely a little contracted between the ears. The tortoife has a kind of fella turcica, the four clinoid proceffes of which are directed forward. The fphenoidal foffa is fomewhat depreffed in the ferpents, but it has no clinoid proceffes. It is a femilunar depreffion, the plane of which is fituated from before backwards.

The bafilar foffa is lower than the other foffæ in the crocodile, and in fome tortoifes.

Foramina of the Cranium.—The interior part of the cranium is frequently not clofed by offification in reptiles and fifhes, and the olfactory nerves pafs through a large vacant fpace, which is not fubdivided into particular holes. This at leaft is the cafe with the cameleon, the iguana, tortoifes, the pike, the anarrhichas, &c. In others, the olfactory hole is contracted, but is ftill fimple, as in the crocodile. It is double in frogs and falamanders. The rays and the fharks have alfo two holes, which are confiderably removed from each other.

The optic holes are likewife fometimes united into one, as in the crocodile: thofe of the tortoife are much removed from each other, and are diftinguifhed from the great hole in the front of the cranium, by only a fmall bony partition. The ftructure of the cranium in the pike is fimilar. In the frogs, the rays, the anarrhichas, and it fhould feem in the greater number of fifhes, the optic holes are at a great diftance from each other, and perforate the fides of the cranium. Thefe animals have no fpheno-orbitar fiffure, and the fmall nerves tranfmitted to the eyes pafs each through a particular foramen.

There is, in general, only one hole on each fide for the three branches of the fifth pair of nerves, which, therefore, fupplies the place of the foramen rotundum, foramen ovale, and in part of the fpheno-orbitar fiffure. This hole, however, is divided into three in the carp.

The meatus auditorius internus exifts in reptiles.

The Face.—In the crocodile the face refembles one-half of a cone irregularly flattened on its convex furface. It is chiefly formed by two offa maxillaria, and two offa nafi, which are fituated almoft parallel to each other, and two offa intermaxillaria, which form the end of the muzzle, and furround the aperture of the nofe like a ring.

The bones analogous to the lacrymalia are four in number, two on each fide. The os malæ, which is very large, after forming the inferior, and affording a fmall procefs to the pofterior edge of the orbit, extends directly backwards to join the great maftoid protuberance: thus the temporal foffa has no communication outwardly; except by a hole which is fmaller than the orbit, and the greater part of which is covered by thefe bones, as by an arch.

The nafal foffæ are continued in a long and narrow tube under the foramen magnum. They perforate the offa palati, and a particular bone which is analogous to the pterygoid proceffes of the os fphenoides. This bone is fituated almoft precifely under the cranium, and is enlarged on each fide until it forms a kind of fquare and almoft horizontal wing. An offeous branch unites it laterally to the os maxillare and os malæ, in fuch a manner that a large hole is left on each fide of the arch of the palate.

In the cameleon the face is concave fuperiorly, and bordered by a ferrated ridge throughout the whole of its circumference. We obferve two holes which communicate with the orbits, and two other oval foramina, which correfpond to the incifive holes in the palatine furface. The bones which compofe the face are nearly the fame as thofe of the crocodile. The other lizards exhibit ftill lefs difference.

The frog and the falamander have the nafal and intermaxillary bones very fhort, and broader than long, which renders their face round anteriorly. The os maxillare is very narrow, and is fcarcely contracted in forming the zygomatic arch. The orbits are large, but have no inferior furface, and therefore communicate with the palatine foffa. The offa palati form the anterior edge of the orbitar foffa inferiorly. They refemble portions of a circle. They are furnifhed with pointed teeth on their circumference. The canal of the nares is very fhort in the falamander. There is only a fimple hole in the frog.

The face of the Surinam toad is very flat, but the bones are the fame as in the frog. The orbitar foffæ are oval, and no aperture fimilar to the canal of the nares can be diftinguifhed.

The face of ferpents is rounded nearly in the fame manner as that of lizards. Between the os frontis and os parietale, there is a particular bone which terminates the frame of the orbit pofteriorly. Thefe animals have no os malæ. We can, however, eafily diftinguifh two offa nafi, two offa maxillaria fuperiora, two offa intermaxillaria, and fome analogous to the palatine arches of birds, which are furnifhed with teeth, and which are articulated to the bone which fupplies the place of the os quadratum, with refpect to the lower jaw. Two particular bones unite thefe arches to the maxillaria fuperiora.

In thofe that have teeth, or poifonous hooks, as the viper, the rattlefnake, &c. there are befides two fmall peculiar bones, articulated and moveable, which fupport thofe teeth. They are fituated upon the intermaxillary bones and the anterior extremity of the offeous branch, which joins the fuperior maxillary bone to the arch of the palate.

The face of the tortoife is circular before, and rounded on every fide. It is compofed of nearly the fame bones as that of the crocodile. The intermaxillary bones are, at a very early period, confolidated with thofe of the upper jaw. The bones analogous to the os malæ are three in number, one articulates with the os temporum and with the two others; it is fituated pofteriorly, and forms the zygomatic arch. The other two portions are received on its anterior extremity; one extends upwards, and unites with the orbitar angle of the os frontis; the other is directed

downward,

downward, and articulates with the pofterior and external procefs of the os maxillare fuperius.

The offa palati are broad, and form the pofterior arch of the nafal foffa.

The bones of the face of tortoifes commonly cover each other at their edges, which are refined into thin laminæ. It is therefore very difficult to diftinguifh the futures.

In the fea tortoifes the temporal foffæ, which are very deep, are covered by an offeous lamina, which forms a very folid arch above them.

The defcription of the jaws, and the temporal foffæ, is given at the beginning of the account of the digeftive organs.

Cavities of the Face.—1. *Nafal Cavity.* It is a broad fpace in the tortoifes, occupying the whole thicknefs of the fnout in front of the eyes, and very fhort from before backwards. Its front opening is large, and nearly fquare, with its plane but little inclined; furrounded by fix bones. There are two round openings behind, correfponding nearly to the middle of the palate.

In the crocodile it is a long and narrow canal, extending from the end of the fnout under the occiput: its bony opening, formed entirely in the two intermaxillary bones, is turned upwards.

Other lizards have the nafal apertures fituated nearly as in birds: that is, the front or outer on the fide of the fnout, and the back or inner in the middle of the palate. They are ftill fhorter in the frogs.

2. The orbit is never feparated from the temporal foffa in reptiles by a partition, but merely by a bony branch; and even this is complete only in the lizards and tortoifes, not in the frogs, falamanders, or ferpents. The plane of its margin is lateral in the tortoifes, ferpents, and cameleon; it is more or lefs directed upwards in the crocodile, falamanders, and frogs. The figure varies from circular to triangular. The inferior furface or floor is never complete: either it is altogether deficient, or it is perforated by a very large aperture. The fame remarks are applicable to the inter-orbitar feptum.

The zygomatic foffæ are fpoken of in the defcription of the jaws and their movements, under the divifion of *Organs of the Vital Functions.*

Foramina of the Face.—Where there is no diftinction between the orbit and temporal foffa, the fpheno-maxillary fiffure is of courfe wanting. There are no internal orbitary holes, as the relation between the orbits and nofe is altogether different from what is obferved in the mammalia.

The crocodile, frog, and falamander, poffefs a large foramen incifivum. The tortoife has two fmall ones: the ftructure of the lizards is not known.

There is no fuborbital opening, reptiles having no lips to receive the artery and nerve, which it tranfmits in the mammalia.

The fpheno-palatine canal appears as a fimple hole in the os palati.

Motions of the Head.—The articulation of the head of reptiles is confiderably behind, but the motions vary in different fpecies.

In the crocodile there is only one condyle, fituated at the under fide of the foramen magnum: the atlas is formed of two portions; the pofterior is fhaped like the fegment of a ring; the anterior, which is thicker, receives the condyle, and is articulated to the fecond vertebra: there are two lateral proceffes, long, flat, and turned backward, which fupply the place of tranfverfe proceffes.

The odontoid procefs of the fecond vertebra is fhort and thick; it is articulated within a cavity in the body of the atlas. This fecond vertebra has tranfverfe proceffes fimilar to thofe of the firft.

All other lizards have nearly the fame conformation; but the condyle feems divided in two by a longitudinal fuperficial furrow.

The tortoifes have likewife only one condyle. In the land fort it is prolonged, and divided into two, as it is in the lizards. In the marine fpecies it prefents three articular faces, like a trefoil leaf. As this condyle penetrates deep into the correfpondent cavity of the atlas, the lateral motion of the head is much confined. The other motions of the head of the tortoife are thofe of projection and retraction; they depend upon the flexion and extenfion of the cervical vertebræ.

The frog, the toad, and the falamander, have the head articulated by two condyles upon the firft vertebra, which is almoft immoveable.

Serpents have three furfaces, in the manner of a trefoil, clofe together, upon one condyle, beneath the occipital foramen. The head is not more moveable on the atlas, than the reft of the vertebræ are upon each other.

Bones of the Spine.—The number of vertebræ, and every other attribute of the fpine, are more varied in this clafs of animals than in any other.

In the tortoifes, feven vertebræ are affigned to the neck: the firft is only a fingle tubercle, the annular portion of which is very diftinct. The furface, by which it is articulated with the head, is formed of three planes; one anterior, and two lateral. The point in which they unite is the moft prominent, and to this is attached a ftrong ligament. The furface which unites it to the next vertebra is a glenoid cavity; the fecond and the following vertebræ have a prominent longitudinal ridge upon the fore-part of their body. The articular proceffes defcend below the body: there are no fpinal proceffes, except one to the fecond vertebra, which points forward, and one to the third in the form of a fimple tubercle. The two laft vertebræ, at a certain age, become anchylofed. There are eight dorfal vertebræ; but they are all anchylofed, together with the ribs and the back-fhell, in one immoveable piece. They have, therefore, neither proceffes nor articular furfaces: they are all narrower in the middle than at the ends. The lumbar and facral vertebræ are likewife confolidated with the back-fhell, but thofe of the tail are free and moveable. The condyle, which forms the body of thefe vertebræ at its articulation with the others, inclines backward, and not towards the head, as thofe of the neck do. There are likewife upon the fore-part of the body, at its bafe, two fmall tubercles; but all the proceffes of thefe vertebræ refemble thofe of the mammalia.

In the family of lizards, the crocodile has feven cervical vertebræ, diftinct indeed, but fo clofely articulated as not to be moveable. The proceffes are fo numerous, long, and clofe, that the animal cannot bend its neck, and the cervical column may, therefore, be regarded as a fingle piece. This correfponds with the reports of travellers, that the crocodile is unable to turn his head round. The anterior furface of the body is concave, and the pofterior convex, throughout the vertebral column of the crocodile. The atlas is compofed of fix pieces, which appear to continue feparate through life: the vertebra dentata has five only. The other cervical vertebræ have on each fide two fhort tranfverfe proceffes, which ferve to fupport the fmall ribs or appendices, which limit the flexion of the neck. Each has two pedicles, attached to the two proceffes juft mentioned: the appendix projects into a fharp procefs before and behind, which touch thofe of the contiguous vertebræ. The five firſt dorſal vertebræ have a lateral tubercle for the head of the rib, and another on the tranſverſe proceſs for its tubercle: thus the rib is articulated only to one vertebra. But the firſt of theſe articular ſurfaces is wanting in the remaining ribs, while each of their tranſverſe proceſſes has two articular faces. The ſame number (ſeven) is found in moſt lizards, though the cameleon has only two. The ſacral vertebræ are very few in every ſpecies, and none of them have a large os ſacrum.

As frogs have no ribs, no diſtinction can be formed with reſpect to the three firſt orders of vertebræ in them. They have in general eight between the neck and the pelvis, all furniſhed with pretty long tranſverſe proceſſes. The laſt are the longeſt, and touch the oſſa ilii. In the toads, the tranſverſe proceſſes are very large, and ſhaped like hatchet blades. The os ſacrum conſiſts of a ſingle bone only: it is long, pointed, compreſſed, and has no coccyx. In the pipa, which has the tranſverſe proceſſes of the ſecond and third vertebræ much longer than the others and almoſt like ribs, this bone is oſſified with the laſt vertebræ.

The ſalamanders have fourteen vertebræ between the head and the ſacrum; they have all nearly the ſame ſhape, except the firſt, which receives the head, and the laſt, which is articulated to the ſacrum. The two extremes of the ſpine alone want the veſtiges of the ribs, which conſiſt of ſmall oblong moveable bones, actually articulated to the tranſverſe proceſſes, which here take a poſterior direction. The articular proceſſes are large, and wedged together. The poſterior reſt upon the anterior, ſo as to impede the motion of the ſpine backward. The ſacrum conſiſts only of a ſingle vertebra, but there are twenty-ſeven in the tail.

In ſerpents, the vertebræ alone conſtitute almoſt the whole ſkeleton. It appears in general, ſays Blumenbach, that the number of vertebræ, in red-blooded animals, is in an inverſe proportion with the ſize and ſtrength of their external organs of motion. Serpents, therefore, which entirely want theſe organs, have the moſt numerous vertebræ; ſometimes more than three hundred. (Comp. Anat. p. 118.) In confirmation of this remark, we may obſerve how numerous the vertebræ are in the elongated fiſhes, as the eel, and in the whales, as the porpoiſe, (above one hundred in the former, and between ſixty and ſeventy in the latter). Birds, whoſe wings give them ſuch vaſt power of locomotion, have very few vertebræ, if we conſider the anchyloſed ones as forming a ſingle piece; and the frog, with its immenſe hind extremities, has a very ſhort ſpine, conſiſting of ſtill fewer pieces than that of birds. The vertebræ of this order are nearly of the ſame form, from the head to the tail: the body, as well as the ſpinous, articular, and tranſverſe proceſſes, are eaſily diſtinguiſhed. In certain kinds, for inſtance the boæ, the ſpinous proceſſes, which are continued throughout the whole length of the back, are ſeparated from each other, and allow reciprocally a motion ſufficiently conſpicuous. Wherever this diſpoſition of the ſpinous proceſſes prevails, the body of the vertebræ, on the ſide next the belly, preſents only an obſcure projecting line. In other kinds of ſerpents, as for example the rattleſnake, the ſpinous proceſſes are long, and ſo large as to touch each other. They have, for their baſis, the articular proceſſes, which lie on each other like tiles. In conſequence of this ſtructure, the motion of the ſpine towards the back is very circumſcribed, but its motion towards the belly and ſides much augmented. The bodies of the vertebræ play very eaſily in theſe directions upon one another, and are armed with a ſharp ſpine tending towards the tail, which only obſtructs their motion when it might produce a luxation. The firſt vertebræ differ from thoſe of the reſt of the body, only in having the rudiments of the ribs much ſmaller: there is no neck in theſe animals. The vertebræ of the tail differ no farther than in having no ribs, and that their ſpines, both ventral and dorſal, are double, or form two ranges of tubercles. The articulation of the bodies of the vertebræ with each other is very remarkable: the anterior part of the body of the vertebra preſents a ſmooth hemiſpherical tubercle, and the poſterior part a correſponding cavity; ſo that each vertebra becomes connected to thoſe next it by a ſort of knee-joint. This mode of articulation fully explains the motion of reptiles, which is performed winding from ſide to ſide, and not up and down, as it is repreſented by painters.

Table of the Number of the Vertebræ in Reptiles.

I. Oviparous Quadrupeds.

Species.	Vertebræ of the Neck.	Vertebræ of the Back.	Vertebræ of the Loins.	Vertebræ of the Sacrum.	Vertebræ of the Tail.
Turtle - - -	7	11	0	3	20
Crocodile - -	7	12	5	2	34
Tupinambis -	7	18	4	2	104
Iguana - - -	5	11	9	2	72
Cameleon - -	2	17	3	1	69
Salamander - -	1	12	1	1	26
Frog - - - - 10 in all.					
Pipa or Surinam toad, 8 in all.					

II. Serpents.

Species.	Vertebræ to which Ribs are joined.	Vertebræ of the Tail.
Viper (berus) - - - -	139	55
Spectacle ſnake (naia) -	192	63
Garter ſnake (natrix) - -	204	112
Amphiſbæna - - - -	54	7
Boa (conſtrictor) - - -	252	52
Common ſnake - - - -	244	More than 60.
Rattleſnake - - - -	175	26
Slow worm (anguis fragilis)	32	17

Of the Ribs and Sternum.—The thorax of reptiles is very various in its ſtructure. Frogs have a ſternum, but no ribs; ſerpents have ribs, but no ſternum; tortoiſes have the ribs oſſified to the back-ſhell, and the ſternum included in the breaſt-plate; the crocodile and lizard have perfect ribs, but their ſternum is almoſt entirely cartilaginous. In the crocodile, the firſt portion of the ſternum is oſſified and elongated. It receives the two clavicles. The remaining part is entirely cartilaginous. It is united with the os pubis, and ſends off eight cylindrical cartilages to the parietes of the abdomen. This ſtructure, conſtituting a ſpecies of abdominal ſternum, apparently for ſupporting the viſcera, is quite peculiar to the crocodile. The ribs are twelve in number, the two firſt and two laſt of which are not attached to the ſternum. The intermediate ribs have upon their poſterior edges cartilages partly oſſified, which ſupply the place of the angles of the ribs in birds. All the poſterior ribs, beginning at the fifth, are only articulated to the tranſverſe proceſſes of the vertebræ, which are of great length. The five firſt articulate with the vertebræ at two points, one on its

its body, and the other on the tranfverfe proceffes. The iguana and the tupinambis have only the upper part of the fternum offified: it is broad, and receives fix ribs and the clavicles; the other ribs are free. The cameleon poffeffes likewife the upper portion of the fternum; but almoft all the ribs have cartilages, which extend to the middle line, and are there united to the oppofite ones. Frogs, though they have no ribs, have neverthelefs a very confpicuous fternum. It forms on the anterior part a cartilaginous appendix, furnifhed by a difk fituated below the larynx. It next receives the clavicles, and then expanding, it terminates at laft in another difk fituated under the abdomen, and which affords an origin for mufcles. There is a peculiar bony cyft of unknown ufe on the internal furface of the fternum, in the rana pipa.

The falamander has ribs, fo fhort that they feem to be the tranfverfe proceffes of the vertebræ; they have only one point of articulation, upon which they have but little motion. Thefe rudiments of ribs are twelve in number on each fide. This reptile has, properly fpeaking, no fternum, but its place is partly fupplied by the bones of the fhoulder, as we fhall prefently fee.

The fkeleton of the chelonian reptiles exhibits to us what appears on the firft view as a completely anomalous organization. In the bony houfe which thefe animals carry about with them, there is fuch a deviation from the ordinary figure, connection, and pofition of the parts, compofing the fkeleton of other vertebral animals, that a hafty view would lead us to infer that the general model to which Nature in all her modifications of form and pofition ever adheres, has been completely loft fight of, and another fubftituted in its place. This inference would be altogether incorrect: a more accurate examination enables us to difcover in the external bony fhells of thefe fingular creatures, all the offeous pieces which belong to the cheft of a mammiferous animal or bird; fo that no effential part is wanting in their thorax, and the fingularity depends merely on the more or lefs complete offification of the whole pectoral cafe, and the peculiar forms refulting from this circumftance. Thus, inftead of the anomaly, which a hafty glance leads us to anticipate, we actually difcover, on the contrary, a new proof of the conftancy, with which an original model is retained throughout whole claffes of animals, even under the wideft differences of external form, as if Nature, having fixed on one general principle of organization, would not be at the trouble of inventing others, but rather chofe, by the ftrangeft modifications, to accommodate the organs to new fituations and forms. It is a new illuftration of that principle, in conformity to which the fin of a whale contains all the bones of an upper limb of a quadruped, the wing of the bat the regular digital phalanges, the fin of a penguin or feal the ufual bones of the extremities of a bird or mammiferous animal, &c.

The bones of the cheft in the tortoifes form a more or lefs convex fhield-like covering, which conftitutes the upper furface of the animal; we call it the upper fhell (carapace, bouclier, &c.); and a nearly flat portion adapted to its concavity below, conftituting the inferior furface of the animal: this is the under fhell (plaftron).

The back fhell is formed by the expanfion of eight ribs or offeous ftaves, which arife from the joints of the vertebræ, and terminate in a border that furrounds the whole fhell: thefe bones are united together by real futures, fituated tranfverfely. Above, and all along the middle part of the fhell, we obferve a row of little offeous plates, almoft fquare, intimately connected together, and to the plates formed by the ribs, by fynarthrofis, and equal in number to the vertebræ. Thefe plates reprefent the rings and fpinous proceffes of the vertebræ. The offeous margin is made up of a great number of pieces, (eleven on each fide, and a fingle one in the middle, before and behind, therefore 24 in the whole,) foldered together, which by their union form an edge or border with three furfaces, *viz.* the fuperior, which belongs to the back fhell; the inferior, which is joined to the breaft-plate by a very thick leather-like fkin; and the internal, which prefents a groove for the reception of the extremities of the ribs. Thefe pieces, which Geoffroy compares to the fternal or cartilaginous portion of our ribs, are wanting in the foft tortoifes, (trionyx, Geoff.); or at leaft remain conftantly cartilaginous or membranous, fo that the middle only of the upper fhell is fuftained by an offeous difk.

The turtles, and the foft tortoifes, are the only genera in which the ribs, confounded in the upper fhell or carapace, are neverthelefs diftinct, both by a prominence very apparent on the infide of the fhell, and by a free unattached portion of their ends projecting beyond the edge of the fhell. But the offeous difk, compofed of articulated pieces, and already mentioned, extends round the ribs in the turtles, receiving their ends, but is wanting in the foft tortoifes. Its folidity is increafed in the former by the great plates which cover it, while it remains flexible in the latter, and is covered only by a fpecies of epidermis.

