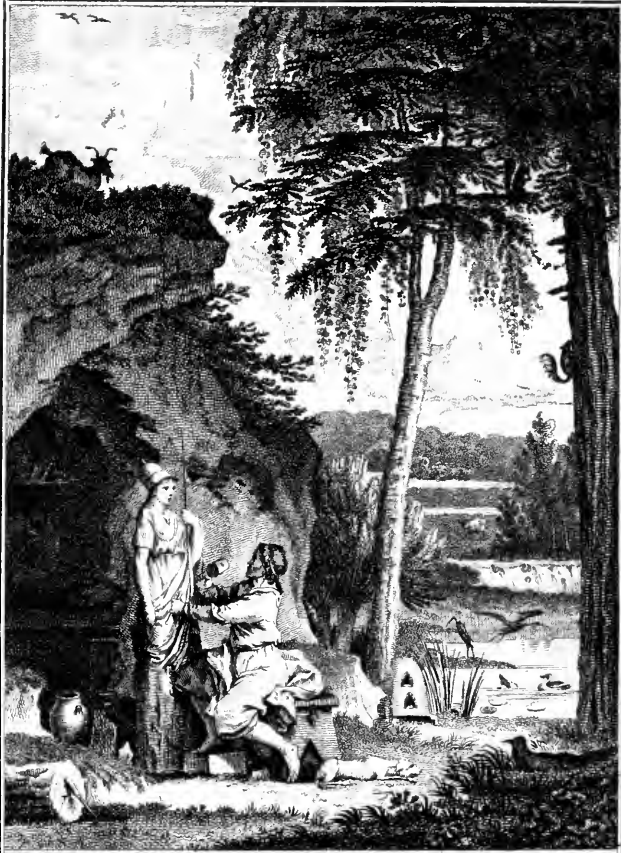




STUDIES
OF
N A T U R E.

VOL. I.



PHILOCTES *in the Island of SAMOS*

L. J. Smith.

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STUDIES
OF
N A T U R E.

BY
JAMES-HENRY-BERNARDIN
DE SAINT-PIERRE.

.....MISERIS SUCCURERE DISCO.

TRANSLATED BY
HENRY HUNTER, D. D.
MINISTER OF THE SCOTS CHURCH, LONDON-WALL.

IN FIVE VOLUMES.

VOL. I.

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M DCC XCVI.

PREFACE.

A MAN who has himself derived pleasure, or instruction, from the perusal of a Book, naturally wishes to have these advantages communicated to others; for we presume, that what has singularly affected ourselves, is likely to produce a similar impression on the rest of Mankind. I have read few Performances with more complete satisfaction, and with greater improvement, than the *Studies of Nature*: in no one have I found the useful and the agreeable more happily blended. What Work of Science displays a more sublime Theology, inculcates a purer Morality, or breathes a more ardent and more expansive Philanthropy? *Saint-Pierre* has enabled

me to contemplate the Universe with other eyes, has furnished new arguments to combat Atheism, has established, beyond the power of contradiction, the doctrine of an universal Providence, has excited a warmer interest in favour of suffering Humanity, and has disclosed sources, unknown before, of moral and intellectual enjoyment. Unfettered by System, unawed by Authority, he looks immediately into Nature; he observes, he thinks, he reasons for himself, and teaches his Reader thus to observe, think, and reason.

Like every one who has the courage to attack established error, and to advance new truths, he has been treated, in his own Country, with affected contempt, has been traduced, has been ridiculed. But time, and farther observation and experience alone must determine,

mine, whether his, or the received Theory of the Tides, that great engine of Nature, be most conformable to the real order of the Globe. He no where discovers the spirit of an adversary; he contends not for triumph, but for what he deems to be truth; he honours the virtues of those whose opinions he finds himself constrained to oppose; for, with him, Goodness is ever in higher estimation than Science, and Probity than Talents.

He discovers more than one trait of resemblance to his illustrious friend, and fellow-labourer in the field of Nature, *John-James Rousseau*; the same over acute sensibility, the same occasional fits of querulousness, the same irritability under the flea-bitings of anonymous criticism. *Saint-Pierre* ought to have known that his immortal Work was

to be transmitted for the instruction and delight of ages and nations unborn, long, long after the diurnal and menſtrual effuſions of anonymous journaliſts had ſunk into everlaſting oblivion. He ought to have held on the majeſtic “tenor of his way,” equally regardleſs of their notice and of their neglect, of their censure and of their approbation, of their flattery and of their frown. What matters it to ſuch a man, whether *Etudes de la Nature* be abuſed or extolled in the *Journal de Paris*? He has unwittingly conferred on his critics an immortality not their own. One *Homer* has formed ten thouſand critics, but all the critics that ever exiſted could not conſtitute the ten thouſandth part of one *Homer*.

It is a ſingular phenomenon in the Hiſtory of the preſent Period, that the Author of *Studies of Nature*, the
profefſed

professed Panegyrist and Pensioner of the ill-fated *Louis XVI.* should be caressed, should be respected, should be promoted to honour, by that very National Convention which degraded, dethroned, decapitated his patron and benefactor. Can a stronger testimony be borne to wisdom and virtue?

Unfortunately for the Translator, the times admitted not of opening a correspondence with the Author, by which he might have availed himself, for obtaining a solution of many difficulties and doubts that arose in the execution of his task, and by which he might have rendered the Translation less unworthy of the Original. The same cause forbade the gratification of a wish which he fondly entertained, that of presenting the English Reader with an engraved portrait of the form of the Man, with
whose

whose mind he was endeavouring to make him acquainted. I have not even been able to discover whether a portrait of him actually exists; at any rate, the present state of things rendered impracticable every attempt to procure a copy of it.

After what the Author has himself said, in his advertisements, of the reception which his Book has met with on the Continent, it would be impertinent to trouble the Reader with any History of the Publication. The incense which has been offered to him, and the abuse he has sustained; the rapid sale of his own successive Editions, and the multiplied piratical depredations committed upon him, constitute together an irresistible proof of the merit of the Work. How it is to be relished by the English Public, must be submitted to the deter-

determination of time. The Translator dares not to flatter himself with the belief, that the enthusiasm of the Reader of this Version is to keep pace with his own admiration of the Original; but if he may judge of the general mind from the sentiments occasionally expressed, by persons of various descriptions, and of both sexes, to whom a considerable part of the Book was submitted, in the progress of Translation, he is not destitute of hope that it may excite something of that interest, and produce a part of that effect, in England, which have attended the several French Editions.

Saint-Pierre, Frenchman as he ardently professes himself to be, omits no occasion to do justice to the English Character. If he combats an astronomical Theory of our deservedly boasted *Newton*, he bestows unreserved praise
on

on his real discoveries, and on what he prizes still more highly, the great qualities of his heart and mind. If he seems to have acquired any advantage over the Prince of Philosophers, he himself ascribes it chiefly to the weapons furnished him by English Observers and Navigators, particularly *Dampier*, *Ellis*, *Anson*, *Carteret*, *Byron*, *Cooke*, *Clerke*, *Wales*, and the great *Newton* himself. Thus, in a noble and liberal mind, candor and acuteness of investigation walk hand in hand.

I have endeavoured to profit by all the foreign Editions which I was able to procure. The few notes which I have presumed to introduce, are marked with my initials, to distinguish them from those of the Author. With all my attention to the press, a few slips, I am sorry to observe, have crept in. In the
hurry

hurry of transcription, the proper name *Samos*, in Vol. I. page 104, has been inadvertently substituted in place of *Lemnos*, and in page 178, line 7, from the bottom, the words *do not* ought to have been omitted; and toward the conclusion of *Paul and Virginia*, in a reference to the *Isle of France*, or *Mauritius*, which is an African Island, instead of the general term *Colonies*, the phrase *West-India Islands* is improperly used. The names of several Tropical vegetables, fishes, quadrupeds, and birds, in a great measure unknown to Europe, are exactly transcribed, or translated, according as the case required. I have, in a few instances, adopted the Author's orthography of certain names of Places, in preference to our own, because it seemed more agreeable to the eye, and, at the same time, conveyed a more distinct sound to the Ear. If I have failed

failed in doing justice to my great Original, it is to be imputed neither to want of zeal nor to wilful inattention: To what then?---capacity inadequate to an undertaking so arduous.

H. H.

Bethnal-Green Road,

4th Nov. 1795.

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ADVERTISEMENT

RESPECTING

THE PRESENT EDITION,

AND

THE WORK IN GENERAL.

THE first Edition of this Work, published in December 1784, was nearly out of print in December 1785. It run it's natural course, in about the space of a year, without my having employed any one trick of the trade to puff it off, to accelerate the sale, or to send it abroad for a market : I may therefore flatter myself, that it has been graciously received in my own Country. It appears likewise to have been relished by strangers ; for, within these six months, pirated impressions of it have appeared at Geneva and Avignon ; and this literary plunder might have injured me, had not M. *Laurent de Villedeuil*, then Director-general of the Press, now Intendant of Rouen, and universally known for the strictest honour and probity of character, given, on my simple request,

the most peremptory orders to prohibit the admission of these pirated copies into the Kingdom *. Farther, the publication of this Work afforded an opportunity to Messrs. the Count *de Vergennes*, the Baron *de Breteuil*, and *de Calonne*, my ancient and illustrious subscribers, at the solicitation of my respectable friends, Messrs. *Hennin* and *Mesnard*, of Conichard, of procuring for me, or for my family, some annual marks of the KING's benevolence.

This success ought, undoubtedly, to have satisfied me; but I am no less so with the honourable professions of friendship which have been tendered to me, by persons of all conditions, and of both sexes, most of whom are unknown to me. Some distinguished me by their visits; and others, by epistolary addresses the most affecting, conveying their thanks for my Book, as if, in giving it to the Public, I had conferred a personal obligation on themselves. Several of them have invited me to

* I have been informed, that, within these four months, they had found their way to Lyons, to Marfeilles, to Toulon, and, undoubtedly, to other places; so that the bookfellers of those cities have not been provided, for four months past, with copies of my Edition, by which the sale of it has been considerably checked. An infringement so unjustifiable of the rights of property of Authors, and of their privileges, and so contrary to Royal authority, ought certainly to be discouraged. And I look for redress against these acts of injustice from the equity of the Magistrate who presides over the Press.

take

take up my residence at their country-seats, and to enjoy those rural scenes, of which, as they are pleased to say, I am so passionately fond. Yes, undoubtedly, I should dearly love a country residence, but a residence which I could call my own, and not another man's.

I made the best acknowledgment in my power, to tenders of service so flattering; but could avail myself only of the good-will which they breathed. Benevolence is the flower of friendship, and its perfume always lasts while you let it remain on the stem, without gathering it. The afflicted father of a family has informed me, that my Studies were to him the sweetest source of consolation in his distress. An Atheist, of a city far distant from Paris, has paid me frequent visits, struck even to admiration, as he said, at the harmonies of plants which I had indicated, and of which he had recognized the existence in Nature.

Personages of real importance, and others who wished to pass for such, have endeavoured to allure me to them, by holding out gilded prospects of melioration of fortune: but as long as I can attain the rare felicity of being beloved, and, what is of still greater importance to me, the power of being useful, so long shall I fly, if I can, the calamity so common, and so humiliating, of being under protection.

tection. I speak not thus out of vanity, but to express my gratitude, in the best manner I am able, as my custom is, for the slightest marks of kindness shewn me, provided I can believe them sincere.

I have reason to believe, then, from these concurring suffrages of persons of character, that GOD has been pleased to bless my labours, though chargeable with manifold imperfections. I consider it to be my duty to render the Work as worthy of the public esteem as I can : accordingly, I have corrected, in this New Edition, the errors of the Press, the blemishes in point of style, and the obscurities in point of meaning, which I remarked in the first ; and this partly by myself, partly with the assistance of certain well-informed friends, without, however, retrenching any thing material, and this too in conformity to their wishes. I have only taken the liberty, for the sake of perspicuity, to make some transpositions in the notes. In the same view I have added some others, and among these, in the explication of the plates, a geometrical figure, which renders perceptible to the eye the mistake of our Astronomers, respecting the flatness of the Earth at the Poles, and affords new proofs of the alternate and half-yearly course of the Atlantic Ocean, by the melting of the polar ices. Finally, I have employed a set of new and
beautiful

beautiful types of the foundery of M. *Didot* the younger, that the reputation of this Artift might contribute it's fhare toward the celebrity of the Work.

I fhould have deemed myfelf happy to derive information refpecting the fubject of my Book, from the illumination, and candid decifions, of literary Journalifts. Gentlemen of this defcription have been left, for this purpofe, entirely to their own difcretion; for I have neither by myfelf, or others, folicted approbation, or deprecated criticifin; but they have, for the moft part, confined themfelves to obfervations of no effential importance. That Journal which contains, of all others, the greateft variety of articles, and which, from the great talents of the perfons engaged in conducting it, feemed moft likely to inftruct me, finds fault with me for having affirmed, That animals were not expofed, by Nature, to perifh, like Man, by famine; and it has objected to me, the cafe of partridges and hares, in the vicinity of Paris, which fometimes die of hunger in the Winter. But as, on the one hand, thefe animals are multiplied without end, all around Paris; and as, on the other, we mow down every thing, even to a blade of grafs, it neceffarily muft, fometimes, happen, that they perifh with hunger, efpecially if the Winter is fomewhat long. The famine, there-

fore, which they endure in our fields, is occasioned by the inconsiderateness of Man, not the improvidence of Nature. Partridges and hares do not die of hunger in the forests of the North, where the Winter lasts for six months together: they know well how to find under the snow, the herbage and fir apples of the preceding year, which Nature has buried there to serve them as a seasonable supply.

The other objections raised, against some of my positions, by the Gentlemen Journalists, are neither more important, nor much better founded. Most of them treat as a paradox the cause of the flux and reflux of the Sea, which I ascribe to the alternate fusion of the polar ices; which ices, in the Winter proper to each Hemisphere, are from five to six thousand leagues in circumference, but in their Summer, are not above two or three thousand. But as no one of them has produced a single argument, either against the principles of my theory, or against the facts by which I support them, or against the consequences which I thence deduce, I have nothing to say in reply, unless that, as to the point in question, they have pronounced a decision, without having examined into the merits of the cause; an expeditious, indeed, but not perfectly equitable, method of administering justice.

The

The Gentleman who has the greatest number of supporters, and who, undoubtedly well merits that support, for the taste which he displays, in his daily criticisms of literary productions, has objected to me, transiently, that I destroy the action of the Moon, which is in such perfect harmony with the phenomena of the tides. It is evident, that he has not taken the trouble to inform himself, either respecting my new Theory, or the old one. I destroy nothing of the Moon's action on the Seas; but, instead of making her to act on the fluid Seas of the Equator, by an astronomical attraction, which produces not the slightest effect on the mediterraneans and lakes of the torrid Zone itself, I make her to act on the frozen Seas of the Poles, by the reflected heat of the Sun, acknowledged by the Ancients *, demonstrated by the
 Moderns,

* "The Moon dissolves ice by the humidity of her influence." Pliny's Natural History, book ii. chap. 101. When the Moon shines, in the nights of Winter, in all her lustre, it freezes, no doubt, very sharply: because that, in this case, the North wind, which occasions this serenity of the air, checks the warming influence of the Moon; but if the wind is stilled ever so little, you see the Heavens covered with vapours which exhale from the Earth, and you feel the Atmosphere softened. I ascribe, as Pliny does, to the light of that Star, a particular action on the frozen waters of the Earth and on the Air; for I have frequently seen, in the fine nights of the torrid Zone, all the clouds of the Atmosphere dispersed, in an ascending direction,

Moderns, and which every man may experimentally demonstrate to himself, with a glass of water.

Besides, it is far from being true, that the phases of the Moon are, all over the Earth, in harmony with the movements of the Seas. The flux and reflux of the Sea, on our coasts, follow rather the mean, than the real motion of the Moon. In other places, they are subject to different laws, which obliged *Newton* himself to admit, “ That there
 “ must of necessity be, in the periodical return of
 “ the Tides, some other mixed cause, hitherto

tion; which suggested the proverb in common use among sailors, *the Moon is eating up the clouds.*

Besides, our Naturalists contradict themselves, in supposing that the Moon moves the Ocean, while they refuse it all manner of influence, not only on the ices, but on plants, because, say they, it's heat does not make the fluid to ascend in the thermometer. I do not know, in fact, whether it does, or does not act, on spirit of wine: but what conclusion can be deduced from this? The igneous particles contained in pepper, cloves, pimento, caustics, &c. which have such a powerful action on the fluids of the human body, would they communicate to spirit of wine the slightest tendency to ascend, by making an infusion of them with that fluid? Fire, as well as the other Elements, undergoes combinations, which multiply it's action, in such and such an alliance, and reduce it to mere nothing in a different situation. We must not pretend, then, with our instruments of Philosophy, to arrive at the capability of determining the effects of natural causes,

“ undiscover-

“undiscovered*.” The explanation of these phenomena, which bid defiance to the Astronomic System, are in perfect harmony with my natural Theory, which ascribes to the alternate heat of the Sun, whether direct, or reflected by the Moon, on the ices of the two Poles, the cause, the variety, and the constant return, of the Tides; and, especially, of the general and alternate Currents of the Ocean, which are the immediate moving principles of these Tides. Our Astronomers, notwithstanding, have never attempted to give any account of the half-yearly versatility of these general Currents, so well known in the Indian Ocean; nay, they appear to have been hitherto ignorant, that there existed similar Currents in the Atlantic. This is, however, a fact which can no longer be called in question, after the new proofs which I exhibit at the end of the Fourth Volume of this Work.

I have advanced, then, no paradox, respecting causes so evident; but I have opposed to an astronomical system, totally destitute of physical proof, facts incontrovertible, deduced from all the kingdoms of Nature; facts which have a multitude of correspondencies in the flux and reflux of all rivers and lakes which are fed from icy mountains, and

* *Newton's Philosophy*, chap. xxv.

which

which I could easily multiply, and exhibit in new lights, relatively to the Ocean itself, if there were occasion, and if health permitted.

One Journal which, from the title it assumes, would seem destined to inform all Europe, as well as that which, from its title, would be thought reserved for the use of the learned, have thought proper to maintain a profound silence, not only with regard to natural truths so new, and so important, but even with respect to my whole Work. Others have opposed to me, as a complete refutation, the authority of *Newton*, who did not think as I do. I respect *Newton* for his genius and for his virtues, but I respect truth still much more. The authority of great names serves but too frequently as a strong hold to error. It is thus that, on the faith of a *Maupertuis*, and of a *Condamine*, Europe has till now believed, that the Earth was flattened at the Poles. I demonstrate, after their own operations, in the *explication of the plates*, at the end of the first volume, that it is lengthened out at the Poles. What answer is it possible to give to the geometrical demonstration which I produce of it? For my own part, I am perfectly convinced, that *Newton* himself would, at this day, renounce such an erroneous opinion, though he was the first who broached it, if the truth must be told.

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The Reader will be, undoubtedly, very much surprized, to find men, of such celebrity, falling into contradiction so unaccountable ; a contradiction adopted on their assertion, and publicly taught in all the Schools of Europe ; and that no one should have appeared to refute the error, and armed with sufficient courage to maintain the truth. I was so astonished at it myself, that I remained for some time under the belief that I, and not they, had, on this article, lost every sentiment of evidence. I dared not even to disclose my thoughts to any person respecting this, any more than the other objects of these Studies ; for scarcely have I met, in my progress through life, any but men sold to the systems which have led to fortune, or to those which promise to do so. Accordingly, the more I was in the right, being alone and not backed by puffers, the more disadvantageous was the ground on which I had to combat them. Besides, how is it possible to reason with persons, who shroud themselves in the clouds of equations, or of metaphysical distinctions, if you press them ever so little by the sentiment of truth ? When such refuges fail, they overwhelm you with authorities innumerable, which have subjugated themselves, without a process of reasoning ; and by which they mean to subdue, in their turn, the man especially who has not joined himself to any party.

What

What then could I have done in this crowd of men, vain and intolerant, to each of whom an European education says, from the days of infancy, *Be the first*; and among so many Doctors titled, and without titles, who have appropriated to themselves the right to freedom of speech, unless it were to shut myself up, as I frequently do, in my freedom of silence? * If I speak there, it is of few things, or of things of slight importance.

In the solitary and unconstrained paths, however, through which I followed truth, I recovered

* In such society, a man is not permitted to remain long in possession of his right of silence; for they who speak chuse to have no hearers but such as are disposed to applaud.

I have remarked, that the degree of attention which the world pays to its orators, is always in proportion to the degree of power, or of malignity, which it supposes them to possess: Truth, reason, wit itself, in that case, go for nothing. If you would make the world listen to you, you must make yourself feared. Those, accordingly, who shine in it, frequently employ turns of phraseology which give you to understand, that they are powerful friends, or dangerous adversaries. Every plain, modest, candid, good man, is, therefore, reduced to silence before them: it is in his power, however, to get deliverance from this state of constraint, if he can bring himself to flatter his tyrants. But this would, in me, produce the diametrically opposite effect, for I can flatter only where I love.

Fly from the world, then, ye who will neither flatter nor malign; for you will lose in it, at once, the good which you expected from it, and that which is the gift of your own conscience.

my

my confidence, with the new rays which her light diffused, recollecting that the most celebrated scholars had been, in all ages, as much blinded by their own errors, as the illiterate are by those of other people. Besides, in order to detect the inconsequent reasoning of modern Astronomers, it was necessary to employ only some principles of Geometry, which are level to my capacity, and to that of all mankind. Accordingly, having full conviction, from a multitude of observations, meteorological, nautical, vegetable, and animal, that the waters of the polar ices had a natural proclivity southward as far as the Equator, and vexed at being contradicted by the operations, more celebrated than they deserve to be, of Geometricians, I had the courage to examine their results, and became convinced, that they ought to be the same with my own. In a former Edition, I presented both the one and the other to the Public: theirs remain without a defence, and mine stand unimpeached, though without declared partisans. In a second Edition, I have demonstrated their error on the principles of Geometry; I now expect a decision from the conscience of every candid Reader.

By the prejudices of education our Astronomers have been thus misled; those prejudices which, from infancy, attach us, without reflecting, to fashionable errors, that lead to fortune, and which

which engage us to reject solitary truths that lead to none. They have been seduced by the reputation of *Newton*, which has been objected to myself, and *Newton* had himself been seduced, as usually happens, by his own system. That sublime Geometrician proceeded on the supposition, that the centrifugal force, which he applied to the motion of the Stars, had flattened the Poles of the Earth, by acting upon it's Equator. *Norwood*, a Mathematician of England, having found, by measuring the Meridian from London to York, the terrestrial degree to be eight fathom greater than that which *Cassini* had measured in France, "*Newton*," says *Voltaire*, ascribed this small excess of eight fathom, in a degree, to the figure of the Earth, which he believed to be that of a spheroid flattened toward the Poles; and he concluded, that *Norwood*, having taken his Meridian in a region to the northward of our's, must have found his degree to be greater than that of *Cassini*, as he supposed the curve of the Earth measured by *Norwood* to be the longer of the two.* It is evident that, the degree being greater, and the curve longer, toward the North, *Newton* ought to have concluded that the Earth was lengthened out at the Poles; but he deduced the directly opposite conclusion, namely, that it

* *Newton's* Philosophy, chap. xviii.

was flattened there. The truth is, his system of the Heavens occupying all the faculties of his vast genius, prevented his detecting on the Earth a geometrical inconsequence: he adopted, therefore, without examination, an experiment which he thought favourable to his system, not perceiving that it was diametrically opposite to him. Modern Astronomers have, in their turn, suffered themselves to be seduced by the reputation of *Newton*, and by a weakness so apt to warp the human mind, that of attempting to explain all the operations of Nature by a single law. *Bouguer* himself, one of their co-operators, in his *Treatise on Navigation*, book v. chap. v. §. 2. page 435, says expressly, that, “on this discovery of the flattening of the Poles, the whole of Physics, almost, depends.”

Our Astronomers, then, have set out on a ramble to the extremities of the Earth, in quest of physical proofs of a celestial system, happy and luminous; and they were so dazzled with it beforehand, that they mistook, in their turn, the truth itself, which, far from the prejudices of Europe, had, in deserts, just sought refuge under their wings. If the most illustrious of modern Geometricians, could fall into so gross an error in his peculiar Science; and if Astronomers, in other respects, abundantly filled with a sense of their

own sagacity, have, under the influence of his name merely, deduced from their own operations a false conclusion in support of that error; rejected the preceding experiments of their Schools, respecting the sinking of the barometer in the North, with the other geographical observations which contradicted it; established on it the basis of all future physical knowledge; and have given it afterwards, by the weight of their own reputation, an authority which has not left, to the rest of the Learned World, so much as the liberty of doubting; it behoves us, poor, ignorant, and obscure men, to take good care of ourselves, we who search after truth singly for the happiness of knowing it. Let us mistrust, then, in our researches after it, all human authority, as *Descartes* did, who, by doubting only, dissipated the Philosophy of the age in which he lived, which had so long concealed the laws of Nature from the eyes of all Europe, by means of the prejudice of the name of Aristotle, then held sacred in every University: and let us assume as a maxim, that which led *Newton* himself to so many real discoveries, and after him the Royal Society of London, who have taken it for their motto: NULLIUS IN VERBA.

To return to literary Journals, if they have, as it were in concert, withheld their approbation from
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the natural objects of these Studies, one of them has advanced, as I am told, that I had borrowed my Theory of the Tides by means of the polar ices, from certain Latin Authors. This Theory is at last, it seems, gaining profelytes, since it is exciting envy.