The offification of the intervals of the ribs, forming the carapace, is perfected gradually, and is not finifhed until long after that of the ribs themfelves: it generally advances from the middle towards the edges. Thus, in a young turtle the ribs will be found feparate from each other, towards their external extremities, for half their length; while in an adult individual of the fame fpecies, the anterior ribs are united throughout, while the intermediate ones are feparated only through about one-fixth of their length.

The carapace is always oval and pointed behind in the turtles; elliptical and gibbous in the land tortoifes; elliptical and flatter in the frefh-water tortoifes. Its furface is rough in the foft tortoifes; elevated into various prominences in the chelydes and the ferpentine, and more or lefs fmooth in the others.

The margin of the upper fhell affumes a different appearance at its anterior part; it is there a fquare piece of bone, convex above, and concave below, which fuftains a fpine for the attachment of mufcles. Its anterior edge has more the form of a crefcent (lunula); there are alfo fome little peculiar pieces above the tail.

The breaft-plate of the tortoife is its fternum; and when deprived of the thick fkin that covers it, exhibits, in fome fpecies, only one folid plate, formed of feveral pieces, united by fynarthrofis: in others, this plate is perforated quite through, and formed of feveral bones, fome of which are fituated in the middle line between the anterior and pofterior part, while others are placed laterally, and faftened together by the help of the former, which fupport them. For further information concerning the offeous fabric of the cheft in thefe reptiles, two memoirs in the 14th vol. of the Annales du Mufeum may be confulted; "Sur les Tortues molles, par Geoffroy St. Hilaire;" "Sur les offemens Foffiles de Tortues, par Cuvier."

In the draco volans the ribs form the fkeleton of the wings, or thofe expanfions of the integuments between the front and back limbs, which are fo called. The five pofterior ribs are elongated and bent backwards for that purpofe. Here progreffive motion is performed by thefe ribs; but they are fuperadded for this purpofe, and make no part of the organs of refpiration. The animal cannot in in truth be ſaid to fly: its lateral membranes act like a parachute, and enable it to take long leaps.

The ribs are uſually articulated to the vertebræ by means of a convex ſurface, which moves upon a ſlightly concave one formed in two of the vertebræ, ſo that the hollow receiving each rib is ſituated between two vertebræ of the back. But in the ſnake tribe the head of the rib has two ſlightly concave ſurfaces, which move upon a convex protuberance belonging to each vertebra; ſo that the rib reſts on a ſingle vertebra. The conſequence of this peculiarity is, that the ribs do not interfere with the motions of the individual vertebræ, and thus that the latter are left free to execute thoſe movements on each other, which take place ſo extenſively in the progreſſion of ſerpents. The articulations of the vertebræ to each other, and to the ribs, are repreſented of the natural ſize from the ſkeleton of a large boa, in the Philoſ. Tranſ. 1812, pt. 1. pl. 6.

We have already ſeen the ribs, inſtead of contributing to the buſineſs of reſpiration, employed for purpoſes of locomotion in the draco volans. They are ſtill more extenſively employed for the ſame purpoſe in the ſerpent tribe, in which they amount ſometimes to 250 pairs, as obſerved by ſir Everard Hume. Theſe bones, in all ſnakes, are continued to the anus, while the lungs ſeldom occupy more than one-half the cavity covered by the ribs. The hind ribs can only be employed for the purpoſe of progreſſive motion, and thus correſpond to the elongated ribs of the lateral membranes in the draco volans.

The ribs of a ſnake may be ſeen to move forwards ſucceſſively when the animal is in motion, like the feet of a caterpillar, and the ends of theſe bones can be diſtinctly felt on the palm of the hand, as the animal paſſes over it.

At the termination of each rib is a ſmall cartilage in ſhape correſponding to the rib, only tapering to the point. Thoſe of the oppoſite ribs have no connection, and when the ribs are drawn outwards by the muſcles, are ſeparated to ſome diſtance, and reſt through their whole length on the inner ſurface of the abdominal ſcuta, to which they are connected by a ſet of ſhort muſcles: they have alſo a connection with thoſe of the neighbouring ribs by a ſet of ſhort ſtraight muſcles.

When the ſnake is going to put itſelf in motion, the ribs of the oppoſite ſides are drawn apart from each other, and the ſmall cartilages at the ends of them are bent upon the upper ſurfaces of the abdominal ſcuta, upon which the ends of the ribs reſt; and as the ribs move in pairs, the ſcutum under each pair is carried along with it. This ſcutum, by its poſterior edge, lays hold of the ground, and becomes a fixed point, from whence to ſet out anew. This motion is beautifully ſeen, when a ſnake is climbing over an angle, to get upon a flat ſurface.

The coluber and boa, having larger abdominal ſcuta, which may be conſidered as hoofs or ſhoes, are the beſt fitted for this kind of progreſſive motion; there is, however, a ſimilar ſtructure of ribs and muſcles in the anguis and amphiſbæna. In the anguis the ribs are proportionally weaker, and as theſe have nothing to correſpond to the ſcuta, this mode of progreſſive motion is probably leſs neceſſary to them. See "Obſervations intended to ſhew that the progreſſive Motion of Snakes is partly performed by means of the Ribs," by ſir Everard Hume, Philoſ. Tranſact. 1812, pt. 1. pag. 183, with figures. We are alſo indebted to ſir Everard Hume, in conjunction with Dr. Ruſſel, for deſcribing more particularly a fact noticed by Blumenbach, (Comp. Anat. p. 117.), *viz.* an adaptation of certain ribs in the cobra de capello (coluber naia, L.) to the accompliſhment of a particular mechaniſm in that animal. This ſerpent is called the hooded ſnake, from a power of expanding the ſkin of the neck, which is effected by the motions of the ribs. In other ſerpents, the ribs, from the firſt vertebra to thoſe of the middle of the trunk, gradually increaſe in length; thence they gradually ſhorten or decline, to near the end of the tail, where they diſappear, or are transformed into ſhort eminences. In the naia, the cervical ribs gradually lengthen to the tenth or eleventh, after which they ſucceſſively ſhorten to the twentieth. Again increaſing in length, they are, at the middle of the trunk, nearly as long as the middle cervical ribs, and then declining as in other ſerpents, diſappear on the tail.

The firſt twenty ribs, inſtead of bending equally with the others towards the belly, go out in a lateral direction, having only a ſlight curvature, and when depreſſed lie at the ſide of the ſpine upon one another. The firſt is ſhorteſt: they lengthen to the tenth, and are again ſhortened to the twentieth; ſo that, when they are extended, they repreſent an oval figure, of which the ſpine is the middle line or long axis. In the extended ſtate of the ribs, the ſkin of the back is brought over them, forming the hood; and in their depreſſed ſtate it recedes. From the rounded form of the hood, the ſkin has the appearance of being inflated; but the moſt careful examination did not diſcover any communication between the trachea or the lungs and the cellular membrane under the ſkin. See "Remarks on the voluntary Expanſion of the Skin of the Neck in the Cobra de Capello," &c. by Pat. Ruſſel, M.D. and Everard Hume, eſq. Philoſ. Tranſ. 1804, pt. 2. pag. 346.

The exiſtence of ribs has been denied in the ſiren lacertina, and proteus anguinus: they have in truth merely very inſignificant rudiments of ribs, that might be eaſily overlooked. Theſe have nothing to do with the reſpiration of the animals, indeed they are too ſmall to anſwer any purpoſe. See the deſcription of theſe animals at the end of the preſent article.

Such rudiments of ribs are ſaid to exiſt in the genus cæcilia, among ſerpents.

Bones of the Shoulder.—In oviparous quadrupeds the glenoid cavity of the ſhoulder is partly compoſed of the ſcapula, and partly *of the clavicle.* The ſcapula, which is elongated, has no ſpine; it contracts and becomes thicker towards the neck. The clavicle is ſimple, ſhort, and flat, and united to the ſternum in the crocodile and lizards. It is broad, and almoſt ſquare, in the iguana and cameleon; in the tupinambis it is oval, and very large and long between the front and back, and has two un-oſſified parts. The frog and toad have two clavicles to each ſhoulder, attached to the two extremities of the ſternum. The ſcapula is bent, and compoſed of two articulated pieces, with the ſuperior one inclined towards the ſpine. The ſame conformation obtains in the Surinam toad. The anterior clavicles appear to correſpond to the os furciforme of birds. The clavicle, the ſternum, and the firſt piece of the ſcapula, are anchyloſed together. The ſalamanders have the ſhoulder formed in a moſt ſingular manner, the ſcapula, clavicle, and ſternum, conſiſt only of a ſingle bone, which receives the head of the humerus. The ſhoulder is almoſt all cartilaginous, but the part anſwering to the ſcapula is more diſtinct than the reſt. It inclines towards the ſpine, where it receives the muſcles by which it is moved. The clavicular part is directed towards the head; that which ſupplies the place of the ſternum turns towards the breaſt, but without uniting with the bone of the oppoſite ſide; the part on the right ſide ſlides over that on the left. This conformation allows a greater dilatation of the breaſt in reſpiration. The tortoiſe

has

has alfo thefe three bones, which unite to form the glenoid cavity, and correfpond with the fcapula, fork, and clavicle. But as their refpective difpofition is very remarkable, it appears neceffary to give a particular defcription of them. One of the bones extends from the bafe of the rudiment of the firft rib, to which it is fixed by a ligament, as high as the humeral cavity, where it is intimately connected with the other two. The fecond bone may be confidered as the continuation of the firft, which it joins at the humeral cavity, of which it forms part. Its other extremity is attached to the breaft-plate, and ftrong ligaments likewife unite the extremity to that of the pofterior bone. Thefe two bones, thus united, are flightly bent outwards, fo as to leave between them and thofe of the oppofite fide, an oval fpace, through which the œfophagus, the trachea, and feveral mufcles, pafs. The firft feems to correfpond to the clavicle, and the fecond to the os furciforme. Finally, the third bone of the fhoulder is fituated below the abdominal and thoracic vifcera, nearer the breaft-plate. It is long, and extends from the humeral cavity, of which it forms the lower part, as far as the abdomen. It feems to fupply the place of the fcapula by the number of mufcles inferted into it, but its fituation is juft the reverfe of that bone. A very ftrong ligament unites this bone to the fecond.

Bone of the Arm.—The humerus of the tortoife has a very remarkable fhape. As in birds it is articulated at once to the fcapula, clavicle, and os furciforme, by a large oval head, the greateft diameter of which lies in the direction of the flatnefs of the bone. A confiderable eminence rifes above this large head, which, by its curvature and its ufes, has fome relation to the olecranon, a procefs which, in this animal, the bone of the fore-arm wants. Below the head there is another eminence, lefs projecting, but more rough, which likewife ferves as a point of infertion to fome mufcles, and fupplies the place of the little tuberofity. The reft of the body of the bone is flattened and narrow towards the middle. In the crocodile, the humerus is round, but a little bent like an S in its whole length. At the extremity that joins the fcapula, it refembles the tibia; its head, inftead of being round, is flat; and its tuberofity, which is fingle, is anteriorly in the form of a ridge, and fomewhat inclined inwards. In the other lizards, and in frogs, the humerus exhibits nothing peculiar. Serpents having no limbs, have confequently no humerus.

Bones of the Fore-arm.—The humerus of the crocodile terminates in two round tubercles. The hollow head of the radius turns upon the external one. Between them the round head of the ulna is fituated, but it has neither olecranon nor figmoid cavity. In the upper part it is the largeft of the two bones, but the fmalleft below. There is nearly the fame conformation in the cameleon, but the bones are more elongated, and the inferior head of the radius is lefs than that of the ulna. In the frog the fingle bone of the fore-arm is articulated by a concave head, with a large round tuberofity on the bafe of the humerus, between its two condyles. On each fide, where the lower part of this bone becomes larger, we obferve a furrow, which is the only veftige of a diftinction into two bones. Troja has pointed out a fingularity in the ftructure of the bone of the fore-arm and of the leg in frogs and toads. Thefe bones confift of a fingle piece, which is folid in the middle, but divided at either extremity into two conical portions, having manifeft medullary cavities. See Memoria fopra la ftruttura fingolare della tibia e del cubito nelle Rane e nei Rofpi, in his Sperienze intorno alla Rigenerazione delle Offa. Nap. 1779, p. 250, t. 7, 8.

The two bones of the fore-arm of falamanders are fituated one above the other. The ulna, which is the loweft, and fomewhat longeft of the two, has no olecranon; but there is a fort of rotula in the tendon of the extenfor mufcles. The ulnar extremity of the humerus is much enlarged. The articulate furface which terminates it is convex, and permits the radius and ulna to turn together in every direction. The two bones of the fore-arm in the turtle are always in a forced ftate of pronation. The radius, which is much longer than the ulna, and fixed to it by a cartilaginous fubftance, is the loweft, and extends even under the carpus. Thefe two bones much refemble each other in the humeral extremity, being formed by a fingle concave furface received upon a correfpondent pulley of the humerus. Their articulation is fuch that it allows them to move together laterally, and a little upward and downward in the action of fwimming.

Bones of the Hand.—The frog, the toad, the falamander, have three ranges in the carpus. The firft confifts of two bones, one radial and one ulnar; the fecond confifts of three bones, the largeft of which bears the rudiment of a thumb with two joints; the third range has likewife three bones. The fecond fingers proceed from the firft of thefe bones; the fourth finger is articulated with the fecond bone; the middle finger articulates with both bones; the little finger joins the third bone. The firft range touches the third inferiorly, becaufe the fecond is cuneiform. There is no bone without the range. In the mud tortoife, the firft range is a fingle bone, which feparates the radius from the ulna: the fecond range confifts of two bones, and a fmall one out of the row, fituated on the ulnar edge: the third range confifts of five bones, one for each bone of the metacarpus. The fea tortoife has three bones in the firft range, the ulnar bone being the longeft. The two anterior bones do not advance much farther. The third range confifts only of three bones for thofe of the metacarpus, and one fmall bone out of the row, fituated upon the radial fide.

In the crocodile, the firft range confifts of two long parallel bones. It has befides two little external bones without the range on the radial fide. The number of the phalanges varies in thefe animals. The crocodile has the hand rounded. It has two phalanges to the thumb, three to the fecond finger, four to the middle and fourth fingers, and only three to the little fingers.

The cameleon has three fingers on one fide, and two on the other, which form, with the three oppofite to them, a kind of forceps. The number of the phalanges is the fame as in the crocodile, with the exception of the little finger, which has four. In the falamander the little finger is obliterated, and the thumb has only two phalanges.

The frog has only one phalanx to the thumb. The two following fingers have only two phalanges. The other two fingers have three.

The hand of the fea tortoife is long, and compreffed in the form of a fin; there are two phalanges to the thumb, three to the three fucceeding toes, and two only to the laft. A fimilar conformation is obfervable in the mud tortoife; with this exception, that its hand is rounded.

Bones of the Pelvis.—In the turtle, that part of the os innominatum which correfponds to the pubis, is the moft confiderable. It proceeds from the cotyloid cavity by a thick portion, which comes forwards and widens into a thin flat lamina, divided into two parts; one is turned towards the middle line, by which the two correfponding bones are united; the other is free, and is directed to the external fide. The portion which correfponds with the ilium is fhort, narrow, and thick; it refts on the fhell, and is joined to the facrum; finally, the portion which is analogous to the

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the ifchium is turned backward and downward, and forms the real offeous circle of the pelvis. This conformation is fo fingular, that the parts of the pelvis of the turtle, when the whole is viewed out of its natural pofition, may very eafily be miftaken for one another; for the pubis refembles the ilium, the ifchium the pubis, and the ilium the ifchium. There is, befides, another very remarkable peculiarity in the pelvis of tortoifes; the ilium, and confequently the whole mafs of the pelvis with which that bone is united, is moveable on the vertebral column.

In the crocodile, and in the tupinambis, the difpofition of the pelvis has a great refemblance to that of the tortoife. In the crocodile the pubis receives the ventral ribs. In the cameleon and the iguana it is narrow, and the bones of the ifchium form, by this union, a projecting creft. In the frog, and in the Surinam and common toads, the offa ilii are much elongated; the pubis and the ifchium are fhort, and united in a fingle folid piece, the fymphifis of which forms a creft, more or lefs round. In the falamander, the conformation is precifely the fame. The offa ilii are narrow, and almoft cylindrical; and the offa pubis completely united with the ifchium, form only a large bony plate without any hole.

Thigh-Bone.—The femur of oviparous quadrupeds refembles that of other animals; it has, however, a double curvature, more or lefs evident. In front it prefents a convexity towards the tibial extremity, and a concavity near the pelvis. In the tortoife the trochanters are well defined, but they are not to be found in the lizards and frogs. The figure of the femur is in general round, except in the Surinam toad, in which it is very flat.

Bones of the Leg.—Oviparous quadrupeds have the tibia and fibula diftinct and feparated from each other throughout their whole length. Thefe two bones are nearly of the fame magnitude in the tortoifes and lizards. The frog has but one bone, but a furrow feems to indicate the union of the tibia and fibula. In thefe animals the tibia and fibula are, for the moft part, directly articulated to the thigh-bone.

Bones of the Ankle.—The aftragalus is articulated to the tibia, and the os calcis to the fibula in all reptiles. The tarfus of the crocodile has five bones, *viz.* an aftragalus, an os calcis, two cuneiformia, anfwering to the two middle metatarfal bones, and one out of the range, which anfwers to the external metatarfal bone. There are four metatarfal bones. The bone fituated without the range ferves to fupport the little toe in the mud tortoife. In the fea tortoife it is very flat. The os calcis and aftragalus are very fmall. In frogs, the aftragalus and os calcis are very long, and might at firft fight be taken for the tibia and fibula, if they did not form the third joint of the pofterior extremity. There are on the fore part, four little cuneiform, five metatarfal bones, and one in the form of a hook, which is very minute. Thefe are fimilar in the Surinam and common toad.

Bones of the Toes.—The number of the toes varies much in reptiles; as may be feen from the following table.

Number of the phalanges of the toes of reptiles, exclufive of the metatarfal bones, beginning at the pollex, or internal toe.

Crocodile - - -	2, 3, 4, 4.
Lizard - - -	2, 3, 4, 5, 4.
Cameleon - - -	3, 3, 4, 4, 3.
Salamander - -	2, 3, 3, 3.
Sea tortoife - -	2, 3, 3, 4, 2.
Mud tortoife - -	2, 3, 3, 3, 2.
Frog - - -	1, 2, 2, 3, 4, 3.

The faurians prefent us with arrangements in their extremities, not met with in any of the mammalia. We have fpecies poffeffing only fore-limbs, or only hind-limbs; others with four limbs, and one toe only on each; and other unufual combinations in the number of toes on the fore and hind-limbs. Thefe circumftances are noticed in thofe lizards which approach to the form of ferpents, and whofe fmall imperfect limbs feem more like rudiments than complete members, ferving as intermediate links between the faurian and ophidian orders. See Lacépède in the Ann. du Mufeum, ii. p. 351, with figures of a lézard monodactyle, and tetradactyle; and Daudin in his Hift. Nat. des Reptiles, vol. iv. in the hiftory of the genera Seps and Chalcide. We know nothing, however, about the ofteology of thefe—we might almoft fay—ridiculous limbs, they are fo obvioufly inadequate to the purpofe of locomotion.

Of the Mufcles.

Mufcles of the Spine.—There are few fpinal mufcles in frogs. The mufcle which is analogous to the ifchio-coccygeus is large and thin, and occupies all the fpace comprifed between the long bone of the coccyx and the ilia. Its fibres are oblique, and it ferves to draw the coccyx into the direction of the fpine. That which is analogous to the lumbo-coftalis, arifes above the laft by a fort of point attached to the coccyx. It extends quite to the head, into which it is inferted, and detaches fibres in its progrefs to each of the tranfverfe proceffes, which form a kind of interfection upon its furface. The obliquus fuperior arifes from the head at the margin of the foramen magnum, and is inferted into the tranfverfe proceffes of the firft dorfal vertebra. There is only one fmall rectus anterior, it arifes from the bafe of the cranium, below the foramen magnum, and is inferted into the firft of the tranfverfe proceffes. The inter-tranfverfales are like the human. The fpinal mufcles of the falamander much refemble thofe of the frog; thofe of the tail are very fimilar to the mufcles of fifhes. The fpine of the tortoife has no motion except in the parts belonging to the neck and tail. Thofe of the back and loins, which are offified together, have no mufcles. The mufcles of the neck are very different from thofe of man. The motions they produce are thofe of elongation, by which the head is protruded from the fhell; and thofe of retraction, by which it is withdrawn, the neck being bent in the form of a Z. The firft of the mufcles proper to the neck is attached to the under part of the anterior lateral border of the back-fhell, and into the tranfverfe procefs of the firft vertebra; it raifes the neck and draws it back. Another proceeds from the anterior and middle part of the fhell: it is inferted by four flefhy lips, which are feparate throughout a confiderable portion of their extent, into the articular proceffes of the third, fourth, fifth, and fixth vertebræ of the neck. It draws the neck back when the head is much extended, and pufhes it out when it is retracted. A mufcle alfo arifes from the articular proceffes of the third, fourth, and fifth vertebræ of the neck, by three flefhy portions that afterwards unite, and terminate in two tendons; one of which is inferted into the tranverfe procefs of the firft, and the other into the fpinous procefs of the fecond vertebra. This mufcle bends the neck upon itfelf, making it defcribe a curve, which is convex downwards; this motion brings the head under the fhell. A mufcle analogous to the longus colli arifes from the under part of the body of the fecond dorfal vertebra, beneath the fhell; it afcends along the neck, and furnifhes aponeurotic flips to al the tranfverfe proceffes, as as far as the ſecond vertebra, where it is inſerted. This alſo is one of the retractors of the head. There are very diſtinct inter-articulares, which by their action elevate each of the vertebræ, and conſequently extend the neck. The tranſverſo-ſpinalis is ſituated on the poſterior part of the neck: it ariſes from all the ſuperior tranſverſe proceſſes, and is inſerted into all the ſpinous proceſſes as far as the ſixth. Finally, a ſhort muſcle proceeds from the upper part of the firſt dorſal vertebra below the ſhell, and is inſerted into the articular proceſſes of the ſixth and ſeventh cervical vertebræ. This muſcle is peculiar to the tortoiſe, and begins the extenſion of the neck when the head is concealed within the ſhell.