To that imputation this is my answer. Had I known of any Latin Author who ascribed the Tides to the melting of the polar ices, I would certainly have named him, as a piece of justice, which the design of my Work, as well as every principle of conscience, demanded of me. I have not had, like so many Philosophers, the vanity of creating, at my ease, a World after my own fancy : but I have endeavoured, with no small labour, to collect the several pieces of the plan of that in which we live, dispersed among the men of all ages, and of all nations, who have observed it with the greatest care. Accordingly, I have taken my ideas of the allongation of the Earth at the Poles, from *Childrey*, *Kepler*, *Tycho-Brabé*, *Cassini*.....and above all, from the operations of modern Astronomers ; of the extent of the frozen Oceans which cover the Poles, from *Denis*, *Barents*, *Cook*, and all the Navigators of the North and South Seas ; of the ancient deviation of the Sun from the Ecliptic, from Egyptian Traditions, Chinese Annals, and even from the Grecian Mythology ; of the total fusion

of the polar ices, and of the universal Deluge which it produced, from Moses and Job ; of the heat of the Moon, and it's effects on ice and water, from *Pliny*, and from recent experiments made at Rome and at Paris ; of the Currents and Tides which flow alternately from the Poles toward the Equator, from *Christopher Columbus*, *Barents*, *Marten*, *Ellis*, *Linschotten*, *Abel-Tasman*, *Dampier*, *Pennant*, *Rennefort*, &c. I have quoted all these Observers in terms of high approbation.

Had I known of any Latin Author, who ascribed to the melting of the polar ices the cause of the Tides, in so much as any one part of the Ocean, I would have quoted him in like manner, reserving to myself the glory of the Architect, that of combining, and arranging these detached observations ; of allotting them to their peculiar seasons and latitudes, in order to clear them of the apparent contradictions, which had hitherto prevented the deduction of any fair consequence from them ; and, in a word, to assign a cause, and evident means, for effects which, during so many ages, had been involved in mystery. I have formed, then, one Whole of all these scattered truths, and have deduced from them the general harmony of the movements of the Ocean, of which the heat of the Sun is the first *cause*, the polar ices are the *means*, and the half-yearly and alternate Currents
of

of the Seas, with the diurnal Tides on our coasts, are the *effects* *. Accordingly, if some persons before me, have affirmed, that the Tides are produced by the melting of the polar ices, which I am to this hour ignorant that any one ever did, I, at least, am the first who demonstrated it. Other Europeans, prior to *Christopher Columbus*, said that

* It will be a matter of some difficulty for many persons, to conceive how our Tides should possibly, in Summer, re-ascend toward the North Pole, at the very season when the Current which produces them is rushing down from that Pole. They may see a very sensible image of these retrograde effects of running waters, at the bridge of Notre-Dame, at the opening of the arch which is supported by the Quay Pelletier. The Current of the Seine, directed obliquely by a kind of dam, against a pile of that arch, produces there a counter-current, which constantly re-ascends against the course of the river, up to the very bubbling over of the dam. In like manner, the meltings of the northern ices descend, in Summer, from the bays adjacent to the polar Circle, going at the rate of from eight to ten leagues an hour, according to *Ellis, Linfjebotten*, and *Barents*; they flow toward the South, in the middle of the Atlantic Ocean; but coming to meet on their shores, almost in front, Africa and America, where they project on both sides, a violent reflux is produced, to right and left, along the coasts of both Continents, which is forced northward above the Capes Boïador and St. Augustin, which are rendered famous by their Currents. Now, as the sources from which they issue have an intermittent flux of acceleration and retardation, occasioned by the diurnal and nocturnal action of the Sun on the ices of the eastern and western Hemisphere of the Pole, their lateral counter-currents, that is, their Tides, have likewise a similar intermittent flux.

there was another World ; but he was the first who landed upon it. If others, in like manner, had affirmed, that the Tides have their origin at the Poles, no one had believed them, because it was an affirmation destitute of proof.

Before it was possible for me to collect and to complete my proofs, and to render them perfectly luminous, it became necessary to dispel those thick clouds of venerable errors, such as Poles flattened, and washed with Seas clear of ice, which our pretended Sciences had spread between truth and us, and which were sufficient to involve all our Physics in an eternal night. Here, then, is the glory at which I aspire, that of assembling some of the harmonies of Nature, in order to form a concert of them, which should elevate Man toward the great AUTHOR of All: or, rather, I have aimed only at the felicity of knowing them myself, and of pointing them out to my fellow-creatures ; for I am ready to adopt any other system, which shall present to the human understanding a higher degree of probability, and to the heart of Man a purer consolation.

To GOD alone glory is to be ascribed, and peace is Man's choicest possession, which is never so pure and so profound as in the perception and the feeling of that very Glory which governs the
Universe.

Univerſe. My higheſt ambition is the delight of diſcovering ſome new rays of it, and, henceforward, my moſt ardent wiſh is to have the remainder of my days illuminated by it, to the excluſion, as far as I am perſonally concerned, of that vain, fantaſtical, unſatisfying, inconstant glory, which the world gives and takes away at pleaſure.

I have been thus diſcuſe on the right which I claim to the diſcovery of the cauſe of the Currents and Tides, from the melting of the polar ices, becauſe, having oppoſed to moſt of the received opinions on that ſubject, many obſervations which I challenge as my own, if each required a ſpecial manifeſto, to aſcertain my property in it, there would be no end to my advancing ſuch pretenſions. Beſides, if they ſhall acquire ſo much celebrity as to procure me, according to the ſpirit of the age in which we live, perfidious applauſe, underhand perſecution, affected commiſeration, all calculated to blaſt my uncertain, tardy, and hitherto hardly budding fortunes, I ſolemnly declare that, aſſociated with no party, and able to oppoſe no one but myſelf ſingly to every new adverſary, inſtead of cramming the public prints, as the cuſtom is, with recrimination, abuſe, complaint, lamentation, the waſte of time, I ſhall defend myſelf only on my own ground, and ſhall oppoſe to my enemies, whether ſecret or avowed,

Truth; and nothing but Truth. It's mirror shall be my Egis; and their image reflected from it, shall become to each a Medusa's head. Or rather, may it be my lot, far remote from fickle and treacherous Man, under the roof of a small rustic cot, which I can call my own, on the border of a wood, elicit the statue of my Minerva from the trunk of her own tree, and place, at last, a whole Globe at her feet.

Farther, if the Gentlemen Reviewers have withheld from me their suffrages, respecting objects of so much importance to the progress of natural knowledge, and if others have got the start of me, in precluding my claim to those of the Public, I can already boast the concurrence of illustrious names, among all conditions of men. The Sorbonne, to whom I am personally unknown, has done me the honour of adopting the new proofs of the Universal Deluge, which I have deduced from the total fusion of the polar ices: these proofs have been laid down as axiomatical, in one of it's theses, maintained, for the first time, by the Abbé *de Vigueras*, in his academical exercise of the 6th July, 1785.

After all, supposing my friends the Reviewers to have expressed still more reluctance to give an account of opinions, which contradict those of Academies,

Academies,

Academies, and strange even to most of themselves ; and which must have had a suspicious appearance, from their very novelty, they have made me most ample compensation, in applauding me, far beyond my desert, for moral qualities, infinitely beyond the value of physical discoveries, and which I should deem myself singularly happy to attain *.

All that is left me, therefore, is to congratulate myself on the general interest, with which the Public has received the moral part of this Work. I have, however, left untouched the great objects of political and moral reform ; the one, because it was not permitted me to treat them as my conscience would have directed ; and the other, because my plan could not comprehend them. I have restricted myself merely to abuses, which it is in the power of Government to rectify : but there are others, as universal, which depend entirely on national manners. Such is, among others,

* I ought, undoubtedly, to distinguish, in the number of my panegyrists, the two first Writers who have given an account of my Work. The one, notwithstanding the finalness of his page, and his propensity to find fault, has announced it in a manner the most flattering ; and the other, devoted to the defence of morals and religion, has placed me by the side of a man, at whose feet I would have thought myself happy to sit, had Providence bestowed on me the blessing of being his contemporary.

the celibacy of most domestic servants. Had it been in my power to have enlarged on this topic, I could have demonstrated, that the arrangements of Society never can contravene the laws of Nature ; that it is the interest of masters to have their domestics marry, because they pay, let them do their best, the expense of the smuggled libertinism of servants, much more excessive, beyond all question, than that of an honest settlement, for the strumpet always will spend more than the woman of character.

I could have demonstrated the pernicious influence which the bad morals of unmarried servants have on the children of their masters. I could, likewise, have dilated on the harshness of our pretended Fathers of families, who abandon their servants, on the first attack of sickness, or the approach of old age, or when they become parents ; on the obligations under which they lie, to provide for the necessities of these men, who are their natural friends, the victims of their ill temper, the witnesses of their weakness, and the sources of their reputation, whether good or bad. I could have insisted on the necessity of re-establishing in, at least, the first rights of humanity, the unfortunate wretches deprived of most of the privileges of citizens. I could have demonstrated what an influence their happiness has on the happiness of families,

families, and on national felicity, from what I have seen in some Prussian families, where you find, in general, domestics zealous, affectionate, respectful, and attached to their masters; for they are born, they marry, and they die in the house of the master; and you frequently find under the same roof a succession of fathers and sons, who have been masters and servants for two or three centuries successively.

Once more, if I have been somewhat diffuse on the disorders and intolerance of Associations, I have respected States; I have attacked particular bodies of men, in the view of defending my country, and above all, in supporting the corps of HUMANITY. Of this we are all members in particular. But GOD forbid that I should think of giving a moment's pain to any one individual possessed of sensibility: I who have assumed the pen, only to support the motto prefixed to my Work; *Miseris succurrere disco*; (*the experience of misery has taught me to succour the miserable.*)

My dear Reader, whatever, then, may be your situation in life, I shall cheerfully submit to your decision, if you judge me as a man, in a Work whose leading object is the happiness of Mankind. If, on the other hand, I have attained the glory of communicating to you some new pleasures, and
of

of extending your views into the unbounded and mysterious field of Nature, reflect that, after all, these are the perceptions but of a man; that they are a mere nothing compared to that which is; that they are the shadows only of that Eternal Truth, collected by one who is himself a shadow, and that a small ray of that Sun of intelligence which fills the Universe, has been playing in a drop of troubled water.

Multa abscondita sunt majora his: pauca enim vidimus operum ejus.

There are yet hid greater things than these be; for we have seen
but a few of his Works. ECCLESIASTICUS xliii. 32.

EXPLA-

EXPLANATION of the PLATES.

FRONTISPIECE.

PLATE FIRST.

THE Frontispiece represents a solitude in the mountains of the Island of Samos. An attempt has been made, notwithstanding the smallness of the field, to introduce, and to display, some elementary harmonies, peculiar to islands and to lofty mountains. Clouds of sand, formed by the winds on the shores of the Island, and of water, pumped up by the Sun from the bosom of the Sea, are wafted toward the summits of the mountains, which arrest them by their fossil and hydraulic attractions.

In the fore-ground of the landscape are presented some of the trees which thrive in cold and humid Latitudes, among others, the fir-tree and the birch. These two species of tree, which, in such situations, are almost always found in company, exhibit different contrasts in their colours, their forms, their port, and in the animals which they nourish. The fir raises into the air his tall pyramid, clothed with leaves stiff, filiform, and of a dark verdure: and the birch opposes to these a pyramidal form inverted, with leaves moveable, roundish, and of a light-green colour.

The

The squirrels are playing along the stem, and among the boughs of the fir ; and the female of the heath-cock makes her nest in the moss which covers the roots. The beavers, on the contrary, have built their habitation at the foot of the birch ; and a bird of that species which eats the buds, is fluttering round the branches. The fir accommodates it's quadrupeds in it's boughs, and the birch finds lodging for it's guest upon it's roots. The habits of their respective birds are equally contrasted. Among all these animals, however, the most perfect harmony subsists. The dog is looking quietly at their different employments, and expresses, by the listlessness of his attitude, the profound peace which reigns among the inhabitants of this desert.

At the entrance of a grotto formed in the side of the mountain, is represented a man busied in carving a statue of Minerva in the trunk of a tree. The figure of this Goddess, the symbol of Divine Wisdom, and the substance out of which it is formed, here characterize the Supreme Intelligence manifested in the harmony of vegetables. This Philosopher is Philocles. His history is to be found in **TELEMACHUS**, Books XIII. and XIV.

ATLANTIC HEMISPHERE.

PLATE SECOND.

Volume I. Page 188.

THIS Plate represents the Atlantic Hemisphere, with it's Sources, it's Ices, it's Channel, it's Currents, and it's Tides, in the months of January and February.

Though I am under the necessity of here repeating several observations which have a place in the text, to these I am going to subjoin some others, worthy, I am bold to say, of the Reader's most serious attention.

Observe, in the first place, that the Globe of the Earth is not represented, here, after the manner of those Geographers, who, in their maps of the World, exhibit it as a cavity, in order to give the retreating parts the appearance of being on a great scale. Their projection conveys a false idea of the Earth, by shewing the retiring parts of it's circumference, as the widest; and, on the contrary, the prominent parts of the middle, as the narrowest. They present, not a convex Globe, but a concave. This figure represents it, such as it would appear to an eye placed in the Heavens, when the Atlantic Ocean is turned to it, and in our Winter.

You may distinguish in it the sources of the Atlantic Ocean, which issue, in Summer, from the North Pole;
it's

it's channel formed by the projecting and retreating parts of the two Continents ; and it's discharge comprehended between Cape Horn, and the Cape of Good-Hope, by which this Ocean empties itself, in Summer, into the Indian Ocean.

The opposite side of this Hemisphere, though still, in a great measure, unknown to us, would present, as well as the Northern, a fluvial channel with all the same accessories ; sources, ices, currents, and tides, formed, not by Continents, but by the projections of islands, and of it's steep beds, which direct, during our Winter, the course of the Southern polar-effusions into the Indian Ocean. However interesting these new projections of the Globe may be, it was impossible for me to make the expenditure necessary to procure engravings of them. It would have been extremely desirable to have exhibited a representation of both Hemispheres, each in it's Summer and in it's Winter, in order to see their different Currents at each season, and to have presented a bird's-eye view of the Poles themselves, as well in Winter as in Summer, in order to convey an idea of the extent of the cupolas of ice which cover them, and the currents which issue from them, at the different seasons of the year. These different sections would have required at least eight plates on a scale greater than this, perceptibly to unfold the harmonies of this single branch of my Studies of Nature. Besides, this increase of charts would have led to more particular and more copious details, respecting the distributions of the Globe, which I did not mean to treat in this Work, except as the subject occasionally presented.

The

The simple aspect of the Atlantic Hemisphere, in the months of January and February, will be sufficient to render intelligible what we have said respecting the polar ices, and their periodical effusions. We shall treat, in their order, of the sources of the Atlantic, of its ices, of its channel, of its currents, of its tides, and even of its discharge.

The Sources of the Atlantic Ocean, are, in Summer, at the North Pole. They are situated in the Baltic Sea, the bays of Baffin and Hudson, at Waigats Strait, &c. It may be remarked on a Globe in relief, that these sources, which constitute the origin of the Atlantic Canal, turn round the Pole in a winding course, nearly similar to the circuitous current of a river round the mountain from which it descends; so that they collect, in this part, all the discharges of the rivers which empty themselves to the North, and carry their waters along into the Atlantic Ocean. From this arises a presumption, that there is, in proportion, much less polar effusion in the part of the South Seas which is opposite to it. We shall farther see, that Nature has subjected to the Atlantic channel the extremities of the two general currents of the Poles, which there terminate, after having made the circuit of the Globe; and it is by way of opposition to the sources from which these currents issue, that I give to the extremities of their courses the name of mouth. But let us at present confine ourselves to the subject of their sources.

We conceive that the waters of these sources must flow toward the Line, whither they are carried to replace those which the Sun is there every day evaporating; but they
have,

have, besides, an elevation which facilitates their course. Not only are the ices from which they proceed very considerably elevated over the Hemisphere, but the Poles have themselves a great elevation of soil. I ground this assertion, in the first place, on the observations of *Tychō-Brhæ* and *Kepler*, who saw the shadow of the Earth oval at the Poles, in central eclipses of the Moon; and on the authority of *Cassini*, who assigns fifty leagues more to the axis of the Earth, than to its diameter in any other direction. In the second place, I have on my side authentic experiments, collected by the Academy of Sciences, but which have no longer been referred to since the opinion became prevalent, that the Earth was flattened at the Poles.

For example, it is well known, that in proportion as you ascend on a mountain, the mercury on the barometer subsides: now, the mercury sinks in the barometer, in proportion as you advance northward. It falls about one line, in our Climates, when you ascend to an elevation of eleven fathom. According to the History of the Academy of Sciences, for 1712, page 4, the weight of one line of mercury, at Paris, is equivalent to an elevation of ten fathoms and five feet, whereas, in Sweden, you have to ascend only ten fathom, one foot and six inches, to make the mercury sink one line. The Atmosphere of Sweden, therefore, is not so high as that of Paris, and consequently the ground of Sweden is higher.

To these observations may be farther subjoined, those made by the Navigators of the North, who have always seen the elevation of the Sun above the Horizon greater, the nearer they approached to the Poles. It is impossible

to ascribe these optical effects to the simple laws of the refraction of the Atmosphere. According to *Buguer*, a well-known Academician, in his *Treatise on Navigation*, book iv. chap. 3. section 3. “Refraction elevates the stars
 “ in appearance; and we are assured, by an infinite num-
 “ ber of certain observations, that when they appear to us
 “ in the Horizon, they are, in reality, 33 or 34 minutes
 “ under it....In regions where the air is more dense, the
 “ refractions must be somewhat stronger, and they are,
 “ likewise, every thing else being equal, somewhat greater
 “ in Winter than in Summer. In the practice of naviga-
 “ tion that difference may be entirely neglected, and per-
 “ petual recurrence may be had to the small table placed
 “ on the margin.”

You see, in fact, at this part of his work, a small table, in which he lays down the greatest refraction of the Sun in the Horizon, at 34 minutes, for all the climates of the Globe. But how came it to pass that *Barents* should have seen the Sun above the Horizon of Nova Zembla, on the 24th of January, in the sign of Aquarius, at five degrees, twenty-five minutes, whereas he ought to have been there, in sixteen degrees, twenty-seven minutes, in order to be perceived in the seventy-sixth degree of northern Latitude, where *Barents* then was? The refraction of the Sun, then, above the Horizon, was nearly two degrees and a half, that is, four times as great, nay, more than *Buguer* supposes it to be, as he assigns only thirty-four minutes, or nearly, for every climate in general.

Barents, in truth, was very much astonished to see the Sun fifteen days sooner than he expected; and he could not be persuaded that it actually was only the 24th of January,

but, by observing that very night the conjunction of the Moon and Jupiter, announced for the Latitude of Venice at one hour after midnight, in the ephemeris of *Joseph Scala*, and which took place that very night, at Nova Zembla, at six of the clock of the morning, in the sign of Taurus; which gave him, at once, the longitude of his hut in Nova Zembla, and the certainty that it must be the 24th of January.

A refraction of two degrees and a half is undoubtedly very considerable. We may, in my opinion, ascribe one half of it to the apparent elevation of the Sun in the very refractive Atmosphere of Nova Zembla, and the other half, to the real elevation of the Observer above the Horizon of the Pole. *Barents*, accordingly, observed, from Nova Zembla, the Sun in the Equator, just as a man sees him earlier from the summit of a mountain, than at it's basis. It is, besides, a principle which admits of no exception, of the harmonic laws of the Universe, that Nature proposes to herself no one end, without constraining all the elements to concur, at once, to the production of it. Of this we have adduced manifold proofs in the course of this Work. Nature, accordingly, having determined to indemnify the Poles for the absence of the Sun, makes the Moon pass toward the Pole, which the Sun abandons: She crystallizes, and reduces into brilliant snows, the waters which cover it; she renders it's Atmosphere more refractive, that the presence of the Sun may be detained longer in it, and restored sooner to it: and hence, also, there is reason to conclude, that she has drawn out the Poles of the Earth themselves, in order to bestow on them a longer participation of the influence of the Orb of Day.

Certain

Certain celebrated Academicians have, it is true, laid it down as a fundamental principle, that the Earth was flattened at the Poles. Hear what the Academician, whom I last quoted, says on this subject. He had been employed, with some others, to measure a degree of the Meridian, near the Equator, which they found to contain 56,748 fathoms: "But," continues he, "what is well worthy of attention, the terrestrial degrees have not been found of the same length, in other regions, where similar operations have been performed, and the difference is too great to be ascribed to the unavoidable errors in observation. The degree upon the polar Circle is found to be 57,422 fathoms. Accordingly, it follows, beyond contradiction, that the Earth is not perfectly round, and that it must be higher toward the Equator, than toward the Poles, conformably to what other experiments indicate, which it is not necessary here to detail. The curving of the Earth is more sudden toward the Equator in the direction of North and South, as the degrees are smaller there: and the Earth, on the contrary, is flatter toward the Poles, because there the degrees are greater." *Bouguer's Treatise on Navigation*, book ii. chap. 14. art. 29.

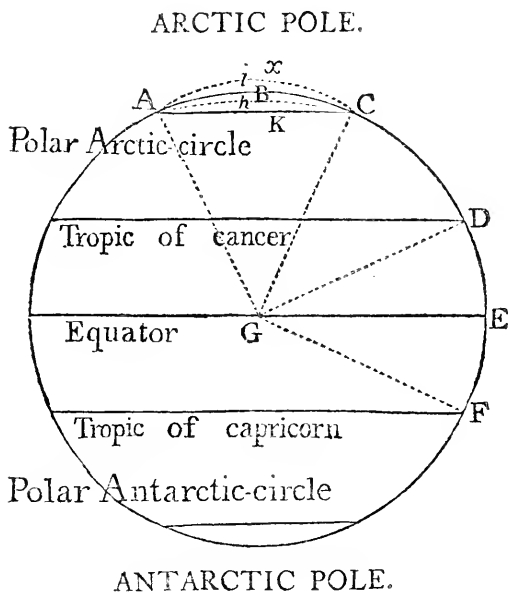
I deduce, without hesitation, a conclusion diametrically opposite, from the observations of these Academicians. I conclude that the Earth is lengthened out at the Poles, precisely for this reason, that the degrees of the Meridian are greater there than under the Equator. Here is my demonstration. If you place a degree of the Meridian, at the polar Circle, over a degree of the same Meridian at the Equator, the first degree, which is 57,422 fathoms, would exceed the second, which contains only 56,748 fathoms, by 674 fathoms, conformably to the operations of the

Academicians themselves. Consequently, if you were to apply the whole arch of the Meridian, which crowns the polar Circle, and which contains 47 degrees, to an arch of 47 degrees of the same Meridian, near the Equator, it would produce a considerable protuberance, it's degrees being greater. This polar arch of the Meridian could not extend, in length, over the equinoctial arch of the same Meridian, because it contains the same number of degrees, and, consequently, a chord of the same extent. If it extended in length, exceeding the second at the rate of 67 $\frac{1}{4}$ fathoms for each degree, it is evident that it would, at the extremity of it's 47 degrees, get out of the circumference of the Earth; that it would no longer pertain to the circle on which it was traced, and that it would form, on applying it to one of the Poles, a species of flattened mushroom, which would project round and round, it's brim touching the Earth in no one point.

In order to render the thing still more apparent, let us always suppose that the profile of the Earth at the Poles, is an arch of a circle, and that it contains 47 degrees, is it not evident, if you trace a curve on the inside of this arch, as the Academicians do, who flatten the Earth at the Poles, that it must be smaller than this arch within which it is described, as being contained in it; and that the more this curve is flattened, the smaller it becomes, as it will approach more and more to the chord of the arch, that is to a straight line? Of consequence, the 47 degrees, or divisions, of this interior curve, will be, each in particular, as they are when taken together, smaller than the 47 degrees of the arch of the containing circle. But, as the degrees of the polar curve are, on the contrary, greater than those of an arch of a circle, it must follow, that the whole curve should

should, likewise, be of greater extent than an arch of a circle: now, it cannot be of greater extent, but, on the supposition of it's being more protuberant, and circumscribed round this arch; the polar curve, of consequence, forms a lengthened ellipsis.

I here present a figure of the Globe, which I have got engraved, in order to render the mistake of our Astronomers perceptible to every eye.



Let x be the unknown arch of the Meridian comprehended above the arctic polar circle $A B C$, and let $D E F$ be the arch of the same Meridian comprehended between

the Tropics. These two arches are, it is well known, each of 47 degrees. But though they both are subtended by equal angles, AGC and DGF , they are by no means of equal expansion: for, according to our Astronomers, a degree of the Meridian at the polar Circle is greater, by 674 fathoms, than a degree of the same Meridian near the Equator. It follows, therefore, that the unknown polar arch x of 47 degrees, exceeds, in extent, the equinoctial arch DEF , which likewise contains 47 degrees, by 47 times 674 fathoms, which amount to 31,678 fathoms, or twelve leagues and two thirds. The question now to be determined, then, is, whether this unknown polar arch x is contained within the circle, in the curve AbC , or coincides with it, as ABC , or falls without it's circumference, in the direction AiC .

The unknown polar arch x cannot be contained within the Globe, as AbC , as is pretended by our Astronomers, who will have it to be flattened there: for if it were contained, it would be evidently smaller than the spherical arch ABC , which surrounds it, conformably to this axiom, that the thing contained is smaller than what contains it; and the more this curve AbC shall be flattened, the less will be it's extent, as it will approach nearer and nearer to it's chord, that is, the straight line AKC .

On the other hand, this polar arch x cannot coincide with the spherical arch ABC , for it exceeds it by twelve leagues and two thirds. It must belong, therefore, to a curve which falls without the circumference of the Globe, as in the direction AiC . The Globe of the Earth, then, is lengthened at the Poles, as degrees of the Meridian are greater there than at the Equator. Astronomers have consequently

frequently erred, in concluding, from the magnitude of those degrees, that the Poles were flattened.