Muſcles of the Ribs, Abdomen, &c.—In the frog, which wants ribs, and the tortoiſe, where they are immoveable, the muſcles which uſually have their inſertions in them, are in thoſe animals extended to other parts. Thus in the tortoiſe, whoſe breaſt-plate occupies the place of the abdominal muſcles, they are inſerted into the pelvis, which they move. With reſpect to thoſe animals, one very remarkable obſervation may, in general, be made. It appears that the very ſingular ſhape of the muſcles and bones depend upon each other. Indeed, as the muſcles are not placed upon the bones, they have not, if we may be allowed the expreſſion, faſhioned them; and the want of motion in the bones, which has given an unnatural figure to the trunk, has alſo given to the muſcles other forms and other uſes. The abdominal muſcles of the frog preſent nothing peculiar, except that the ſkin does not adhere to their ſurfaces, and that inſtead of being inſerted into the ribs, they are faſtened to the ſternum by a ſtrong aponeuroſis. The ſame obſervations may be made with reſpect to the ſalamanders.

We have deſcribed, in the oſteology, the adaptation of the ribs of ſerpents to the purpoſe of progreſſive motion; and now proceed to point out the muſcles by which they are moved forwards or backwards, and connected to the abdominal ſcuta. The ribs are brought forwards by five ſets of muſcles placed on the outſide of the cheſt, and paſſing obliquely from above, downwards, outwards, and backwards. 1. One from the tranſverſe proceſs of each vertebra to the rib behind it. 2. The next ſet ariſes from the ribs, at a ſhort diſtance from the ſpine, paſſes over two ribs, ſending a ſlip to each, and ends in the third. The third ariſes from the poſterior edge of each rib, paſſes over two ribs, and is inſerted into the third rib behind it. The fourth ſet paſſes over one rib and is inſerted in the ſecond. The fifth goes from rib to rib.

The muſcles carrying the ribs backwards are found on the inſide of the cheſt, and ſlant from the ſpine forwards and outwards. A ſtrong ſet ariſes from the anterior ſurface of the vertebra, goes over four ribs, to be inſerted into the fifth about its middle. The ſerrated portions of a ſtrong flat muſcle, forming the muſcular covering of the abdomen, ariſe from this part (the middle of the internal ſurface) of each rib. The right and left muſcles unite in a beautiful middle tendon. Thus it is obvious, that the inferior half of each rib (below the origin of the ſerrated portion juſt deſcribed) is external to the abdominal muſcle, and conſequently free for the purpoſe of progreſſive motion.

The ends of the ribs are connected to the abdominal ſcuta by a ſet of ſhort muſcles: they are alſo connected together by ſhort and ſtraight muſcles. Another ſet goes from the heads of the ribs obliquely backwards to be fixed in the ſkin at the edge of each ſcutum. See ſir E. Hume's paper quoted in the oſteology; and particularly plates 4 and 5 from Mr. Clift's drawings, in which the parts are repreſented.

There is a complicated muſcular apparatus for extending and retracting the ribs, and carrying the ſkin forwards and backwards in the cobra de capello. The ribs are raiſed or carried forwards by four ſets of muſcles, all ariſing from and inſerted in theſe bones, and directed obliquely from above, downwards and outwards.

The ſkin of the back is brought forwards on the neck by a large ſet of very long muſcles, ariſing ſucceſſively from each of the firſt twenty ribs, by a tendon, which ſoon becomes fleſhy. The longeſt is about two inches. They go backwards to be inſerted into the ſkin, which they can bring forwards to a great extent when the ribs have been firſt extended.

The muſcles which carry the ribs back again lie on the inſide of the cheſt under the ſpine. One ſet goes from the vertebræ of the neck to the lower edges of the ribs: but they paſs obliquely upwards and outwards over three ribs, to be inſerted into the fourth, thus acquiring a length of fibre, by which the range of motion produced is much increaſed. The ſecond ſet goes from the ends of the ribs forwards to the ſkin, which they will draw back. The third ſet from the root of one ſcutum to the ſcutum immediately above it, ſo as to bring it down upon the other. Sir E. Hume's and Dr. Ruſſel's paper, and particularly the engravings from Mr. Clift's drawings. Phil. Tranſ. 1804, pt. 2.

Muſcles of the Head.—The muſcles of the head of the tortoiſe cannot be deſcribed under names ſimilar to thoſe of mammiferous animals and birds, becauſe the ſhell affords inſertion to the greater number of them. We will, therefore, only diſtinguiſh them by the points of attachment. Thus, on viewing the back part of the neck, we remark, 1ſt, at the anterior part of the back-ſhell, near the angle of the lunula, a broad muſcle, which extends to the lateral and poſterior parts of the head, into which it is inſerted. It pulls the head backward. 2. Beneath, and from the middle of the anterior lunula of the back-ſhell, there ariſes another muſcle, which is thin and round, and which, in ſeparating from that of the oppoſite ſide, forms an angle like the letter V: it is inſerted on the outſide of the preceding muſcle, and has the ſame uſe. 3. A muſcle analogous to the ſplenius capitis riſes from the ſpinous proceſſes of the fourth and fifth cervical vertebræ, by diſtinct ſlips, and is inſerted into the occipital arch. Its uſe is to raiſe the head. 4. A muſcle analogous to the rectus major anticus riſes from the inferior tubercles of the four vertebræ next to the atlas, and is inſerted, fleſhy and thick, into the depreſſion of the cuneiform proceſs below the condyle. 5. The trachelo-maſtoideus riſes from the inferior tubercles of the ſecond and third cervical vertebræ, by two thin aponeurotic tendons; it is inſerted, by a very thick and entirely fleſhy portion, into the protuberance that anſwers to the maſtoid proceſs. Its uſe is to bend the head laterally. 6. Laſtly, at the ſuperior part of the cervical ſpine there is a ſhort muſcle, which proceeds from the inferior part of the foramen, formed by the temporal foſſa, and is inſerted into the ſpinous proceſſes of the firſt, ſecond, and third vertebræ of the neck. On viewing the neck in front, we obſerve the muſcle analogous to the ſterno-cleido-maſtoideus attached to the ſtrong aponeuroſes that ſurround the humerus at its articulation with the ſcapula. The lower part of it, for one-third of its length, can only be ſeen, the remainder being concealed by a muſcle compoſed of tranſverſe fibres, which ſupplies the place of the mylo-hyoideus, and platiſma-myoides. It is inſerted into a proceſs correſponding to the maſtoid. Its uſe is to draw

draw the head inwardly, and to produce a ſmall elevation of the ſhoulders. The longus capitis ariſes from the third vertebra of the back, and is inſerted by a ſlender tendon into the cuneiform proceſs of the occiput. The frogs have very few of the muſcles of the head: moſt of thoſe which are inſerted in it are employed in moving the ſuperior extremities, or are proper to the vertebral column. The muſcle analogous to the obliquus ſuperior ariſes from the firſt tranſverſe proceſſes of the ſpine, and is inſerted into the ſuperior part of the occiput: its direction is oblique from without inwards. That which is analogous to the rectus capitis anticus minor, ariſes from the tranſverſe proceſs of the firſt vertebra, and is inſerted into the baſis of the cranium below the foramen magnum. Theſe are the only two muſcles proper to the head in frogs: they are ſimilar in the land ſalamander.

Muſcles of the Shoulders.—In the frog (which has no ribs) the ſerratus major has an extraordinary ſhape, which appears to be occaſioned in part by the want of the cervical vertebræ: it forms three diſtinct muſcles. The firſt ariſes from the occiput, near to the foramen magnum. It divides into two bellies, which are inſerted into the ſuperior ſpinal angle of the ſcapula; one on the internal, and the other on the external ſide. The ſecond proceeds from the ſecond tranſverſe proceſs, and paſſes under the dorſal portion of the ſcapula, towards its ſpinal edge. The third proceeds from the third tranſverſe proceſs, and paſſes underneath the preceding, keeping ſtill nearer to the edge. There is beſides another muſcle proper to the ſcapula, ſituated upon its internal ſurface, between the two conſtituent parts, which make it appear broken. It appears to draw theſe two parts cloſer together, and by its contraction renders the angle they form with each other more acute. There is no muſcle analogous to the pectoralis minor. The place of the levator, or angularis ſcapulæ, is ſupplied by a very conſiderable muſcle which riſes from the baſe of the occiput; it becomes perceptibly ſmaller as it approaches the ſhoulders, and is inſerted into the poſterior edge of the cartilaginous part of the ſcapula. The omo-hyoideus is long and thin; it comes from the great inferior horn of the os hyoides, and is inſerted under the neck of the ſcapula. The trapezius is wanting. The muſcle analogous to the rhomboides is very thin. It ariſes from the dorſal proceſſes, and is inſerted into the ſpinal edge of the ſcapula. There is no ſubclavius muſcle. The ſterno-maſtoideus has only one belly, which extends obliquely from the poſterior part of the head, behind the ears, to the neck of the oſſeous part of the ſcapula. Its action is evidently that of pulling the ſhoulder towards the head, and raiſing it up. We ſhall deſcribe the muſcles of the tortoiſe ſeparately, as they differ conſiderably from thoſe of other red-blooded animals. They are only three in number. One of them, though very unlike the trapezius, is ſimilar in its uſe; it riſes from the lower ſurface of the back-ſhell among the ribs, from the ſecond to the fifth. It is very thin, and paſſes to the external margin of the third bone of the ſhoulder, which ſeems to correſpond with the ſcapula. A muſcle analogous to the levator ſcapulæ, is inſerted into the curve formed by the joint of the two firſt bones of the ſhoulder. It ariſes by ſeven fleſhy heads from the tranſverſe proceſſes of the ſeven vertebræ of the neck. Another little long muſcle ariſes from the inner ſurface of the back-ſhell near the ſternal extremity of the firſt rib, and is inſerted into the dorſal extremity of the firſt bone of the ſhoulder. It is perhaps analogous to the coſto-clavius.

Muſcles of the Arm.—The pectoralis major of the frog is compoſed of two portions, placed one above the other. They produce two tendons which are inſerted on each ſide of the humeral groove. The latiſſimus dorſi ariſes from the inferior part of the back, where it is thin. It becomes thicker, and is attached to the broad part of the ſcapula, which it entirely covers. It is inſerted, by a ſtrong tendon, into the internal ſurface of the humerus, above one-third of its length from its ſuperior end. In the frog there is neither the ſupra nor the infra-ſpinatus. The ſubſcapularis or coraco-brachalis, (for the muſcle of which we now ſpeak ſupplies the place of both,) ariſes from the internal ſurface of the ſcapula, at its junction with the clavicle, and is inſerted into the interior part of the humerus about one-third from the head. The deltoid is formed of three portions. The firſt, which is the longeſt, and very ſlender, proceeds from the anterior part of the ſternum. The ſecond ariſes from the union of the clavicle with the ſcapula, at the internal ſurface, runs over the bone above the joint, then ſends a thin tendon to the firſt in its paſſage, and is partly inſerted in the linea aſpera, and partly in the inferior portion of the humerus. The third is diſtinct; it riſes partly from both the ſcapula and clavicle, and is inſerted into the ſcapular extremity of the humerus. The teres major and teres minor are wanting. Beſides theſe muſcles, in which we diſcover an analogy to thoſe of mammiferous animals, there is one which ariſes from the ſecond tranſverſe branch of the ſternum, and is inſerted into the inner edge of the groove of the humerus by a broad tendon. It may be regarded as an aſſiſtant to the pectoralis major. This conformation appears to prevail in the ſalamander.

If the tortoiſe has fewer muſcles proper to the ſhoulder than common, it has an extraordinary number inſerted into the humerus. That which correſponds to the pectoralis major is compoſed of five portions. Two are ſuperficial; one ariſes from the edge of the anterior part of the breaſt-plate, and proceeds to its inſertion in the leſſer tubercle of the humerus. The other is much more extenſive: it riſes from a great part of the internal ſurface of the breaſt-plate, and is alſo inſerted by a flat tendon in the leſſer tubercle of the humerus: but it is prolonged by a fan-like aponeuroſis, which extends over the inferior ſurface of the arm, and even of the fore-arm. One of the three deeper portions of the pectoralis major ariſes from the greater part of the ſecond bone of the ſhoulder, and is inſerted into the humerus, below its ſcapular articulation; another ariſes from the expanſion of the interoſſeous ligament, which unites the ſecond bone of the ſhoulder to the third, and proceeds to join its tendon intimately with that of the preceding portion. Laſtly, the third, which is the moſt deep-ſeated of all, ariſes from the ſuperior ſurface of the third bone of the ſhoulder, or that which is next the back-ſhell. Its tendon is conjoined with thoſe of the preceding. The muſcle analogous to the deltoides is alſo compoſed of two portions; one ariſes from a ridge on the anterior part of the breaſt-plate; the other, which is its acceſſory, is placed more deeply, and united to its correſponding muſcle. They are inſerted by one common tendon into the leſſer tubercle of the humerus, which they draw towards the neck in the action of ſwimming. There is another muſcle much deeper ſeated, which ſeems likewiſe an aſſiſtant to the deltoides. It riſes from the dorſal extremity, and all the internal edge of that bone of the ſhoulder which correſponds with the clavicle, and proceeds to be inſerted into the humerus below the leſſer tuberoſity. On the internal ſurface of the humerus, we find a muſcle riſing from the looſe extremity of the ſternal face of the third bone of the ſhoulder: it is inſerted in the humerus, about one-third from its lower end, by a thin tendon. It bears ſome relation to the ſterno-radialis of the frog, and performs the ſame office.

The

The levator brachii is a very thick muſcle, which ariſes from the third bone of the ſhoulder, the exterior edge of which it ſurrounds, and is inſerted into the proceſs of the humerus reſembling the olecranon, which it pulls upward and outward. A muſcle analogous to the teres major ariſes from the neck of the third bone of the ſhoulder, externally, and is inſerted into the humerus between the two tuberoſities. It pulls the humerus backward. Another muſcle, which ſeems a ſubſtitute for the latiſſimus dorſi, riſes from the interior part of the back-ſhell, to which it is attached obliquely, to the interval between the two firſt ribs. It is inſerted into the body of the humerus behind the greater tubercle, by a flat tendon. It pulls the humerus towards the upper ſhell, when the animal ſtands upon all its four feet. A muſcle, the uſe of which ſeems the ſame as that of the levator brachii, riſes from the whole internal ſurface of that bone of the ſhoulder which anſwers to the clavicle, and is inſerted into the whole length of the olecraniform proceſs, or great tuberoſity of the humerus. It is very fleſhy, and appears to be formed of two portions. Finally, the muſcle analogous to the ſcapulo-radialis, or biceps flexor cubiti, ariſes from the anterior border of the humeral cavity, and is inſerted into the external and ſuperior ſurfaces of the humerus by a ſmall tendon, which reaches as far as the baſe of the radius. It extends the member, and brings it toward the head.

Muſcles of the Fore-arm.—The frog has, properly ſpeaking, no biceps; its place is ſupplied by another, and much ſtronger muſcle, ſituated on the breaſt, under the pectoralis major, with which it has the ſame inſertions. At the articulation of the humerus it ſends out a ſtrong tendon, which paſſes along the groove of the humerus, and through a tendinous ring, formed by the two parts of the pectoralis major, under the deltoides. It is inſerted into the humeral extremity of the radius, and may be named ſterno-radialis. There is no brachialis internus. The triceps is compoſed of three parts, nearly as in man, but they are proportionally larger. There is but one ſupinator, which ariſes from the external condyle, and is inſerted into the carpus. There is alſo but one pronator, which riſes from the internal condyle, and is inſerted into the carpus. In the turtle, theſe muſcles are almoſt entirely aponeurotic, and produce but very little motion, the place of the member being ſupplied by a fin, as in the cetacea. In general, the muſcles of the humerus produce the motions of the fore-arm.

Muſcles of the Hand and Fingers.—In the ſea tortoiſes, which have the carpus compreſſed and fitted for ſwimming, the muſcles are only ſimple bands of aponeurotic fibres, which ſtrengthen the ſeveral articulations. The muſcles of the hand of the frog and ſalamander are very ſimilar to thoſe of man. Thoſe of the thumb are wanting, except the extenſor, which comes from the external condyle, and is inſerted into the laſt phalanges. The other muſcles vary very little.

Muſcles of the Pelvis.—In the tortoiſe, the muſcle analogous to the quadratus lumborum expands under the back-ſhell, between the laſt anterior ribs; it ariſes from the ilium, towards the articulation of that bone with the os ſacrum, which in this animal is moveable. This mobility of the pelvis is aſſiſted by a muſcle analogous to the rectus abdominis, which, as we have obſerved, inſtead of extending under the belly, is attached under the poſterior extremity of the breaſt-plate by two fleſhy portions, the one anterior, the other poſterior, which are both inſerted in the anterior margin of the external branch of the pubis. There is no pſoas parvus in frogs. The quadratus lumborum extends from the long tranſverſe proceſs of the third vertebra, to the origin of the long bone of the pelvis, which is analogous to the ilium. It is inſerted in this bone, which it raiſes towards the head; their ilium being moveable, like that of the tortoiſe.

Muſcles of the Thigh.—In the frog there is only one glutæus, which is in the place of the medius. It ariſes from the elongation which ſupplies the place of the os ilium, and is inſerted below the head of the femur. The pyriformis comes ſtraight from the point of the coccyx, and is inſerted about one-third from the top of the os femoris. The gemini and the obturator internus are wanting. The quadratus femoris is long. It ariſes from the poſterior ſymphiſis of the iſchium, and is inſerted into the inner ſide of the thigh-bone, about one-third from the head. They have neither the pſoas magnus nor parvus. The iliacus is proportionally elongated. The pectineus deſcends to the middle of the thigh-bone. The three adductors have the ſame origins and inſertions as in man. The obturator externus is to be found, though there is no foramen ovale. It ariſes from the ſymphiſis pubis, and its fibres are attached to the capſular ligament. In the tortoiſe, the muſcles of the thigh produce motions proper to ſwimming; that is to ſay, the abduction, the adduction, depreſſion, and elevation of the thigh. The muſcle analogous to the adductor longus ariſes from the ſymphiſis pubis, and is inſerted into the internal part of the thigh-bone, about one-third from its tibial extremity. Another muſcle, which cannot be eaſily compared to any in man, ariſes from the interior of the ſacrum, and is inſerted into the little trochanters. It is another adductor femoris. A muſcle, compoſed of different radiated faſciculi, ariſes from the broad inferior ſurface of the os pubis, and forms a thick tendon inſerted into the little trochanter. It occupies the place, and anſwers the purpoſes, of the pſoas and iliacus. That which is analogous to the adductor brevis ariſes from the ſymphiſis of the bones of the iſchium, and the interoſſeous ligament of the pubis. It is inſerted into the os femoris, below the little trochanter. The muſcle anſwering to the glutæus maximus ariſes from the ſpine, oppoſite to the laſt rib, and is inſerted into the thigh-bone, below the great trochanter. The muſcles analogous to the glutæus medius and minimus can hardly be diſtinguiſhed from each other. They riſe from the internal ſurface of the os pubis, and are inſerted into the great trochanter. That which reſembles the obturator internus ariſes from the internal ſurface of the ilium, and the ſuperior edge of the cotyloid cavity, and is inſerted into the great trochanter.

Muſcles of the Leg.—The frog has the thighs round, like thoſe of a man, and the muſcles of the leg are very conſpicuous. The triceps femoris is formed only of two very diſtinct portions. The vaſtus externus and cruralis are manifeſtly but one. There is no rectus anterior. The biceps flexor cruris has only one belly. It ariſes from the poſterior and internal part of the ilium, and is inſerted into the exterior and anterior ſurface of the tibia, for there is no fibula. The ſemi-membranoſus is like the human; but the ſemi-tendinoſus is compoſed of two bellies, one of which riſes from the ſymphiſis pubis, and the other from that of the iſchium. The ſartorius is ſituated exactly in the front of the thigh, without any obliquity. There is nothing remarkable in the gracilis. There is no diſtinct poplitæus. Some differences occur in the muſcles of the leg of the tortoiſe. Theſe have a relation to the faculty of ſwimming, for which its extremities are fitted. The muſcle which takes the place of the ſemi-membranoſus ariſes from the interoſſeous ligament of the pelvis, and proceeds to form a ſtrong aponeuroſis at the inferior part of the leg. That which correſponds to the ſemi-tendinoſus ariſes alſo from the interoſſeous ligament;

ment; it paſſes under the ham, and is inſerted into the tibia, which it bends. That which is analogous to the ſartorius ariſes from the os pubis, near the interoſſeous ligament, and paſſes over the knee, to be inſerted into the tibia, which it extends. A muſcle compoſed of two fleſhy portions, both of which ariſe from the lateral parts of the ſacrum, is inſerted below the head of the tibia, and bends the leg. In its action, it much reſembles the biceps, from which, however, it differs with reſpect to its attachments. Another muſcle, reſembling the faſcia lata, and very thin in its fleſhy part, ariſes from the ſides of the coccyx. It paſſes under the ſkin of the ſin, to its inſertion, almoſt oppoſite to the heel. It bends the leg upon the thigh, and extends the foot upon the leg. The muſcle analogous to the biceps ariſes from the ſacrum and ilium. It goes to the external ſurface of the leg, where it is inſerted into the fibula. The extenſor of the leg preſents nothing particular. The muſcle analogous to the rectus anterior ariſes from the internal ſurface of the pubis, and joins the common tendons of the extenſors.

Muſcles of the Ankle.—In the frog, the gaſtrocnemius has only one belly; it has, however, a ſmall tendon, by which it is inſerted into the outward ſide of the head of the tibia. Its tendon runs under the heel, and there ſliding over a ſeſamoid bone, expands itſelf under the foot, to form the plantar faſcia. There is neither ſoleus nor plantaris. The tibialis anticus riſes by a ſtrong tendon from the lower part of the os femoris. About the middle of the tibia it divides into two bellies, one internal, the other external. The tendon of the firſt is inſerted into the tibial baſe of the long bone of the tarſus, and that of the ſecond into the ſame bone, a little more outwardly. An aſſiſtant to this muſcle ariſes from the middle and anterior part of the tibia, and proceeds to the internal ſide of the baſe of the long bone of the tarſus. The tibialis poſticus reſembles the human, but it is only inſerted into one bone of the tarſus, *viz.* that which is long, and ſituated at the inner ſide. There is but one muſcle, to which the term peroneus can apply. It ariſes by a ſlender tendon, from the external condyle of the thigh, and is inſerted into the baſe of the tibia, on the outſide, by two tendinous portions, one of which extends to the bone of the tarſus. It extends the leg with reſpect to the thigh, or, more properly, the thigh with reſpect to the leg. Beſides theſe muſcles, which extend from the leg to the foot, there is another which ariſes from the metatarſal extremity of the tibia, at its internal edge, paſſes between the two bellies of the tibialis anticus, and proceeds very obliquely to its inſertion, at the digital extremity of the long bone of the tarſus, on its inner ſide. In the ſea tortoiſe, the muſcles of the feet are ſupplied by aponeurotic fibres, ſomewhat fleſhy, which ſerve only to ſtrengthen the articulations, and keep the fins properly extended.

Muſcles of the Toes.—There is no extenſor longus digitorum in the frog; neither is there any flexor proprius pollicis. The extenſor brevis digitorum is very diſtinct, it ariſes from the whole length of the long external bone of the tarſus, and extends obliquely to all the four toes, the laſt excepted. It is inſerted into the laſt phalanges. There are ſuperior and inferior interoſſeous muſcles, which are very apparent, to the number of ten. Their direction is very oblique. The flexor communis digitorum is ſituated under the long bone of the tarſus, on the inner ſide, and is covered by the aponeuroſis of the gaſtrocnemius. When it reaches the little bones of the tarſus it divides into five tendons, which receive, at their inner ſide, aſſiſtant fleſhy fibres, apparently proceeding from a muſcle ſituated below the long bone of the tarſus, on the inner ſide. It may perhaps repreſent the flexor longus. In the ſea tortoiſe all theſe muſcles have their places ſupplied by bundles of aponeurotic fibres.

On the Support of the Body, and its Motions in Progreſſion.—*Standing* is an attitude common to all animals, but the circumſtances attending it differ very conſiderably. In moſt of the oviparous quadrupeds, the knees and elbows are directed outwards as they ſtand, and even during their various progreſſive motions. The poſterior members, articulated more in proportion at the ſides of the body, are ſo bent, that the belly deſcends to the ground, and moves along it.

Turtles reſt on their plaſtron, and on their four flattened, elongated, and fin-like members. They may be compared to ſeals in their mode of executing movements. They employ their members, either in ſwimming, or in walking on the ſea-ſhore, or in digging holes in the ſand to receive their eggs.

In tortoiſes, ſtanding is nearly the ſame as moſt in other oviparous quadrupeds; and the direction of their body is horizontal. Batracians, and frogs in particular, generally have their body, when at reſt, in an oblique elevation; the arms ſuſtaining the front part, while the back remains on the ground. The formation of the poſterior limbs does not render them adapted to raiſe the body in a vertical direction, but merely to puſh it forwards.

Serpents, in a ſtate of repoſe, coil up their body in ſeveral circles, either riſing one above the other, or arranged one within the other; and the head is elevated above this coil. Thoſe which inhabit trees are twiſted round the branches. The chalcides and biped lizards may be compared to ſerpents when at reſt, for they are coiled up, and their limbs ſerve merely to prevent the body from rolling.

Walking exhibits different modifications, according to the number and form of the limbs, and the relative ſize of the fore and hind-feet. Where they are of equal length, the animals move with great velocity: hence the names of certain ſpecies, as lacerta agilis and velox. When, however, the limbs are too ſmall and weak for the body, the movements are ſlower, as in the crocodile, the chalcides, and the toad.

The feet of the cameleon, and its prehenſile tail, make it a better climber than moſt reptiles.

The limbs being all of nearly equal length in the ſcinks, they cannot leap well: while the iguanas and tupinambes exhibit conſiderable agility. The frogs are the great jumpers, from the great length and ſtrength of the hind limbs. But they can hardly walk; moving the front legs only with facility, and being obliged almoſt to drag the hind ones after them.

Serpents can leap or project their bodies by the ſudden extenſion of ſeveral articulations: they form ſeveral curves with their body, and then ſuddenly ſtraighten them, either in whole or in part, according to the leap which they may wiſh to make.

Creeping, properly ſo called, belongs only to ſerpents, and conſiſts of a projection of the body backwards or forwards, produced by the alternate motion of one or ſeveral of the lower parts againſt the ground. The following modifications are exhibited in different inſtances. 1. Creeping by vertical undulations. 2. By horizontal undulations. 3. By two or three undulations of the poſterior third part of the body, while the two anterior thirds are elevated vertically. 4. A ſliding kind of crawling, by ſmall undulations formed by the alternate approximation and ſeparation of rows of ſcales placed tranſverſely under the body. 5. The

5. The fame kind of motion, produced by the alternate formation and difappearance of folds in the fkin of the fides. 6. Without any undulation, merely by the alternate approximation and feparation of rings of the body.

The repulfive motions, by which reptiles move their bodies forwards in water, are nearly the fame as they employ in jumping; but they muft be much quicker. To rife in the water, they muft ftrike back the water below and behind them, and diminifh the breadth of their body, as much as poffible, by carrying their fwimming organs backwards after each ftroke. Thus we fee the frog, after ftriking, extend its long hind legs, fo as to offer no refiftance to the paffage of the body through the liquid. The act of fwimming offers the following modifications. 1. External fwimming (on the furface of the water, breathing air) by vertical undulations, without fwimming organs. The ferpents. 2. The fame by lateral undulations, affifted by the feet. Iguanas, lizards, &c. 3. Swimming under the furface, breathing externally; by four palmated feet, and without tail. Hyla palmata (Rana maxima, Linn.) 4. The fame with four legs and no tail. Frogs properly fo called. 5. The fame with four feet, an elongated body, and depreffed tail. Crocodiles, falamanders. 6. The fame by means of four fin-like fcaly members, and no tail. 7. Swimming under water, breathing by means of branchiæ.

The dragons are the only reptiles capable of flying. Their flight is nearly the fame with that of the polatouche, or flying fquirrel. Daudin, Hift. Nat. des Rept. t. 1. p. 256.

The Brain.—The brain of reptiles does not fill more than one-half of their very fmall cranium; hence its relative fize to that of the body is very inconfiderable. Its proportion to the body is faid to be, in the tortoife $\frac{1}{2240}$, in the turtle $\frac{1}{5688}$, in the coluber natrix $\frac{1}{792}$, in the frog $\frac{1}{172}$. Blumenbach juftly obferves, that anatomifts have hitherto beftowed but little labour on the brains of the amphibia. The dura mater forms no proceffes in this order; the interval between it and the pia mater is filled with fluid; the brain is fmall and fimple, and confifts of five roundifh eminences. Of thefe, the fingle one, placed at the front of the medulla fpinalis, is clearly the cerebellum, as in all animals which have a nervous fyftem. Whether the four others are to be regarded as the two hemifpheres, and the thalami nervorum opticorum, is more doubtful. According to Blumenbach, the cerebellum does not exhibit the arbor vitæ.

All the parts of the brain of reptiles are fmooth, and without circumvolutions. The optic thalami are fituated behind the hemifpheres, but are not covered by them. They contain each, as in birds, a cavity which communicates with the third ventricle. At the extremities of this ventricle, we obferve the anterior and pofterior commiffure, but there is no foft commiffure, nor tubercula quadrigemina.

In the tortoife the hemifpheres form an oval. Their anterior part is feparated from the pofterior by a fulcus, and reprefents a kind of bulb, which ferves as a root to the olfactory nerves. The fize of this bulb is about equal to one-third of the hemifphere. The interior of the hemifphere is, as ufual, excavated by a ventricle, and contains a fubftance analogous to the corpus ftriatum, and which pretty much refembles in its form that of birds.

The optic thalami are not larger than the bulbs of the olfactory nerves. Their form is nearly round. They extend downward and forward, under the hemifpheres, to produce the optic nerve. The valve of the cerebrum is fituated between them and the cerebellum. No tubercle is either placed above it or before it, and it gives origin, as ufual, to the fourth pair of nerves.

Before the optic thalami, and under the pofterior part of the hemifpheres, there is a tubercle which correfponds to that we have remarked in birds.

The cerebellum is nearly hemifpherical. The fourth ventricle penetrates a confiderable way into its fubftance.

In the frog the hemifpheres are longer and narrower. The optic thalami are larger in proportion to the hemifpheres. Their ventricle is very diftinct. It is the contrary in falamanders, which have the optic thalami very fmall, and the hemifpheres almoft cylindrical.

The cerebellum of thefe two kinds of reptiles is flat, triangular, and lies pofteriorly on the medulla oblongata.

In the ferpents the two hemifpheres form together a mafs which is broader than long. The optic thalami are almoft round, and one-half lefs than the hemifpheres, behind which they are fituated. The olfactory nerve has no apparent bulb. The cerebellum is exceedingly fmall, flat, and in the form of a portion of a circle.

In all thefe animals the inferior furface of the brain is nearly fmooth. The optic thalami make no projection downward, and the pons Varolii does not exift.

Cuvier affigns, as the diftinguifhing character of the brain in reptiles, the pofition of the optic thalami behind the hemifpheres. And he ftates the following as the points in which reptiles, fifhes, and birds, differ from the mammalia. The want of corpus callofum, fornix, and their dependencies. Some tubercles, more or fewer, between the corpora ftriata and the optic thalami. The thalami containing ventricles, and being diftinct from the hemifpheres. The abfence of any tubercle between the thalami and the cerebellum, as well as the abfence of the pons Varolii. Reptiles and fifhes are diftinguifhed from the mammalia and birds by the want of the arbor vitæ.

The brain of the tortoife has been delineated by Caldefi, offervazioni intorno alle Tartarughe, tab. 2. fig. 5: that of the frog by Ludwig, de cinerea cerebri fubftantia; by Vicq d'Azyr in the Mem. d'Acad. des Sciences, 1783; and by Ebel, in his Obfervat. Neurol. ex Anat. Compar.; and that of the viper, by Vicq d'Azyr.

Origins of the Nerves.—The olfactory nerves arife, as in birds, from the anterior extremity of the hemifpheres. The optic nerves feem to derive their origin from a common eminence, fituated under the middle of the hemifphere. The other nerves exhibit no particularities as to their origin.

Diftribution of the Nerves.—The *olfactory* nerve proceeds to the noftrils in this clafs nearly in the fame manner as in birds; but it is longer. The canal which receives it is partly offeous and partly cartilaginous. The two canals have only one common aperture within the cranium. The olfactory nerves of reptiles are generally much more folid than thofe of the preceding claffes.

The two *optic* nerves are joined together, as in the mammalia. There is nothing worthy of remark about the third, fourth, and fixth pairs.

Reptiles have the three branches of the *fifth pair*. In the fea tortoifes the ophthalmic paffes, fome way, in the dura mater before it enters the orbit. It tranfmits filaments to the mufcles of the globe of the eye, and particularly to the two lachrymal glands. The fuperior maxillary branch is the largeft of the three. It is united to the inferior branch at its origin, but when it reaches the interior of the orbit, it feparates from it to take another direction. It paffes along the floor of the orbit, defcribing a very marked curvature, the convexity of which is external. A very great number of filaments proceed from the concave or internal fide,

fide, which are loft in the lachrymal gland. The trunk is afterwards divided into two branches :—one internal, which correfponds to the fpheno-palatine and fub-orbitar nerve. It furnifhes filaments to the palate and to the nofe; and when arrived at the anterior part of the orbit, it proceeds outwardly and fpreads upon the face. The other branch of the principal trunk is external; it paffes alfo upon the floor of the orbit, to which it gives many filaments, and at length iffuing from the inferior part of the orbit, it expands upon the face, anaftomofing with the other facial nerves.

The inferior maxillary branch proceeds almoft vertically downward to the pofterior pa t of the orbit, before the petrous and articular procefs of the os temporum. In its courfe towards the lower jaw, it paffes between the temporal and pterygoid mufcles, to which it fends feveral filaments. Having arrived at the lower jaw, before the articular furface, it enters the oblong aperture, and divides in the fubftance of the bone. It forms feveral branches on the inner part of the jaw, which are loft in the mufcles of the tongue, and on the outfide fome others which ramify under the fkin.

The *facial* nerve exifts in birds and reptiles, but its fize is fmall, becaufe thefe animals have no lips, and becaufe their mouth, as well as a great part of their face, is covered with a horny or fcaly fubftance, in confequence of which thefe parts have but little motion or fenfibility. We find, however, fome of the branches: they are not indeed eafily followed in diffection, but their trunk always exifts.

The *auditory* is united to the facial nerve as in the mammalia, and paffes into a meatus auditorius, whence its branches go into the ear. They will be defcribed in the account of the ear.

We have nothing remarkable to ftate refpecting the *par vagum* or eighth pair of nerves in reptiles. We obferve evidently that it is diftributed to the lungs, the heart, the œfophagus, and ftomach, and that it forms plexufes on thefe organs, in the fame manner as the great fympathetic nerve produces them round all the arteries of the trunk. On leaving the cranium, the par vagum forms decuffations with the lingual and gloffo-pharyngeal nerves; they afterwards feparate from each other: the gloffo-pharyngeus is pofterior, the par vagum in the middle, and the lingual anterior. The par vagum does not always come out of the cranium by a fingle hole; it is formed of two or three filaments, which afterwards rejoin, upon receiving a communicating filament from the gloffo-pharyngeus, and one farther down from the lingual; the nerve then augments fomewhat in diameter, and defcends into the breaft.

We have nothing to remark concerning the gloffo-pharyngeal and hypogloffal nerves.

Tortoifes have eight pair of *cervical nerves*, which are diftributed nearly in the fame manner as in mammalia. The three laft pairs join in forming the brachial plexus. The green lizard has four pair of cervical nerves, but only the two laft enter into the compofition of the plexus. In falamanders and frogs the cervical nerves cannot be properly diftinguifhed from the dorfal, as the animals have no ribs. A pair comes out between the firft and fecond vertebræ, which is fent to the mufcles of the inferior part of the neck, and under the fkin that covers them. Thefe nerves alfo afford fome filaments to the fhoulder. From this diftribution they may be regarded as real cervical nerves. In frogs only two pairs enter into the compofition of the plexus. In the falamander there are diftinctly four.

We refer to the tables which indicate the number of the vertebræ in reptiles, in order to fhew the number of nerves which iffue from their foramina. The diftribution of thefe nerves is the fame as in other animals, and to point it out would be only repeating what we have already defcribed in man.

Nerves of the front Limbs.—In the tortoife the three laft pairs of cervical nerves, and the firft of the dorfal, proceed to the thoracic member, where they form a plexus in the following manner: the fifth cervical paffes behind the other four pairs, croffes them in their courfe, and unites with them in its paffage. It then turns round the fcapula, which in this animal is articulated with the firft dorfal vertebra. We fhall return to the defcription of this nerve. The fixth cervical pair proceeds directly along the fcapula on its internal furface: it is croffed pofteriorly by the fifth, and towards the lower third of the fcapula receives the feventh cervical pair. The feventh is flender, croffed by the fifth and the firft dorfal pair, and united with the fixth, in the manner we have pointed out. The firft dorfal pair partly joins the feventh cervical, almoft at the point where it comes out of the vertebral canal; it is then fent to the mufcles of the fhoulder.

We fhall now purfue each of the cords we have mentioned to their termination.

The large nerve produced by the fifth cervical pair, having arrived behind and near the true articulation of the fcapula with the fpine, divides into three branches; one, which is but a filament, appears to be diftributed to the articular capfule; a fecond, which is very flat, and from the fides of which a vaft number of leffer branches extend to the mufcles of the fkin, appears to take the place of the mufculo-cutaneus; the third branch, which accompanies the mufcles of the fcapula under the fkin, defeends to the humerus, without producing any remarkable branches. At this place, however, it fends off feveral ramifications to the extenfor mufcles of the fore-arm. The trunk continues its direction forward, expands and lofes itfelf under the fkin, and may be followed as far as the hand: it may, perhaps, be regarded as fupplying the place of the ulnar nerve.

The fixth pair of cervical nerves having, as we have fhewn, affifted in forming the brachial plexus, paffes along the internal furface of the fcapula; about the lower third of that bone it receives the feventh pair; the nerve then becomes thicker, but foon after divides into two branches; one, which is flender, paffes into the groove, between the furca and the clavicle, and then fpreads over the articular capfule of the humerus, after furnifhing numerous filaments to the mufcles which furround it; the nerve may be regarded as analogous to the articular in man. The trunk of the nerve, which evidently fupplies the place of the median, upon reaching the articulation of the humerus with the fcapula, tranfmits filaments to the adjoining mufcles. On arriving at the palmar furface of the fore-arm, it divides into three portions, two of which are on the ulnar fide, and fink deeply into the mufcles; the third, which is much larger, follows the radial fide of the fore-arm, and at the bafe of the thumb proceeds to the palm of the hand, and detaches filaments to each of the fingers.

The feventh cervical pair unites, as we have ftated, to the fixth, at the pofterior part of the fcapula, to form the median and articular nerves. We have, therefore, no occafion to return to its defcription. The firft dorfal pair is loft in the mufcles of the fhoulder, and is not continued throughout the arm.

The brachial plexus of the lizard differs a little from that of the tortoife; it is formed by two dorfal, and the two laft cervical pairs: the firft of the cervical furnifhes only one of its branches to the plexus; the other going to the neck.

In

In the frog, the nerves, which are to be diſtributed to the arm, proceed from a very thick cord, which comes from between the ſecond and third vertebræ: this makes the largeſt nerve in the whole body; it is ſoon after joined by a filament from the ſucceeding pair, with which it intimately unites; this cord proceeds towards the axilla; it ſends off a branch, which paſſes above the ſhoulder, and is loſt in the muſcles of that part. The trunk continues its courſe to the arm, and very ſoon forms two principal branches, and beſides theſe, it alſo ſends ſome filaments to the extenſors of the fore-arm, and the articular capſule of the head of the humerus.

Of theſe two nervous cords, one is directed forward upon the humerus, and repreſents the median nerve; it detaches ſome filaments to the muſcles of the ſkin. Arrived at the fold of the fore-arm, the nerve plunges amongſt the muſcles, along with the tendon of the ſterno-radialis, which ſupplies the place of the biceps; it afterwards divides into two branches, placed one above the other: the moſt ſlender is ſituated between the flexor muſcles of the fingers; the larger upon the furrow, which indicates the union of the two bones of the fore-arm; they paſs under the ligaments of the carpus; having reached the palm, the ſuperficial branch is loſt in the ſkin, which covers that part, and the deep-ſeated is diſtributed to each of the fingers, nearly as in man. It alſo furniſhes ſome filaments to the muſcles of the hand.

The other cord repreſents the radial nerve; it turns round the humerus, and furniſhes, in the firſt place, ſome branches to the extenſor cubiti; continuing to deſcend round the humerus, it arrives before the articulation with the bone of the fore-arm: it is afterwards divided; one of the branches is loſt under the ſkin, the other paſſes under the back of the hand, and terminates on the convexity of the fingers. From this deſcription it will appear, that the nerves of the arm in frogs very much reſemble thoſe of the wing in birds.

In the ſalamander, the nerves of the arm are diſtributed as in the frog, but the brachial plexus is formed by two cervical, and two dorſal pairs, if we may regard as dorſal vertebræ, thoſe which ſuſtain rudiments of the ribs.

There are no brachial nerves in ſerpents.

Nerves of the hind Limbs.—In lizards, there is only a ſmall nervous filament, which proceeds from the femoral nerve, and ſupplies the place of the obturator. The femoral nerve is itſelf formed of the two laſt lumbar pairs, and paſſes above the bones of the pelvis to be diſtributed in the muſcles of the anterior part of the thigh. The ſciatic nerve is produced by the three pairs of nerves, which follow, and which alſo receive a filament from the laſt lumbar pair; the only cord they form proceeds along the inſide of the thigh, ſubdividing in the muſcles, and extending to the toes.

The diſtribution of the nerves in the abdominal member is nearly the ſame in the ſalamander; there are no differences, except in the manner in which the plexus is formed. The femoral is produced by a ſingle lumbar pair, which tranſmits a branch to the ſciatic plexus, formed by the two ſucceeding pairs.

In the frog, three pairs of nerves enter into the compoſition of the femoral plexus, before which they run the whole length of the oſſa ilii, which are very long: when arrived at the thigh, the plexus ſends off a nerve, which correſponds to the anterior femoral; it is diſtributed in radiated filaments to the fore part of the thigh. The reſt of the plexus proceeds into the pelvis, and forms a large cord, which paſſes to the poſterior part of the thigh, and may be regarded as the ſciatic nerve. A great number of filaments are afterwards detached from it to the muſcles: about the middle and poſterior part it divides into two branches, which paſs under the ham, and repreſent the two popliteal nerves, the external and internal: theſe are afterwards diſtributed to the foot of the poſterior leg, nearly in the ſame manner as to the human foot.