I shall conclude this demonstration by an image more trivial indeed, but equally sensible. If you divide the two circumferences of an egg, in length and in breadth, each into 360 degrees, would you conclude that this egg was flattened toward it's extremities, because the degrees of it's circumference in length, were greater than the degrees of it's circumference in breadth? What is very singular here, is, that Academicians employ the same figure nearly, to deduce results which flatly contradict each other. They represent the Globe of the Earth like a Dutch cheese. They take it for granted that the Globe is very elevated over the Equator. "The curve of the Globe," says *Bouguer*, in the passage above quoted, "is more sudden toward the Equator, in the direction of North and South, because the degrees there are smaller: and the Earth, on the contrary, is flatter toward the Poles, because the degrees there are greater. One would imagine that the Equator was distinguished only by the greatest rapidity of motion performed in the space of twenty-four hours; but it is marked by a distinction still more real, namely, a continued elevation, which must be about six marine leagues and a half quite round the Earth, and every where at an equal distance from both Poles."

We here see the strange consequence deduced, at once, from the flattening of the Earth at the Poles, and from the magnitude of the degrees of the Meridian at that part, which necessarily give to the polar circle a projection beyond it's circumference: those which may be deduced from the elevation and more sudden curve of the Equator, would

be no lefs extraordinary. They are precifely thefe, if both the one and the other exifted, there would be no Sea under the Equator ; becaufe the courfe of the waters would be in this cafe determined, by the elevation of fix leagues and a half, and by the more fudden curvature of that part of the Earth, to withdraw from it, and, by the power of gravity, to flow toward the flattened Poles, nearer to the centre, and there to re-eftablifh the fpherical fegment which the Academicians have cut off. Accordingly, on this hypothefis, the Seas would cover the Poles, and would there be of a prodigious depth, whereas we fhould have nothing but elevated Continents under the Line. But Geography demonftrates the direct contrary ; for it is around the Line that we find the greateft Seas, and a great quantity of Land barely up to their level ; and, on the contrary, elevated countries and lofty beds of water are very frequent, efpecially toward the North Pole.

Let us now proceed to confider the polar ices. Though they are here reprefented, precifely in the fugitive, and leaft vifible, parts of the Globe, it is eafy to form a judgment of their very confiderable extent from the arch of the Meridian which embraces them. At the South Pole, where they are in a fmall quantity, having juft undergone all the ardor of the Summer of that Hemisphere, they ftill extend from that Pole to the 70th degree of fouthern Latitude at the leaft. They there form, accordingly, a cupola, of an arch of more than 40 degrees, which, at the rate of twenty-five leagues, at leaft, to a degree, for degrees at this part of the Globe, conformably to the experience of our Academicians, are greater than toward the Equator, give a breadth of more than a thoufand and twenty leagues, or a circumference of more than three thoufand. It is impoffible to call

call in question these dimensions, for they are taken from the last observations of Captain *Cook*, who made the tour of this cupola during their Summer.

The ices of the North Pole are much more extensive, because they are represented in their Winter. On both the one and the other, a crest is expressed, of about twenty leagues of elevation, at the Poles. I shall not here repeat what I have already said respecting the height of those ices which are discovered floating at the extremities of their cupolas, the elevation of which extends to twelve, nay, to fifteen hundred feet. I was exceedingly desirous of procuring a representation, around these ices, of an irradiation, or kind of *Aurora Borealis*, which might have rendered perceptible their circular extent, and have heightened the picturesque effect of the Globe, by rendering it's Poles radiant; for the South Pole, too, emits nocturnal coruscations, as *Cook* observed; and it appears that these glories owe their origin to the ices. But *M. Moreau* the younger, who made the drawings for the plates of this Work, and particularly those under review, with all the intelligence and complaisance which characterize him, made me sensible that the Chart had not a field sufficiently ample. He has, in other respects, rendered these polar ices abundantly luminous, to make them distinguishable, without eclipsing the contours of the islands, and of the Continents which they cover.

As to the Atlantic channel, you can easily distinguish in it, the prominent and the retreating parts of the two Continents, in correspondence with each other. If to this you add the sinuosity of it's source to the North, which seems to pursue a serpentine progress round our Pole, and it's wide
and

and divergent mouth, formed by Cape Horn on the one side, and the Cape of Good-Hope on the other, by which it discharges itself, for six months, into the Indian Ocean, as we shall presently see, you will perceive in it all the proportions of a fluviatic canal. As to it's declivity, in taking it's departure from the Pole, to empty itself even in the Indian Ocean, and South-Sea, by the Cape of Good-Hope, I believe it to be, as I have said in the text, nearly the same with that of the course of the Amazon.

Let us now consider the course of the polar effusions, produced by the action of the Sun on the ices of the Poles. There issues every year, a general Current from that which is heated by the Sun: and as that great Luminary visits them alternately, it follows that there must be two general opposite currents, which communicate to the Seas their movement of circulation, and which are known in India by the name of the easterly and westerly monsoons, or Winter and Summer.

This being laid down, let us examine the effusions of the South Pole, which is here represented in it's Summer. The general Current, which issues from it, divides into two branches, the one of which sets in toward the Atlantic Ocean, and penetrates even to it's northern extremity. When this branch comes to force it's way between the prominent part of Africa and America, finding itself straitened on passing from a wider to a narrower space, it forms, on the coast, two counter-currents, or *vortices*, which proceed in contrary directions. The one of these counter-currents runs to the East, along the coasts of Guinea, up to the fourth degree South, according to the testimony of *Dampier*. The other takes it's departure from Cape St. Augustin,
proceeds

proceeds to the South-West, along the coasts of Brasil, up to Maires-Strait inclusively. This effect is the result from a law in Hydraulics, the operation of which is generally known: it is this, that as often as a current passes from a wider channel into a narrower, it forms on the sides two counter-currents. The truth of this may be ascertained, by observing the current of a brook, to the passage of the water of a river under the arches near the abutment of a bridge, &c. Accordingly, the current bears to the East, along the coasts of Guinea, and to the South-West, along the coasts of Brasil, during the Summer of the South-Pole. But in the middle of the Atlantic Ocean, and beyond the strait of the two Continents, it pushes on to the North in full force, and advances to the very northern extremities of Europe and of America, bringing us twice every day, along our coasts, the tides of the South, which are the half-daily effusions of the two sides of the South Pole.

The other branch, which issues from the South Pole, takes a direction to the westward of Cape Horn, rushes into the South Sea, produces in the Indian Ocean the Eastern monsoon, which takes place in India during our Winter; and having made the tour of the Globe by the West, comes to the East, to unite itself by the Cape of Good-Hope, to the general Current which enters into the Atlantic Ocean. It is possible, partly, to trace on the Chart this general Current of the South Pole, with its two principal branches, its counter-currents and its tides, by the arrows which indicate its direct, oblique, and retrograde movements.

Six months after, that is, in our Summer, commencing toward the end of March, when the Sun, at the Line,
begins

begins to forsake the South Pole, and proceeds to warm the North, the effusions of the South Pole are stayed; those of our Pole begin to flow, and the Currents of the Ocean change in all Latitudes. The general Current of the Seas then takes it's departure from our Pole, and divides, like that of the South, into two branches. The first of these branches derives it's sources from Waigats, Hudson's-bay, &c. which then flow, in certain straits, with the rapidity of a sluice, and produce, to the North, tides which come from the North, from the East, and from the West, to the great astonishment of *Linschotten*, *Ellis*, and other Navigators, who had been accustomed to see them come from the South along the coasts of Europe.

This Current, formed by the fusion of most of the ices of the North of America, of Europe, and of Asia, which, at that season, present a circumference of almost six thousand leagues, descends through the Atlantic Ocean, passes the Line, and finding itself confined at the same Strait of Guinea and Brasil, it forms on it's sides, two lateral counter-currents, which set in northward, as those formed, six months before, by the Current of the South Pole, set in southward. These counter-currents produce, on the coasts of Europe, the tides which always appear to come directly from the South, though they actually come, at that season, from the North.

The branch which produces them advances afterward to the South, doubles the Cape of Good-Hope, takes it's course eastward, forms, in the Indian Ocean the westerly monsoon; and having encompassed the Globe, even to the South-Sea, it proceeds to Cape Horn, re-ascends along the coast of Brasil, and there produces a current which terminates

ates at Cape St. Augustin, and is opposed to the principal Current, which descends from the North.

The other branch of the Current, which, in Summer flows from our Pole, on the opposite side of our Hemisphere, issues through the passage called the North-Strait, situated between the most easterly extremity of Asia, and the most westerly of America. It descends into the South-Sea, where it is re-united to the first branch, which then forms, as has been said, the westerly monsoon of that Sea. Besides, this branch, which issues by the North-Strait, receives much less of the icy effusions than that of the Atlantic Ocean, because the deep bays which are at the sources of that Ocean, and the contours of these same sources, which surround the Pole spirally, receive, as we have seen, the greatest part of the icy effusions of the North Pole, and pour them into the Atlantic Ocean.

The Ocean, accordingly, flows, twice a year round the Globe, in opposite spiral directions, taking its departure alternately from each Pole, and describes on the Earth, if I may venture to say so, the same course which the Sun does in the Heavens.

This Theory, I confidently affirm, is so luminous, that, by means of it, a multitude of difficulties may be resolved, which involve in much obscurity the journals of our Navigators. *Froger*, for example, says, that in Brazil the Currents come in conformity to the direction of the Sun; that is, they run northward, when he is in the northern signs of the Zodiac, and southward, when he is in the southern signs. It is impossible, assuredly, to explain this versatile effect,

effect, from the pressure, or the attraction of the Sun and of the Moon between the Tropics, as these two Luminaries never transcend their bounds, and always proceed in one direction, from East to West: but here is the solution, When this Current of Brasil runs to the South in our Winter, it is the general counter-current of the South Pole, which is then setting in to the North; and when this Brazilian Current runs to the North in our Summer, it is the extremity of this same general Current, which returns by Cape Horn.

The same thing does not take place respecting the Current in the Gulf of Guinea, which is opposite, and which runs always to the East, though it be in precisely the same situation; for, in our Winter, this Current in the Gulf of Guinea, is the extremity of the general Current of the South Pole, which returns by the Cape of Good-Hope, and which, at that season, sets in to the North, along the coasts of Africa, from the thirtieth degree of South Latitude, as far as to the fourth degree of the same Latitude, according to the testimony of *Dampier*. But this extremity of the general Current which sets in to the North, and which then takes its departure from the fourth degree South, to join the general Current, does not enter into the Gulf of Guinea, because of the prodigious retreat of that Gulf; so that, in this part only, the Sea flows always to the East, conformably to the observation of all African Navigators.

I shall support the principles of my Theory by well-authenticated facts, supplied by Navigators of the highest credit. Hear what *Dampier* says of the Currents of the Ocean, in his *Treatise of Winds*, pages 386 and 387.

“ Besides,

“ Besides, it is certain, that, universally, Currents change
“ their courses at certain seasons of the year: in the East-
“ Indies, they run from East to West one part of the year,
“ and from West to East the other part. In the East-
“ Indies, and in Guinea, they change only about the time
“ of full Moon. But this is to be understood of the parts
“ of the Sea which are at no great distance from the coast:
“ not but that there are, likewise, very powerful Cur-
“ rents, in the great Ocean, which are not subjected to
“ these laws; but that is not common.

“ On the coast of Guinea the Current sets in to the
“ East, except at full Moon, or about it. But to the South
“ of the Line, from Loango up to 25 or 30 degrees, it
“ runs with the wind from South to North, except toward
“ full Moon.

“ To the East of the Cape of Good-Hope, from the
“ thirtieth degree to the twenty-fourth South Latitude, the
“ Current sets in to the East, from the month of May to
“ October, and the wind blows during that period from
“ West-South-West, or South-West; but from October to
“ May, when the wind is between East-North-East, and
“ East-South-East, the Current sets in to the West; and
“ this is to be understood of five or six leagues distance from
“ land, up to fifty, or thereabout; for at five leagues from
“ land, there is no Current, but we have a tide; and be-
“ yond fifty leagues from land, the Current entirely ceases,
“ or becomes imperceptible.

“ On the coast of India, to the North of the Line, the
“ Current runs with the monsoon. But it does not change
“ quite so soon, sometimes by three weeks or more; after
“ that,

“ that, it changes no more till the monsoon is fixed in the
 “ opposite direction. For example, the western monsoon
 “ commences about the middle of April, but the Current
 “ does not change till the beginning of May; and the east-
 “ tern monsoon commences about the middle of September,
 “ but the Current changes not till October has begun.”

Dampier seems to ascribe the cause of these Currents to the winds, which he calls Monsoons. But this is not the proper place for investigating the cause of the atmospheric revolution, which, however, likewise depends on the Poles, whose Atmospheres are more or less dilated in Winter and in Summer, and whose revolutions must precede those of the Ocean. I shall confine my attention, at present, to the retardation of the westerly Current, which does not affect the Indian Ocean till the month of May, in order to demonstrate, that it is the same which takes its departure from our Pole, in the month of March, and which takes place in various regions of India at eras proportional to the distance of the point from which it sets out.

This Current arrives, then, toward the month of April, at the Cape of Good-Hope; and this it is which renders the passage round the Cape so difficult to vessels returning from India in Summer. I shall once more support myself, on this ground, by the authority of *Dampier*, in his *Voyage round the World*, vol. ii. chap. 14. This was on his return from India to Europe.

“ We lost time in trying to reach the Cape, which we
 “ could not make till the month of October or November;
 “ and it was now only the end of March. In fact, it is
 “ not usual to make the Cape after the tenth of May.”

In

In addition to this, the Dutch East-India Company do not permit their ships to remain there later than the month of March, because from that period the Winds and the Currents steadily set in from the West, which drive the shipping on the coast: hence we see, that this Current, which comes from the West, in doubling the Cape, arrives there in the month of April.

From the preceding passage, in *Dampier's Treatise on Winds*, we have seen that this westerly Current reached the coasts of India toward the middle of May: I shall produce another authority to prove that it reaches, about the middle of June, the island of Tinian, which is much farther to the East. I extract it from *Anson's Voyage*, chap. 14; in the year 1742, on the subject of the island of Tinian. “The
 “ only good anchoring ground for large ships is off the South-
 “ West part of the island. The bottom of this road is
 “ filled with rocks of coral, very sharp pointed. It is unsafe
 “ to anchor there from the middle of June to the middle of
 “ October, which is the season of the *westerly monsoons*;
 “ and the danger is farther increased by the extraordinary
 “ rapidity of the current of the tide which *sets in to the*
 “ *South-West*, between this island and that of Agnigan.
 “ During the other eight months of the year, the weather
 “ there is steady.” Observe, by the way, that while the monsoon, or the current, comes from the West, the tide bears in a contrary direction between those two islands; which is a confirmation of what we have said, that tides are, for the most part, only the counter-currents of general Currents forced through narrow straits.

It is, accordingly, evident that this Current, which leaves our Pole in March, reaches the Cape of Good-Hope in

April, the coast of India in May, the island of Tinian by the middle of June; and that it traces round the Globe, the spiral line which I have indicated. It might be possible to calculate the velocity, by the time employed in running over these several distances, and in reaching the other points of Latitude, till it gets up with Cape Horn, from which it sets in to the North, as far as Cape St. Augustin, where it meets the general Atlantic Current toward the end of July. But the detail of so many curious circumstances would carry me too far.

In no one respect is it possible to ascribe the general Currents of the Indian Ocean, which, as has been said, sets in, for six months, to the East, and six months to the West, to the attraction or pressure of the Sun and of the Moon, between the Tropics; for these Orbs move invariably in one direction, and their action is the same at all times, within the extent of that Zone to which their motion is restricted. Besides, if their action were the cause of it, when the Sun is to the North of the Line, the westerly monsoon ought to be felt on the coasts of India, as early as the month of March, for the Sun is then nearly in the Zenith of the Indian Ocean; but it becomes not perceptible till six weeks after, that is, till the month of May.

On the contrary, when the Sun is to the South of the Line, and at the greatest distance from the Indian Ocean, the monsoon takes place there a little after our autumnal Equinox, that is, in the month of October. Hence it is evident, that these revolutions of the Indian Ocean have not their focuses under the Equator, but at the Poles; and that the revolution of the month of March, which proceeds from the North by the West, takes six weeks to render itself perceptible

perceptible in India, because of the vast circuit which it is obliged to make round the Cape of Good-Hope; whereas that of the South Pole, which commences in the month of September, arrives much sooner, because it has no circuit to make: and, finally, that the era of these versatile revolutions commences precisely at the Equinoxes, that is, the very moment when the Sun withdraws from the one Pole, on his way to warm the other.

It is manifest, therefore, that the half-yearly and alternate Currents of the Indian Ocean derive their origin from the half-yearly and alternate fusion of the ices of the North and South Poles; and that their direction from East to West, and from West to East, is determined, in this Ocean, by the very projection of the Continent of Asia.

The Atlantic Ocean has, in likemanner, two half-yearly and alternate Currents, which have the same origin, but one natural direction from North to South, and from South to North, though with some deviation from West to East, and from East to West, by the very projection of the Atlantic channel. Our Navigators go on the supposition that, in this channel, there is but one perpetual Current, which, in our Hemisphere, always runs from South to North. Into this mistake they have been led by the course of the tides, which, in fact, always do set in to the North along our coasts, and those of Bahama; but especially, by our Astronomical system, which ascribes all the movements of the Ocean to the action of the Moon, between the Tropics.

How many errors may one single prejudice introduce into the elements of human knowledge! It blinds even the most enlightened of Mankind, to such a degree, as to make

them resist the clearest evidence, and to reject, for a long series of ages, the experience which every year is accumulating.

I have collected from a multitude of Sea Voyages, and principally from those which Captain *Cook* performed round the World, with equal sagacity and intelligence, a great variety of nautical observations, which demonstrate, that the Currents of the Atlantic Ocean are alternate and half-yearly, like those of the Indian Ocean. Notwithstanding, the very persons who made and who relate these observations, misled by the prejudice, that the action of the Moon between the Tropics alone communicates motion to the Seas, and unable to reconcile their Currents with the course of that Luminary, deduced only this conclusion, that they were naturally irregular, and their cause inexplicable.

Had they adhered to their own experience, which assured them that these Currents changed twice every year; that, in the Indian Ocean, they run for six months in the same direction with the course of the Moon, and six months directly opposite to it; and, in the Atlantic Ocean, in directions which have no relation whatever to the course of that Star; that they are much more rapid as you approach the Poles, than between the Tropics, under the very gravitation of the Moon; and, finally, that they diverge from the Pole that is heated by the Sun, toward that which he has deserted; they would then have referred the causes of these variations to the Summer and Winter of each Hemisphere; and they would have dissipated, in part, that cloud of error, with which our pretended Sciences have veiled the operations of Nature.

Though

Though these nautical observations are decisive as to myself, for they have been made by enlightened partisans of the Astronomical System which they totally subvert, while they confirm the truth of my theory, I shall, however, quote two still more curious, more authentic, and more impartial than all the others, because they have not been picked up by men bred to the Sea, and who, consequently, have neither the prejudices nor the systems of the profession. The one has the inhabitants of a whole kingdom to vouch for him; and the other, one of the most terrible epochas of the naval History of Europe: and both of them wonderfully confirm one of the most agreeable harmonies of the vegetable History of Nature, the elements of which I have presented in the emigration of plants.

From the first of these observations, we shall demonstrate, that the Atlantic Current comes, in fact, from the South, and sets in northward, as Navigators believe, but this only during our Winter. It is, accordingly, produced, in this direction, by the effusions of the ices of the South Pole; which, in our Winter, flow toward the North; and not by the action of the Moon between the Tropics, according to our Astronomers, because, at that very season, the Navigators of the Southern Hemisphere have found, beyond the Tropics, this same Current coming from the South, which assuredly could not take place, if this Current were produced by the action of the Moon on the Equator; for, on this hypothesis, it would flow in a contrary direction in the Southern Hemisphere. But this is by no means the case, as I am able to prove, by the Journals of *Abel Tasman*, of *Dampier*, of *Frazer*, of *Cook*, &c. who found beyond the Tropics, in the Southern Hemisphere, this Current setting in from the South, but only during our Winter.

By the second of these observations we shall demonstrate, that the Atlantic Current comes from the North, and sets in southward in our Hemisphere, contrary to the opinion of Navigators, but only during Summer. Of consequence, it then proceeds directly from the effusions of the ices of the North Pole, which, in our Summer, flow toward the South; and it evidently destroys, by this direction toward the Equator, the pretended action of the Moon between the Tropics, which, according to our Astronomers, impresses on the Ocean a motion toward both Poles.

The first of these observations is related by Mr. *Thomas Pennant*, a well-informed English Naturalist, unfettered by prejudice and by system, at least as far as this important subject is concerned. It is extracted from his *Voyage*, in 1772, to the Hebrides, small islands on the West of Scotland*. “But,” says this enlightened Traveller, “what
“is more real, and more worthy of attention, is this, that
“there are frequently found here (on the Island of Ilay) on
“the coasts of all the Hebrides and Orkney Islands, the seeds
“of the plants which grow in Jamaica, and the adjacent
“Islands; such as those of the *dolichos urens*, *guilandina*
“*linduc*, *bonducetta*, the *mimosa scandens* of LINNÆUS.
“These seeds, which are here called Molucca beans, grow
“on the banks of the rivers of Jamaica; and thence wafted
“along by the westerly winds and currents, which predominate for two-thirds of the year, in that part of the Atlantic, they are driven even to the shores of the Hebrides.
“The same thing sometimes happens to the turtles of

* Printed at Geneva in 1785, in a Collection of Voyages and Travels to the Mountains and Islands of Scotland; Paris, Nyon senior, 2 vols. 8vo. vol. i. page 216 and 217.

“America,

“ America, which are caught alive on these coasts; and
 “ this is put beyond the reach of doubt, since there was
 “ found, on the coast of Scotland, a part of the mast of the
 “ *Tilbury* man of war, which took fire, and was burnt near
 “ Jamaica.”

Mr. *Pennant* has neglected to inform us at what season those seeds, and those turtles, reach the western coast of Scotland. Such omission of dates is an essential defect, though very common with Travellers, who frequently neglect those of even their own particular observations. It is only, however, by means of these dates, that we are enabled to take a glimpse of the combined harmonies of Nature. What shall we think, then, of the taste of our Compilers of Voyages and Travels, who retrench these as tedious and unimportant circumstances? It is easy to see, notwithstanding, in the present case, that the seeds from the rivers of Jamaica, and the turtles of America, arrive in Winter on the coasts of the Hebrides and of the Orkneys, being driven thither, according to Mr. *Pennant*, by the “ westerly winds and currents,” which “ predominate there,” says he, “ two-thirds of the year.”

Now, it is well known that the westerly winds blow there all the Winter through; which is confirmed, in this relation, by its own proper testimony, and, in the same Collection, by other Travellers to Scotland. After all, it cannot possibly be the West-wind which wafts these seeds and these tortoises so far from Jamaica northward. The winds have no hold of bodies level with the surface of the water; and, assuredly, those from the West could not drive them to the North. Nay, Currents from the West could not possibly produce this effect, for they would hurl

them to the East ; and as Jamaica is about 18 degrees to the North of the Line, these seeds and tortoises would be driven ashore on the coast of Africa of the same Latitude, and not in the 59th degree North, on the coasts of the Hebrides and Orkneys, where, in fact, they do come ashore.

The Current, therefore, which wafts them along, proceeds in a northern direction, tending a little toward the East, precisely as the Atlantic channel itself does, in that part of it. Accordingly, the important observations of the inhabitants of Scotland, on the subject of the grains of the Island of Jamaica, of the turtles of America, and of a fragment of the mast of the *Tilbury*, thrown upon their coasts, incontestably prove that the Atlantic Current comes from the South, and sets in to the North, as Navigators are disposed to believe. But it has this direction only in our Winter ; for I am going to demonstrate by another observation, no less curious, that in Summer, and in the same Latitudes, the Atlantic Current comes from the North, and sets in to the South, in direct opposition to the pretended action of the Moon between the Tropics, and contrary to the opinion of Navigators. But I ought not to say *opinion*, for they have not a well-informed opinion on the subject.

We have already produced the testimony of the most respectable northern Navigators, who unanimously bear witness, that the Atlantic Current comes from the North, and sets in to the South in Summer, in it's northern extremity : such are those of *Ellis*, of *Barents*, of *Linschotten*, &c. who, having navigated, in Summer, toward the vicinity of the arctic polar Circle, attest that the Currents, and even the tides have a southerly direction, and descend from the North, or,

at

at most, from the North-West, or North-East, according to the bearing of the bays into which they have penetrated.

We have besides adduced, in support of this important truth, the testimony of the Navigators of North-America, quoted by *Denis*, Governor of Canada, who attest that the Currents of the North annually convey, in Summer, toward the South, long banks of floating ices, of a very considerable depth and elevation, which run a-ground so far to the South as the banks of Newfoundland: and, finally, we have quoted the observation of *Christopher Columbus*, who, in a much more southern Latitude, nay, approaching to the Tropic of Cancer, found, by experience, in September, that the middle of the Atlantic channel run southward, and, consequently, descended from the North. To these authorities we might subjoin those of a multitude of other Navigators, who paid attention only to the driving of their ships, and were convinced, in Summer, of the existence of this northern Current, without daring to admit it, or venturing to oppose their own experience to an Astronomical System, which had got into vogue.

But that I may omit nothing relating to a subject so essential to Navigation, and to the study of Nature, and to remove every possibility of doubt as to the existence of this northern Current in Summer, we shall confine ourselves to a single observation, but connected with a well-known historical event. This observation is the less liable to suspicion, that it is related without an intention to favour any one System, by a Traveller, who was neither Mariner nor Naturalist, and who deduced no other consequences from it, except those which concerned his fortune and his liberty.

It

It is that of *Souchu de Rennefort*, Secretary to the Supreme Council of Madagascar, on leaving the Azores, the 20th of June, 1666, at that time on his return to Europe. *History of the East-Indies*. Book iii. chap. 5.