Great Sympathetic Nerve.—There is no deſcription of the diſtribution of this nerve in reptiles, except in the mud tortoiſe; in which animal it was diſſected by Cuvier. It is only diſtinct in the interior of the back-ſhell; it has a diſpoſition analogous to that of the cervical ganglion. The pneumo-gaſtric nerve, however, adheres ſo cloſely to it, that they cannot be ſeparated: we did not perceive any filament on the neck, which could be regarded as the trunk of the nerve.

On the peritoneum, and on the bodies of the vertebræ, there appear very diſtinct nervous ganglia, which are manifeſtly produced by the great ſympathetic.

The ganglia are exactly ſimilar to thoſe of birds. There are two ſuperior and two inferior filaments, which paſs under the tranſverſe proceſs of the vertebra, that is united to the back-ſhell: from the internal edge of each ganglion, a ſplanchnic nerve proceeds, which forms a plexus round each of the arteries produced by the aorta; one is alſo ſent to aſſiſt in forming the pulmonary plexus.

This nerve may be very eaſily traced to the internal parts of the firſt vertebra of the tail.

Phyſiology of the Nervous Syſtem.—The obvious differences of ſtructure between the warm-blooded animals and reptiles, in this ſyſtem; the exceedingly ſmall brain and large nerves of the latter, contraſted with the ſlender nerves and large encephalon of the former, lead us to expect no leſs ſtriking differences in their economy, than thoſe which we actually diſcover. Are we to explain by this difference the little influence that the brain exerciſes over the other functions, and the great individual and independent vitality, if we may uſe the expreſſion, of the parts, which appear in ſo many inſtances in the amphibia? The ſevereſt injuries, which in man or the warm-blooded animals would excite a ſympathetic diſturbance of every function, highly dangerous, and in moſt caſes fatal, are borne with little apparent ſuffering, and reſtored with facility. (See the facts adduced in the phyſiology of the circulating ſyſtem, to prove the tenacity of life in this claſs.) Can we explain in the ſame way the reproductive powers of this claſs? Blumenbach ſeems to conſider the explanation ſufficient. "The extraordinary ſtrength," ſays he, "of the reproductive power in ſeveral amphibia, and the aſtoniſhing facility with which the proceſs is carried on, muſt be explained, if I miſtake not, from the great magnitude of their nerves, and the diminutive proportion of their brain. The former parts are in conſequence leſs dependent on the latter; hence the whole machine has leſs powers of motion and diſplays leſs ſympathy: the mode of exiſtence is more ſimple, and approaches more nearly to that of the vegetable world, than in the warm-blooded claſſes: but, on the contrary, the parts poſſeſs a greater individual independent vitality. Since, in conſequence of this latter endowment, ſtimuli, which operate on one part, or one ſyſtem, do not immediately affect the whole frame by ſympathy, as in warm-blooded animals, we are enabled to explain the peculiar tenacity of life, which is diſplayed under various circumſtances in this claſs; *viz.* frogs continue to jump about after their heart has been torn out; and tortoiſes have lived for months after the removal of the whole brain from the cranium. The long continued power of motion in parts which

which have been cut off from the body, as in the tail of the water newt, and in fragments of the blindworm, may be explained upon the fame principles." Handbuch der Naturgefchichte, ed. 6. § 98. p. 221.

The clofe connection between the brain, heart, and lungs in warm-blooded animals, in confequence of which the ceffation of action in one very fpeedily ftops the others, and confequently brings on general death, has been fully explained in various articles of this Dictionary; *viz.* DEATH, HEART, LUNGS, NERVOUS *Syftem*.

Obfervations and experiments have not yet been fufficiently multiplied, to enable us to underftand all the minutiæ connected with this fubject. But obvious phenomena, which we have already alluded to, fhew us a vaft difference in this refpect between mammalia and reptiles. The interruption of refpiration, which is fatal in two or three minutes in the human fubject, does not ftop the action of the heart and brain until after fome hours in reptiles. The removal of the heart, or of all the blood from the circulating fyftem, does not prevent the action of the brain, and thus prove fatal, until after fome hours. And, laftly, the removal of the whole brain, or decapitation, which, by interrupting the action of the mufcles employed in breathing, is almoft fuddenly fatal in warm-blooded animals, does not very greatly affect reptiles. At leaft, they only feem to die from inanition after the operation. Hence breathing cannot be under the immediate influence of the brain in thefe animals, for its interruption is fatal in a few hours. Le Gallois afferts that death follows much more quickly, when decapitation is effected below the occipital foramen, than above it, becaufe in the latter cafe the part of the brain is left, which he has afferted to be neceffary to refpiration; *viz.* the origin of the eighth pair. (See his Expériences fur le Principe de la Vie, p. 42.) He does not, however, afford us the materials of drawing any accurate comparifon, and he allows, that when decapitation is performed in the firft vertebra of the neck, the animal furvives the operation much longer than it can furvive the interruption of refpiration. He fays, that falamanders live three or four months, and feem to die only from inanition, when decapitation has been performed above the foramen magnum.

To the fmall influence of the brain upon the nerves, Blumenbach is inclined to refer, in fome degree, the low temperature of reptiles. Although he confiders it now as certain, that the lungs are the fource, and the oxygenous part of the atmofphere the material, whence the heat of living animals is derived, he afcribes to the action of the nervous fyftem a confiderable influence in exciting and fupporting the evolution of animal heat. Specimen, p. 22.

The brain feems to exercife as complete and prompt a dominion over the voluntary mufcles in thefe, as in warm-blooded animals. Their motions are equally lively, and the force of contraction does not feem at all inferior.

We know of very few facts that throw light on the intellectual faculties of reptiles. Yet there is fufficient evidence of their poffeffing memory and a capability of inftruction. The frog and tree-frog can be taught to feed from the hand; and acquire a flight attachment to their mafter. (Daudin, v. 8. p. 88.) The rattlefnake, the hooded-fnake (col. naia), the boæ, and the coluber natrix in Europe (at leaft commonly in Germany), are taught to dance, and exhibit various motions at command. (Kæmpfer, Amœnitates Exoticæ, p. 565.) In the hiftorical accounts of the religion of ancient Egypt, we learn that the priefts of Memphis bred up crocodiles in their temples, and fucceeded fo far in depriving them of their ferocity, as to employ them in religious ceremonies. Befides the accounts of Herodotus, Strabo, &c. on this fubject, we have the authority of a refpectable eye-witnefs concerning very furprifing fuccefs in taming a crocodile; fee J. Greaves's Mifcellaneous Works, p. 525: and for the like fuccefs in the common toad, fee Blumenbach, Specimen, &c. p. 27. We know not on what grounds the ferpent gained his character for wifdom, intelligence, forefight; why he was felected as an emblem for the goddefs of prudence, or chofen by the Epidaurians as the reprefentative of Efculapius.

Of the artificial inftincts, which are fo frequent in the mammalia and birds, not even a trace is to be met with in the whole clafs of reptiles.

There is no *regular fleep*, or intermiffion of activity, in the organs of fenfation and voluntary motion, recurring at ftated intervals, in reptiles: unlefs, perhaps, in the turtles, of whom it has been reported by fome.

Winter fleep, on the contrary, feems to prevail through the whole clafs. Herodotus obferved this of the Nilotic crocodile, which, he fays, paffes four months of the winter without eating. Catefby has remarked it of the crocodile of Carolina; and Lacoudrenier reports, that thofe of Louifiana betake themfelves to the muddy marfhes when the cold comes on, and remain fo torpid, that they may be cut without fhewing figns of fenfibility. But the warm days of winter re-animate them. Journal de Phyfique 1782, t. 20. p. 333.

No animals, except infects, are fo fenfible to heat as reptiles. The warmth of the fun feems to give them new life: as it increafes, their vivacity and agility are augmented. Cold, on the contrary, benumbs them, and would be actually deftructive, if they did not withdraw from its pernicious influence. They retire into the crevices of walls or rocks, the hollows of old trees, holes in the earth, or the bottoms of ponds, &c. to await the return of the genial feafon. The phenomena of this winter fleep are the fame in reptiles, as in warm-blooded animals. The fufpenfion of the actions of the nervous fyftem is followed by an univerfal torpor of the other functions. As the brain and the organs of voluntary motion become inactive, the circulation languifhes, refpiration is barely continued, and vital temterature is reduced to the loweft degree.

Spallanzani found that when the temperature was reduced to $1\frac{1}{2}°$ below zero, the heart of a ferpent beat only twice in a minute, and refpiration was fufpended. (Rapports de l'air avec les etres organifés, t. 1. p. 230.) In a temperature of 7°, the heart foon recovered its action, and beat ten or twelve times in a minute: in ftill higher temperatures, the pulfations were 28 or 30 *per* minute. (Ibid.) In the lethargic ftate, thefe animals changed the air very little. Frogs became equally lethargic in reduced temperatures; the heart beating very flowly, and the air being flightly changed. Ibid. p. 470.

Cold appears to be the immediate caufe of this winter torpor; hence both reptiles and warm-blooded animals may be preferved in fituations artificially warmed throughout the period of their winter fleep, without becoming torpid; but if the torpidity has commenced, they cannot be artificially awakened without danger. It is well known that the falamander, the water-newt, the tree-frog, and the alpine marmot, may be kept awake through the winter in a room warmed by a ftove. Gleditfch witneffed the fatal effects of violent excitement in the winter fleep in the frog (Mem. de l'Acad. de Berlin, 1762, p. 17.): it has been obferved alfo in the marmot, the dormoufe, and the fwallow.

It may be remarked further, of warm-blooded animals, as well as reptiles, that fome fpecies affemble together, and are gregarious in their torpidity, while others are folitary.

The

The bat, ſwallow, frog, and ſalamander, exemplify the former.

Organs of the Senſes.

Organ of Viſion.—Reptiles, like all vertebral animals, have two moveable eyes occupying the cavities of the head called orbits, and poſſeſſing in their ſtructure the ſame eſſential parts as in man. Their ſtructure has not been much inveſtigated: there is ſome information in a memoir of Petit, in the Acad. des Sciences, 1737; and an account of the tortoiſes in Caldeſi.

They occupy the ſides of the head, except in the crocodile, where they are placed above, between the cranium and jaw.

In the proteus they are covered by the integuments, and thus concealed until the latter are removed: this animal is, therefore, like the zemni or mus typhlus among mammalia, and conſequently blind. All other reptiles have the ſenſe of ſight, and ſome poſſeſs even large and prominent eyes.

The tortoiſe has, at the anterior part of the ſclerotica, ſimilar oſſeous laminæ to thoſe of birds. They are incloſed in that membrane, without being continued into its ſubſtance, and may be eaſily ſeparated from it. There are ſimilar laminæ in the cameleon and ſeveral other lizards, but they do not form the anterior diſk, they merely ſurround the lateral part. Daudin has found this ſtructure in the common iguana and the great tupinambis of America.

"In the tortoiſe," ſays Cuvier, "the ciliary proceſſes project ſo very little, that we could ſcarcely recognize them, were it not for the elegant impreſſion they leave on the vitreous body; but in the crocodile theſe proceſſes are very beautiful, and very conſpicuous: they are each terminated by a nearly right angle. I have obſerved theſe proceſſes in the form of elongated threads in a large foreign tree-frog; there are alſo ſuch, though not diſtinct, in the toad. I have not obſerved them in the common lizards, nor in the ſerpents.

"The iris of reptiles reſembles that of fiſhes in its golden colours; ſometimes it is red or browniſh. The veſſels are more viſible than in fiſh; they form a beautiful net-work on the iris of the crocodile.

"The figure of the pupil varies; in the crocodile it is vertically oblong, as in the cat: in frogs rhomboidal. The tortoiſe, cameleon, and common lizards, have it round; the gecko rhomboidal.

"The optic nerve in all reptiles paſſes through the membranes of the eye directly, and by a round hole, as in quadrupeds; it forms internally a ſmall tubercle, from the edges of which the retina proceeds.

"The cryſtalline is more ſpherical in the turtle and frog, than in the mammalia: the ratio of its axis to its diameter is in the former 7 to 9, in the latter 7 to 8: theſe proportions are nearly thoſe which it has in fiſhes."

Muſcles of the Globe.—There are ſix in the tortoiſe, diſpoſed like thoſe of fiſhes: and beſides, four ſmall ones, which cloſely embrace the optic nerve, and ſpread over the convex portion of the ſclerotic, after being interrupted by the muſcle of the third eye-lid. The ſame ſtructure is found in the crocodile.

In frogs and toads there is a great funnel-like muſcle, which embraces the optic nerve, and is divided into three portions; its inferior fibres advance more towards the edge of the eye than the ſuperior. There is only a ſingle ſtraight muſcle on the inferior part, and conſequently only a ſingle depreſſor. There is one very ſhort oblique muſcle attached to the anterior part of the orbit, and inſerted directly into the adjoining part of the globe. The muſcle of the third eye-lid is ſo cloſe to the inferior part of the ſuſpenſory muſcle, that it becomes ſtretched when the latter ſwells; which accounts for the elevation of the third eye-lid when the eye is lowered.

Blumenbach remarks, that no inſtance of the leucæthiopic formation, or deficiency of the colouring matter of the choroid coat and iris, has ever been ſeen in reptiles; although it is ſo common in the two warm-blooded claſſes, and in the human ſubject. Specimen, p. 27.

Many reptiles ſhun the light, lying hid by day, and coming out to ſeek their food at night. Others appear very fond of light, whether that of the ſun, as the green lizard and green frog; or of artificial flame, like that of a candle, as the tree-frog.

It ſeems peculiar to the cameleon to have the power of moving the two eyes at the ſame time in different directions; ſo that he is not neceſſarily obliged, like other animals, to bring the two optic axes into the ſame direction.

Eye-lids.—Reptiles vary ſingularly with reſpect to the number and diſpoſition of their eye-lids: ſerpents have none; crocodiles and tortoiſes have three, and the third is vertical, as in birds: there are alſo three in frogs, but the third is horizontal like the other two. The third eye-lid is the part called membrana nictitans.

The crocodiles are remarkable for having bone in the upper eye-lid: in general there is only a ſingle bit near the anterior angle; but in the crocodilus palpebroſus the whole eye-lid is occupied by a plate divided into three pieces. See Cuvier in Annales du Muſeum, v. 10.

The horizontal eye-lids of crocodiles and tortoiſes cloſe exactly; they have each an enlargement at their edge, but no cilia; the third eye-lid is ſemi-tranſparent; it moves from behind forwards, and may cover the whole eye; it has only one muſcle, which is analogous to the pyramidalis of birds: it is fixed in the ſame manner to the poſterior part of the globe inferiorly. After having turned round the optic nerve, it repaſſes under the eye to ſend its tendon to that eye-lid; but there are neither the muſculus quadratus, nor its ſheath, as in birds.

In the other lizards there are alſo very remarkable varieties. The common lizards have, for eye-lids, a kind of circular veil extended before the orbit, and perforated by a horizontal fiſſure, which is capable of being cloſed by a ſphincter muſcle, and opened by a levator and depreſſor; its inferior part has a ſmooth round cartilaginous diſk, as in birds; there is, beſides, a ſmall internal eye-lid, but it has no proper muſcle; it is entirely wanting in the cameleon, in which animal alſo the ſlit of the eye-lids is ſo ſmall, that the pupil can ſcarcely be obſerved through it. The gecko has no moveable eye-lid; its eye is protected by a ſlight margin of the ſkin, as in ſerpents. A ſimilar diſpoſition ſeems to prevail in the ſcink.

Blumenbach has examined more particularly the ſtructure of the part which covers the front of the eye in ſerpents. "Theſe animals," he obſerves, "are commonly ſaid to throw off the external layer of the cornea with the reſt of their epidermis when they change their ſkin. On examining this matter more minutely in the coluber natrix, I find that that part of the epidermis, which is perfectly tranſparent and ſtretched before the eye, is not actually connected to the cornea, but ſeparated from it by a ſmall quantity of water. It is immoveable, ſo that the globe moves behind it, as behind a window." Specimen, &c. p. 26.

In frogs and toads the ſuperior eye-lid is only a projection of the ſkin, and almoſt immoveable; the inferior is more moveable, and has a ſwoln edge; but the third, which moves from below upward, is moſt employed by theſe animals:

mals: it is very tranfparent; it has one mufcle fituated tranfverfely, behind the globe, which forms a thin tendon on each fide of the eye, to be inferted into the free edge of the third eye-lid.

The falamanders have only two eye-lids, which are horizontal, flefhy, and little moveable; it appears that they may entirely cover the eye.

Reptiles vary as much with refpect to their lachrymal glands as to their eye-lids.

The fea tortoifes have a very confiderable gland at the pofterior angle; it is reddifh, granulated, divided into lobes, and extends under the arch which covers the temple.

In the frefh-water tortoifes we find two fmall blackifh glands, which alfo exift in toads and frogs; but their excretory ducts have not yet been accurately obferved.

Serpents, like fifhes, have no gland in the eye; they have, however, a peculiar ftructure near the eye, the office of which is not very obvious; the following account of it is given by fir Everard Hume.

"An oval cavity is placed at the inner angle of the eye in fome ferpents, the opening into which is within the inner angle of the eye-lid, and directed towards the cornea. In this opening there are two rows of projections, which appear to form an orifice capable of dilatation and contraction. Thefe cavities are lined with cuticle, which is fhed with the reft of that integument. From the fituation of thefe oval cavities, they muft be confidered as refervoirs for a fluid, which is occafionally to be fpread over the cornea; and they may be filled by the falling of the dew, or the moifture fhaken off from the grafs, through which the fnake paffes." Phil. Tranf. 1804, p. 75. with a figure.

Organ of Hearing.—Such an organ is poffeffed by all reptiles. Its conftruction varies confiderably in the different orders and genera: thefe varieties affecting the external or acceffory parts, as the tympanum, officula, &c. more than the effential portion of the organ, its membranous labyrinth, on which the auditory nerve is expanded. No reptile has any external ear; and the crocodile affords the only example of a kind of external meatus. Frogs, teftudines, and moft of the lizard kind, have a tympanum and Euftachian tube; but thefe parts are wanting in the falamander, and moft of the ferpents. The ear of the turtle, tortoife, frog, lizards, and ferpents, are defcribed and delineated by Brunelli in the Comment. Inftit. Bonon. v. 7. Comparetti has exhibited figures of the fame fubjects in his Obfervationes Anatomicæ de aure interna comparata, Patav. 1789, 4to. Scarpa has given moft beautiful engravings of the ear in the turtle, crocodile, green lizard, falamander, viper, and blind-worm, in his Difquifitiones de Auditu et Olfactu.

The Labyrinth.—The membranous labyrinth of the ear, in reptiles, is, in general, compofed, as in fifhes, of three canals and a fac; but there are fome fpecies which have an additional part.

In the falamanders, whofe ear, like that of fifhes, confifts of the labyrinth only, the three canals are fituated above the fac; they are depreffed fuperiorly, and form together a triangle which is almoft equilateral; each has its ampulla, and the fac contains a body of the confiftence of ftarch, as in the rays and fharks.

Frogs and toads differ very little from falamanders, with refpect to the membranous labyrinth; they have the fame parts in the fame pofition, and their fac alfo contains one amylaceous fubftance: their three canals form nearly a complete circle, by their junction with the fac.

Crocodiles and lizards have alfo three canals, but they are larger, and each approaches nearer to a perfect circular form: the fac is fituated proportionally more within the head; its membranous parietes are furnifhed with feveral blood-veffels, which are particularly confpicuous in the crocodile. The folid parts it contains are three in number, and they are fmaller, and even fofter, than thofe of the chondropterygious fifhes. Laftly, their labyrinth is rendered remarkable by having an additional part to thofe we have already defcribed: this is the firft veftige of the cochlea; it is the production of the fac, in the form of a cone flightly arched; it is directed, under the cranium, towards the middle line, and is divided into compartments, or rather canals, by a double cartilaginous feptum; one apartment communicates with the fac; the other, which is a continuation of the firft, reflected on itfelf, terminates at a very fmall hole, which is clofed by a membrane that feparates it from the cavity of the tympanum.

This organ is precifely fimilar to that which is found in all birds. Comparetti was the firft who defcribed it in lizards. It is very large in the crocodile, and may be eafily prepared from young fubjects.

It is more difficult to find this in the cameleon and the marbled lizard. A veftige of it may be obferved in the ferpents. The production which may be compared to this trumpet, or rudiment of the cochlea in the tortoife, is very fimilar to the part we named the fac, ftrictly fo called, in fifhes; and this refemblance confifts not only in its form, but in the fmall amylaceous fubftances it contains: this feems to leave no doubt of the analogy between the fac and the cochlea in man, or of that between the part we call the finus, and the veftibule. We muft, therefore, judge of the perfection of the labyrinths of thefe different ears, by the degree in which the cochlea is developed.

Tortoifes and ferpents have the femi-circular canals, like other reptiles. In the tortoife they are proportionally very fhort.

The *offeous labyrinth* of reptiles refembles that of the chondropterygii; that is to fay, it envelopes the whole of the membranous labyrinth, but in a manner more or lefs clofely.

In the tortoife, the feptum, which feparates the veftibule from the cranium, is not offified; it remains partly membranous. The membranous femi-circular canals are much fmaller than the bony cavities containing them.

In the crocodile and other lizards, the offeous labyrinth clofely embraces the membranous, or completely covers it by a thin and hard lamina.