“From 40 degrees,” says he, “up to 45, we saw broken masts, sail-yards, and round-tops of ships, which awakened an apprehension that some dreadful naval disaster had taken place. We were not a little afraid that these fragments might have run foul of one of our convoy, a vessel of considerable burden, called the *Virgin*, an old crazy ship, and very leaky. It has been since ascertained, that this wreck was occasioned by the naval combat which took place between the French and Dutch on one side, and the English on the other. It would have been a happiness to those concerned to have known this sooner.”

In fact, the vessel on board of which *Rennefort* was, and to whom it was unknown that France and England were at war, had the misfortune to be taken and sunk by an English frigate, as far up the channel as *Guernsey*, ten days after this observation, that is the 8th of July.

This horrible devastation, scattered over the Ocean, through a space of three degrees, or 75 leagues, was the effect of the most obstinate and bloody combat that ever took place on that element, between the English and the Dutch. It began the 11th of June, and lasted four days. The English fleet consisted of 85 ships of war, and the Dutch fleet of 90, commanded by *De Ruyter*. There were 21 thousand men nearly on each side, and 4,500 pieces of cannon. In that engagement the English lost 23 ships, most
of

of which were burnt or sunk, and the Dutch only 4; but there was scarcely a ship which did not lose her masts in whole, or in part. Nine thousand men, nearly, perished on both sides. The Historians of each Nation, as usual, exalted the glory of their own fleet up to the skies. One thing is certain, that nine thousand human bodies, mutilated and half burnt, given up to sharks and sea-dogs, presented, to the monsters of the deep, the spectacle of a ferocity which has no example, except in the annals of the Human Race; and that this prodigious number of round-tops, sail-yards, and masts, floating about, mixed with flags bearing red crosses and white crosses, must have conveyed some information to the Barbarians of all the Southern regions of the Atlantic Ocean, in what manner the Powers, who pretend to be subjected to the laws of JESUS CHRIST, settle their quarrels*.

These

* These wrecks were, undoubtedly, carried farther than the Azores. It is probable that, at this season, a considerable part of them floated as far as the coasts, and the western islands of Africa. Now the ground of this quarrel between England and Holland was precisely the African Slave-Trade. Those Powers had commenced hostilities the year before, on the coasts of Guinea, and at the Cape-de-Verd Islands, to the ruin of these Countries. I suppose, therefore, that those awful monuments, of the battle off Ostend, must have passed through the Cape-de-Verd Islands, and near to that of St. John, which is so little frequented by Europeans, that the Portugueze call it *Brava*, or savage. Its good and hospitable inhabitants, according to an English Navigator, of the name of *Roberts*, who had a most delightful opportunity of putting these amiable qualities to the test, are so humble, that they look on men of their own colour as subjected, by the authority of GOD himself, to the yoke of white men. In this opinion they are confirmed by observing the balance of European commerce, one of the beams of which presents to Europe benefits only, while the other, weighed down by calamities, continually presses on wretched Africa.

But

These wrecks, scattered over 75 leagues of Sea, came from about twelve miles to the North-west of Ostend, where this naval combat was fought, and were carried as far

But when from the summit of their rocks, under the shade of their cotton-trees, and of their plantains, they beheld, along their peaceful shores, this frightful train of masts, yards, galleries, poops, prows, half burnt, stained with human blood, and intermingled with European standards, they then saw the scale, loaded with the miseries of Africa, rise for a moment, and the other, in its turn, sink with an oppressive weight on Europe: and from this re-action of calamity, they, undoubtedly, perceived that an universal Justice governs, by equal laws, all the Nations of the Globe.

A King of France, it has been said, ordered the bodies of malefactors to be thrown into the river, marked with this dismal inscription: *Let the King's Justice pass.* The Chinese and Japanese punish, in the same manner, the pirates who infest the navigation of their rivers. Thus the wrecks of these ships of war, which had so often scattered terror over the Atlantic Ocean, were hurried along by its Currents; and their enormous bulging hulks, blackened by the fire, reddened with human blood, and become a sport to the billows of Africa, spoke much more distinctly than any inscription could, to the oppressed inhabitants of those shores: *Behold now, O, ye black men! the glory of the Whites, and the Justice of GOD, passing along.*

It would be a calculation worthy, I do not say of our modern Politicians, who no longer set a value on any thing in the World, except gold and power, but of a friend of humanity, to ascertain, Whether the Negro Slave-trade has not occasioned as many woes to Europe as to Africa; and, What are the benefits of which it has been productive to these two divisions of the Globe.

In the first place, it would be necessary to take into the account, of the calamities of Africa, the wars which its Potentates wage with each other, in order to find a supply of slaves to answer the demand of European traders; the barbarous despotism of its Sovereigns, who, for the attainment of this object, deliver up their own subjects; the unnaturally degraded character of their subjects, who, after their example, frequently drag to these inhuman markets their wives and their children;

the

far as the Azores, which *Rennefort's* Squadron was leaving, when he fell in with them. Ostend is about 51 degrees North; and the Azores about 40, and far to the West.

The

the depopulation of most of the maritime countries of Africa, reduced to a desert, by the emigration of their inhabitants, who have been swept away into slavery; the mortality of a very considerable proportion of these wretches, who perish on their passage to America and the West-Indies, by unwholesome food and the scurvy, excessive labour, scantiness of provisions, the merciless whippings, and other punishments which they are doomed to endure in our Colonies, and which destroy the greatest part, with misery, mortification and despair.

Here, undoubtedly, is a sad detail of tears and bloodshed, on the African side of the account. But it is balanced, at least, by an equal train of evils on that of Europe: if you state on this side, the very navigation of the coast of Africa, the corrupted air of which carries off the seamen of our trading vessels by whole crews at once, as well as the garrisons of our settlements on the coast, and up the country, by the dysentery, the scurvy, putrid fevers, and especially by a fever peculiar to the coast of Guinea, which brings the stoutest man to his grave in three days. To these physical evils may be added, the moral maladies of Slavery, which destroy, in our American Colonies, the very first feelings of humanity; because, wherever there are slaves, tyrants spring up, together with the influence of this moral depravation upon Europe. Add to the evils of this quarter of the World, the resources, in the field-employments of America, from which our own commonalty and peasantry are excluded, multitudes of whom are languishing at home, in wretchedness, for want of employment, and the means of subsistence; the wars which the Slave-trade kindles among the maritime Powers of Europe, their settlements taken, and retaken; their naval engagements, which sweep away nine thousand men at a stroke, without reckoning those who are maimed for life; their wars which, like a pestilence, are communicated to the interior of Europe, by their alliances, and to the rest of the World by their commerce; when all these are taken into the statement, it must be allowed that the amount of European evils is a complete balance to those of Africa.

As

The first of these wrecks were put in motion, from the North-west of Ostend, on the 11th of June, which is the date of the beginning of the engagement, conformably to *De Ruyter's* letter, and the History of France, and they were found near the Azores by the 20th of the same month at farthest, as must be concluded from the relation of *Rennefort*, though the date of every day, in particular, is not inserted. The Currents from the North had, accordingly, wafted them along, in nine days, more than 275 leagues to the South; without taking into the account, the considerable progress which had been made to the westward, on the whole amounting to much more than 34 leagues a day.

As to the balance of benefits, it is reduced, on both sides, to a very narrow compass. It is impossible, with a good conscience, to enumerate among the blessings which the inhabitants of Africa derive from the sale of their compatriots, our iron sabres, with which they mangle each other, our wretched firelocks, with which they contrive to knock one another on the head, and our ardent spirits, which destroy their reason and their health: the whole then is reduced, in their favour, nearly, to a few paltry mirrors and tinkling-bells.

With respect to the benefits derived from this trade to Europe, there is sugar, coffee, and cotton, with which America and its Islands supply us, by means of the labour of negro slaves; but these rude and formless productions can stand no manner of comparison with the perfected manufactures, and the crops of every kind, which might be derived from the same fields, by free, happy, and intelligent, European cultivators.

It appears to me, that, if this balance of evils so oppressive, and of benefits so trivial, were presented to the maritime and Christian Powers of Europe, they would discover, at length, that it is not sufficient to have banished Slavery from their own territories, in order to render their subjects industrious and happy; but that they must likewise proscribe it in their Colonies, for the sake of these very subjects themselves, for that of the Human Race, and for the glory of their Religion.

It was not the wind, surely, which hurried those fragments toward the South-West with so much rapidity: the prevailing wind, at that season, was contrary to them. *Rennefort's* Squadron, which had just met them, were sensible of no other wind, but that which was carrying them to the North-East; and *De Ruyter*, in his dispatches, makes mention only of the South-West winds, which blew during the engagement. Besides, as has been formerly observed, what hold could the winds have of bodies, level with the water? Much less could they have been carried southward, by the tides, which then set in to the North, on our coasts: it must have been, therefore, a direct Current from the North which carried them to the South, even in opposition to the tides, and somewhat to the West, by the direction of the Atlantic channel. The Atlantic Current, therefore, sets in to the South, in Summer, notwithstanding the pretended action of the Moon between the Tropics, and its course, at that season, can be ascribed only to the melting of the northern polar ices.

These two observations, so authentic, farther confirm a position elsewhere laid down, that islands are placed at the extremities of currents. *Linschotten*, who had sojourned at the Azores, remarks, that the fragments of most of the shipwrecks suffered in the Atlantic Ocean are thrown upon their coasts. The same thing happens on the shores of the Bermudas, on those of Barbadoes, &c. These floating bodies are wafted to prodigious distances, regularly and alternately, as the Currents of the Ocean themselves are. The seeds of the island of Jamaica are, accordingly, conveyed, in Winter, as far as the Orkneys, that is more than 1060 leagues from South to North, and a distance of more than 1800 leagues, by the flux of the South Pole; and, beyond
a doubt;

a doubt, the fluviatic seeds of the Orkneys are carried along, in Summer, to the shores of Jamaica, by the flux of the North Pole.

These self-same correspondencies must subsist between the vegetables of Holland and of the Azores. I am not acquainted with any of the seeds peculiar to the rivers of Jamaica; but I am absolutely certain, that they possess the nautical characters which I have observed in those of all fluviatic plants. Here, then, is a new confirmation of the vegetable harmonies of Nature, founded on the emigration of plants. It may be likewise applied to the emigration of fishes, which pursue such long and winding directions through the open Sea, guided, unquestionably, by the floating seeds of fluviatic plants, for which they have, in all countries, a decided preference of taste, and which Nature produces on the banks of rivers particularly, with a view to their nourishment.

It appears to me possible for Mankind, by means of the alternate Currents of the Ocean, to maintain a regular mutual correspondence, free of all expense, over all the maritime countries of the Globe. It might, perhaps, be possible, by these means, to turn to very good account those vast forests which cover the northern districts of Europe and of America, consisting mostly of fir, and which rot on the face of those deserted lands, without producing any benefit to Man. They might be committed, in Summer, in well-compacted floats, first to the current of the rivers, and afterward to that of the Ocean, which would convey them, at least, to the Latitude of our coasts which are stripped of planting, as the course of the Rhine pours every year into Holland, prodigious rafts of oak, felled in the forests of Germany. The
wrecks

wrecks of the naval engagement off Ostend, conveyed with such rapidity as far as the Azores, discover, in some degree, the extent of the resources which Nature offers to supply in this way.

Geography might, likewise, make this a source of many future useful and important discoveries. To the effects of those Currents is *Christopher Columbus* indebted for the discovery of America. A simple reed of foreign growth, thrown on the western coasts of the Azores, suggested to that great Man, the probability of the existence of another Continent to the West. He farther thought of availing himself of the Currents of the Ocean, on his return from his first voyage to America; for, being in imminent danger of perishing in a storm, amidst the Atlantic Ocean, without having it in his power to inform Europe, which so long slighted his services, and derided his enlightened theory, that he had actually, at length, found out a New World, he inclosed the History of his discovery in a cask, which he committed to the waves, confident that, sooner or later, it would reach some shore.

A common glass bottle might preserve such a deposit for ages on the surface of the Deep, and waft it repeatedly from Pole to Pole. It is not for the sake of our haughty and unfeeling Academicians, who refuse to see any thing in Nature, which they have not imagined in their closet, it is not for them that I thus dwell on the detail, and the application of these oceanic harmonies; no, it is for your sake, unfortunate mariners! It is from the mitigation of the woes to which your profession exposes you, that I one day expect my noblest and most durable recompence. One day, perhaps, a wretched individual of your description, ship-

wrecked on a desert island, may intrust to the Currents of the Seas, the sad task of announcing to the habitations of Men, the news of his disaster, and of imploring assistance. Some Cëyx, perhaps, perishing amidst the tempests of Cape Horn, may charge them to waft his expiring farewell; and the billows of the Southern Hemisphere shall speed the tender sigh to the shores of Europe, to soothe the anguish of some future Alcyone.

After the facts which I have just detailed, it is no longer possible to doubt, that the Indian and Atlantic Oceans have their sources in the half-yearly and alternate fusions of the ices of the South and North Poles; as they have half-yearly and alternate Currents perfectly corresponding to the Summer and Winter of each Pole. These Currents, it may well be believed, flow with much greater velocity, than the floating bodies on their surface. There is produced, at the Equinoxes, a retrogressive impulsion in the whole mass of their waters at once, as appears, at these eras, from the universal agitation of the Ocean in all Latitudes. This total, and almost instantaneous subversion cannot possibly be produced by the operation of the Moon and of the Sun, which proceed always in one direction, and are constantly confined within the Tropics: but, as I have again and again repeated, it is produced by the heat of the Sun, which then passes almost instantaneously from the one Pole to the other, melts the frozen Ocean which covers it, communicates, by the effusion of its ices, new sources to the fluid Ocean, opposite directions to its currents, and inverts the preceding preponderancy of its waters.

Much less is it possible to deduce, as has been done, the cause of the tides, from the action of the Sun and of the
Moon

Moon upon the Equator ; for, if this were so, they must be much more considerable between the Tropics, near to the focus of their movements, than any where else : but this is by no means the case. Hear what *Dampier* says, respecting the tides on the coasts of India, near the Equator, in his *Treatise on the Winds*, page 378.

“ From Cape Blanc, on the coasts of the South-Sea, “ from the third to the thirtieth degree of South Latitude, “ the flux and reflux of the Sea is only a foot and a half, “ or, at most, two feet.....The tides in the East-Indies rise “ very little, and are not so regular as with us, that is, in “ Europe :.....They rise,” says he, in another place, “ to “ four, or, at most, five feet.” He afterwards informs us, that the highest tide which he ever observed on the coast of New Holland, did not take place till three days after the full, or new Moon.

The weakness, and the very considerable retardation of these Tides, between the Tropics, evidently demonstrate, therefore, that the focus of their movements is not under the Equator ; for if it were so, the tides would be tremendous on the coasts of India, which are in it's vicinity, and parallel to it : but their origin is near the Poles, where they rise, in fact, from twenty to twenty-five feet, near Magellan's Strait, according to the *Chevalier Narbrough*, and to a height equally considerable at the entrance of Hudson's-Bay, if we may believe *Ellis*.

Let us make a brief recapitulation. The tides are the half-daily effusions of the ices of one of the Poles, just as the general Currents of the Ocean are it's half-yearly effusions. There are two general opposite Currents annually,

because the Sun warms by turns, in the course of one year, the southern and northern Hemispheres ; and there are two tides every day, because the Sun warms, by turns, every twenty-four hours, the eastern and the western side of the Pole that is in fusion. The same effect exactly is visible in many lakes situated in the vicinity of icy mountains, which have currents, and a flux and reflux in the day-time only. But it cannot admit of doubt, that, if the Sun warmed, during the night, the other side of those mountains, they would produce, likewise, another flux and reflux in their lakes, and, consequently, two tides in twenty-four hours, like the Ocean.

The retardation of the tides of the Ocean, which is about twenty four minutes the one from the other, arises from the daily diminution of the diameter of the icy cupola of the Pole in fusion. Accordingly, the focus of the tides is removing farther and farther from our coasts. If their intensity is such, according to *Bouguer*, that our evening tides are the strongest in Summer, it is because they are the diurnal effusions of our Pole, produced by the heat of the day in the sultry season. If, at that season, they are less strong in the morning than in the evening, it is because they are the nocturnal effusions which come from the other part of the Pole, and discharge themselves into the sources, in the spiral direction of the Atlantic Ocean, but in a smaller quantity.

If, on the contrary, at the end of six months, the strongest tides, that is, those of the evening, become the weakest ; and the weakest, that is, those of the morning, become the strongest : it is because they are then produced by the action of the Sun on the South Pole, and the cause being opposite, the effects must be so likewise. If the tides are
stronger

stronger one day and a half, or two days after the full Moon, it is because that Luminary increases by her heat the polar effusions, and, consequently, the quantity of water in the Ocean. The Moon possesses a degree of heat which not only evaporates water, as was ascertained by recent experiments at Rome and at Paris, but which melts the ices, as *Pliny* relates, in conformity to the observations of Antiquity. “The Moon produces thaw, resolving all ices and frosts by the humidity of her influence.” *Natural History*, Book ii. chap. 101. Finally, if the tides are more considerable at the Equinoxes than at the Solstices, it is because, as has been observed, at the Equinoxes, there is the greatest possible mass of water in the Ocean, for the greatest part of the ices of one of the Poles is then melted, and those of the opposite Pole then begin to dissolve.

We are not to imagine that every tide is a polar effusion of the particular day when it happens; but it is an effect of that series of polar effusions which perpetually succeed to each other; so that the tide which takes place to-day on our coasts, is, perhaps, part of that which takes place, it may be for six weeks together; and it's motion is kept up by those which flow every day in it's series. Thus in a row of balls placed on a billiard table, the first which receives an impulsion, communicates it to the next, and that one to the following, and so through the whole series, and the last only is detached from the row with what remains of the moving force. But here, too, we must admire that other harmony which pervades the most remote effects of Nature: it is this, that the evening and morning tides take place on our coasts, as if they issued that very day from the higher and lower part of our Hemisphere; and that the tides of Sum-

mer are precisely opposite to those of Winter, as the Poles themselves from which they flow.

I could support this new theory by a multitude of facts, and apply it to most of the nautical phenomena which have hitherto been deemed inexplicable; but the time and the space left me forbid it. It is sufficient for me to have deduced from it the principal movements of the Seas. I was under the necessity of tracing the windings of this labyrinth with an application and labour of which the Reader cannot easily form an idea. I have shewn him it's entrance and outlet, and present him with the clew. He will be able, undoubtedly, to go much farther without my assistance. I can venture to assure him, that, by taking advantage of these principles, in perusing journals and Sea voyages, that pretend to any thing like exactness in dates and observations, such as those of *Abel Tasman*, of *Hugues*, of *Linsbatten*, of *General Beaulieu*, of *Fröger*, of *Frazer*, of *Dampier*, of *Ellis*, &c. he will find a new light diffused over those passages of marine journals, which are, for the most part, so dry, and so obscure.

Had time and means been granted me to unfold this part of my subject, and to display it in all the luminous simplicity of which it is susceptible, I have the vanity to think that I could have rendered it, in many other respects, highly interesting. I would have procured a representation, on two large solid globes, of the two general Currents of the Ocean, in Winter and in Summer, with arrows which should have expressed the exact intervals between one tide and another; and of their counter-currents, lateral to the passage of all straits, which produce on different shores the counter-

counter-tides, half-daily, daily, weekly, lunar, half-yearly. These counter-tides should have produced others, on the return, at the passage of islands; so that the Ocean would have been represented as a vast fluid issuing from each Pole, to make the circuit of the Globe, and forming, on its shores, a multitude of counter-currents, and counter-tides, all dependant on the effusions of one Pole singly. I should have employed for this purpose the best authenticated marine Journals.

It would, then, have been evidently clear, that the bays of Continents, and even of Islands, are sheltered from the general Currents; and I would have demonstrated, on the contrary, that the course and the direction of all rivers are adapted to those Currents and those tides of the Ocean, in order to accelerate them in certain places, and to retard them in others, just as the course of brooks and rivulets is itself adapted to the current of rivers, and for the same end.

I would have done more; in order to vindicate Geography from the charge of dryness, and to unite the graces which all the kingdoms of Nature communicate to each other, instead of arrows, I should have illustrated my subject by figures more analogous to the Seas, and have added new proofs to the theory of those polar effusions, by a representation of several species of fishes of passage, which, at certain seasons of the year, resign themselves to their currents, in order to pass from the one Hemisphere to the other.

This much is certain, that the principal point of their union, as well from the one Pole as from the other, pre-

cifully is at the strait formed by Guinea and Brasil, where, as has been said, are formed those two great lateral counter-currents which return toward the Poles. There is the rendezvous of the fishes from the North Pole, and from the South. Herrings, whales, and mackarel, are, in Summer, found in great abundance on those shores. The whales of the North have formerly been so common at Brasil, that, according to the report of Navigators, the fishery on its coasts was farmed out, and produced a considerable revenue to the King of Portugal. I know not how it may be at present: perhaps the noise of European artillery may have chased them away from those coasts. A very productive cod-fishery was likewise carried on there, known all over America by the name of the Brasil cod.

On the other hand, according to the testimony of *Bosman*, a Dutch Navigator, who has published a very good account of Guinea, the whales of that species which is called *North-caper* are found in great abundance on the coasts of Guinea. He alleges that they resort thither to bring forth their young: *Artus* has favoured us with a catalogue of the fishes of passage which appear on that coast during the different months of the year. Though it is very imperfect, we are enabled by it to distinguish the fishes which are peculiar to each Pole. In the months of April and May, it is a species of ray which rises to the surface of the water: in June and July, a sort of herring, in such quantities that the Negroes, on throwing among them a simple leaden weight, at the extremity of a long line, furnished with hooks, always draw up a considerable number at every throw. During the same months they catch a great many lobsters, similar, says *Artus*, to those of Norway.

In September, innnmerable legions, and various species, of mackarel arrive there. At that feafon, too, appears a kind of mullet, which, unlike all other fifhes, who delight in filence, flock to noife. The Negros avail themselves of this inflinct as the means of catching them. They tie to a piece of wood furrounded with hooks, a fort of cornet with it's clapper; thus furnished, it is thrown into the fea; and the motion of the waves tolling about the cornet, produces a certain noife, which attracts the fifh in queftion, fo that, in attempting to lay hold of the piece of wood, they are thus themfelves caught. Kind Nature, accordingly, thus furnifhes to the poor Negroes a fifhery adapted to their capacity and induftry.

This fpecies of mullet appears, from it's inflinct, deftined to travel through turbulent feaf, and at noify feafons, for he is vifible only about the autumnal Equinox, at the revolution of the feafons. But in the months of October and November, thofe fhores are crouded with fifhes, whofe names and manners are unknown to Europe, and which feem to appertain to the South Pole, whofe Currents are then in a ftate of activity. Such are, a fea pike or jack, the teeth of which are extremely fharp, and the bite very dangerous: a fpecies of falmon, with white flefh, and of an exquisite flavour: another called the ftar of the fea: a fpecies of fea-dog, which has a very large head, and the throat in form of a warming-pan; it is marked on the back with a crofs: fome of them grow to fuch a fize, that a fingle one is fufficient to load two or three canoes. In December arrive vafit quantities of the korkofedo, or moon-fifh; they appear likewise in June. The korkofedo feems to regulate his progrefs by the follices. He is as broad as long; and is caught by a bit of fugar-cane fixed on a hook. The tafte
which

which this fish has for the sugar-cane is another proof of the harmonies established between fishes and vegetables. Finally, in the months of January, February, and March, may be seen, on the coast of Guinea, a species of small fish with large eyes, which *Artus* supposes to be the *oculus*, or *piscis oculatus* (eyed-fish) of *Pliny*. This, too, is an inhabitant of the boisterous equinoctial Seas, for he frisks and jumps about with a great deal of noise.

Had time permitted, I would have extended these elementary concords to the different inhabitants of the departments of the Ocean. We should have seen, for example, the cause of the alternate transition of turtles, which, for six months of the year, take up their abode in certain islands, and which are found again, six months after, in other islands, seven or eight hundred leagues distant, putting it beyond the power of imagination to conceive how an amphibious animal, so sluggish and unwieldy, should be able to make a passage so immense toward places which it is impossible she should perceive. We should have seen their heavy-sailing squadrons committing themselves, almost without motion, in the night-time, to the general Current of the Ocean, coasting by moon-light the gloomy promontories of islands, and seeking, in their deserted creeks, some sandy and tranquil bank, where, far from din, they may undisturbedly deposit their eggs.

Others, such as the mackarel, never fail to arrive, at the accustomed season, on other shores, conveyed by the same Currents, because then they are blind. "When the mackarel come to the coasts of Canada," says *Denis*, formerly Governor of that country, "they have not the least glimmering of sight. They have a speck on their eyes, which

“ which does not fall off till toward the end of June ;
“ thenceforward they see, and are caught by the line*.”
His testimony is confirmed by other Navigators, though
there was no necessity for it.

Other fishes, such as herrings, expose their silvery legions to glitter in the Sun on the northern strands of Europe and America, shaded with firs, and advance forward and forward, till they reach even the palm-groves of the Line, forcing their way along the shores, in opposition to the tides of the South, which are continually supplying them with fresh pasture.

Others, as the thunny, make their way, by favour of these very tides, and enter, in the Spring, into the Mediterranean, of which they make a complete circuit ; and, though they leave no trace on their watery way, they do not fail to render themselves visible in the darkest night, by means of the phosphoric lights which their motion excites. It is by those same gleams of light that we perceive, in the night-time, the turtle with their dusky colour, on the surface of the waters. You would imagine that these animals, surrounded by light, had flambeaus affixed to their fins and tails. The phosphoric qualities, accordingly, of the sea-water, are in unison even with the nocturnal voyages of fishes.

The Sun is the grand mover in all these harmonies. Arrived at the Equinox, he abandons one Pole to Winter, and gives to the other the signal of Spring, by the fires with which he environs it. The heated Pole pours out, in every

* Natural History of North-America, chap. ii.

direction, torrents of water, and of melted ices, into the Ocean, to which it supplies new sources. The Ocean then changes it's course; it draws into it's general Current most of the fishes of the North toward the South; and by it's lateral counter-currents, those of the South toward the North. It attracts others even from the Continent, by the alluvions of the land, which the rivers discharge: such are the fishes with scales, as salmon, which love, in general, to make their way upward against the course of rivers.

These floating legions are attended by innumerable cohorts of sea-fowls, which quit their natural climates, and hover around the fishes, to live at their expense. It is then that we find the sea-fowls of the South flocking to the shores of the North, as the pelican, the flamingo, the heron, the stork: and those of the North finding their way to the South, as the lomb, the burgomaster, the cormorant. It is then that sands and shallows the most deserted, are crowded with inhabitants, and that Nature presents new harmonies on every shore.

If the voyages of the inhabitants of the Seas would have diffused new light on the Currents of the Ocean, these same Currents would have furnished us with new light respecting the forms and manners of fishes, which have to us such an uncouth appearance. Most of these fishes cast their spawn in such abundance, that the Sea is frequently covered by it for several leagues together. The Currents carry off this spawn to prodigious distances, and while the fathers and mothers unconcernedly indulge in the dalliance of love, on the coasts of Norway, their fry are hatching on those of Africa or Brasil.

We should have seen their categories, so wonderfully varied, of a configuration perfectly adapted to the different sites of the Ocean: some, cut out into long sword-blades, like the African fish which bears that name, take pleasure in penetrating into the narrowest crevices of rocks, and in stemming the most rapid currents: others, equally flat, are cut into a circular form, with two long horns, like sail-yards, issuing from the head, and inverted behind, to serve them as a helm, as the silvery moon-fish of the Antilles. These moon-fish are continually sporting among the billows which break upon the rocks, without a single instance being known of any one thrown ashore. Other fishes of a triangular shape, and cut into the form of the chest whose name they bear, advance into the very middle of the shelvy ground upon the shore, where there is scarcely any water, and display, in the bosom of the dusky rocks their blue shining robes, bespangled with stars of gold.

While some, perpetually restless, scratch and scrape into every chink along the beach, in quest of their prey; others, in perfect tranquility respecting their provision, remain immoveable, on a fixed station, expecting it. Some, incrusted in lumpish habitations of stone, pave the ground of the shores, as the *helmet*, the *lambi*, and the *thuilée*; others, attached by threads to little pebbles, ride at anchor at the mouths of rivers, as the *muscle*; others glew themselves to each other, as the *oyster*; others fix themselves as the heads of nails to the rocks, to which they cling by suction, as the *limpit*; others bury themselves in the sand, as the *harpe*, the *cockle*, the *knife-handle*; and most of the shell-fish whose exterior garments are clear and brilliant; others, as the *lobster* and the *crab*, armed with bucklers and corsets,

in ambush among the stones, where they present to view only the extremities of their horns and their great claws.

Had it been in my power, I would have studied the contrasts which those innumerable families form on the slime and on the rocks, where their shells sparkle with the fires of *Aurora*, and with the lustre of purple and of the *lapis-lazuli*. I would have described those sea-covered regions, clothed with plants of an infinite variety of forms, which never receive the rays of the Sun but through the medium of water. Their very valleys, where the currents gush with the rapidity of sluices, produce plants elastic, and perforated, such as the leaves of the sea-peacock, through the apertures of which the waves pass as through a sieve. I would have represented their rocks, rising from the depth of the abyss, like mounds incapable of being moved, with cavernous sides, presenting brittle beds of madrépores, and festooned with moveable garlands of *fucus*, *alga-marina*, and other sea-weeds of all colours, which serve as shelter, and bedding, for the calves and horses of the Sea.

During storms, their dark bases are covered with clouds of a phosphoric light; and sounds unutterable, issuing from their untraceable mazes, invite to the prey the silent legions of the inhabitants of the mighty Deep. I would have endeavoured to force my way into those palaces of the Nereïds, in order to unveil mysteries hitherto concealed from the human eye, and to contemplate from afar the footsteps of that infinite WISDOM which are impressed on the oozy bottom of the Ocean. But researches so laborious, though so delightful; of such importance to our fisheries, and so fertile of materials for natural History, far transcend the fortunes and the exertions of a Solitary.

I have

I have the confidence, however, to flatter myself with the belief, that the new Theory which I have presented, respecting the causes of the general Currents, and of the Tides of the Ocean, may be rendered useful to Navigation. It appears to me, that a vessel taking her departure hence in the month of March, with the course of our polar effusions, and keeping in the middle of the Atlantic channel, might proceed, in Summer, all the way to the East-Indies, continually favoured by the current. This I am able even to prove by the experience of various Navigators. It is true that, during the season which is the Winter of the South Pole, the weathering of the Cape is dangerous, because the westerly monsoon, which then predominates, in those Seas, excites in them frequent storms, as well as on the coasts of India, which are opposed to it; but I believe these inconveniences might be avoided, by stretching out into a higher Latitude.

The same vessel might return from the East-Indies, six months afterwards, during our Winter, aided by the effusions of the South Pole. Advantage might be taken, on the contrary, of the counter-currents of the general Currents, or of their lateral Tides, to go or return, at the intermediate seasons, by coasting along the Continents. It is easy to deduce from this theory other means of information for the navigation of all Seas: for example, assistance might be derived from those currents for the discovery of new islands; for every island is situated at the extremity, or at the confluence of one or more currents, as every volcano is placed in a counter-tide.

Here I close these nautical disquisitions, in which there are undoubtedly, inaccuracies of style, and manifold imperfections

perfections of various kinds; but determined by particular circumstances to bring this Work, without delay, before the tribunal of the Public, I have hastened to present my Country with this last testimony of my attachment. I reckon on the indulgence of the really intelligent, and presume to hope they will have the goodness to rectify my mistakes.

STUDIES
OF
N A T U R E.

STUDY FIRST.

IMMENSITY OF NATURE: PLAN OF MY WORK.

SOME years have elapsed, since I formed the design of composing a general History of Nature, in imitation of *Aristotle*, *Pliny*, Chancellor *Bacon*, and several illustrious modern Authors. The field appeared to me so vast, that I could not believe the possibility of it's being entirely pre-occupied. Besides, Nature invites to the cultivation of herself, persons of every age and country; and if she promises the golden harvest of discovery, only to men of genius, she reserves some gleanings, at least, for the simple and unlearned; for such, especially, as, like myself, are making a pause every step they advance, transported at the beauty of her divine productions.

I was farther prompted to the execution of my great design, in the view of rendering an accept-

able service to my fellow creatures, and of meriting their approbation; particularly that of *Louis XVI.* my illustrious benefactor, who, after the example of *Titus* and *Marcus-Aurelius*, devotes his whole attention to the felicity of mankind.

In Nature herself alone we must expect to find the laws of Nature; and we plunge into difficulty and distress, only in proportion as we deviate from these laws. To study Nature, therefore, is to act the part of a good subject, and of a friend to humanity. I have employed, in my researches, all the powers of reasoning I possess; and, though my means may have been slender, I can say, with truth, that I have not permitted a single day to pass, without picking up some agreeable, or useful, observation.

I proposed to begin the composition of my Work, when I had ceased from observing, and when I should have collected all the materials necessary to a History of Nature; but I found myself in the condition of the child, who, with a shell, had dug a hole in the sand, to hold the water of the Ocean.

Nature is of unbounded extent, and I am a human being, limited on every side. Not only her general History, but that of the smallest plant, far transcends

transcends my highest powers. Permit me to relate, on what occasion I became sensible of this.

One day, in Summer, while I was busied in the arrangement of some observations which I had made, respecting the harmonies discoverable in this Globe of ours, I perceived, on a strawberry plant, which had been, accidentally, placed in my window, some small winged insects, so very beautiful, that I took a fancy to describe them. Next day, a different sort appeared, which I proceeded, likewise, to describe. In the course of three weeks, no less than thirty-seven species, totally distinct, had visited my strawberry plant: at length, they came in such crowds, and presented such variety, that I was constrained to relinquish this study, though highly amusing, for want of leisure, and, to acknowledge the truth, for want of expression.

The insects, which I had observed, were all distinguishable from each other, by their colours, their forms, and their motions. Some of them shone like gold, others were of the colour of silver, and of brass; some were spotted, some striped; they were blue, green, brown, chestnut coloured. The heads of some were rounded like a turban, those of others were drawn out into the figure of a cone. Here it was dark as a tuft of black velvet, there it sparkled like a ruby.

There was not less diversity in their wings. In some they were long and brilliant, like transparent plates of mother-of-pearl; in others, short and broad, resembling net-work of the finest gauze. Each had his particular manner of disposing and managing his wings. Some disposed theirs perpendicularly; others, horizontally; and they seemed to take pleasure in displaying them. Some flew spirally, after the manner of butterflies; others sprung into the air, directing their flight in opposition to the wind, by a mechanism somewhat similar to that of a paper-kite, which, in rising, forms, with the axis of the wind, an angle, I think, of twenty-two degrees and a half.

Some alighted on the plant to deposit their eggs; others, merely to shelter themselves from the Sun. But the greatest part paid this visit from reasons totally unknown to me: for some went and came, in an incessant motion, while others moved only the hinder part of their body. A great many of them remained entirely motionless, and were like me, perhaps, employed in making observations.

I scorned to pay any attention, as being already sufficiently known, to all the other tribes of insects, which my strawberry plant had attracted; such as the snail, which nestles under the leaves; the butterfly, which flutters around; the beetle, which
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digs about it's roots ; the small worm, which contrives to live in the *parenchyme*, that is, in the mere thickness of a leaf ; the wasp and honey-bee, which hum around the blossoms ; the gnat, which sucks the juices of the stem ; the ant, which licks up the gnat ; and, to make no longer an enumeration, the spider, which, in order to find a prey in these, one after another, distends his snares over the whole vicinity.

However minute these objects may be, they, surely, merited my attention, as Nature deemed them not unworthy of her's. Could I refuse them a place in my general History, when she had given them one in the system of the Universe ? For a still stronger reason, had I written the history of my strawberry plant, I must have given some account of the insects attached to it. Plants are the habitation of insects ; and it is impossible to give the history of a city, without saying something of it's inhabitants.

Besides, my strawberry plant was not in its natural situation, in the open country, on the border of a wood, or by the brink of a rivulet, where it could have been frequented by many other species of living creatures. It was confined to an earthen pot, amidst the smoke of Paris. I observed it only at vacant moments. I knew nothing of the insects

which visited it during the course of the day ; still less of those which might come only in the night, attracted by simple emanations, or, perhaps, by a phosphoric light, which escapes our senses. I was totally ignorant of the various species which might frequent it, at other seasons of the year, and of the endless other relations which it might have, with reptiles, with amphibious animals, fishes, birds, quadrupeds, and, above all, with Man, who undervalues every thing which he cannot convert to his own use.

But it was not sufficient to observe it, if I may use the expression, from the heights of my greatness ; for, in this case, my knowledge would have been greatly inferior to that of one of the insects, who made it their habitation. Not one of them, on examining it with his little spherical eyes, but must have distinguished an infinite variety of objects, which I could not perceive without the assistance of a microscope, and after much laborious research. Nay, their eyes are inconceivably superior even to this instrument ; for it shews us the objects only which are in it's focus, that is, at the distance of a few lines ; whereas they perceive, by a mechanism of which we have no conception, those which are near, and those which are far off. Their eyes, therefore, are, at once, microscopes and telescopes. Besides, by their circular disposition

tion round the head, they have the advantage of viewing the whole circuit of the heavens at the same instant, while those of the Astronomer can take in, at most, but the half. My winged insects, accordingly, must discern in the strawberry plant, at a single glance, an arrangement and combination of parts, which, assisted by the microscope, I can observe only separate from each other, and in succession.

On examining the leaves of this vegetable, with the aid of a lens which had but a small magnifying power, I found them divided into compartments, hedged round with bristles, separated by canals, and strewed with glands. These compartments appeared to me similar to large verdant inclosures, their bristles to vegetables of a particular order; of which some were upright, some inclined, some forked, some hollowed into tubes, from the extremity of which a liquid distilled; and their canals, as well as their glands, seemed full of a brilliant fluid. In plants of a different species, these bristles, and these canals, exhibit forms, colours, and fluids, entirely different. There are even glands, which resemble basons, round, square, or radiated.

Now, Nature has made nothing in vain. Wherever she has prepared a habitation, she immedi-

ately peoples it. She is never straitened for want of room. She has placed animals, furnished with fins, in a single drop of water, and in such multitudes, that *Leeuwenhoek*, the natural Philosopher, reckoned up to thousands of them. Many others after him, and, among the rest, *Robert Hook*, have seen, in one drop of water, as small as a grain of millet, some 10, others 30, and some as far as 45 thousand. Those who know not how far the patience and sagacity of an Observer can go, might, perhaps, call in question the accuracy of these observations, if *Lyonnet*, who relates them in *Leffer's* Theology of Insects *, had not demonstrated the possibility of it, by a piece of mechanism abundantly simple. We are certain, at least, of the existence of those beings whose different figures have actually been drawn. Others are found, whose feet are armed with claws, on the body of the fly, and even on that of the flea.

It is credible, then, from analogy, that there are animals feeding on the leaves of plants, like the cattle in our meadows, and on our mountains; which repose under the shade of a down imperceptible to the naked eye, and which, from goblets formed like so many funs, quaff nectar of the colour of gold and silver. Each part of the flower

* Book II. chap. 3. See the last note.

must present, to them, a spectacle of which we can form no idea. The yellow *antheræ* of flowers, suspended by fillets of white, exhibit to their eyes, double rafters of gold in equilibrio, on pillars fairer than ivory; the *corolla*, an arch of unbounded magnitude, embellished with the ruby and the topaz; rivers of nectar and honey; the other parts of the flowret, cups, urns, pavilions, domes, which the human Architect and Goldsmith have not yet learned to imitate.

I do not speak thus from conjecture: for having examined, one day, by the microscope, the flowers of thyme, I distinguished in them, with equal surprise and delight, superb flagons, with a long neck, of a substance resembling amethyst, from the gullets of which seemed to flow ingots of liquid gold. I have never made observation, of the *corolla* simply, of the smallest flower, without finding it composed of an admirable substance, half transparent, studded with brilliants, and shining in the most lively colours.

The beings which live under a reflex thus enriched, must have ideas, very different from ours, of light, and of the other phenomena of Nature. A drop of dew, filtering in the capillary, and transparent, tubes of a plant, presents, to them, thousands of cascades; the same drop, fixed as a wave

on the extremity of one of it's prickles, an Ocean without a shore ; evaporated into air, a vast aërial Sea. They must, therefore, see fluids ascending, instead of falling ; assuming a globular form, instead of sinking to a level ; and mounting into the air, instead of obeying the power of gravity.

Their ignorance must be as wonderful as their knowledge. As they have a thorough acquaintance with the harmony of only the minutest objects, that of vast objects must escape them. They know not, undoubtedly, that there are men, and, among these, learned men, who know every thing, who can explain every thing, who, transient like themselves, plunge into an infinity on the ascending scale, in which they are lost ; whereas they, in virtue of their littleness, are acquainted with an opposite infinity, in the last divisions of time and matter.

In these ephemerous beings, we must find the youth of a single morning, and the decrepitude of one day. If they possess historical monuments, they must have their months, years, ages, epochs, proportioned to the duration of a flower ; they must have a chronology different from ours, as their hydraulics and optics must differ. Thus, in proportion as Man brings the elements of Nature near him, the principles of his Science disappear.

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Such, therefore, must have been my strawberry plant, and its natural inhabitants, in the eyes of my winged insects, which had alighted to visit it; but though I had been able to acquire, with them, an intimate knowledge of this new world, I was still very far from having the History of it. I must have, previously, studied its relations to the other parts of Nature; to the Sun which expands its blossom, to the winds which sow its seeds over and over, to the brooks whose banks it forms and embellishes. I must have known, how it was preserved in Winter, during a cold capable of cleaving stones asunder; and how it should appear verdant in the Spring, without any pains employed to preserve it from the frost; how, feeble and crawling along the ground, it should be able to find its way, from the deepest valley, to the summit of the Alps, to traverse the Globe from north to south, from mountain to mountain, forming, on its passage, a thousand charming pieces of chequered work, of its fair flowers, and rose-coloured fruit, with the plants of every other climate; how it has been able to scatter itself from the mountains of Cachemire to Archangel, and from the *Felices*, in Norway, to Kamfchatka; how, in a word, we find it, in equal abundance, in both American Continents, though an infinite number of animals is making incessant and universal war upon it, and no gardener is at the trouble to sow it again.

Supposing

Supposing all this knowledge acquired, I should still have arrived no farther than at the history of the *genus*, and not that of the *species*. The varieties would yet remain unknown, which have each it's particular character, according as they have flowers single, in pairs, or disposed in clusters; according to the colour, the smell, and the taste of the fruit; according to the size, the figure, the edging, the smoothness, or the downy clothing of their leaves. One of our most celebrated botanists, *Sebastian le Vaillant* *, has found, in the environs of Paris alone, five distinct species, three of which bear flowers, without producing fruit. In our gardens, we cultivate at least twelve different sorts of foreign strawberries; that of Chili, of Peru; the Alpine, or perpetual; the Swedish, which is green, &c. But how many varieties are there, to us totally unknown! Has not every degree of latitude a species peculiar to itself? Is it not presumable, that there may be trees which produce strawberries, as there are those which bear pease and French-beans? May we not even consider as varieties of the strawberry, the numerous species of the raspberry and of the bramble, with which it has a very striking analogy, from the shape of it's leaves; from it's shoots, which creep along the ground, and replant themselves; from the rose-

* *Botanicon Parisiense.*

form of it's flowers, and that of it's fruit, the seeds of which are on the outside? Has it not, besides, an affinity with the eglantine and the rose-tree, as to the flower; with the mulberry, as to the fruit; and with the trefoil itself, as to the leaves; one species of which, common in the environs of Paris, bears, likewise, it's seeds aggregated into the form of a strawberry, from which it derives the botanic name of *trifolium fragiferum*, the strawberry-bearing trefoil? Now, if we reflect, that all these species, varieties, analogies, affinities, have, in every particular latitude, necessary relations with a multitude of animals, and that these relations are altogether unknown to us, we shall find, that a complete History of the strawberry-plant would be ample employment for all the Naturalists in the world.

What a task, then, would it be, to write the History, in like manner, of all the species of vegetables, scattered over the face of the whole Earth? The celebrated *Linnaeus* reckoned up from seven to eight thousand of them; but he had not travelled. The famous *Sherard*, it is said, was acquainted with sixteen thousand. Another Botanist swells his catalogue up to twenty thousand. Finally, one still more modern, boasts of having himself made a collection of twenty-five thousand; and he estimates the number of those which he has not seen, at four or five times as many. But all these enumerations

enumerations must be extremely defective, if it is considered, as has been remarked by this last Observer himself, that we know little or nothing of the interior of Africa; of that of the three Arabias, and even of the two Americas; very little of New Guinea, New Holland and Zealand, and of the innumerable islands of the South Sea, the greatest part of which are themselves still undiscovered. We know hardly any thing of the Isle of Ceylon, except a little of the coast; of the great island of Madagascar; of the immense archipelagos of the Philippines and Moluccas, and of almost all the Asiatic islands. As to that vast Continent, with the exception of some great roads in the interior, and some parts of the coast resorted to by the traffick of Europe, we may affirm that it is wholly unknown to us.

How many immense districts are there in Tartary, in Siberia, and even in many of the kingdoms of Europe, where the foot of Botanist never trod! Some, indeed, have given us a herbal of Malabar, Japan, China, &c. but if we reflect, that, in these countries, their researches never penetrated beyond the sea-coast, and were generally confined to one season of the year, when a part only of the plants, peculiar to each climate, appear; that they have visited only the narrow regions adjoining to our European factories; that they have never dared
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to plunge into deserts, where they could have found neither subsistence nor guide ; nor ventured themselves among the numerous tribes of barbarous Nations, whose language they did not understand ; we shall find reason to conclude, that their boasted collections, however valuable, are still extremely imperfect.

In order to be convinced of this, we have only to compare the time employed by them, in making their collections of plants, in foreign countries, with that which it cost *Le Vaillant* to collect those of the vicinity of Paris only. The learned *Tournefort* had already made this a particular study ; and, after a master so indefatigable had completed his Work, all the Botanists of the capital, it was thought, might have gone to rest. *Le Vaillant*, his pupil, had the courage to walk over the same ground after him, and discovered such a considerable quantity of distinct species, overlooked by *Tournefort*, that he doubled, at least, the catalogue of our plants. He made it amount to fifteen or sixteen hundred. And even then, he did not include in this enumeration, those which differ only in the colour of the flowers, and the spots of the leaves, though Nature frequently employs such signs as these, in the vegetable world, to distinguish the species, and to form their true characters. Hear what
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what *Boerhaave*, his illustrious Editor, says of his laborious researches :

Incubuit quippe huic labori ab anno 1696, usque in Martium 1722 ; toto quidem tanti decursu temporis in eo occupatus semper, nullum præteriens unquam, cujus plantas haud excuteret, angulum : vias, agros, valles, montes, hortos, nemora, stagna, paludes, flumina, ripas, fossas, puteos, undequaque lustrans. Contigit ergo, crebro, ut detegeret maximi quæ Tournefortii intentissimos oculos effugerant.* (Preface to the *Botanicon Parisiense*, page 3 and 4.)

Sebastian le Vaillant, accordingly, employed no less than twenty-six whole years, in his own country, and with the assistance of his pupils, in completing his botanical description of the plants of a few square leagues ; whereas the persons who pretend to give us the Botany of many foreign coun-

* He devoted his whole attention to this laborious undertaking, from the year 1696 to March 1722. During a period of such length, he was constantly and unweariedly employed in it, never passing by the smallest corner without examining what plants it contained. With the eye of an Observer, he pried into every place, the roads, fields, vallies, mountains, gardens, forests, pools, morasses, rivers, their banks, ditches, wells : hence he had, frequently, the good fortune, to discover many things which escaped even the eager eyes of the great *Tournefort*.

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tries, were alone and unassisted, and dispatched the business in a few months. But, though his sagacity and perseverance seem to have left us nothing more to wish for, I have my doubts, whether he has made a complete collection of all the gifts which Flora scatters over our plains; and whether he has seen, if I may use the expression, to the bottom of her basket. Pliny observed plants, in places not comprehended in *Boerhaave's* enumeration, and which grow on the tiles that cover our houses, on rotten sieves, and the heads of ancient statues. It is, undoubtedly, certain, that we are, from time to time, discovering some, at no great distance from Paris, which have no place in the *Botanicon* of *Le Vaillant*.

For my own part, if I might be permitted to hazard a conjecture, respecting the number of the distinct species of plants, spread over the Earth, such is my idea of the immensity of Nature, and of her subdivisions, that I am disposed to believe, there is not a square league of earth, but what presents some one plant peculiar to itself, or, at least, which thrives there better, and appears more beautiful, than in any other part of the world. This makes the number, of the primordial species of vegetables, amount to several millions, diffused over as many millions of square leagues, of which the surface of our Globe consists. The farther south

we advance, the more their variety increases within spaces of the same dimension. The Isle of Taïty, in the South Sea, was found to have a botany peculiar to itself, and which had nothing in common with that of the places in Africa and America, which are situated in the same latitude; nay, totally different from that of the adjacent islands. And if we now reflect, that each plant has several different names, in it's own country; that every Nation imposes particular denominations, and that all these names, at least the greater part, are varying every age, what difficulties does not the vocabulary alone oppose to the study of Botany?

All these preliminary notions, however, would still form only a useless Science, did we even know, in the most complete detail, all the parts of which plants are composed. It is the combination of these parts, the attitude of the plants, their port, their elegance, the harmonies which they form, when grouped, or in contrast with each other, which it would be interesting to determine. I do not know that any thing has been so much as attempted on this subject.

As to their virtues, it may be affirmed, that they are, for the most part, unknown, or neglected, or abused. Their qualities are often perverted, in making cruel experiments on innocent animals,
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while they might be usefully employed as miraculous remedies, to counteract the ills of human life. We have preserved, for example, in the Royal Cabinet at Paris, arrows more formidable than those of Hercules, though dipped in the blood of the snake of Lerna. Their points are impregnated with the juice of a plant so venomous, that, though exposed to the air for many years, they can, with the slightest puncture, destroy the most robust of animals, in a few minutes. The blood of the creature, be the wound ever so trifling, instantly coagulates. But if the patient, at the same instant, is made to swallow a small quantity of sugar, the circulation is immediately restored. Both the poison and the antidote have been discovered by the savages which inhabit the banks of the Amazon; and it is of importance to observe, that they never employ in war, but only in the chase, this murderous method of destroying life.

Wherefore do not we, who pretend to so much humanity and illumination, endeavour to ascertain, by experiment, whether this poison might not be rendered medicinal in cases of a sudden dissolution of the blood; and sugar, in cases of sudden coagulation? Alas! how is it to be expected we should apply to the preservation of Mankind, the malignant and destructive qualities of a foreign vegetable, we who are continually

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abusing,

abusing, for mutual destruction, the precious gifts which Nature has bestowed, in the view of rendering human life innocent and happy? The elm and the beech, under the shade of which our shepherds and their mates delight to dance, are hewn down into carriages, for mounting the thundering ordnance. We intoxicate our soldiers into madness, that they may kill each other, without hatred, with that very juice of the vine which Providence has given to be the means of reconciliation among enemies? The lofty fir-trees, planted by the benignant hand of Nature, amidst the snows of the North, to shelter and warm the inhabitants, are converted into masts, for the vessels of Europe, to carry the flames of devouring fire against the peaceful inhabitants of the Southern Hemisphere; and the canvas, designed for the humble clothing of the village-maid, becomes a sail for the plundering corsair, to extend his ravages to remotest India. Our crops, and our forests, are wafted over the Ocean, to spread desolation over both the Old and New Worlds.