Cavity of the Tympanum and its Appendages.—Among reptiles, the falamander has the labyrinth completely inclofed within the cranium, and deprived of all external communication, as in the fifhes that have fixed branchiæ. But the other genera of the fame order have all a feneftra, called *oval,* fupporting an offeous plate, analogous to the bone called ftapes in man. The lizard genus has another aperture, clofed only by a membrane, and called feneftra rotunda.

The barrel, or cavity of the tympanum, cannot be faid to exift in ferpents: the ftalk of the plate, filling the feneftra ovalis, is furrounded by the flefh, and its extremity touches the fkin, near the articulation of the lower jaw.

In toads and frogs, the whole of its pofterior part is membranous; it communicates immediately with the back of the mouth, by a large hole, which may be feen on opening the mouth of the animal. It is very fmall, and almoft entirely membranous in the pipa, in which the labyrinth is connected with the feneftra ovalis by only a very long canal.

It is alfo membranous pofteriorly and inferiorly in the common lizards, and in the cameleon: it communicates with the bottom of the palate by a fhort wide canal.

The

The barrel of the crocodile may be divided into two parts: one external, which is very wide, and clofed on the outfide by the membrane of the tympanum, and the fkin, but entirely furrounded by the bones; and one internal, which is feparated from the former by a contraction, and which communicates with the two feneftræ, and with fome cavities analogous to the maftoid cells of man, but much larger. One of thefe cavities is placed between the femicircular canals, and the other is directed backward and outward. The barrel is fituated towards the fuperior part of the cranium.

The cavity of the tympanum in the tortoife is placed more laterally: it is not fo wide externally; and the contraction, which feparates the external part from the internal, is lefs confpicuous, becaufe the projection, which it forms, is rounded, and not acute, as in the crocodile. The internal portion is prolonged backward, in the form of a large round cell: in the bottom of the cavity, oppofite to the membrane of the tympanum, there is a narrow canal, in which the officulum is funk, and which communicates with the feneftra ovalis. The Euftachian tube is a canal of a moderate length, which proceeds downward, and a little backward, and terminates in the palate, behind and within the articulation of the jaw.

The Membrana Tympani and its offeous Frame.—Animals which want the barrel of the tympanum, as fifhes, falamanders, &c. have no membrana tympani. That membrane is alfo wanting in feveral reptiles that have a barrel, as the cameleon: the fkin paffes over the external aperture of their ear, without undergoing any change, either in its thicknefs or its ftructure; and the exiftence of the organ of hearing can only be afcertained by diffection. On removing the fkin, and fome portions of the mufcles, we find, in fome fpecies, and particularly in the flow-worm (anguis fragilis), a kind of membranous expanfion.

In the tortoife, the large external aperture of the barrel is clofed by a very thick cartilaginous plate, which is itfelf covered by a fcaly fkin, perfectly fimilar to that of the reft of the head.

In frogs and toads, the membrana tympani is on a level with the head, and the fkin that covers it becoming finer, it is rendered perceptible by an oval fpot, which is fmoother than the reft of the head, and ufually of a particular colour.

In common lizards, the membrana tympani is alfo level with the head, but very thin, fmooth, and tranfparent; for at that part the fkin becomes as fmooth and fine as the cornea of the eye.

In the crocodile, it is of the fame nature, but more funk into the head, and covered by two flefhy lips, which fupply the place of the external ear.

In lizards, though the point of the cone formed by the membrana tympani projects lefs than in birds, it is alfo directed outward, as in them. The membrane is nearly plane in frogs and tortoifes.

The membrana tympani is on a level with the adjacent parts of the head, and confequently is nearly vertical in all animals in which its fituation is fuperficial; but in thofe which have it funk, its inclination, whether confidered with relation to the head itfelf, or to the external meatus, varies confiderably.

It inclines obliquely upward, and to one fide, in the crocodile.

The offeous frame, to which the membrane is attached, is not marked by any prominent edge: it is interrupted pofteriorly. Its great axis is vertical in the tortoife and the common lizards, and its anterior arch is more convex. In the crocodile, it is a regular oval, the great axis of which is directed obliquely backward.

Officula Auditus.—The frog and the toad have two officula in the ear: one fupplies the place of the malleus and the incus; it is attached to the membrana tympani by a flender branch, which forms an acute angle with the part that paffes into the barrel: that part has the fhape of a club; its internal extremity is the thickeft, and articulates by a double furface to the fecond officulum, which correfponds to the ftapes. The latter has a femi-elliptic form, and is applied to the feneftra ovalis by its plane furface: both thefe bodies, which are offeous in other animals, are cartilaginous in the frog and toad.

Lizards and tortoifes refemble birds, in having a fingle officulum with a thin hard ftalk, and an oval or triangular plate (columella). It is attached to the membrane of the tympanum in lizards, and particularly in the crocodile, by a cartilaginous branch; but in the tortoife, its outward extremity is directly implanted in the cartilaginous mafs, which correfponds to the membrana tympani itfelf.

In the crocodile, the plate is an elongated ellipfis, the great axis of which is fituated longitudinally.

In the tortoife, the bone is enlarged in the form of a trumpet, and is applied to the feneftra by a regularly oval and concave furface.

Serpents have an officulum, but no membrana tympani. Its external extremity touches the bone that fupports the lower jaw: it is furrounded by the flefh, and is applied to the feneftra by a concave plate, the edges of which are irregular.

In the cameleon, the plate alfo reprefents the wide end of a trumpet; its ftalk becomes cartilaginous, and is loft in the flefh.

The feneftra veftibularis of falamanders is clofed only by a fmall cartilaginous operculum, which has no ftalk, and is concealed by the flefh.

Mufcles of the Officula.—Little is known about thefe in reptiles. It appears that ferpents, cameleons, and falamanders, are entirely deftitute of them, and that they are very indiftinct in the teftudines. Comparetti has made fome refearches on this fubject, but without any clear or fatisfactory refults.

External Meatus, &c.—All parts of the ear, external to the membrana tympani, are wanting in reptiles. In the crocodile only is there any appearance of an external meatus, the fkin forming a kind of lip or operculum above the membrana tympani: the latter is entirely concealed, except when this covering is removed. This muft be the part mentioned by Herodotus as the external ear of the crocodile, to which the Egyptians attached rings.

Diftribution of the Nerves.—In reptiles and fifhes, but efpecially in the latter, we can obferve, ftill better than in warm-blooded animals, the conftancy with which the branches of the auditory nerve proceed to the ampullæ of the femi-circular canals. In reptiles it divides before it paffes into the offeous labyrinth, which it enters by feveral holes.

Organ of Touch and Integuments.—It does not feem clear that reptiles poffefs the fenfe of touch, that is, the power of recognifing, by any parts of their fkin, the figure, hardnefs or foftnefs, roughnefs or fmoothnefs, of bodies. To the impreffions of heat and cold, there is no doubt of their being fenfible.

In no clafs do we obferve fo much variety in the nature of the integuments; the fkin is different in almoft every fpecies. In many the ftructure is fo fingular, that if we judged by this alone, we fhould form them into feparate claffes. What

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a contraſt does the ſhell or bony caſe of the tortoiſe form to the ſmooth ſkin of the tree-frog; how different are the annulated ſkin of the amphiſbæna, the ſcaly covering of other ſerpents, and the integuments of the toad, rough and tuberculated.

Epidermis.—When we examine what parts of the body are covered with ſkin in the tortoiſe and turtle, we can recognize it at firſt ſight only on the head, neck, limbs, and tail; the other parts exhibit to us merely an oſſeous box or exterior ſkeleton, incloſing the body. But, if we examine more attentively, we ſhall find this ſkeleton covered by an extremely thin epidermis, which may be detached in tranſparent laminæ, ſimilar, in figure, to the horny plates, and varying in its conſiſtence in the different ſpecies. It reſembles a ſmooth and tranſparent parchment in the teſtndo centrata of Boſc (Daudin, t. ii. p. 153.) The epidermis covering other parts of theſe animals is a ſmooth thin layer, not eſſentially different from that of the frog and ſalamander, and detached in ſhreds ſeveral times in the year.

The epidermis of the ſalamander and frog is a ſoft thin membrane, covered with a mucous ſecretion; which anſwers a particular uſe in ſome kinds, as the rana calamita, enabled by its aſſiſtance to adhere to the ſmootheſt bodies. This ſecretion, a ſimple and innocent mucus, is very different from another, which is found in many reptiles, poſſeſſing extremely powerful ſenſible properties; the latter is deſcribed under the head of peculiar ſecretions, in the latter part of this article.

The thin tranſparent cuticle of the frog, ſalamander, and newt, is very frequently changed, being detached in large portions. Blumenbach ſtates that this change takes place in the ſummer months at leaſt once a week. Specimen, p. 26.

The epidermis of lizards covers all their ſcales, and is detached in ſmall dried portions, or in larger pieces. It forms alſo a thin continuous ſtratum in ſerpents, enveloping the whole ſurface, and ſpread over every ſcale and plate. It is detached annually, at a certain ſeaſon, in a ſingle piece, like a ſheath. The caſt ſkin (ſlough, exuviæ) is turned inſide out, ſo that its exterior ſurface is the part previouſly in contact with the true ſkin. The animal eſcapes at the mouth, which is the only opening by which it can get out of the ſheath. The part correſponding to the jaws is firſt detached, and turned back, ſo as to expoſe to us the ſnout, covered by a new ſkin. As the head paſſes out of its ſheath, the latter goes backwards in the ſame proportion towards the tail, and is thus at laſt completely inverted. The tranſparent piece correſponding to the eye (ſee an account of the eye) has its concavity outwards.

Rete Mucoſum.—In all reptiles there is, under the epidermis, a mucous tiſſue, of which the colours vary very much. In the teſtudines, for inſtance, the ſkin which covers the feet and neck is not only differently coloured by the rete mucoſum, but the ſymmetrical ſpots, which we remark on the ſcales, are produced by the ſame ſubſtance. This we diſcover by diſſection. The thickneſs of the ſkin greatly diminiſhes as it approaches the breaſt-plate and the back-ſhell. It paſſes below the ſcales which cover thoſe parts, and which are, themſelves, covered by the epidermis and rete mucoſum; the variegated colours of which form the ſpots which we obſerve through the tranſparent parts. A rete mucoſum is equally found in the lizards, ſerpents, ſalamanders, frogs, &c. It is variouſly coloured in each ſpecies; and it preſents often the moſt beautiful and charming tints. We find in this claſs almoſt all the known ſhades, even blue, bright red, orange, pearly, gold and ſilver.

Reptiles are remarkable for the changes of colour which they exhibit, according to the ſeaſon or climate in which they live, or to temporary affections of various kinds. In this way the cameleon has been moſt celebrated, and has afforded a very trite ſubject to poets and moraliſts. The changes are, in reality, very remarkable, and are particularly noticeable when the animal paſſes from the ſhade into the ſun, or *vice verſâ*, when he is touched, or any thing placed round him, &c.

This property, however, is, by no means confined to the cameleon. Brown long ago obſerved it in ſeveral ſpecies of lizards (Natural Hiſtory of Jamaica, p. 462.); and it occurs alſo in reptiles of theſe climates. The green iguana, the agame, and the green lizard, are ſometimes green, ſometimes browniſh in their colour. The former is particularly obſerved in the copulating ſeaſon; and is loſt in the cold and rainy parts of the year. The common tree-frog of Europe exhibits various tints from the brighteſt emerald green to grey, blueiſh, violet, or brown. Other frogs and ſalamanders change their colours alſo, particularly about the copulating ſeaſon.

The Papillæ.—Reptiles reſemble birds with reſpect to the papillæ; we find none except under their feet; they are very thick, and projecting in ſeveral ſpecies of lizards, and particularly in the cameleon. We cannot diſtinguiſh them in the ſea tortoiſe, which have the feet in the form of fins. They do not exiſt in ſerpents, or at leaſt have not the form of papillæ.

Cutis.—Reptiles which have the body unfurniſhed with ſcales, or only partly covered by them, have a very compact and denſe ſkin. We have an example in the tortoiſes, ſalamanders, frogs, and toads. In the two laſt genera, in particular, the cutis is rendered remarkable by not adhering to the body in all its points, as in the other animals, in which it is intimately united with the cellular ſubſtance. In thoſe genera, however, it adheres only at the edges of the mouth, in the middle line of the body, the arm-pits and the groins. In all the other parts the body is free within the cutis, which incloſes it like a ſac.

In lizards and ſerpents we find, as in fiſhes, a ſtrong cutis under the ſcales, even adhering very cloſely to the muſcles.

Cutaneous Muſcles.—There is no cutaneous muſcle on the trunk of frogs, becauſe the ſkin does not adhere to that part of their body. Under the throat, however, we find ſome fibres, which are attached to the margin of the jaw, and inſerted into the cellular ſubſtance that unites the ſkin to the origin of the breaſt.

In tortoiſes the cutaneous colli is very viſible, and ſeems to be formed of two parts; it is extended from within the concavity of the lower jaw to the bottom of the neck, at the anterior part of the breaſt-plate. A middle cellular line unites it with the muſcle of the other ſide; it takes its origin from the tranſverſe proceſſes of the cervical vertebræ. Being ſpread over all the muſcles of the neck, it ſerves as a girdle to them; in its lower part it is perforated by the ſterno-maſtoideus, which, as we have already obſerved, ariſes from the lateral parts of the breaſt-plate.

Secretions of the Skin.—Among reptiles, thoſe that have ſcales, as ſnakes and lizards, have the ſkin almoſt dry; but thoſe with naked ſkins, as ſalamanders and frogs, have the ſurface of the body always copiouſly lubricated with viſcous matter.

Toads and ſalamanders have even the power of augmenting the ſecretion of this liquor, and of making it exude, like a dew, through the pores of the ſkin.

The cutaneous glands are more viſible in cold-blooded animals, than in the mammalia.

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The ſalamanders have ſeveral glands ranged along the back, which form elevations or lumps on the ſkin.

The toads have them ſcattered irregularly on the whole ſurface of the body; we obſerve, in particular, two which are very large, behind their ears; theſe glands produce an acrid humour, which is a poiſon to very ſmall animals.

In lizards, we obſerve a very regular row of ſmall pores, which alſo yield a viſcous humour.

Abſorption of water by the ſkin of the frog.—Townſon found that the frog, and tree-frog, when placed on a moiſtened paper, could abſorb the moiſture ſo rapidly, as nearly to double their weight in two hours, under certain circumſtances. He ſtates that they do not drink, but take in all their fluid in this way. (See his tracts and obſervations in natural hiſtory.) Daudin has verified the obſervation. He kept two frogs without any fluid for ſeven days, and then placed them in a bottle on moiſtened ſheets of paper. In two hours they had nearly doubled their weight. Hiſt. Nat. des Reptiles, tom. i. p. 115.

Fingers.—The number of the fingers, and their flexibility, vary more in reptiles than in all the other claſſes.

Common lizards have, in general, five fingers, of different lengths, well calculated to embrace objects in every direction. Some, as the crocodiles, have them palmated, at leaſt in the poſterior feet. Others, as the gecko, have them inveſted inferiorly with imbricated ſcales.

The cameleon has them united by the ſkin, as far as the nails, in two parts, which form the forceps. The ſkin of their inferior ſurface is furniſhed with ſenſible papillæ. The long lizards, called ſeps and chalcides, have only three very ſmall toes. The ſalamanders and frogs have them naked and deſtitute of nails. In tree-frogs, the extremity of the toes is enlarged into a ſpongy diſk, capable of adhering with force to bodies. In tortoiſes, the toes are palmated. Laſtly, the ſerpents are completely deprived of feet and toes.

The long ſeparate toes of the batracian order, and of ſeveral lizards, ſeem well enough calculated to ſerve as organs of touch; they might be applied to objects, and would ſurround them in various ways. They ſeem, however, to be employed merely as inſtruments of motion.

"It has been ſaid of ſerpents (obſerves Blumenbach), with more ingenuity than truth, that their whole body is a hand; by which they gain juſt notions of the tangible properties of bodies. There is much more foundation for ſtating that the ſenſe of touch, which is here meant, does not exiſt in any of the amphibia." Syſtem of Comparative Anatomy, p. 319.

Among the reptiles the ſcales vary greatly, according to the genera. In tortoiſes they are plates of a horny ſubſtance, which are very hard and denſe in the greater number. But in the teſtudo coriacea, and ſeveral others, they are ſoft and flexible: ſometimes theſe ſcales are imbricated, as in the hawk's-bill turtle; and then they are ſmooth, or channelled longitudinally; at other times they form compartments of different figures: in the latter caſe they are more or leſs convex, and ſurrounded with furrows, or concentric channels, in the midſt of which are points, which are either ſcabrous, elevated, or blunt, as in the ſpecies named geometrica, græca, &c.

In the crocodile the ſcales are bony, arranged in tranſverſe bands, and ſituated, in reſpect to each other, like the ſtones of a pavement. In the other lizards and ſerpents they conſiſt of horny ſubſtance, and preſent almoſt every poſſible variety of form and arrangement.

Organ of Smelling.—This is leſs completely developed in the amphibia than in the two warm-blooded claſſes of vertebral animals. The ſenſe of ſmelling is the moſt imperfect of the ſenſes in this claſs, ſays Daudin, if we may judge by the ſtructure of the noſtrils. Reptiles do not ſeem to employ their ſmell in diſcovering or ſelecting their food, or for any of the purpoſes to which the faculty is ſubſervient in other animals.

We find, however, in the whole claſs, naſal cavities opening on the ſnout in front, and on the palate behind, lined with a vaſcular pituitary membrane, on which olfactory and naſal nerves are diſtributed.

There are alſo different projecting laminæ within the noſe; but they conſiſt of folds of the internal membrane, and are not ſuſtained by oſſeous parts. The tortoiſe has three laminæ, which divide the naſal cavity into ſeveral foſſæ. The middle one correſponds to the external aperture of the noſtrils; between it and the next there is an oblique canal, which leads to the poſterior nares. We find only ſome tubercles in frogs, and other ſmall ſpecies. It does not appear that any reſearches have been made reſpecting the parts in the crocodiles.

The olfactory nerve differs in reptiles little from that of birds, as to its origin and courſe; it differs leſs in its diſtribution, ſince it alſo divides, according to Scarpa, upon the ſeptum, and the membranous fold correſponding to the ſuperior turbinated bone, without proceeding farther.

The *external nares* of reptiles, more or leſs approximated, and ſuſceptible of contraction and dilatation, are uſually furniſhed with only ſome fleſhy ſtrata, which dilate or contract their entrance. This is obſervable in the greater number of lizards, which differ from each other only as to the poſition of their external nares. They are cloſeſt to each other in the crocodiles. The tupinambis, the ſtellions, and the cameleons, have them more removed, and ſituated more laterally. In the ſalamanders they are exceedingly ſmall. In frogs we obſerve a ſmall tube, the motion of which is very apparent, becauſe it is extremely uſeful in reſpiration, as we have already ſhewn. The tortoiſes have alſo two very ſmall approximated noſtrils. In the matamata, and one or two other ſpecies, they are ſituated at the end of a ſhort cartilaginous proboſcis. The external noſe is alſo rather elongated in ſome ſerpents; for example, in the vipera ammodytes, and the coluber naſica. In the reſt of this order there are ſmall lateral nares, capable of ſlight extenſion. In the rattle-ſnake, and ſome others, there is a ſmall blind hole, near the noſe, on each ſide; we have deſcribed it under the head of peculiar organs. See Scarpa de Auditu et Olfactu, for a deſcription and figures of the noſe in the turtle and viper.

The Organ of Taſte.—All reptiles poſſeſs a tongue, but whether they have the ſenſe of taſte is not ſo clear. As they all ſwallow their prey whole, there ſeems to be little room for the exerciſe of taſte. We have already ſpoken of the tongue, in the account of the ſalivary glands; and have entered further into a conſideration of its mechaniſm and moving powers in our deſcription of the organs of maſtication and deglutition.

Subſtance of the Tongue.—Reptiles vary greatly with reſpect to the tongue, as well as in many other circumſtances. The tongue of toads and frogs is entirely fleſhy, attached to the lower jaw, and, in a ſtate of repoſe, inflected in the mouth.

In ſalamanders, it is attached as far as the point, which is not moveable, and the whole tongue is only free on its lateral parts. Crocodiles have it attached to the lower jaw, both by the edges and the point; and authors long ſuppoſed that this animal had no tongue. It is entirely fleſhy in both theſe genera.

The ſtellions and the iguanas have a fleſhy tongue, which poſſeſſes nearly the ſame mobility as that of the mammalia.

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The feinks and geckos differ only in having the tongue notched at the extremity; and in that refpect it refembles the tongue of the flow-worms, to which, in general, the feinks are very much allied.

In common lizards, the tupinambis, or monitor, &c. the tongue is fingularly extenfile; it terminates in two long flexible points, though femi-cartilaginous; it completely refembles that of ferpents, if we except the flow-worms and the amphifbæna, which cannot elongate their tongue, but which have it flat, and only forked at the extremity.

The cameleon has a cylindrical tongue, which may be confiderably elongated by a mechanifm analogous to that which takes place in wood-peckers.

Structure of its Surface.—The tongue of the tortoife is furnifhed fuperiorly with long, foft, clofe, conic papillæ, which give it the appearance of velvet.

In the crocodile they are very fhort, and reprefent rather flight rugæ than papillæ. They form, on the contrary, a very diftinctly villous furface in the iguanas and the ftellions. The tongue of the cameleon is furnifhed with deep, clofe, and very regular tranfverfe rugæ; in the lizards, with extenfile and forked tongues; and in the ferpents, that organ is fingularly fmooth, and as it were horny towards its points.

The falamanders have, like the iguanas, a fine villous furface to the tongue; but in the frogs and toads the furface is perfectly fmooth to the eye, and always mucous.

No reptile has two kinds of papillæ, nor glands with a calyx.