But let us drop the history of Man, and resume that of Nature. If, from the vegetable, we make a transition to the animal kingdom, a field of incomparably greater extent presents itself. An intelligent Naturalist, at Paris, some years ago, announced, that he was in possession of more than
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thirty thousand distinct species of animals. I know not whether the King's magnificent Cabinet may not contain more; but I know well, that his Herbals contain only eighteen thousand plants, and that about six thousand are in a state of cultivation in the Royal Botanic Garden. This number of animals, however, so superior to that of vegetables, is a mere nothing, in comparison with what exists on the Globe.

When we recollect, that every species of plant is a point of union for different genera of insects, and that there is not, perhaps, a single one, but which has, peculiar to itself, a species of fly, butterfly, gnat, beetle, lady-bird, snail, &c. that these insects serve for food, to other species, and these exceedingly numerous, such as the spider, the dragon-fly, the ant, the formicaleo; and to the immense families of small birds, of which many classes, such as the wood-pecker, and the swallow, have no other kind of nourishment; that these birds are, in their turn, devoured by birds of prey, such as kites, falcons, buzzards, rooks, crows, hawks, vultures, &c. that the general spoil of these animals, swept off by the rains, into the rivers, and thence to the Sea, becomes the aliment of almost innumerable tribes of fishes, to the greatest part of which the Naturalists of Europe have not hitherto given a name; that numberless

legions of river and sea-fowls prey upon these fishes: we shall have good ground for believing, that every species of the vegetable kingdom serves as a basis to many species of the animal kingdom, which multiply around it, as the rays of a circle round its centre.

At the same time, I have not included in this superficial representation, either quadrupeds, with which all the intervals of magnitude are filled, from the mouse, which lives under the grass, up to the camelopard, who can feed on the foliage of trees, at the height of fifteen feet; or the amphibious tribes; or the birds of night; or reptiles; or polypuses, of which we have a knowledge so slender; or sea insects, some families of which, such as the crab-fish, shrimp, and the like, would be alone sufficient to fill the greatest cabinets, were you to introduce but a single individual of every species. I do not include the madrépore, with which the bottom of the sea is paved between the Tropics, and which present so many different species, that I have seen, in the Isle of France, two great halls filled with those which were produced in the immediate vicinity of that Isle, though there was but a single specimen of each sort.

I have made no mention of insects of many kinds, as the louse and the maggot, of which every
animal

animal species has its particular varieties, proper to itself, and which triple, at least, the kingdom of creatures existing by respiration. Neither have I taken into the account, that infinite number of living things, visible and invisible, known and unknown, which have no fixed determination, and which Nature has scattered about, through the Air, over the Earth, and along the depths of the Ocean.

What an undertaking, then, would it be, to describe each of these beings, with the sagacity of a *Reaumur*? The life of one man of genius, would be scarcely sufficient to compose the History of a few insects. However curious may be the memoirs transmitted to us, after the most careful research, respecting the manners, and the anatomy, of the animals most familiarly known, in vain do we still flatter ourselves with our having acquired a complete acquaintance. The principal requisite, in my opinion, is yet wanting; I mean, the origin of their friendships and of their feuds. In this consists, if I am not mistaken, the essence of their History, to which must be referred their instincts, their loves, their wars; the attire, the arms, and the very form which Nature gives them. A moral sentiment seems to have determined their physical organization. I know not of any Naturalist who has engaged in a research of this sort. The Poets have endeavoured to explain these

wonderful and innate instincts, by their ingenious fictions. The swallow Progné flies the forest; her sister Philomela delights to sing in solitary places. Progné thus, one day, addresses her :

Le désert est-il fait pour des talens si beaux ?
 Venez faire aux cités eclater leurs merveilles :
 Aussi bien, en voyant les bois,
 Sans cesse il vous souvient que Térée autrefois,
 Parmi des demeures pareilles,
 Exerça sa fureur sur vos divins appas.—
 Et c'est le souvenir d'un si cruel outrage,
 Qui fait, reprit sa sœur, que je ne vous suis pas :
 En voyant les hommes, hélas !
 Il m'en souvient bien davantage. *

I never hear the enchantingly melancholy song of a nightingale, shrouded in shrubbery, and the lengthened piou-piou, which interrupt, like sighs, the music of that solitary songster, without believing, that Nature had revealed her adventure to

* Thus imitated :

Why waste such sweetness on the desert air !
 Come, charm the city with thy tuneful note.
 Think too, in solitude, that form so fair
 Felt violation : flee the horrid thought.

Ah ! sister dear, sad Philomel replies,
 'Tis this that makes me shun the haunts of men :
 Tereüs and Courts the anguish'd heart allies,
 And hastes, for shelter, to the woods again.

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the sublime *La Fontaine*, at the time she inspired him to compose these verses. If these fables were not the history of men, they would be, to me, at least a supplement to that of animals. Philosophers of name, unfaithful to the testimony of their reason and conscience, have dared to represent them as mere machines. They ascribe to them blind instincts, which regulate, in a manner perfectly uniform, all their actions, without passion, without will, without choice, and even without any degree of sensibility. I one day expressed my astonishment at this to *J. J. Rousseau*; and said to him, it seemed exceedingly strange, that men of genius should maintain a position so extravagant. He very sagely replied, *The solution is this, When Man begins to reason, he ceases to feel.*

In order to confute the opinions of such Philosophers, I shall have recourse, not to those animals whose sagacity and industry excite our admiration, such as the beaver, the bee, the ant, &c. I shall produce only one example, taken from the class of those which are most indocile, such as fishes, and shall select it from among a species, governed by an instinct the most impetuous and the most stupid, which is gluttony.

The shark is a fish so voracious, that he will not only devour his own species, when pressed by hunger,

ger, but he swallows, without distinction, every thing that drops from a ship into the sea, cordage, cloth, pitch, wood, iron, nay, even knives. Nevertheless, I have been a frequent witness of his abstinence, in two remarkable circumstances; the one is, however urged by famine, he never touches a kind of small fish, speckled with yellow and black, called the pilot fish, who swim just before his snout, to guide him to his prey, which he cannot see till he is close to it; for Nature, as a counterbalance to the ferocity of this fish, has rendered him almost blind. The other case is this, when you throw into the sea a dead fowl, the noise brings him to the spot, but on discovering it to be a fowl, he immediately retires, without devouring it; this has furnished sailors with a proverb: *The shark flees from the feather*. It is impossible, in the first case, not to ascribe to him some portion of understanding, which represses his voracity, in favour of his guides; and not to attribute, in the second, his aversion to feathered flesh, to that universal reason, which, destining him to live along the shallows, where cadaverous substances, of creatures perishing in the sea, fall and are deposited, inspires him with an aversion for feathered animals, that he may not destroy the sea-fowls, which resort thither in great numbers, employed, like himself, in looking out for a livelihood, and in cleansing the shores from impurities.

Other

Other Philosophers, on the contrary, have ascribed the manners of animals, as those of men, to education ; and their natural affections, as well as their animosities, to resemblance or dissimilitude of form. But if friendship is founded in similitude of form, how comes it, that the hen, who walks in security, at the head of her brood, among the horses and oxen of a farm-yard, though part of her family is sometimes accidentally crushed by the feet of those animals, collects her young with anxious inquietude at sight of the hawk, a feathered animal like herself, who appears in the air but as a black point, and whom, perhaps, she hardly, if ever, saw before ? Why does the dog, in the yard, fall a barking, in the night time, at the smell only of the fox, an animal which has a strong resemblance to himself ? If habits of long standing could influence animals, as they do men, how has it been possible to render the ostrich of the desert familiar to such a degree, that he has been made to carry children on his plumeless crupper ; whereas no skill has, hitherto, been able to tame the swallow, a bird which has, from time immemorial, built his nest in our houses ?

Where can we find, among the Historians of Nature, a *Tacitus*, who shall unveil to us these mysteries of the Cabinet of Heaven, without an explanation of which, it is impossible to write the
History

History of a single animal on the Earth? We find no one species deviating, like the human, from the laws imposed on it by Nature. Bees, universally, live in republics, as they did in the time of *Esope*. The common fly has always been a vagabond, a herd without any police or restraint. How comes it that, among these, no *Lycurgus* has ever yet arisen, to reduce them into order, for the general good; and to prescribe to them, as Philosophers tell us the first Legislators among men did, laws dictated by their weakness, and by the necessity of uniting in society?

On the other hand, Whence is it, as *Machiavel* affirms of Nations possessing too much happiness, that among the canine species, exulting in the superiority of their strength, no *Catiline* arises, to impel his associates to take advantage of the security of their masters, and destroy them at once; no *Spartacus* to rouse them to liberty by his howling, that they may live as sovereigns of the forest, they to whom Nature has given arms, courage, and skill to subdue, in whole armies, animals the most formidable? When so many trivial laws of Nature are, under our very eyes, unknown, or misunderstood, how dare we to assign those which regulate the course of the stars, and which embrace the immensity of the Universe?

To the difficulties opposed to us by Nature, let us add those which we ourselves throw in the way. First, methods and systems of all sorts prepare, in every man, his manner of viewing objects. I do not speak of Metaphysicians, who explain all by means of abstract ideas; nor of Algebraists, with their formulæ; nor of Geometricians, with their compasses; nor of Chymists with their salts; nor of the revolutions which their opinions, though intolerant in the extreme, undergo in every age. Let us confine ourselves to notions the most universally admitted, and supported by the highest authority.

To begin with Geographers. They represent the Earth as divided into four principal parts, whereas, in reality, there are only two. Instead of the rivers which water it, the rocks which form its barriers, the chains of mountains which divide it into climates, and other natural subdivisions, they exhibit it speckled all over with parti-coloured lines, which divide and subdivide it into empires, dioceses, principalities, electorates, bailliwicks, salt-magazines. They have disfigured the originals, or substituted names without a meaning, in place of those which the native inhabitants of every country had given them, and which so well expressed their nature. They call, for example, a city, near to that of Mexico, where the Spaniards
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shed such oceans of human blood, the *City of Angels*, but to which the Mexicans give the name of *Cuet-lax-coupan*, that is, *the snake in the water*, because that of two fountains, which issue from thence, one is poisonous; they call the *Mississippi*, that great river of North America, which the natives denominate *Méchaſſipi*, *the father of waters*; the *Cordelieres*, those high mountains bordering on the South Sea, which are always covered with snow, and which are called by the Peruvians, in the royal language of the Incas, *Ritisiyu*, *snow-ridge*; and so of an infinite number of other proper names. They have stripped the works of Nature of their distinctive characters, and Nations of their monuments.

On reading these ancient names, with their explanations, in *Garcillaſo de la Vega*, in *Thomas Gage*, and the earliest navigators, you have impressed on the mind, by means of a few simple words, the landscape of every country, and something of its natural History: without taking into the account, the respect attached to their antiquity, for this renders the places, which they describe, still more venerable. Those only of the Chinese, who traffic with the Europeans, know that their country is called China. The name given it by the inhabitants is *Chium-boa*, *the middle-kingdom*. They change the name of it, when the families of their sovereigns become

become extinct. A new dynasty gives it a new name; thus the law has determined, to instruct Kings, that the destiny of their people was attached to them, as that of their own family. Europeans have destroyed all these correspondencies. They shall for ever bear the punishment of this injustice, as well as that of so many other of their violations; for, obstinately persevering in giving what names they please to the countries which they seize, or in which they settle, it comes to pass that, when you see the same countries on maps, or in Dutch, English, Portuguese, Spanish, or French books of travels, you are utterly incapable of distinguishing any thing. Their very longitude is changed, for every Nation now makes its own capital the first meridian.

Botanists mislead us still more. I have spoken of the perpetual variations of their dictionaries; but their method is no less faulty. They have devised, in order to distinguish plants, characters the most complicated, which frequently deceive them, though derived from all the parts of the vegetable kingdom, while they have never been able to express, by a single descriptive term, their combination, from which the unlearned can distinguish them at first sight. They must have magnifying glasses and scales, in order to class the trees of a forest. It is not sufficient to see them standing
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and covered with leaves, the Botanist must examine the flower, and frequently the fruit too. The clown knows them all perfectly, in the boughs which compose his faggot.

In order to give me an idea of the varieties of germination, I am shewn, in bottles, a long series of naked grains of all forms; but it is the capsule which preserves them, the downy tuft which reforms them, the elastic branch which darts them to a distance, that it imports me to examine. To shew me the character of a flower, it is presented to me dry, discoloured, and spread out on the leaf of a herbary. Is it in such a state that I can distinguish a lily? Is it not on the brink of a rivulet, raising its stately stem over the verdant declivity, and reflecting, in the limpid stream, its beautiful calix*, whiter than ivory, that I discern, and admire,

* According to Botanists, the lily has no *calix*, but only a *corolla*, consisting of many petals. They call the flower a corolla, and the case which contains the flowers a calix. This is, evidently, an abuse of terms. *Calix*, in Greek, and in Latin, means a cup; and *corolla*, a little crown. Now, an infinite number of flowers, as the cruciform, the papilionaceous, those with long throats, and a multitude of others, are not formed like a coronet, nor their cases like cups. I dare venture to affirm, that if Botanists had given the simple name of case, or wrapper, to the parts of the plant which inclose and protect the flower before it blows, they would have been on the road to more than one curious discovery.

mire, the king of the vallies? Is not it's incomparable whiteness rendered still more dazzling, when spotted, as with drops of coral, by the little, scarlet, hemispherical lady-bird, garnished with black specks, which constantly resorts to it as an asylum? Who can discover the queen of flowers in a dried rose? In order to it's being an object, at once, of love and of philosophy, it must be viewed when, issuing from the cleft of a humid rock, it shines on it's native verdure, when the zephyr balances it, on a stem armed with thorns; when Aurora has bedewed it with her tears; when, by it's lustre and it's fragrance, it invites the hands of lovers. A cantharide, sometimes, lurking in it's corolla, heightens the glowing carmine, by presenting the contrast of his emerald-coloured robe; it is then this flower seems to say, that, symbol of pleasure, from her charms, and the rapidity of her decay, like pleasure too, she carries danger around her, and repentance in her bosom.

Naturalists betray us into still wider deviations from Nature, in attempting to explain, by uniform

discovery. This impropriety of elementary terms in the Sciences, is the first twist given to human reason; it is thereby put, from the very first setting out, entirely aside from the path of Nature. See *Vol. II. Study XI.*

laws, and by the mere action of air, water, and heat, the expansion of so many plants, growing on the same dunghill, of colours, forms, favours, and perfumes so different. Do they try to decompose the principles of them? Poison and food present, in their stoves, the same results. Thus Nature sports herself with their art, as with their theory. The corn plant alone, gathered in handfuls only by the vulgar, answers a thousand valuable purposes, while a multitude of vegetables have remained entirely useless, in the laboratories of the learned.

I remember my having read, many years ago, several grave dissertations on the manner of employing the horse-chestnut as food for cattle. Every Academy in Europe has, at least, proposed it's own; and the result of all their learned disquisitions was, that the horse-chestnut was useless, unless prepared by a very expensive process, and that, even then, it was good only in the manufacture of tapers and hair powder. I was astonished at this, not that Naturalists should be ignorant of it's use, and that they had studied it merely as an article of luxury, but that Nature should have produced a fruit of no use even to the brute creation. But I was, at last, cured of my ignorance, by the brutes themselves. I happened to take my walk, one day,
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to the *Bois de Boulogne* *, with a branch of the horse-chestnut in my hand, when I perceived a goat feeding. I went up, and amused myself with stroking her. As soon as she perceived the horse chestnut bough, she seized, and snapped it up, instantly. The lad who tended her told me, that the goats were all very fond of this plant, and that it contributed greatly to the increase of their milk. I perceived, at some distance, in the chestnut alley, which leads to the *Château de Madrid*, a herd of cows eagerly looking for horse-chestnuts, which they greedily devoured, without sauce or pickle. Thus, our learned and ingenious systems conceal from us natural truths, with which every peasant is acquainted.

What a spectacle do our cabinets of preserved animals present? To no purpose has the art of a *Daubenton* endeavoured to keep up the appearance of life. Let industry do it's utmost to preserve the form, their stiff and motionless attitude, their fixed and staring eyes, their bristly hair, all declare that they have been smitten with the stroke of death. In such a state, even beauty itself inspires horror; whereas objects the most homely are agreeable, when placed in the situation which Na-

* The *Bois de Boulogne*, and *Château de Madrid*, are a wood, and castle, not many miles from Paris.

ture has assigned them. I have been often highly diverted, in the West-Indies, at the sight of a crab on the sand, straining, with his claws, to break into a huge cocoa-nut ; or a shaggy ape balancing himself on the summit of a tree, at the extremity of a *lianne*, loaded with pods and brilliant flowers.

Our books of Natural History are merely the romance of Nature, and our cabinets her tomb. To what a degree have our speculations and our prejudices degraded her? Our treatises on Agriculture shew us, on the plains of Ceres, nothing but bags of grain ; in the meadows, the beloved haunt of the nymphs, only bundles of hay ; and in the majestic forest, only cords of wood and faggots.

What shall we say of the violence done to her by Pride and Avarice? How many charming hills have been reduced to a state of villanage, by our laws! What majestic rivers degraded into servitude by imposts!

The History of Man has been disfigured in a very different manner. If we except the interest which religion, or humanity, has prompted some good men to take, in favour of their fellow-creatures, the rest of Historians have written under the impulse of a thousand different passions. The Politician represents Man, as divided into nobility
and

and commonalty, into papists and huguenots, into foldiers and flaves; the Moralift, into the avaricious, the hypocritical, the debauched, the proud; the Tragic Poet, into tyrants and their victims; the Comic, into drolls and buffoons; the Phyfician, into the pituitous, the bilious, the phlegmatic. They are univerfally exhibited as fubjects of averfion, of hatred, or of contempt: Man has been univerfally diffe&ted, and now nothing is fhewn of him but the carcafe. Thus the mafter-piece of Creation, like every thing elle in Nature, has been degraded by our learning.

I do not mean to affirm, however, that from fuch partial means, no ufeul difcovery has proceeded: but all thefe circles, within which we circumfcribe the Supreme Power, far from determining it's bounds, only mark the limits of human genius. We accuftom ourfelves to crowd all our own ideas into that narrow fpace, and difhoneftly to reject all that does not accord with them. We a&ct the part of the tyrant of Sicily, who fitted the unhappy traveller to his bed of iron: he violently fretched, to the length of the bed, the limbs of thofe who were fhorter, and cut fhort the limbs of thofe who were longer. It is thus we apply all the operations of Nature to our pitiful methods, in order to reduce the whole to one common ftandard.

Hurried away myself, by the spirit of the age in which I live, I gave, at the end of the journal of my voyage to the Isle of France, a system of botany, in which I pretended to explain the expansion of plants, as our Naturalists explain that of madrépores, from the mechanism of the small animals which constitute them. I quote this Work, though I composed it merely as an amusement, to prove how easy it is to support a false principle by true observations; for having communicated it to *J. J. Rousseau*, who was, it is well known, a great proficient in Botany, he said to me; *I do not adopt your system; but it would cost me, at least, six months to refute it; and even then, I could not flatter myself with the certainty of having succeeded.* Had the decision of this candid gentleman been wholly unreserved, it could not have justified my libertinism.

Fiction embellishes the history of Man only, it degrades that of Nature. Nature is herself the source of all that is ingenious, amiable, and beautiful. By applying to her the violence of our imaginary laws, or by extending to all her operations, those with which we are acquainted, we conceal others, worthy of the highest admiration, with which we are totally unacquainted. We add, to the cloud with which she veils her divinity, that of our own errors. They get into credit by time, by professorships, by books, by protectors, by associations,

ciations, and especially by pensions; whereas no one is paid for searching after truths, which have the improvement of Mankind for their only object. We carry with us, into researches so independent and so sublime, the passions of the college and of the world, intolerance and envy.

Those who enter first on the career, oblige those who come after them to walk in their footsteps, or to give it up; as if Nature were their patrimony, or, as if the study of Nature were an exclusive trade, that did not admit of every one's participation. What trouble did it cost to eradicate, in France, the metaphysics of *Aristotle*, which had become a species of religion? The philosophy of *Descartes*, which supplanted it, might have subsisted to this day, had it's revenues been as ample. That of *Newton*, with it's attractions, is not more solidly established. I have an unbounded respect for the memory of these great men, whose very deviations have assisted us, in opening great highways through the vast empire of Nature; but, on more occasions than one, I shall combat their principles, and, especially, the general applications which have been made of them, in the full persuasion, that, if I renounce their systems, I promote their intentions. It was the study of their whole life to raise men toward the DEITY, by their sublime discoveries, without suspecting, that the

laws which they were establishing in Physics, might, one day, serve to subvert those of Morality.

In order to form a right judgment of the magnificent spectacle of Nature, we must suffer every object to remain in its place, and remain ourselves in that which she has assigned to us. It is from a regard to our happiness, that she has concealed from us the laws of her Omnipotence. How is it possible for a being so feeble as Man, to embrace infinite space? But she has brought within our grasp what it is at once useful and delightful to know: namely, the emanations from her beneficence. In the view of uniting Mankind, by a reciprocal communication of knowledge, she has given to each of us, in particular, ignorance, treasuring up Science in a common stock, to render us necessary and interesting to each other.

The Earth is covered over with vegetables and animals, the simple vocabulary of which no Scholar, no Academy, no one Nation, will ever be able perfectly to acquire; but it is to be presumed, that the human race is acquainted with all their properties. In vain do enlightened Nations boast, that they are the great repositories of all the Arts and Sciences. It is to Savages, to men utterly unknown, that we are indebted for the first observations, which are the source of all Science. It is
neither

neither to the polished Greeks nor Romans, but to Nations which we denominate barbarous, that we owe the use of simples, of bread, of wine, of domestic animals, of cloths, of dye-stuffs, of metals, and of every thing most useful, and most agreeable, for human life.

Modern Europe glories in her discoveries; but the invention of the art of Printing, one of the fairest titles to immortality, is to be ascribed to a person so obscure, that several cities of Holland, of Germany, nay, of China, have claimed the discovery as their own. *Galileo* would never have calculated the gravity of air, but for the observation of a fountain-player, who remarked that water could rise only up to thirty-two feet in the tubes of a forcing engine. *Newton* had never read the starry heavens, unless a spectacle-maker's children, in Zealand, had, at play, with the lenses in their father's shop, suggested the first idea of the telescopic cylinder. Our artillery would never have subjugated the New World, but for the accidental discovery of gun-powder by a lazy monk; and whatever glory Spain may pretend to derive from the discovery of that vast Continent, the Savages of Asia had planted Empires there, long before the arrival of *Christopher Columbus*. What must have become of that great man himself, if the good and simple inhabitants whom he found in the
country

country had not supplied him with provisions? Let Academies, then, accumulate machines, systems, books, eulogiums: the chief praise of all is due to the ignorant, who furnished the first materials.

Advancing no higher claim, I presume to contribute my humble offering. It is the fruit of many years of application, which, amidst storms long and severe, stole away in these calm researches, like a single day of serenity. I earnestly wished, if it should not be permitted me to reach a boundary, at which to stop, to communicate to others, at least, the pleasure which I had enjoyed on my way.

I have conveyed my observations in the best style of which I am capable; frequently stepping aside to the right hand and to the left, as the subject carried me; sometimes abandoning myself to a multitude of projects, which the infinite intelligence of Nature inspires; sometimes dwelling with complacency on happier seasons and situations, which are never more to return; sometimes plunging into futurity, panting after a more fortunate state of being, of which the goodness of Heaven affords us now and then a glimpse, through the dark clouds of this wretched life. Descriptions, conjectures, perceptions, views, objections, doubts, nay, my very ignorances, I have heaped all on one
pile;

pile; and I have given to these ruins the name of *Studies*, as a Painter does to the studies of a great original, to which he was unable to give a finishing.

Amidst this disorder, it was necessary, however, to adopt something like method, without which, the confusion of the matter must have still more increased the insufficiency of the Author. I have followed the most simple. First, I endeavour to refute the objections raised against a Providence; I, then, proceed to examine into the existence of certain sentiments, which are common to all men, and which constrain us to acknowledge, in all the works of Nature, the laws of her wisdom and goodness; and, finally, I make application of these laws to the Globe, to Plants, to Animals, and to MAN.

Such, from the outset, is the manner in which I propose to direct my course. If, in the rapid sketch I am going to present of it, the Reader should be disgusted with its driness, I must intreat him to reflect, that the same complaint must lie against all abridgments; that, in return, I spare him the fatigue of a preface; and that *Pliny*, who had a much better head than mine, has not hesitated to make up the first book of his Natural History, of the bare titles of the Chapters which compose it.

I said,

I said, then, to myself: In the FIRST PART of my Work, I will display the blessings bestowed by Nature, on the age in which we live; and the objections which have been started in it, against the Providence of it's AUTHOR. I will conceal no one of these that I know of; and in order to give them greater force, I will exhibit them in their combination. I will employ, in refuting them, not metaphysical reasonings, like those of which the objections consist, and which never brought any dispute to a termination, but the facts themselves of Nature, which admit of no reply. With these same facts, I will raise, in my turn, difficulties which militate against the principles of human Science, and which have been deemed infallible. I will from thence proceed to infer the feebleness of our reason; I will enquire whether there be universal truths, and what we are to understand by order, beauty, correspondency, harmony, pleasure, happiness, and their contraries; and, finally, what an organized body is.

From this examination of our faculties, and of the effects of Nature, will result the evidence of many physical laws, constantly directed to one single end, and that of a moral law, which affects Man alone, and the sentiment of which has been universal, in all ages, and among all Nations. These are necessary preliminaries. Before we attempt

tempt to rear the fabric, the ground must be cleared, and the foundation laid.

In the SECOND PART, I shall make application of these laws to the Globe; I shall examine it's form, it's extent, the division of it's Hemispheres, and as it is composed, like every other organized work of Nature, of parts similar, and of parts contrary. I shall consider, successively, it's different elements, and the manner of their adaptation to each other, the fire to air, the air to water, the water to the earth. This order establishes among them a real subordination, of which the Sun is the principal agent. But he is not the only mover in Nature, and still less the Sovereign Disposer. His uniform action on the elements would, at last, separate or confound them. Other laws counterbalance his, and maintain the general harmony.

I shall point out the admirable variety of his course, the effects of his heat and light, and the wonderful manner in which they are weakened or multiplied in the Heavens, in the inverse ratio of latitudes and seasons. I shall speak of the great reverberations of Heaven, of the Moon, of the *Aurora Borealis*, of the Stars, and of the mysteries of Night, only so far as the human eye is permitted to perceive them, and the heart to feel their impression.

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I shall speak, likewise, of the nature of *Fire*, not to explain it, but to evince our profound ignorance of the subject. This element, which renders all things else perceptible, itself eludes our most eager researches. We shall demonstrate, that there is neither animal, nor plant, nor even fossil, capable of subsisting any length of time in it. It is the only being which increases it's bulk by communicating itself. It penetrates all bodies, without being penetrated by them. It is divisible only in one dimension. It has no gravity. Though nothing attracts it to the centre of the Earth, it is diffused through all the parts of the Globe. It's nature differs from that of all other bodies. It's destructive and indefinable character seems to favour the opinion of *Newton*, who considered it only as a motion communicated to matter, and thereby reduced the number of Elements to three. However, as it is one of the four general principles of life, in every living creature; as we often discover it, in others, in a dormant state, and as there is no one, as we shall see, but what has organs, or parts, disposed to weaken, or to multiply these effects, we must acknowledge it not only to be an Element, but Nature's primary agent.

From the Fire I shall pass to the *Air*. I shall examine the quality which it has of expanding and contracting, of heating and cooling; and the effects

fects of that vast stratum of frozen air which furrounds our Globe, about a league above the surface, and of which hardly any one of the phenomena has hitherto been explained.

I shall, next, consider the effects of *Water*: in what manner heat evaporates, and cold fixes it; it's different existences; of volatility in the air, in clouds, in dew, and in rain; of fluidity on the earth, in rivers, and in Seas; of solidity at the Poles, and on lofty mountains, in snow and ice. I shall enquire, how the Seas, which are the great reservoirs of this element, are distributed, with relation to the Sun; how they receive from him, through the mediation of the air, a part of their movements; in what manner they continually renew their waters, by means of the ice accumulated at the Poles; the annual or periodical fusion of which, maintains their flux and reflux as constantly, as the fusion of the ices on the summit of high mountains renews and supplies the waters of great rivers. I shall hence deduce the phenomena of the Tides, of the Monsoons in the Indian Ocean, and of the principal Currents of the vast watery Element.

I shall, afterwards, hazard my conjectures respecting the quantity of water which furrounds the Earth, in the three states of volatility, fluidity,
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and solidity ; and shall examine whether it is possible, that, on being all reduced to a state of fluidity, they should entirely cover the Globe.

I shall consider in what manner all the parts of the *Earth*, that is, the dry land, are distributed with relation to the Sun ; so that there should be no cavity of valley, nor elevation of rocky mountain, but what must be, at some season of the year, exposed to his rays, and disposed, at the same time, in the most perfectly adapted order, to multiply, or to mitigate his heat, by it's form, or even by it's colour. I will demonstrate that, notwithstanding the apparent irregularity of the different parts of this Globe, they are opposed, with so much harmony, to the different currents of air, that there is no one but what is, by turns, ventilated by winds, hot, cold, dry, and humid ; that the cold winds blow most constantly into warm countries, and warm winds into cold countries ; that these countries, in their turn, re-act on the air ; so that the cause of the winds is not to be sought, according to the received opinion, in the places whence they proceed, but in those which they visit.

I shall, after that, speak of the direction of mountains, of their declivities, and of their aspects, with relation to the lakes and Seas, whose emanations their different ridges are all adapted to receive ;

receive ; of the matter which attracts them, and fixes round their peaks, rising like so many electric needles.

Finally, I shall examine, For what reason Nature has divided the Globe into two Hemispheres ; what means she employs to accelerate, or retard, the course of rivers, and to protect their mouths against the movements and currents of the Ocean. I shall treat of banks, of shallows, of rocks, of isles, whether in seas or rivers ; and I shall prove, I am confident to say, to a demonstration, that these parcels detached from the Continent, are no more ruinous fragments, violently separated from them, than bays, gulfs, and inland-seas, are violent irruptions of the Ocean.

I shall terminate this part, by indicating the principal agents, employed by Nature, in repairing her works : how she makes use of fire to purify, in the form of thunder, the air, so frequently loaded with mephitic vapours during the violent heats of Summer ; and the waters of great lakes and Seas, by the volcanos which she has placed in their neighbourhood, at the extremity of their currents, and which she has multiplied in warm countries ; how she cleanses the basons of these very waters, which, in the course of a few ages, would be choked up by the accumulated spoils of
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the Earth, by means of tempests and hurricanes, which agitate them to the very foundation, and cover their banks with the wreck ; and how, after having restored these wrecks to their first elements, by fires in the air, by volcanos, and the perpetual motion of the waves, which reduces them to sand, and to an impalpable powder on the shore of the Sea, she repairs, by means of winds and attractions, the incessant diminution of the mountains, occasioned by the rains and torrents.

I shall demonstrate, in a word, that, notwithstanding the enormous masses of the mountains, the profundity of the vallies, the tempestuous Oceans, and temperatures the most opposite, which enter into the composition of this Globe, the communication of all it's parts has been rendered easy to a being so small, and so feeble, as Man, and is possible only to him. This last view will furnish me with some curious conjectures respecting the earliest voyages undertaken by Mankind.

I flatter myself, that I have said enough to shew, in this simple prospectus, that the same Intelligence, whose productions we so justly admire in plants and animals, presides equally in the edifice which we inhabit. The Earth has, hitherto, been considered as only in a state of ruin ; and it

is this prejudice which renders the study of Geography so insipid ; but I venture to affirm that, after perusing my trivial observations, the course of a rivulet, on a map, will appear more agreeable than the port of a plant in a Botanist's herbal, and the topography of a place, as interesting as it's landscape.

In the THIRD PART of this Work, I will shew how the different parts of plants are disposed in correspondence with the Elements, in such a manner that, far from being a necessary production of theirs, as some Philosophers pretend, they are, on the contrary, almost always in opposition to their action. I shall refer, therefore, their flowers to the Sun ; the thickness of their barks, the scurf which covers their buds, the hair, the down, the resinous substances with which they are clothed, to the absence of solar heat ; the pliancy, or stiffness, of their stems, to the different impulsions of the Air ; their leaves, to the waters of Heaven ; finally, their roots, to sands, to mires, to rocks, by their fibres, their pivots, and their long cordage. This last relation of plants to the Earth is, if I may judge, the most important of all, though the least observed, for there is not a single one, but what is attached to it, whether it floats in water, or balances itself in the air ; no one but derives part, at least, of it's nutriment from thence, and,

in it's turn re-acts on the Earth, by the shade which contributes to it's freshness, by the offal which fertilizes it, and by the roots which bind it's different *strata*.

I shall adhere, however, to the exterior characters by which Nature seems to divide them into different genera. Their principal character, it is very difficult to determine, not only because the simplest plant unites a very great variety of relations to all the Elements, but because Nature does not place the character of her works, in any one of the parts, but in their combination. We shall seek that of each plant, therefore, in it's grain, which, as being the principle, must unite every thing proper for it's expansion, and determine, at least, the Element in which it must grow. Those, accordingly, which have grains extremely volatile, or furnished with tufts of down, pinions, sails, &c. shall be referred to the Air. They grow, in fact, in places exposed to the wind, as most part of the gramineous, of the thistle tribe, &c. Those which have fins, floaters, and other instruments of swimming, shall be assigned to the Water; not only such as the fucus, the alga, and other sea-plants, but the cocoa-tree, the walnut, the almond, and other vegetables which affect the Water's edge. Those, finally, which, by their roundness, and other varieties of form, are adapted for rolling, springing,

springing, catching, &c. and are susceptible of various other movements, shall be allotted to the Earth, properly so called.

This reference of plants to Geography, presents to us, at once, a great general order of easy comprehension, and a multitude of subdivisions, which we may run over, very agreeably, in detail. First, their genera divide themselves, like those of animals, into aërial, aquatic, and terrestrial. Then, their classes are subdivided relatively to the Zones, and to the degrees of latitude of each Zone; such are, to the South, the class of palms, and, to the North, that of firs; and their species to the territory of that Zone, according as it is champaign, mountainous, rocky, marshy, &c. Accordingly, in the class of palms, the cocoa-tree of the seashore, the latanier on the strand, the date of the rocks, the palmist of the mountains, and so on, crown the various sites of the torrid Zone; whereas in that of firs, the pine, the spruce, the larch, the cedar, &c. divide among themselves the empire of the North. This order, by putting every vegetable in its natural place, furnishes us, besides, with the means of tracing the use of all its parts; and, I am bold enough to affirm, of tracing the reasons which have determined Nature to vary their form, and to create so many species of the same genus, and so many varieties of the same species,

cies, by discovering to us the admirable correspondency which they have, in every latitude, with the Sun, the Winds, the Water, and the Earth.

On this plan, we have a glimpse of the light which Geography may diffuse over the study of Botany; and of the light with which Botany, in it's turn, may illuminate Geography; for, supposing we were enabled to form botanical charts, in which, by colours and signs, should be represented, in each particular country, the reign of each vegetable there produced, by determining it's centre and limits, we might perceive, at once, the fecundity proper to each district. This knowledge would supply very ample means of rural economy, as we might substitute to the indigenous plants which were there in greatest abundance, and most vigorous, such of our domestic plants as are of the same species, and which would there infallibly succeed. Besides, these different classes of vegetables would, in their various natural arrangement, indicate the degrees of the humidity, of the dryness, of the cold, of the heat, and of the elevation of each district, with a precision which our barometers, thermometers, and other physical apparatus, can never attain. I omit a multitude of other relations, productive of pleasure and of utility, which would result from such classification, but which I shall endeavour to unfold in their place.

In

In the FOURTH PART, which treats of Animals, I shall pursue the same track. I shall present, first, their relations to the Elements. Beginning with that of Fire, I shall consider the relation which they have to the Luminary which is the source of it, from their eyes furnished with lids and lashes, to moderate the lustre of his light; from that state of torpidity, called sleep, into which most of them fall, when he is no longer above the Horizon; and by the colour of their skin, and the thickness of their furs, corresponding to their distance from him.

We shall then trace the relations in which they stand to the Air, by their attitude, their weight, their lightness, and the organs of respiration; to the Water, by the various curves of their bodies, the unctuousness of their hair and plumage, their scales and fins; and, finally, to the Earth, by the form of their feet, sometimes forked, or armed with prongs and claws, adapted to a hard soil, sometimes broad, or furnished with a hide, suited to a yielding soil, and by other means of progression, which Nature has varied, in proportion to the obstacles which are to be surmounted.

On the whole of this we shall observe, as in the case of Plants, that so many configurations, so different, far from being, in animals, mechanical effects

fects of the action of the Elements in which they live, are, on the contrary, almost always, in the inverse ratio of these very causes. Thus, for example, a great many fishes are cased in rough and hard shells, in the bosom of the waters ; and many animals, the inhabitants of the rocks, are clothed with soft furs. We shall divide animals, therefore, as we did vegetables, by referring their genus to the Elements, their classes to the Zones, and their species, to the different Districts of each Zone. This arrangement, at once, puts every animal in it's natural place ; but we shall reduce it to a fixedness of determination, still more precise, and more interesting, by referring the species of animal to that of the plant which a particular District produces in greatest abundance.

Nature herself indicates this order. She has adapted to plants, the smelling, the mouths, the lips, the tongues, the jaws, the teeth, the beaks, the stomach, the chylication, the secretions which ensue, in a word, the appetite and instinct of animals. It cannot, indeed, be affirmed with truth, that every species of animal lives on one single species of plant ; but any person may convince himself, by experiment, that each of them prefers some one to every other, when permitted to choose. This preference is particularly remarkable, at the season when the production of their young engages attention.

attention. Then they are determined in favour of that which provides them, at once, with nutriment, litter, and shelter, in the most perfect suitability to their situation. Thus the goldfinch affects the thistle, and hence, in the French language, derives his name from that of the plant *, because he finds a rampart in it's prickly leaves, food in it's seeds, and materials for his nest in it's down. The bird-fly of Florida, for similar reasons, prefers the bignonia: this is a creeping plant, which finds it's way to the tops of the highest trees, and frequently covers the whole trunk. He builds his nest in one of it's leaves, which he rolls into the form of a cornet; he finds his food in it's red flowers, resembling those of the foxglove, the nectareous glands of which he licks; he plunges his little body into them, which appears in the heart of the flower, like an emerald set in coral; and he gets in, sometimes, so far, that he suffers himself to be surprized there, and caught.

In the nests of animals, then, we shall look for their character, as we sought that of plants in their grains. It is from these we shall be enabled to determine the Element in which they must live, the proper site of their habitation, the aliment best adapted to their constitution, and the first lessons

* In French, goldfinch is *chardonneret*, and thistle *chardon*.

of industry, of love, or of ferocity, which they receive from their parents. The plan of their life is contained in their cradles. However strange these indications may appear, they are those of Nature, who seems to tell us, that we may distinguish the character of her children, like her own, in the fruits of love, and in the care which they take of their posterity.

She, frequently, lodges under the same roof, the vegetable and animal life, and unites the destiny of the one to that of the other. We see them bursting together from the same shell, blowing, expanding, propagating, dying, in a similar progression. At the same instant of time they present, if I may be allowed the expression, the same metamorphoses. While the plant is unfolding, in succession, it's germs, it's buds, it's flowers, it's fruits, the insect is displaying, successively, on one of it's leaves, the egg, the worm, the nymph, the butterfly, which contains, like it's parents, the seeds of it's posterity, with those of the plant which nourished it. It is thus that fable, far less marvellous than Nature, inclosed the life of the Dryad within the bark of the Oak.

These relations are so striking, in insects, that Naturalists themselves, notwithstanding their prodigious number of isolated, and indeterminable classes,

classes, have characterized some of them by the name of the plant on which they live; such are the caterpillar of the tithymale, and the silk-worm of the mulberry. But I do not believe there is a single animal which deviates from this plan, not even excepting the carnivorous. Though the life of these last appears to be, in some measure, ingrafted on that of the living species, there is not one among them, but what makes use of some species of vegetable. This is observable, not only in dogs, which feed on the grass that bears their name, and in wolves, foxes, birds of prey, which eat the plants denominated from the names of the respective animals, but even in the fishes of the Sea, which are entire strangers to our Element. They are attracted, at first, to the banks, by insects, whose spoils they collect, which establishes between them and vegetables, intermediate relations; afterwards by the plants themselves, for most of them come to spawn on our coasts, only when certain plants are in flower, or in fruit. If these happen to be destroyed, the fishes visit us no longer.

Denis, Governor of Canada, relates, in his Natural History of North America*, that the cod, which, in shoals, used to frequent the coasts of the

* Vol. II. chap. 22. page 350.

Island of Miscou, disappeared in 1669, because in the year preceding, the forests had been devoured by a conflagration. He remarks, that the same cause had produced the same effect in different places. Though he ascribes the disappearance of these fishes to the particular effects of fire, and is, in other respects, a very intelligent Writer, we shall demonstrate, by other curious observations, that it must have been occasioned by the destruction of the vegetables which used to attract them to the shore. Thus, every thing in Nature is in strict alliance. The Fauns, the Dryads, and the Nereids, walk every where hand in hand.

What a charming spectacle would a botanical Zoology present? What unknown harmonies would be reflected from a plant to an animal, and from an animal to a plant! What picturesque beauties would appear! What relations of utility, of every species, contributing either to pleasure or to profit, would result from it! The introduction of a new plant into our fields, would be sufficient to allure a new set of songsters to our groves, and shoals of unknown fishes to the mouths of our rivers. Might it not be possible to increase even the family of our domestic animals, by peopling the glaciers of the lofty mountains of Dauphiné, and of Auvergne, with herds of rein-deer, an animal so valuable in the northern parts of Europe; or with the

the lama of Peru, who delights in the snows at the foot of the Andes, and whom Nature has clothed in the finest of wool? A little moss, a few rushes of their own country, would be enough to fix them in ours.

Attempts have frequently been made, I admit, to propagate the breed of foreign animals in our parks, by observing even the choice of those species whose native climate came nearest to ours; but they all languish and die, because no care was taken to transplant with them their proper vegetable. You see them always restless, with the head hanging down, scratching up the ground, as if demanding from it the nourishment which they had lost. A single herb would have been sufficient to quiet them, by recalling the tastes of their early life, the breezes which used to fan them, the cool fountains and refreshing shades of their native country: less unhappy, however, than Man, who can be cured of regret only by the total loss of memory.

In the FIFTH PART, we shall speak of MAN. Every Work of Nature has presented to us, hitherto, only partial relations; Man will furnish such as are universal. We shall examine, first, those which he stands in to the Elements. Beginning with that of Light and Fire; we shall observe, that his eyes are turned, not towards
Heaven,

Heaven, as the Poets, and even some Philosophers, allege, but to the Horizon; so that he may view, at once, the Heaven which illuminates, and the Earth which supports him. His visual rays take in near half of the celestial Hemisphere, and of the plane on which he treads, and their reach extends from the grain of sand, which he tramples under foot, to the star which shines over his head, at an immeasurable distance.

He alone, of animals, can enjoy equally the day and the night; he alone can bear to live within the torrid Zone, and upon the ice of the frigid. If certain animals are partakers with him in these advantages, it is only by means of his instructions, and under his protection. For all this he is indebted to the Element of Fire, of which he alone is the Sovereign Lord. Some Authors pretend, that certain of the brute creation understand the management of it, and that the monkeys in America keep up the fires kindled by travellers in the forests. No one denies that they love its heat, and resort to it for warmth, when Man retires. But as they have perceived its utility, Why have they not preserved the use of it? However simple the manner of keeping up fire may be, by supplying it with fuel, not one of them will ever attain to that degree of sagacity.

The

The dog, much more intelligent than the monkey, a witness every hour of the effects of fire; accustomed, in our kitchens, to live only on meat that is dressed, if you give him raw flesh, will never dream of going to roast it on the coals. This barrier, which separates Man from the brute, weak as it may appear, is insurmountable to animals. And this is one of the great blessings of Providence, bestowed for the general security; for how many unforeseen, and irreparable conflagrations would take place, were Fire at their disposal? God has intrusted the first agent in Nature, to that being alone who, by his reason, is qualified to make a right use of it.

While some Historians bestow this faculty on the brutes, others deny it to Man. They allege, that many Nations were entirely destitute of it, till the arrival of the Europeans among them. To prove this, they quote the inhabitants of the Marianne Islands, otherwise called the Isle of Thieves, by a calumnious imputation so common among sailors; but this assertion is grounded on bare supposition; namely, on the very natural astonishment expressed by these Islanders, on seeing their villages set on fire by the Spaniards*,

* See the History of their Discoveries, by Magellan; the History of the Marianne Isles, by Father Gobien, vol. ii. page 44; and that of the West-Indies, by Herrera, vol. iii. page 10 and 712.

whom

whom they had received with kindness. They contradict themselves, at the same time, by relating, that these very people used canoes, daubed over with bitumen, which necessarily supposes, in the case of savages unacquainted with iron, that fire had been employed in the hollowing of their canoes, or, at least, in careening them. Finally, we are told, that they fed on rice, the preparation of which, however simple, requires, of necessity, the application of fire.

This Element is universally necessary to human existence, even in the hottest climates. By means of fire alone, Man guards his habitation, by night, from the ravenous beasts of prey ; drives away the insects which thirst for his blood ; clears the ground of the trees and plants which cover it, and whose stems and trunks would resist every species of cultivation, should he find means, any other way, to bring them down. In a word, in every country, with Fire he prepares his food, dissolves metals, vitrifies rocks, hardens clay, softens iron, and gives, to all the productions of the Earth, the forms, and the combinations, which his necessities require.

The benefits which he derives from the Air are no less extensive. Few animals are, like him, capable of respiring, with equal ease, at the level of the
the

the Sea, and on the summit of the loftiest mountains. Man is the only being who gives it all the modulations of which it is susceptible. With his voice alone, he imitates the hissing, the cries, the singing of all animals; while he enjoys the gift of speech, denied to every other. Sometimes he communicates sensibility to the Air; he makes it sigh in the pipe, to complain in the flute, to threaten in the trumpet, and to animate to the tone of his passions the brass, the box-tree, and the reed. Sometimes he makes it his slave; he forces it to grind, to bruise, and to move, to his advantage, an endless variety of machinery. In a word, he yokes it to his car, and constrains it to waft him even over the billows of the Ocean.

That Element, in which few of the inhabitants of Earth are able to live, and which separates their different classes, by a boundary more insurmountable than that of Climate, presents to Man alone the easiest of communications. He swims in it, he dives, he pursues the sea-monster to the abysses of the deep; he hunts and slabs the whale even under mountains of ice; and alights on every island in the bosom of the Sea, and asserts his empire over it.

But he had no need of that which he exercises over Air and Water, to render his sovereignty

universal. He has only to remain on the Earth where he was born. Nature has planted his throne on his cradle. Every thing that lives comes thither to pay him homage. There is not a vegetable but what fixes it's roots under his feet, not a bird but there builds his nest, not a fish but there deposits her spawn.

Whatever irregularity may appear on the surface of his domain, he is the only being formed with the capacity of pervading all it's parts. And what, in this respect, excites the highest admiration, there is established, among all his limbs, an equilibrium so perfect, so difficult to be preserved, so contrary to the laws of our mechanism, that there is no Sculptor capable of forming a statue resembling Man, broader and heavier above than below, which shall be able to maintain an erect position, and remain immoveable, on a basis so small as his feet. It would be quickly overfet by the slightest breath of wind. How much more, then, would be requisite to make it walk like Man? There is no animal whose body is susceptible of so many different movements; and I am tempted to believe, that he unites in himself all the possible varieties of animal motion, on seeing how he bends, kneels, creeps, slides, swims, tumbles himself into the form of an arch, rounds himself like a wheel, like a bowl, walks, runs, leaps, springs, mounts, descends,

descends, climbs; in a word, how his frame is equally adapted to clamber to the summit of the rock, and to walk on the surface of the snow; to traverse the river and the forest, to pick the moss of the fountain, and the fruit of the palm-tree; to feed the bee, and to tame the elephant.

With all these advantages, Nature has collected in the human figure every thing that is lovely in colour and form, whether from harmony or from contrast. To these she has added movements the most majestic and the most graceful. From an accurate observation of this, Virgil has been enabled to finish, by a master-stroke, the portrait of Venus disguised, talking with Eneas, who remained ignorant who she was, while beauty only was displayed, but distinguished her the instant she began to move: *Vera incessu patuit Dea*; "Her gait declared the Goddess." *

The AUTHOR of Nature has united in Man every species of beauty, and has formed of these a combination so wonderful, that all animals, in

* Milton's description of Eve is still more characteristic of female majesty:

Grace was in all her steps, Heaven in her eye;

In every gesture, dignity and love.

PAR. LOST, BOOK IV.

their natural state, are struck, at sight of him, with love, or terror; this we shall demonstrate by more than one curious remark. Thus, too, is fulfilled the Word which conferred on him the original sovereignty of the World: * “ And the fear of
 “ you, and the dread of you shall be upon every
 “ beast of the Earth, and upon every fowl of the
 “ Air, upon all that moveth upon the Earth, and
 “ upon all the fishes of the Sea: into your hand
 “ are they delivered.”

As he is the only being who has the disposal of Fire, which is the principle of life, so he alone practises Agriculture, which is its support. All frugiverous animals have, like him, occasion for it, most of them the experience, but no one the practice. The ox never thinks of re-sowing the grain which he treads out in the barn floor, nor the monkey, the maize of the field which he plunders. We are presented with far-fetched theories of the relations which may subsist between brutes and Man, in the view of reducing them to a level, while the trivial differences are overlooked, which are continually before our eyes, and interpose between us and them an immeasurable interval, and which are the more wonderful, the more easy it appears to surmount the difficulty.

* Genesis ix. 2.

Every one of the brute creation is circumscribed within a narrow sphere of vegetables, and of means necessary to gather them. No one extends it's industry beyond it's instinct, be it's wants what they may. Man alone raises his intelligence up to that of Nature. He not only pursues her plans, but recedes from them. He substitutes others in their place. He covers regions destined for forests with corn and wine. He says to the pine of Virginia, and to the chestnut of India, "You shall grow in Europe." Nature second's his efforts, and seems, by her complaisance, to invite him to prescribe laws to her.

For him she has covered the Earth with plants, and though their species be infinite, there is not a single one but may be converted to his use. She has, first, selected some out of every class, to minister to his pleasure, or support, wherever he pleases to fix his habitation: from among the palm-groves of Arabia, the date; among the ferns of the Moluccas, the sago; among the reeds of Asia, the sugar-cane; among the solanums of America, the yam; among the lianne tribe, the vine; among the papilionaceous, the French-bean and the pea; finally, the potatoe, the manioc, the maize, and an innumerable multitude of fruits, grains, and roots, proper for food, are distributed

for him, in every family of vegetables, and over every latitude of the Globe. She permits the plants which are most useful to him to grow in all climates; the domestic plants, from the cabbage up to the corn, alone, like Man himself, are citizens of the World. The others serve for his bed, for his roof, for his clothing, for medicine, at least for fuel. And, in order that there might be no one but what should contribute to the support of his life, and that the distance, or ruggedness of the soil in which they grow might interpose no obstacle to his enjoyment of them, Nature has formed certain animals to seek them out for him, and to convert them to his use.

These animals are formed, in the most wonderful manner, at once to live in situations the most rugged, and, animated by an instinct the most tractable, to associate with Man. The lama of Peru, with his forked feet, armed with two spurs, scrambles over the precipices of the Andes, and brings back to him his rose-coloured fleece. The rein-deer, with her broad and cloven hoof, traverses the snows of the North, and fills for him her dugs distended with cream, in the mossy pastures. The ass, the camel, the elephant, the rhinoceros, are detached, on his service, to the rocks, to the sands, to the mountains, and to the morasses of the torrid

torrid Zone. Every region is supporting a race of servants for him; the roughest, the most robust; the most patient, the most ungrateful.