Peculiar Organs and Secretions.—Many amphibia produce fingular and fpecific odours, particularly when irritated. In the water newts the fmell has been compared to that of chopped parfley; in toads to garlic; in the crocodile there is a very ftrong fmell of mufk; and feveral tortoifes have this mufk-like fmell. A fingularly fetid odour is produced by the rattlefnake, when angry. May we fuppofe that this is a defence againft hoftile attacks, in the falamanders and water newts, as it feems to be in the viverræ, and fome frogs?

It may probably ferve in fpring, as Blumenbach fuggefts, as a means of venereal excitement. For if, after handling female toads for fome time, the hand is plunged into water, where there are male toads, they flock inftantly to the fpot, and clofely embrace the fingers. Specimen, p. 29.

The notion that this odour is employed by the rattlefnake to fuffocate, fafcinate, or in any way whatfoever to act on the animals which form its prey, is entirely ungrounded, as we have already explained.

There are generally manifeft organs for the fecretion of the fubftances in which thefe properties refide. Small granulated tubercles are feen under the thighs of the lizards, the chalcides, and the marbled iguana of Surinam, and near the anus of the amphifbæna, producing, particularly in the coupling feafon, a fluid, and fmelling like dry hay.

Mufk Gland of the Crocodile.—It lies under the fkin of the lower jaw, on each fide, about its middle. It is a fmall gland, of a homogeneous whitifh tiffue, and covered by a tendinous fheath. It fecretes an unctuous blackifh-grey fluid, fmelling moft ftrongly of mufk, and collected in a fmall bag, which opens externally by a large orifice.

Anal Glands have alfo been obferved in the crocodile and alligator, as well as in feveral ferpents. They may be feen of confiderable fize in female colubres, under the tail behind the cloaca, in the part occupied by the penes of the males. They contain a thin yellow fubftance. Tyfon has defcribed them in the rattlefnake. Other fnakes have been defcribed as producing powerfully fetid odours from the mouth.

Poifonous and Acrid Secretions.—There is a ftriking difference in this refpect between warm-blooded animals and reptiles: none of the former produce any thing poifonous, unlefs we fhould make an exception concerning the liver of the urfus arctos, which is defcribed by Ger. de Veer, one of the unfortunate fufferers, to have been nearly fatal when employed as food by Heemfkerk and his companions, compelled to winter in Nova Zembla. Blumenbach's Specimen, p. 30.

Befides the terrible poifon with which fo many ferpents are armed, already defcribed in our account of the teeth, there are feveral more or lefs actively hurtful fecretions in this clafs.

The glands or crypts under the fkin, forming the cutaneous eminences in the falamander and toad, produce an irritating fluid, which they feem to have the power of excreting at pleafure. Blumenbach defcribes the acrimony of this fluid in the rana bombina, from his own experience of its effects. Having cut his hand while handling fome of thefe animals, and applied it to his mouth to fuck the wound, he found a cauftic heat fuddenly pervade the tongue and fauces, like what is produced by chewing the bark of the laurel; and it continued for feveral hours. P. 24.

It feems to be an analogous fluid in the falamander, by means of which this moft innocent little animal, fo unjuftly deemed venomous, can extinguifh a few coals when placed in them. But the contortions of the body fufficiently atteft the pain produced by this cruel experiment, which is foon fatal, if prolonged. The fabulous notion of the ancients, that this little reptile can live in fire, is well known; and Benvenuto Cellini has ventured to affert the truth of it, on the faith of his own experiments. See his Life.

The notion of the falamander being able to live in fire is the more extraordinary, when we contraft it with the fact, that it has been found in cakes of ice, and after remaining frozen for fome days, recovered. So that it can actually furvive congelation.

Dr. Barton of Philadelphia has named an aquatic falamander, which he found near that city, falamandra venenofa, from the nature of the fluid which exudes from the tubercles of its back. Daudin, tom. viii. p. 229.

The gecko of Egypt produces a poifonous fluid of confiderable activity. "It exudes (fays Haffelquift) from the lobules of the toes; the gecko feeks for places and objects impregnated with marine falt, and paffing feveral times over them, leaves its venom behind. I faw in 1750, two women and a girl, who nearly died in Cairo from eating cheefe which had been thus poifoned. I had another opportunity of noticing the acrimony of this fluid, in the production of red, inflamed, and itching puftules on the hand of a man, who endeavoured to catch the animal." The French naturalifts, attached to the Egyptian expedition, confirm the report of Haffelquift. Daudin, tom. iv. p. 110, 111.

Rattle of the Genus Crotalus.—This fingular organ confifts of many pieces, from one to thirty, or more, perfectly fimilar, not only in form, but often alfo in fize, compofed of a brittle, femi-tranfparent, horny fubftance, fimilar to that of fcales. The piece immediately connected to the body forms a fmall fheath, moulded on the laft vertebræ of the tail, which it inclofes, and from which it is feparated only by a thin membrane. Its furface prefents three circular rifings, correfponding to three elevations of the vertebræ: the firft, or neareft to the animal's tail, is the largeft, and the two others decreafe fucceffively. All the pieces are encafed one in the other, the pofterior two-thirds of each being enveloped by the following. Of the three rifings or rings on each piece, the anterior only is vifible, the two pofterior

terior being concealed by the following piece. The laſt, or extreme portion, has all its three rings viſible; and the organ conſiſts, externally, of this piece, and the firſt rings of all the others. The two laſt rings of each piece, included in the two firſt of the ſucceeding, retain it in its place; but, as the diameter of the former is leſs than that of the latter, each piece is quite looſe, and plays freely about that which it envelops. None, except the firſt, is united to the ſkin of the animal, or connected by any muſcle, nerve, or veſſel; it is, therefore, merely an exterior covering, moved, as any foreign body would be, when the end of the tail is agitated.

The different pieces of the organ are formed ſucceſſively on the ſkin of the tail, receiving from it the materials neceſſary for its developement, and adhering to it until its growth is complete. A ſecond piece, entirely ſimilar to the firſt, is formed under it, and detaches it from the end of the tail. It is puſhed backwards, leaving between its edge and the ſkin of the tail an interval occupied by the firſt ring of the new piece, of which the ſecond and third rings are covered by the firſt piece. The latter is retained by this connection, but plays freely round the firſt piece. A third piece is formed under the ſecond, as that was under the firſt; puſhing the ſecond backwards, but retaining it by its two poſterior rings being included in the cavity of the ſecond piece.

If the vertebræ of the tail continue of uniform diameter, all the pieces will be of the ſame ſize, and the rattle, conſequently, is of one breadth throughout. On the contrary, if the vertebræ grow while the rattle is being formed, the pieces increaſe in ſize, and thus the rattle tapers to its end.

It is evident, from the preceding deſcription, that one piece only can be formed at each partial moulting of the end of the tail; but as we do not know whether theſe moultings coincide with the general ſeparation of the epidermis from the body, nor the periods of their recurrence, the number of pieces not only affords no proof of ſpecific differences, but alſo indicates nothing about the age of the animal. Lacépéde, Hiſt. Nat. des Serpens, 12mo. t. 2. p. 217.

Horns, &c. of other Serpents and Reptiles.—The Egyptian ceraſtes is ſo named, from its two moveable, pyramidal, four-ſided, curved horns, about two lines in length, placed above the eyes. They conſiſt of ſucceſſive ſtrata, of which the exterior ſeparates like an epidermis, exhibiting always four grooved ſides. The exterior ſtratum ſeparates thus with the animal's ſkin, like the epidermis of the ſcales, which this reſembles entirely in its texture. Lacépéde, ubi ſupra, t. 1. p. 256.

In the batracian order, the horned frog has a conical horny elevation above each eye; and the rana margaritifera a peculiar hard criſta on each ſide of the head.

The cecilia ibiara has two ſmall tentacula or cirri, ſcarcely viſible near the noſtrils; and the ſerpent, which Lacépéde has named erpeton tentaculé (Annales du Muſeum, t. 2. p. 280.) has two fleſhy appendages, covered with ſcales, extending from the end of the ſnout horizontally forwards. Is there any probability that theſe parts in the cecilia and erpeton are organs of touch?

Facial Pouches of Serpents.—A ſmall bag has been obſerved in the rattleſnake, in ſixteen colubres, and three boæ, between the eye and the noſtril; it has a rounded form, reſting in a hollow of the bone, in ſhape not unlike the orbit. A ſmall orifice behind the noſtril leads to it. Theſe bags, which are lined with cuticle, have their covering caſt with the reſt of the animal's ſkin. The cavities in queſtion were noticed in the rattleſnake by Tyſon, Phil. Tranſ. v. 13. p. 26; and they have been ſince deſcribed and delineated by Dr. Ruſſel and ſir Everard Hume. (Phil. Tranſ. 1804, p. 70.) The latter anatomiſt diſcovered nothing like a ſecretory apparatus about them, nor any thing that could lead to conjectures concerning their office. They appear moſt analogous, in ſituation and ſtructure, to the ſmall bags of the deer and antelope, called by the French larmiers.

We conclude our review of the ſtructure and phyſiology of reptiles with the ſummary of the principal differences between their economy and that of the warm-blooded claſſes, which terminates the excellent "Specimen" of Blumenbach.

"Et calidis quidem animalibus a prima inde formationis origine ad ultimum uſque vitæ halitum phlogiſticus ut hodie audit proceſſus. Mammalium fœtui placentæ adminiculo, quæ fœtale phlogiſton materno elemento igneo commutat. Pullo incubato poroſæ teſtæ et albuminis ope, quæ itidem igneo pabulo aditum, phlogiſto vero ſuperfluo exitum concedunt. In lucem vero editis tum mammalibus tum avibus, perpetuo et alterno reſpirationis rhythmo.

"Internus porro huic phlogiſtico proceſſui cum reliquis functionum claſſibus nexus, maxime cum iis ſyſtematis nervoſi, ut hiberni mammalium veterni, phænomenis quæ ſupra tetigimus, veriſimillimus redditur.

"Ipſius porro nervoſi ſyſtematis ſumma cum reliquis functionibus conſpiratio, præſertim ope reactionis ſenſorii ab ea encephali portione pendente, quæ præter originis nervorum ſuper eſt.

"Ex his omnibus ſummus quidem functionum vigor, mobilitas ſumma, hinc corpus vivum infinitis modis innumerorum, et multifariorum ſtimulorum impetui et impreſſionibus ſuſcipiendis aptum: hinc præ ceteris omnibus ſumma hominis prærogativa, in quo, uti, pridem obſervante Hippocrate, confluxio una, conſpiratio una, conſentientia omnia, ita et omnium maximus et innumerus cum univerſa reliqua cum ambiente creatione nexus.

"Longe alia e contrario amphibiorum natura.

"Phlogiſticus proceſſus noſtratibus perexiguus lentiſſimus.

"Debilis etiam in omnibus amphibiis ſanguinis in encephali functiones influxus.

"Exigua porro parvi ſenſorii in craſſas nervas reactio.

"Minor hinc in univerſum conſenſus; minus unius functionis in alteram imperium.

"Minor hinc totius machinæ animatæ mobilitas.

"Verum eo major ab altera parte ſimplicioris iſtius vitæ tenacitas, quod parte una affecta, ſyſtemate uno afflicto, non tam facile reliqua in conſenſum trahantur.

"In univerſum ergo vita magis vegetativa, reproductioni—ut per utrumque organicum naturæ regnum conſtat—longe magis opportuna, quam quæ altioris ordinis facultatibus, conſenſibus, et complicatæ conſpirationis ſubtilitate viget." P. 36.

Anatomical Deſcription of the Proteus Anguinus, and Siren Lacertina.—See Cuvier, Récherches ſur quelques Reptiles douteux, inſerted in Humboldt's Recueil d'Obſervations de Zoologie et d'Anatomie comparée faites dans ſon Voyage, t. 1.

By the word *amphibious*, applied to animals, naturaliſts have meant to deſignate the power of living, and particularly of breathing, equally well in water and in air. In this ſenſe it cannot be applied, with propriety, to any of the animals who have received the appellation from the ancients, and moſt modern naturaliſts. Without ſpeaking of the otters and hippopotami, which are true aerial quadrupeds, viſiting the water merely in ſearch of food, the ſeals and cetaceous

 animals,

animals, compelled by their organs of motion to paſs the whole, or nearly the whole of their life in water, can abſolutely breathe air only.

All the reptiles to whom Linnæus ſubſequently transferred this name of amphibious animals, are ſimilarly circumſtanced in their adult ſtate; they can only breathe air, whether they live conſtantly in this element, as the lizard kind, or betake themſelves, for a longer or ſhorter period, to the water, as the frogs and ſalamanders. On the other hand, the cartilaginous fiſhes, which this ſame naturaliſt had joined to the reptiles, like all other fiſhes, can only breathe by the intervention of water; they have only gills; and it is by having repreſented as lungs the forked ſwimming bladder of ſome of them, that Dr. Garden cauſed the miſtake of Linnæus.

The larvæ or tadpoles of the batracian reptiles only, that is to ſay, of the ſalamanders and frogs, the tree-frogs and toads, have both branchiæ and lungs; breathe, at leaſt for a certain time, both the air in its elaſtic ſtate, and that which is contained in water; conſequently participate equally the nature of aerial and aquatic animals; and may, therefore, without impropriety, bear the name of *amphibious* in its moſt ſtrict acceptation. But with theſe it is only a tranſitory, and with ſome perhaps only a momentary ſtate. As their lungs are developed, their branchiæ are obliterated, and they entirely loſe the latter, often even before reaching their full ſize, and particularly before they are capable of reproduction. Such, at leaſt, is the reſult of obſervations on all the tadpoles of theſe climates, on all which it is poſſible to follow in their various developements.

But naturaliſts have obſerved three other animals, uniting, like our tadpoles, the two kinds of reſpiratory organs, not appearing to loſe any of them at any epocha of their lives, and of ſuch form and ſize, that it is ſaid in the countries which they inhabit, no perfect reptile is known, of which they could be the larvæ. Are theſe creatures perfect animals—true permanent amphibia? Should they be conſidered an intermediate claſs between reptiles and fiſhes? We proceed to examine this queſtion, obſerving, in the firſt place, that the ſtructure of the circulating organs in the common tadpoles, which has been deſcribed in a former part of this article, muſt be kept in view as a point of compariſon.

Anatomy of the Siren Lacertina.—This animal is common in the rivers and marſhes of South Carolina, and is remarkable for poſſeſſing only the fore feet. Dr. Garden ſent an individual to Linnæus, accompanied with a deſcription, in which he mentioned the ſimultaneous exiſtence of branchiæ and lungs, and declared that there is no ſalamander in Carolina large enough to have been produced from the ſiren. Hence Linnæus determined to eſtabliſh for it a particular order of reptiles, the amphibia meantes. Nearly at the ſame time it was deſcribed in the Philoſophical Tranſactions by Ellis, whoſe deſcription was accompanied with an anatomy of the animal by Mr. J. Hunter. Yet ſeveral naturaliſts conteſted the reſult of theſe examinations. Pallas, Hermann, Schneider, and others, conſidered that it might be a larva. Camper, on the faith of an imperfect ſpecimen, in which no lung could be found, concluded it was a fiſh, (Kleine Schriften, tom. iii. pl. 1. p. 20.); and Gmelin, on his authority, claſſed it among the eels.

Cuvier has had an opportunity of diſſecting and deſcribing it. His account, which ſettles the diſputes ſatiſfactorily, is contained in the Recherches already quoted, and has furniſhed the materials of the following deſcription. The facts are repreſented in the 11th and 13th plates of the firſt volume of Humboldt's Recueil d'Obſervations de Zoologie et d'Anatomie comparée. The length was half a metre, but it reaches ſometimes between 30 and 40 inches. The body is much like that of an eel. The anus is at 15 centimetres from the poſterior extremity. The head is not ſeparated from the body by a neck: it is rounded, and terminated by an obtuſe ſnout. The mouth is ſmall, and the lips, which are not conſiderable, are not ſupported by any bones, as they ſometimes are in fiſhes. The noſtrils are two ſmall holes near the edge of the upper lip. The eyes are placed above the angle of the mouth: they are round, ſmall, without eye-lids, and only viſible becauſe the ſkin, in paſſing over them, becomes tranſparent. You may ſkin the head, like that of an eel, without injuring the eye-ball.

The openings of the gills are three vertical ſlits placed in ſucceſſion behind the head: through them the water from the mouth is diſcharged. But there are no gills within, as in the lamprey for example; although Garden, Ellis, and Camper ſuppoſed it. The only branchiæ are three tufts or fingers, attached to the ſuperior angle of the ſlits, to which Ellis and Garden gave the name of opercula, but of which Linnæus recognized the true nature. There are ſurely only three on each ſide, of which the firſt is the ſmalleſt, and the third the largeſt. The different ſtatements concerning their number, which embarraſſed M. Schneider, ariſe from the name having been given to different parts. For example, Linnæus, who rightly deemed the tufts to be branchiæ, reckons three, without opercula (branchia ad latera colli utrinque tria, exſerta); but Garden, who conceived that the branchiæ were connected to the arches, ſays there are four, with three opercula, or one operculum of three lobes.

Each of the tufts conſiſts of a large fleſhy and conical pedicle, of which the inferior edge is divided into two rows of appendices, which are themſelves again twice divided in the ſame manner. The animal muſt have the power of moving theſe branchiæ in every direction: the net-work of branchial veſſels is expanded on their ramifications.

The fore feet, ſhort and ſlender, are placed a little behind the branchial apertures. There are four fingers, of which the laſt phalanges are pointed, but not furniſhed with nails. There is not the ſmalleſt appearance of ſcales on the ſkin.

Oſteology.—Although the individual examined by Cuvier had not reached its full ſize, oſſification was conſiderably advanced. The cranium, lower jaw, and ſpine, were perfectly oſſified. On the large bones of the arms there were epiphyſes, and the ſcapula was almoſt entirely cartilaginous. The latter bone remains conſtantly in this ſtate in the ſalamanders. The branchial arches were entirely cartilaginous, and probably continue ſo, as no point of oſſification could be obſerved, although the os hyoides and its branches were already almoſt completely hardened.

From the head to the end of the tail there are ninety vertebræ: the anus is oppoſite to the forty-fifth, yet it is far from being oppoſite to the middle of the body, becauſe the vertebræ of the tail, particularly towards its end, are much ſmaller than the others. The land ſalamander has thirty-eight, and the aquatic about forty. The pelvis is ſuſpended oppoſite to the fifteenth or ſixteenth, in the former; to the fourteenth or fifteenth, in the latter. There is not the ſmalleſt veſtige of pelvis or hind leg in the ſiren: there is not even any germ of theſe parts, although they exiſt in the tadpole at all ages. It is, therefore, very certainly never deſtined to have hind legs. There is a kind of imperfect pelvis, even in the ophiſaurus (anguis ventralis, glaſs-ſnake), a true ſerpent, though analogous to the lizards in ſome points, but never poſſeſſing hind legs.

Eight vertebræ only of the ſiren, from the ſecond to the ninth,

ninth, support ſmall ribs, or rather very ſhort falſe ribs. In the land ſalamander there are twelve or thirteen, and in the aquatic eleven. Theſe ſmall ribs, loſt among the muſcles, are only obſerved in the genus of ſerpents called cæcilia, where they exiſt in great number.

The individual vertebræ are very differently ſhaped from thoſe of ſalamanders, frogs, and cæcilia. The body is terminated before and behind by a hollow cone filled with cartilage, which unites it to the adjoining bones, as in fiſhes. There is a ſmall longitudinal prominence below; and above, a criſta holding the place of the ſpinous proceſs, and bifurcated behind. The four angles of the ſuperior ſurface are occupied by the articular apophyſes, of which the anterior have their articular faces turned upwards, and the poſterior downwards. The tranſverſe proceſſes are formed of two triangular plates: one, inferior and horizontal, comes off from the whole ſide of the body of the vertebræ; the other ſlants backwards, and reaches from the anterior articular proceſs to the poſterior edge of the preceding. At the extreme point of their union we find the ſurface to which the rudiment of rib is articulated, in thoſe vertebræ which have ribs.

None of the allied genera reſemble the ſiren in the form of the vertebræ; and their ſingular ſhape would alone be ſufficient to authoriſe us in conſtituting a ſeparate genus for this animal. The head leads equally to the ſame concluſion, being entirely different from that of the ſalamander, and other reptiles. The noſtrils, ſimply excavated at the ſides of the ſnout, do not penetrate into the mouth: neither the orbit nor the temporal foſſa is cloſed below. Hence the upper jaw-bone does not form a complete bony circle; its anterior part only is formed by the intermaxillary bones, and has no teeth. Thus the ſiren has only palatine teeth attached to the two plates, and not implanted in the palate. The prominence, having the ſurface for the articulation of the lower jaw, is much ſhorter than in the ſalamander. The lower is articulated with it by a convex ſurface, ſhaped like the ſegment of a ſphere: its coronoid proceſs is very ſhort; each of its branches is compoſed of three pieces at leaſt. The teeth are attached to their internal ſurface, and not implanted in their edges. The head is articulated to the neck by means of two condyles.

The bony apparatus of the branchiæ reſembles that of fiſhes, with a few ſlight differences. A longitudinal bony piece bears, at each of its extremities, a pair of tranſverſe portions. Each of theſe anterior portions is joined to a cartilage, which aſcends behind the head, ſuſpended by a ſtrong ligament to the ſides of the occiput: it is analogous to the piece which ſupports the radii of the branchioſtegal membrane in fiſhes. But here there are no radii; and there is even a ſolution of continuity between this piece and the firſt arch of the branchiæ. This firſt arch, the largeſt of all, is joined to the poſterior tranſverſe piece mentioned above. The three others are joined to a third bony piece, ſimilar to the preceding, but ſuſpended behind it, and not articulated to the longitudinal piece. Theſe four arches are ſimply cartilaginous. Their ſuperior extremity is ſuſpended to the ſecond rib by a ligament, but not articulated to it. Their edges exhibit a ſeries of ſmall fine denticuli, which border the three branchial apertures: the anterior edge of the firſt arch, and the poſterior of the laſt, not concurring in the formation of any opening, have none of theſe denticuli. The ſkin is immediately attached to theſe arches, and they ſupport nothing, as we have already ſtated, analogous to the branchiæ of fiſhes. The tufts, which have no bone in their interior, are the only branchiæ.

The oſteology of the legs is the ſame as in the ſalamander: it compriſes a ſlender ſcapula, terminated above by a cartilaginous dilatation; a large cartilaginous plate, which may be regarded as a double clavicle, analogous to that of the frog, the uſe of which is to protect the front of the cheſt; a humerus; two bones of the fore-arm; a carpus, of which the bones were too ſmall and ſoft to be reckoned; a metacarpus and phalanges.

Organs of Senſe.—The ear is the only one which Cuvier could obſerve accurately; it ſeemed to reſemble that of the ſalamander. In the outer ſide of the bone incloſing the labyrinth, is an oval aperture, ſimply cloſed by a cartilaginous plate, covered by ſoft parts.

Organs of Circulation and Reſpiration.—There is a ſingle auricle of conſiderable ſize, with its circumference denticulated, receiving all the blood of the body, and the lung; two large valves are placed at the mouth of the vena cava. This auricle communicates with the ventricle by a ſingle orifice; and the blood departs from the latter by the aorta only. The heart is therefore exactly the ſame as that of the frog, the ſalamander, and of fiſhes.

The trunk of the aorta, or rather of the veſſel, which in fiſhes is called the branchial artery, is furniſhed with fleſhy and thick ſides, and its baſis has three ſtrong valves. It divides into three branches on each ſide for the three branchial tufts, and no branch goes from it to any other part. Theſe arterial branches become attached to the three cartilaginous arches in their way to the branchiæ; but they form no plexus on them, which proves that branchiæ are not attached to theſe arches as in fiſhes, and as Garden, Ellis, and Camper imagined in the ſiren.

Arriving at the branchial tufts, the arteries ramify over all their ſubdiviſions, and the veins bring back the blood in a contrary direction. The ſame circumſtances may be ſeen in the branchiæ of young aquatic ſalamanders, in which perhaps the circulation of the blood can be more eaſily obſerved with the microſcope, than in any other animal organ.

Having quitted the tufts, the branchial veins aſſume the texture of arteries, and join together, towards the ſpine, to form the deſcending aorta; but they produce, before their union, the branches which in other animals ariſe from the aſcending aorta, that is, thoſe of the head, arms, and lungs: the latter come from the third of theſe branchial veins converted into arteries.

The lungs are two long cylindrical bags, extending to the poſterior end of the abdomen, and then bent forwards. The veins and arteries form a looſe network on their membrane. Air enters them through a larynx placed on the os hyoides, and opening between two ſmall rounded margins placed vertically. A very ſlight cartilaginous prominence is obſervable on each ſide in its interior, and the glottis is between theſe: but there is no chorda vocalis with a ſharp edge. Yet it does not follow that the obſervers, who have aſcribed a voice to the ſiren, are inexact; for the approximation of the two prominences juſt mentioned would be ſufficient for its production.

The trachea is a ſimple membranous, white, and thick canal, without any perceivable cartilaginous rings.

Organs of Digeſtion.—We have already mentioned the jaws and teeth. The tongue is not fleſhy, nor very moveable: it is ſupported, as in fiſhes, by the anterior extremity of the os hyoides. It does not reſemble that of the ſalamander, and much leſs that of the frog, both of which are more free behind than in front, and have a very glandular ſurface.

The œſophagus is folded longitudinally. The coats of the ſtomach are moderately thick; it firſt ſwells a little, then

then becomes mufcular and contracted, and is narrower than the duodenum. The latter is the wideft part of the inteftine, which becomes fmaller towards the anus. Although longer than the abdominal canal, and confequently forming feveral flight turns, it exhibits no great folds. There is no cæcum, nor any remarkable change of ftructure to point out the diftinctions of different kinds of inteftine. The pylorus has no valve; the mucous membrane of the ftomach is fmooth; that of the inteftine has papillæ like fmall fcales.

The canal is fupported by two parallel mefenteries, of which the right adheres to the whole length of the liver. There is no omentum.

The liver is black, elongated, and occupies more than three-fourths of the length of the abdomen. The gall-bladder is lodged in a deep groove towards its middle, and furnifhes a fingle canal, opening into the inteftine a little beyond the pylorus. No duct could be perceived coming directly from the liver, but fuch a one might have been confounded with the numerous mefenteric veffels.

A flender and very long fpleen is attached to the mefentery of the left fide, and occupies more than three-fourths of the length of the abdomen.

Organs of Generation.—The individual examined by Cuvier was a female. The ovaries were confiderably developed, about one-fourth of the length of the abdomen, oblong, compofed of lobes, filled with very vifible ova, although fo flaccid that they probably did not approach to the fize which they would have reached in the feafon of reproduction. A fhort and ftraight oviduct was clofely connected to the kidney: this part was very different from the long tortuous tubes of the frog and falamander, and approached to the ftructure of fifhes.

Organs of Secretion.—The kidnies were fmall, well fupplied with blood-veffels, and fituated at the fides of the rectum. The bladder elongated, and not divided as in frogs.

The conclufions drawn by Cuvier from the preceding account are; 1. That the firen, into whatever ftate it may pafs, is a diftinct animal, different in all the details of its organifation from the falamanders and their larvæ which we are acquainted with.

2. That it is very certainly not deftined to poffefs hind feet, and confequently is a biped reptile.

3. There is no reafon to fuppofe that it ever lofes its branchiæ, fince it is found to poffefs them at the largeft fize to which we know of its reaching, and the unanimous teftimony of thofe, who have feen the animal in its native country, proves that no individual has ever been feen without them.

4. That it is effentially different from fifhes in its ofteological ftructure, and even in the organifation of the branchiæ.

5. That it therefore conftitutes a particular genus of batracian reptiles, preferving always the double refpiratory organs; and may be confidered as a permanent larva of that family.

Anatomy of the Proteus Anguinus.—This animal was firft noticed in the Synopfis Reptilium of Laurenti, in 1768. Scopoli gave a more minute account of it in 1772, in his Annus quintus Hiftor. Nat. p. 75. Naturalifts were divided in opinion, whether it fhould be regarded as a perfect animal, or only as the larva of fome reptile. An excellent defcription of it, both as to its external characters and ftructure, was publifhed in the Philofophical Tranfactions for 1801, pt. 2, by Dr. Schreibers of Vienna, in a paper entitled "An hiftorical and anatomical Defcription of a doubtful amphibious Animal of Germany, called by Laurenti Proteus Anguinus." Cuvier has fince defcribed it in his Recherches fur quelques Reptiles douteux.

The individual examined by Cuvier was 0.25 of a metre in length, and of the fize of the little finger: Mr. Schreibers faw one of 0.33, or 13 Englifh inches. The body is flightly compreffed, and grooved at the fides, like the firen. The tail is more flattened, and furnifhed at its edges and end with a fin, which does not reach either above or below farther than the anus. The feet are flender; the knee and elbow being about their middle, and directed as in the falamanders; the fore-feet are terminated by three equal toes without nails, the hind-feet by two only; a combination, which is hitherto unique in the animal kingdom.

The head has fome refemblance to that of an eel; the opening of the mouth is of moderate fize, and furnifhed with thin lips. The noftrils are a longitudinal flit on each fide, parallel to the fide of the upper lip. No eye is perceptible externally; but when the animal is fkinned, it is feen under the integuments as a black point, about the thirtieth of a line in breadth.

In the depreffion produced by the mufcles at the fides of the cranium are feen the openings of the branchiæ. They are three, covered in fome degree by a prominence of the fkin, fupported by a mufcular ftratum. The branchiæ are three fmall appendages, of a red-blood colour in the living animal.

The fkin is whitifh, foft, fmooth, and prefents fome fmall prominences, when examined with a magnifying glafs.

Ofteology.—When the mufcles, that fwell the cranium externally, are removed, it appears flat, and quite on a level with the face; the latter terminates in a point in front. The middle of the cranium has its fides parallel; the pofterior part fwells out in the fituation of the prominences to which the lower jaw is articulated, which are directed forwards. Behind, the occiput has two lateral criftæ for the mufcles. The head is articulated with the atlas by two condyles: the under furface of the cranium is very flat.

There is no diftinct zygomatic arch, orbit, or temporal foffa.

All round the upper jaw is a row of fmall pointed and vertical teeth; and in front only a fmall additional row before the others. The inferior jaw has a fingle row of teeth. Its two branches are nearly rectilinear, and make an angle of about 45°. It has no afcending branch, and the coronoid procefs is inconfiderable. All thefe parts are well offified and firm; and, although the futures are ftill vifible, we cannot fail to fee that the bones belong to an animal very near the adult ftate.

The bony apparatus of the gills is much more firm than in the firen or axolotl, and fomewhat differently compofed. The hyoideal branches are flender, and fufpended to the fides of the cranium behind the articulation of the lower jaw. The os hyoides is fhort and thick, and fupports behind two pieces equally fhort and thick, which diverge a little. The firft arch of each fide, which is the largeft, is articulated to the extremity of one of thefe pieces, and has the two other arches attached to its pofterior edge.

There are fifty-fix vertebræ: the pelvis is attached to the thirty-firft; and the twenty-five following belong to the tail. Six only of thefe vertebræ, beginning with the fecond, fupport rudiments of ribs, ftill fmaller than thofe of the falamander and the firen.

All the vertebræ, excepting the laft of the tail, are perfectly offified: their form is peculiar to this fpecies.

Organs of Digeftion.—The tongue is fhort, with little power of motion in front, and fupported by the anterior extremity of the os hyoides. The inteſtinal canal extends nearly in a ſtraight line through the abdomen. The œſophagus is folded longitudinally; and the ſtomach is only a rather larger portion of the canal, not marked by any conſtriction. There is neither cæcum nor large inteſtine. An oblong liver, pointed at the two ends, of a blackiſh-grey colour, with two notches in its left edge, occupies about two-thirds of the length of the animal. A large gall-bladder, attached to the internal ſurface of the liver, pours the bile into the inteſtine by a ſhort canal. The pancreas is ſmall and narrow, and attached to the inteſtine oppoſite to the gall-bladder. An oblong narrow ſpleen is attached to the meſentery, and is about one-fourth of the length of the liver. The meſentery is ſimple, and has the uſual veſſels. There is no omentum.

The Organs of Circulation are the ſame as in the ſiren, except that the branchial veins unite together, to form the deſcending artery, rather lower down.

Organs of Reſpiration.—The branchiæ are moved, as in the axolotl, the ſiren, &c.: but no reptile has ſo ſmall a proportion of lung as the proteus. There is no larynx, properly ſo called, only a ſmall opening at the bottom of the pharynx, which is the entrance of a common creſcent-ſhaped cavity, the angles of which are prolonged to form the lungs. The latter are merely two very thin membranous canals, terminated by a ſlight dilatation, preſenting in their interior no diviſion into cells, and exhibiting very few blood-veſſels on their parietes. When we conſider how little difference there is between ſuch lungs and the forked air-bladders of ſome cartilaginous fiſhes, we can hardly help concluding that there is ſome analogy between the two organs.

Organs of Generation.—In the female diſſected by Cuvier, oblong lobed ovaries, full of very diſtinct ſmall ova, were ſituated towards the lower part of the abdomen, at the ſides of the rectum. Very long oviducts, making ſeveral turns, like thoſe of the ſalamander, aſcend to the anterior third part of the cavity.

Organs of Secretion.—There are kidnies and a bladder, as in the ſalamanders: the former are very long, and paſs high up in the abdomen.

All theſe obſervations, and particularly thoſe concerning the oſteology, make it clear that the proteus is a particular animal, different from all hitherto known: they alſo make it very probable that it is an adult animal, not deſtined to undergo any further change of ſtate.

A proteus taken alive threw up from its ſtomach many ſhells of the genus helix, but it would not take theſe ſhells or any other food, and became daily more languid and weak. It ſeemed, when alive, very torpid, and moved but ſeldom; it ſwam, however, ſometimes, with the help of its broad tail, very ſwiftly, in every direction. The firſt days it crept ſlowly on the bottom, and ſeemed to look for food; it often took a ſhell into its mouth, but gave it out again, ſwallowing none. Several times it roſe to the ſurface, ſtretched its head out of the water, and took in air, but returned directly to the bottom. It uſes its feet in creeping on the bottom, and in aſcending along the ſides of the veſſel, if of wood. It creeps very ſlowly or deliberately, inſomuch that this motion ſeemed quite characteriſtic of the animal.

It often produces a hiſſing kind of noiſe, pretty loud, more ſo than one ſhould expect from the ſize of the animal, and reſembling that produced by drawing the piſton of a ſyringe.

All the habits of the proteus deſignate a ſlowneſs and weakneſs agreeing very well with the exceſſive ſmallneſs of its pulmonary organs, and the very inconſiderable extent of their ſurface.

It is a very rare animal, having been hitherto found, and that in very ſmall numbers, only in thoſe lakes of Carniola, which are celebrated on account of their ſubterranean communications and the ſingular phenomena which reſult from them. That of Cirknitz is the moſt famous, and is regarded as the ſource of all the others. According to Laurenti, the firſt proteus was found in this: but Schreibers aſſures us that it only inhabits the lake called Sitticher See, communicating with the Cirknitz; and that it is thrown out in the overflowings, which occur once or twice a-year.

Cuvier thinks it probable that its natural abode is in the ſubterranean communications extending from one lake to the other. It has, in fact, all the characters of a ſubterraneous, as well as of an aquatic, animal. Its ſmall eyes, concealed and rendered uſeleſs by an opaque ſkin, recall to us the blind rat (zemni, mus, or ſpalax typhlus) which lives under ground, and has exactly the ſame organization.

In a letter to Cuvier, Schreibers informed him that, ſince the publication of his paper in 1801, he has met with ſeveral individuals, all perfectly alike, among which he had in vain ſought for one without the branchiæ. That he himſelf has ſome, which have been two years in his poſſeſſion, alive and well, although they have taken no food the whole time.

For the external figure and anatomy of this animal, ſee the plates ſubjoined to Dr. Schreibers' paper in the Phil. Tranſ. and pl. 13 of the Recueil d'Obſ. de Zool. et d'Anat. Comparée de Humboldt, v. 1.

Another of theſe doubtful animals has been figured in the Annales du Muſeum, v. 10. p. 230. pl. 17. under the name of protée, or ſalamandre tetradactyle, by Lacépéde, who has there deſcribed its external conformation. It poſſeſſes branchial appendages, eyes covered by the epidermis, and two rows of fine teeth. As only the ſpecimen deſcribed in the above quoted work is known (without any information about the quarter whence it came), its anatomical ſtructure has not been examined. All the appearances lead us to expect an internal organization like thoſe of the proteus and ſiren.

The following are the principal ſources of information on the ſubjects of the preceding article. Cuvier, Leçons d'Anatomie Comparée. Blumenbach's Manual of Comparative Anatomy; alſo his Specimen Phyſiologiæ comparatæ inter Animalia calidi et frigidi ſanguinis, 4to. Goett. 1787; or in Commentation. Soc. Reg. Scient. Goettingenſ. v. 8. Daudin, Hiſtoire Naturelle des Reptiles, in the 8vo. edition of Buffon by Sonnini, 8 tomes. Brongniart, Memoire ſur une nouvelle Claſſification des Reptiles. Lacépéde, Hiſtoire Naturelle des Quadrupedes ovipares et des Serpens. Latreille, Hiſt. Nat. des Salamandres de France, avec figures. Schneider, Hiſtoria Amphibiorum. Schoepff, Hiſtoria Teſtudinum, 4to. Schneider, Naturgeſchichte der Schild-kröten. Roeſel, Hiſtoria Ranarum. Memoires pour ſervir à l'Hiſtoire des Animaux. Tyſon's Anatomy of a Rattleſnake, Phil. Tranſ. v. 13. Swammerdam Biblia Naturæ. Charas, Nouvelles Expériences ſur la Vipère. Caldeſi, Oſſervazioni Anatomiche intorno alle Tartarughe, 4to. Hermann, Tabulæ affinitatum Animalium. Spallanzani's Diſſertations. Cuvier, Recherches ſur les Reptiles douteux, in Humboldt, Recueils d'Obſerv. de Zool. et d'Anat. Comp. v. 1. Various papers by Cuvier and Geoffroy St. Hilaire, in the Annales du Muſeum.

Reptiles are likewiſe uſed, abuſively, for plants which creep on the earth, or on other plants, as wanting ſtrength of ſtalk to ſuſtain themſelves.

Such

Such are cucumbers, melons, &c.; fuch alfo are ivy, the vine, and bryony.

REPTON, in *Geography*, a confiderable town in the hundred of Repton-and-Grefley, and county of Derby, England, is fituated near the banks of the river Trent, at the diftance of eight miles S.W. from the town of Derby, and four N.E. from Burton-upon-Trent in Staffordfhire. Among antiquaries it is celebrated as the fcite of the capital of the Mercian monarchy, and the burial-place of feveral of its fovereigns. At that period it was called Hreopandune; and is conjectured by fome to have rifen upon the ruins of the Roman ftation Repandunum; and the town is called Reppendune in ancient deeds. In the Saxon annals Repton is faid to have been noted for a noble monaftery of men and women, eftablifhed, under the government of an abbefs, previous to the year 660. This abbey was deftroyed by the Danes in the reign of Buthred, the laft king of Mercia, and remained in a defecrated ftate till the year 1172, when it was refounded as a priory by Matilda, widow of Ranulph, fecond earl of Chefter, who beftowed upon the monks the tithes of Repton, and confiderable eftates in the neighbourhood, befides Bartlow in Effex, and lands at Granfden, in Huntingdonfhire. At the diffolution its revenues were eftimated at 167*l.* 18*s.* 2*d.* In the original ftructure were depofited the remains of feveral of the Mercian kings; as were likewife thofe of Rynechardus, brother to Sigebert, king of the Weft Saxons. Some portions of the later buildings are yet in exiftence, being converted into a fchool-houfe and apartments for the mafter and ufher. The fchool-room, as appears from the windows and other traces, was either the refectory, or the hall, of the priory. It is fupported by a row of ftrong round columns, with pointed arches. At the northern extremity of this room was the dormitory; and on the eaft fide were fituated the cloifters, the area of which is now a garden. Adjoining the cloifters ftood the church which Fuller, in his "Church Hiftory," defcribes as an elegant and fpacious ftructure, fupported in the interior by pillars of alabafter, fragments of which have been occafionally laid open. Foundations of other buildings, befides thofe mentioned, may ftill be plainly traced in various directions; and on the fcite of the prior's lodging is a manfion called Old Trent, built about a century ago, which difplays, towards the water, a curious brick tower with an ornamental cornice, part of a former building, erected by Prior Overton in the reign of Henry VI.

Repton confifts chiefly of one ftreet of fcattered houfes, extending about a mile in length, and watered by a fine ftream, which difcharges itfelf into the Trent. At the lower end of the town ftands the parifh church, a large, handfome edifice, ornamented with a fine fpire two hundred feet high. Tradition affirms that the prefent is the third church which has occupied the fame fcite; and there can be no doubt that parts of it are of different and diftant dates. The nave and fide aifles feem to be of the reign of Edward III.; but the chancel is probably more ancient, as its columns are maffive, and its arches femicircular. Beneath this part of the church is a crypt, bearing a ftrong refemblance, in form and ornaments, to the crypt under Canterbury cathedral, and alfo to that under St. Peter's in the Eaft, at Oxford. In the interior of this building are feveral handfome monuments to the memory of the Thacker family. Within a clofe behind the church, a labourer fome years ago difcovered a cemetery, which contained among many other human fkeletons, one of an extraordinary fize, meafuring nine feet in length. This difcovery is noticed by Dr. Pegge in the Philofophical Tranfactions for the year 1734. An old ftone crofs, confifting of a fingle fhaft, placed upon eight octagonal fteps, ftands in the area fronting the church. The parifh of Repton, according to the parliamentary returns of 1811, contains 326 houfes, and 1648 inhabitants, who are chiefly engaged in purfuits connected with agriculture.

At a fhort diftance from Repton is Sudbury, the feat and property of the family of Vernon, which is of great antiquity, deriving its defcent from Richard de Vernon, a Norman lord, who accompanied the Conqueror to England; and was one of the feven barons created by Hugh Lupus, the great earl of Chefter. Sir Ralph de Vernon, who was alive in the reign of Edward II., is faid to have reached the extraordinary age of 150 years. Sudbury church, an ancient fabric, ftanding in the garden near the houfe, is decorated with many fepulchral tombs to members of this family. One, in commemoration of Catharine, daughter to the late lord Vernon, is remarkable for the beauty of the epitaph, which was written by William Whitehead, poet-laureat.

At Egginton, on the banks of the river Dove, weft of Repton, is a feat of fir Henry Every, whofe family was originally feated in Somerfetfhire. Part of the old manfion here was deftroyed by fire in the year 1736, and the prefent houfe then erected on its fcite.

Bretly park, the feat of the earl of Chefterfield, is about three miles S.W. of Repton. About three miles E. of Bretly is Calke hall, the feat of fir Henry Harpur, bart. The houfe is a fpacious quadrangular edifice, feated in a park furrounded by eminences. Beauties of England and Wales, vol. iii. by John Britton and E. W. Brayley, 1802.

END OF VOL. XXIX.

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