But animals alone, in which are united the greatest number of utilities, live with him over the whole face of the earth. The sluggish cow pastures in the cavity of the valley, the bounding sheep on the declivity of the hill. The scrambling goat browses among the shrubs of the rock; the hog, armed with a snout, turns up the foundation of the marshy ground, with the help of an appendage of spurs, which Nature has planted above his heels, to prevent his sinking in it; the swimming duck feeds on the fluviatic plants; the hen, with attentive eye, picks up every grain scattered about, and lost in the field; the pigeon, on rapid wing, collects a similar tribute from the refuse of the grove, and the frugal bee turns to account, for Man, even the small dust on the flower.

There is no corner of the Earth where the whole vegetable crop may not be reaped. Those plants which are rejected by one, are a delicacy to another; and even to the finny tribes, contribute to their fatness. The hog devours the horse-tail and hen-bane; the goat, the thistle and hemlock. All return, in the evening, to the habitation of
F 4 Man,

Man, with murmurs, with bleatings, with cries of joy, bringing back to him the delicious tribute of innumerable plants, transformed, by a process the most inconceivable, into honey, milk, butter, eggs, and cream.

Man subjects, to his dominion, not only the whole vegetable, but the whole animal creation, though their smallness, their swiftness, their strength, their cunning, nay, the very Elements, may seem to exempt them from his jurisdiction.

To begin with the infinite legions of insects, his duck and his hen feed upon them. These fowls swallow even various sorts of venomous reptiles, without sustaining the slightest injury. His dog subdues for him every other species of brute. The numerous varieties of that animal are evidently adapted to their several uses and ends; the shepherd's dog, for the wolf; the terrier, for the fox; the grey-hound, for animals of the plain; the mastiff, for those of the mountain; the pointer, for birds; the water-spaniel, for the amphibious race; in a word, from the little lap-dog of Malta, formed only for amusement, up to the huge hunter of the Indies, who, according to Pliny and Plutarch, scorns to attack any thing inferior to the lion or the elephant, and whose breed still subsists among the Tartars, their species are so varied, in form, in
size,

size, in respect of instinct, that I am constrained to believe, Nature has produced as many sorts of them, as she has produced animal species to be subjugated. We cross the breed of cats, of goats, of sheep, of horses, a thousand different ways; and after all our efforts and combinations, we can produce only a few trivial varieties, which deserve, in no respect, to be compared with the natural varieties of the canine species.

While some Philosophers assign to every species of dog a common origin, others ascribe a difference of origin to Man. Their system is founded on the variety of size and colour in the human species; but neither colour, nor stature, are distinctive characters, in the judgment of all Naturalists. According to them, colour is merely accidental; superior stature only a greater expansion of forms. Difference of species arises from the difference of proportions: now this characterizes that of dogs. The proportions of the human body no where vary; the black colour, within the Tropics, is simply the effect of the heat of the Sun, which tinges him in proportion as he approaches the line. And it is, as we shall see, one of the blessings of Nature. His size is invariably the same in every age, and in all places, notwithstanding the influence of food and climate, by which other animals are so powerfully affected. There are breeds of
horses

horses and of black cattle, double the size the one of the other, as any one may be convinced, by comparing the large artillery horses of Holstein, with the small poneys of Sardinia, no taller than sheep; and the huge Flanders ox with the diminutive one of Bengal; but from the tallest to the shortest of the human race, there is not, at most, the difference of a foot. Their stature is the same, at this day, as it was in the time of the Egyptians; and the same at Archangel as in Africa, as is evident from the length of mummies, and that of the tombs of the ancient Indians, found in Siberia, along the banks of the river Petzora.

The somewhat contracted stature of the Laplanders is to be imputed, I presume, to their sedentary mode of living; for I have observed, among ourselves, a similar contraction of size in persons of certain occupations, which require little exercise. That of the Patagonians, on the contrary, is more expanded than that of the Laplanders, though they inhabit a latitude as cold, from their greater disposition to be moving about. The Laplander passes the greater part of the year shut up amidst his herds of rein-deer; whereas the Patagonian is perpetually a stroller, for he lives entirely by hunting and fishing. Besides, the first travellers to whom we are indebted for our knowledge of these two nations, have greatly exaggerated the smallness

smallness of the one, and the magnitude of the other, because they saw the Laplanders squatted on the floor of their smoky huts; and the Patagians in a position which magnifies every object, namely, at a distance, on the summit of their rocky shores, whither they flock as soon as a vessel appears, and through the fogs which are so frequent in their climates, and which, it is well known, greatly increase the apparent size of all bodies, especially when in the Horizon, by refracting the light wherewith they are surrounded.

The Swedes and Norwegians, who inhabit similar latitudes, in which the cold prevents, as it is alleged, the expansion of the human body, are of the same stature with the natives of Senegal, where the heat, for the opposite reason, ought to favour growth; and neither the one nor the other is taller than we are. Man, over the whole Globe, is at the centre of all magnitudes, of all movements, and of all harmonies. His stature, his limbs, his organs, have proportions so adjusted to all the works of Nature, that she has rendered them invariable as their combination. He constitutes himself alone, a genus which has neither class nor species, dignified, by way of excellence, with the title of **MANKIND.**

He

He forms a real family, all the members of which are scattered over the face of the Earth, to collect her productions, and are capable of maintaining a most wonderful correspondence, adapted to their mutual necessities. Man has been, in every age, the friend of Man, not merely from the interests of commerce, but by the more sacred, the more indissoluble, bands of Humanity. Sages appeared, two or three thousand years ago, in the East, and their wisdom is now illuminating us at the remotest verge of the West. To-day, a savage is oppressed in the wilds of America; he sends his arrow round from family to family, from nation to nation, and the flame of war is kindled in the four quarters of the Globe. We are all bondsmen for each other.

We shall frequently recur to this great truth, which is the basis of the morality of Subjects as well as of Sovereigns. The happiness of every individual is attached to the happiness of Mankind. He is under obligation to exert himself for the general good, because his own depends on it. But interest is not the only motive which renders virtue a duty to him; to Nature he is indebted for its sublimest lessons. Being born destitute of instinct, he was laid under the necessity of forming his intellect on her productions. He could imagine nothing but after the models of every kind
with

with which she had presented him. He was instructed in devising and perfecting the mechanic Arts, from plans suggested by the industry of animals; and in the liberal Arts and Sciences, after the model of Nature's own immediate harmonies and plans. To her sublime studies he is indebted for a light which illuminates no other animal. Instinct discovers to the animal it's necessities only; but Man alone, has raised himself from the dark womb of profound ignorance, to the knowledge and belief of a GOD.

This knowledge has not been confined to a Socrates, or a Plato: No, they have it in common with Tartars, Indians, Savages, Negros, Laplanders; with men of every description. It is the result of every contemplation, whatever be the object, a grain of moss, or the Sun. On it are founded all the associations of the human race, without a single exception.

As Man has formed his intellect on that of Nature, he has been obliged to regulate his moral sense by that of her AUTHOR. He felt, that, in order to please Him who is the principle of all good, it was necessary to contribute to the general good; hence the efforts made by Man, in every age, to raise himself to GOD, by the practice of virtue. This religious character, which distinguishes

guishes him from every other sensible being, belongs more properly to his heart than to his understanding. It is, in him, not so much an illumination as a feeling, for it appears independent even of the spectacle of Nature, and manifests itself with equal energy in those who live most remote from it, as in those who are continually enjoying it. The sensations of the infinity, of the universality, of the glory, and of the immortality with which it is connected, are incessantly agitating the inhabitants of the city, as well as those of the country. Man, feeble, miserable, mortal, indulges himself, every where, in these celestial passions. Thither he directs, without perceiving it, his hopes, his fears, his pleasures, his pains, his loves; and passes his life in pursuing, or combating, these fugitive impressions of DEITY.

Such is the career which I have prescribed to myself. But as, in a long voyage, we sometimes perceive, on our way, flowery isles, in the bosom of a great river, and enchanting groves on the summit of inaccessible precipices: in like manner, the progress we shall make in the study of Nature, will gradually disclose to us some delightful prospects. With these we shall, at least, feast the eye as we pass along, if we are not permitted to stop, and survey them at leisure. We shall have frequent occasion to remark, that the works of Nature

ture exhibit contrasts, harmonies, and transitions, which wonderfully unite their different empires to each other.

We shall examine by what magic it is, that the contrasts are productive, at once, of pleasure and pain, of friendship and hatred, of existence and destruction. From them proceeds that great principle of LOVE, which divides all the individuals into two great classes, objects loving, and objects beloved. This principle extends from animals and plants, which are distinguished by sex, down to insensible fossils; as metals, which have magnetic powers, most of which are still unknown to us; and from salts which strive to unite in the fluids where they swim, up to the Globes, which have a mutual attraction in the Heavens. It opposes individual to individual by difference of sex, and genus to genus by difference of forms, in order to extract from them harmonies innumerable.

In the Elements, Light is opposed to Darknefs, Heat to Cold, Earth to Water, and their accords produce days, temperatures, views, the most agreeable. In vegetables, we shall see, in the forests of the North, the thick and gloomy foliage, the tranquil attitude and the pyramidical form of the fir, contrast with the tender verdure, and moveable foliage, of the birch, which, from it's
spreading

spreading top and slender base, presents the appearance of a pyramid inverted. The forests of the South will exhibit similar harmonies, and we shall find them even in the herbage of our meadows.

The same oppositions reign in the animal kingdom; and, to instance only in such as are most familiar to us, the bee and the butterfly, the hen and the duck, the indigenous sparrow and rambling swallow, the nimble courser and sluggish ox, the patient ass and capricious goat; in a word, the cat and dog, display an endless contrast, on our flower-beds, in the meadow, in our houses, of forms, of movements, of instincts.

I do not comprehend, in these harmonical oppositions, the carnivorous animals, which make war on the others, and whose corresponding intercourse regards them not as living, but as dead. I understand by contrast, that which Nature has established between two classes, different in manners, in inclinations, and in figures, and to which, nevertheless, she has given certain secret sympathetic sensibilities, which engage them, in their natural state, to inhabit the same places, to associate together, and to live in peace. Such is the contrast of the horse, who delights to gallop about in the same field where the ox walks gravely on, ruminating

minating as he goes. Such, again, is that of the afs, who, well-pleafed, follows, with a flow and meafured pace, the nimble-footed goat, up to the very precipices over which fhe scrambles. From the bee and the butterfly, up to the elephant and the camelopard, there is not a fingle animal on the Earth but what has its contraft, Man only excepted.

The contrafts of Man are all within himfelf. Two oppofite paffions, Love and Ambition, balance all his actions. To Love, are referable all the pleafures of the fenfes; to Ambition, all thofe of the foul. Thefe two paffions are in perpetual counterpoife in the fame fubject; and while the firft is accumulating on Man every kind of corporeal enjoyment, and infenfibly finking him below the level of the beafts; the fecond prompts him to aim at univerfal dominion, and to exalt himfelf, at length, up to the DEITY. Thefe two contradictory effects are obfervable in all men, who have it in their power, without obftruction, to follow thefe oppofite impulfes, whether in the clafs of Kings, or that of flaves. The *Neros*, the *Caligulas*, the *Domitians*, lived like brutes, and exacted the adoration due to Gods. We find in Negroes the fame incontinence, the fame pride, and the fame ftupidity.

Nature, however, has bestowed these two passions on Man, as a source of happiness. She produces an equal number of each sex, in order to direct the love of every man to a single object, and in that object she has united all the harmonies which are scattered over her most beautiful productions. There is between Man and Woman a wonderful analogy of forms, of inclinations, and of tastes; but there is a difference still greater, of these very qualities. Love, as we shall have occasion to observe, results only from contrasts, and the greater they are, the more powerful is its energy. I could easily demonstrate this, by the evidence of a thousand historical facts. It is well known, for example, with what a mad excess of passion that tall and clumsy soldier *Mark Anthony* loved, and was beloved by, *Cleopatra*; not the person whom our Sculptors represent, of a tall, portly, Sabine figure, but the *Cleopatra* whom Historians paint, as little, lively, sprightly, carried, in disguise, about the streets of Alexandria, in the night-time, packed up in a parcel of goods, on the shoulders of *Appollodorus*, to keep an assignation with *Julius Cæsar*.

The influence of contrasts, in Love, is so certain, that, on seeing the lover, it would be easily possible to draw the portrait of the beloved object, without having seen it, provided only it were
known

known that the passion was extremely violent. Of this I myself have made proof, on various occasions; among others, in a city where I was entirely a stranger. A gentleman of the place, one of my friends, carried me to visit his sister, a very virtuous young lady, and he informed me, as we were going, that she was violently in love. Being arrived at her apartments, and Love happening to become the subject of conversation, it came into my head to say to her, that I knew the laws which determined our choice in love, and that, if she would permit me, I could draw her lover's picture, though he was utterly unknown to me. She bid me defiance: upon this, taking the opposite to her tall and buxom figure, to her temperament and character, which her brother had been describing to me, I painted her favourite as a little man, not overloaded with flesh, with blue eyes, and fair hair, somewhat fickle, eager after information. Every word I uttered made her blush up to the eyes, and she became seriously angry with her brother, accusing him of having betrayed her secret. This, however, was not the case, and he was fully as much astonished as herself.

These observations are of more importance than we, generally, imagine. They will enable us to demonstrate, to what a degree our Institutions deviate from the Laws of Nature, and weaken the

power of Love, when they assign to Woman the studies and the employments of Man. Virtue alone knows how to turn these contrasts to good account, in the married state, in which the duties of the two sexes are so very different. There, too, she presents to their natural ambition, a career the most sublime, in the education of their children, whose reason it is their duty to form; and their sweetest recompense to receive, in exchange, the first sentiments of filial affection. In the hearts of their children their memory is to be perpetuated on the earth, in a manner more affecting, and infinitely more indelible, than the memory of Kings on public monuments. What power can equal that which confers existence, and the power of thought; and what recollection can last so long as that of filial gratitude?

The government of a good King has been compared to that of a Father; but the empire of a virtuous Father can be compared only to that of God himself. Virtue is, to Man, the true law of Nature. It is the harmony of all harmonies. Virtue alone can render Love sublime, and Ambition beneficent. It can derive the purest gratification even from privations the most severe. Rob it of Love, Friendship, Honour, the Sun, the Elements, it feels that, under the administration of a Being just and good, abundant compensation is reserved

reserved for it, and it acquires an increase of confidence in GOD, even from the cruelty and injustice of Man. It was virtue that supported, in every situation of life, an *Antoninus*, a *Socrates*, an *Epictetus*, a *Fenelon*; that rendered them, at once, the happiest, and the most respectable of Mankind.

If, on the one hand, Nature has established contrasts, in all works, on the other, she has deduced from them harmonies which re-unite them all again. It would appear that, having fixed upon a model, it was her intention to communicate to all places a participation in it's beauty. The light and disk of the Sun are, accordingly, reflected a thousand different ways, by the planets in the heavens, by the parhelions and rainbow in the clouds, by the *Aurora-borealis* in the ices of the North; in a word, by the refractions of the Atmosphere, the reflexes of the waters, and the specular reflexions of most bodies on the Earth. The islands, in the midst of the Ocean, represent the mountainous forms of the Continent; and the mediterranean Seas and Lakes in the bosom of mountains, represent the vast plains of the mighty Deep.

Trees, in the climate of India, affect the port of herbs; and the herbs in our gardens that of trees. A multitude of flowers seem modelled after the rose

and the lily. Among our domestic animals, the cat appears to be formed on the model of the tyger, the dog on that of the wolf, the sheep on that of the camel. Every species has its correspondent, Mankind only excepted. That of the monkey, which some would make a variety of the human species, has relations, much more direct, to other animals. The man of the woods, with his long arms, his meagre feet, his fleshless paws, his flattened nose, his lipless mouth, his round eyes, his abominable hairy coat, has, certainly, a very imperfect resemblance to the Apollo of the Vatican; and whatever inclination one might have to reduce Man to the beast, it would be difficult to find, in the female of that animal, a second model of the human figure, which should come near the Venus de Medicis, or the Diana of Allegrain, which is shewn at Lucienne. But I have seen monkeys which had a strong resemblance to the bear, as the bavian of the Cape of Good-Hope; or to the greyhound, as the maki of Madagascar. Some are formed like little lions; such is a very handsome white species, with a mane, found in Brasil. I presume that most species of quadrupeds, especially among the ferocious kinds, have their counterparts in those of the monkey tribe.

These same correspondencies are likewise discernible in the numerous varieties of parrots, which,

which, in their forms, their bills, their claws, their scream, and their sports, imitate, for the most part, birds of prey. Finally, they extend even to the plants, denominated, for this very reason, *mimofas*, which represent, in their flowers, or in the aggregation of their grains, insects and reptiles, such as snails, flies, caterpillars, lizards, scorpions, &c.

Nature, in forming and presenting these correspondencies, must have some intention, which I do not comprehend. What is very remarkable, they are common only between the Tropics, where the forests swarm with every species of the monkey and parrot race. Perhaps she meant to exhibit, under harmless forms, those of the noxious animals, which are there found in great numbers, in order to expose to the light of day the terrible figure of those sons of darkness and carnage, and that none of her productions should remain concealed, in the womb of Night, from the eyes of Man.

Whatever may be in this, no one animal, on the face of the Earth, is formed on the noble proportions of the human figure; and if Man, under the impulse of passion, frequently degrades himself to the level of the beasts, his restlessness, his intelligence, and his sublime affections, sufficiently de-

monstrate, that he himself is the counterpart of the DEITY.

Finally, the spheres of all beings have a communication, by means of rays, which seem to unite their extremities. We shall remark on the stalactities and chrySTALLIZATIONS of fossils, the processes of vegetation; and I think we may perceive even the movement of animals in that of their magnetic influence. On the other hand, we shall see plants forming themselves, after the manner of fossils, without any apparent organization; such is, among others, the truffle, which has neither leaves, nor flowers, nor roots. Others represent, in their flowers, the figure of animals, as the orchites; or their sensibility, as the sensitive plant, which lets fall, and shuts its leaves at the slightest touch; or their instinct, as the *dionæa muscipula*, which catches flies. The petals of this plant are formed of opposite little leaves, impregnated with a sugary substance, which attracts the flies; but the instant they alight, these little leaves suddenly close together with a spring, like the jaws of a fox-trap, and pierce the fly with their prickly edges.

There are others still more astonishing, as having within themselves the principle of motion; such is the *bedysarum movens*, or *burum chandali*,
imported

imported, some years ago, from Bengal into England. This plant moves, alternately, the two pendent lobes which are attached to it's leaves, though no exterior or apparent cause contributes to this species of oscillation.

But, without going so far in quest of wonders, we shall find, perhaps, in our common gardens, appearances of Nature still more surprizing. We shall see the pea, for example, pushing out it's tendrils, precisely at the height where they begin to stand in need of support, and curling them round the boughs, with an address which can hardly be ascribed to chance. These relations seem to suppose intelligence; but we shall find others still more amiable, which are a demonstration of goodness, not in the vegetable, but in the hand which formed it. The *sylphium*, of our gardens, is a great ferulaceous plant, which resembles, on the first glance, what is known by the name of the sun-flower. It's capacious leaves are opposed at the base, and their cavities uniting, form an oval cup, in which the rain water collects, to the quantity of a pretty large glass-full. They are placed in stories, not in the same direction, but at right angles, in order to receive the rain water that falls in the whole extent of their circumference. It's square stem is very commodious for being firmly caught by the claws of birds; and it's
flowers

flowers produce seeds of which many of them are excessively fond, particularly the thrush. So that this whole plant, like the perch of a parrot-cage, presents, at once, to the birds, a resting place, and meat, and drink.

We shall, likewise, speak of the smell and taste of plants. We shall remark, under these relations, a great number of botanical characters, which are not the least certain. It was from the smell and taste that Man acquired the first knowledge of their poisonous, medicinal, or nutritive qualities. Nay, the very sounds of plants are not to be overlooked; for, when agitated by the winds, most of them emit sounds peculiar to themselves, and which produce harmonies, or contrasts, the most agreeable, with the sites of the places where they usually grow. In India, the hollow canes of the bamboo, which shade the banks of rivers, imitate, as they rustle against each other, the gushing noise excited by the motion of a ship through the water; and the pods of the cinnamon, agitated by the winds on the mountain's top, the tic-tac of a mill. The moveable leaves of the poplar convey to our ears, in the wood, the bubbling of a brook. The green meadows, and the calm forests, fanned by the zephyrs, represent, in the hollow of the valley, and on the declivity of the rock, the undulations and murmurs of the waves

waves of the sea breaking on the shore. The early inhabitants of the Globe, struck with these mysterious sounds, imagined that they heard oracles pronounced from the trunk of the oak, and that Nymphs and Dryads, inclosed in the rugged bark, inhabited the mountains of Dodona.

The sphere of animals extends still farther these wonderful harmonies. From the motionless shelly race, which pave and strengthen the capacious bed of the Sea, to the fly who wings his way by night, over the plains of the torrid Zone, glittering with rays of light like a star, you will find in them the configurations of rocks, of vegetables, of stars. A thousand ineffable passions, a thousand instincts animate them, which they express in songs, in cries, in hummings, nay, even in the articulate sounds of the human voice.

Some of them compose noisy republics, others live in a profound solitude. The whole life of some is employed in waging war, that of others in making love. In their combats they use every imaginable species of armour, and every possible method of availing themselves of the weapons with which Nature has furnished them, from the porcupine, who darts his pointed arrows at the foe, to the torpedo, who invisibly smites his assailant, as with a stroke of electricity.

- Their

Their loves are not less varied than their animosities. One must have his seraglio; another is satisfied with a transient mistress; a third unites himself to a faithful companion, whom he never abandons till death makes the separation. Man unites, in his enjoyments, their pleasures and their transports; and, fatiated, sighs, and demands of Heaven felicity of a different kind.

We shall examine, simply by the light which reason supplies, whether Man, subjected, by his body, to the condition of the animal creation, all whose necessities he unites in himself, is not, by his soul, allied to creatures of a superior order: whether Nature, who has assigned the jurisdiction of the immensity of her productions on the Earth, to a being naked, destitute of instinct, and who must undergo an apprenticeship of several years in learning to walk only, has reduced him, from his birth, to the alternative of studying their qualities, or of perishing; and whether she has not reserved to herself some extraordinary means of interposing for his relief, amidst the evils of every kind which check his existence, even among beings of the same species with himself.

On reviewing the transitions which unite the different kingdoms, and which extend their limits to regions hitherto unknown, we shall not adopt the
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the opinion of those who believe, that the works of Nature, being the results of all possible combinations, must present every possible mode of existence. "You will find in them," say they, "order, and, at the same time, disorder. Throw about the characters of the alphabet, in an infinite variety of manners, and you shall form of them the Iliad, and poems superior even to the Iliad ; but you will have, at the same time, an infinity of formless assemblages." We adopt this comparison, observing, however, that the supposition of the twenty-four letters of the alphabet suggests a previous idea of order, which it was necessary to admit as a foundation even to the hypothesis of chance. If, then, the multiplied throws of these twenty-four letters gave, in fact, an infinite number of poems, good and bad, how many must principles, much more numerous, of existence in itself, such as the elements, colours, surfaces, forms, depths, movements, produce of different modes of existing, were we to take but a single hundred of the modifications of each primordial combination of matter !

We should have, at least, the general transitions of the different kingdoms. We should see plants walking on feet like animals ; animals fixed in the earth by roots like plants ; rocks with eyes ; herbs which

which vegetated only in air. The chief intervals of the spheres of existence would be filled up. But every thing possible does not exist. There exists nothing but what is useful relatively to Man. The same order which pervades the general combination of the spheres, subsists in the parts of each of the individuals which compose them. There is not a single one which has, in its organs, either deficiency or redundancy.

Their mutual adaptation is so perceptible, and they possess characters so very striking, that if you were to shew to a Naturalist of ability any representation of a plant, or animal, which he had never seen, he could tell, from the harmony of it's parts, whether it were a creature of the imagination, or a copy after Nature. One day, the students in Botany, wishing to put to trial the knowledge of the celebrated *Bernard de Jussieu*, presented to him a plant which was not in the collection of the Royal Garden, requesting him to indicate it's genus and species. The moment he cast his eyes on it, he replied, "This plant is artificially composed; you have taken the leaves of one, the stalk of another, and the flower of a third." This was the fact. They had, however, selected, with the greatest art, the parts of such as had the most striking analogy.

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I am confident to affirm, that, by the method which I shall propose, the Science may be carried still much farther, and that we shall be enabled, by it, to determine, at sight of an unknown plant, the nature of the soil in which it grew ; whether it is a native of a hot or a cold country ; whether it is an inhabitant of the mountain, or of the stream ; and, perhaps, even the animal species to which it is particularly allied.

In studying these laws, most of which are unknown, or neglected, we shall reject others, which are founded only on particular observations, and which have been too much generalized. Such are, for example, the following ; that the number and fecundity of created beings are in the inverse ratio of their magnitude ; and that the time of their decay is in proportion to that of their increase. We shall shew, that there are mosses less prolific than the fir, and shell fish less numerous than whales : such is, to name only one, the hammer-fish. There are animals which grow very fast, and decay very slowly : this is the case of most fishes. I should never have done, if I went about to prove, that the longevity, the strength, the size, the fecundity, the form, of every being, is adapted, in a most wonderful manner, not only to its individual happiness, but to the general happiness of all, from which results that of Mankind.

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We shall, likewise, reject those analogies, so commonly admitted, which are drawn from climate and soil, in order to explain all the operations of Nature by mechanical causes; for I shall demonstrate, that she frequently produces in these, both vegetables and animals, whose qualities are diametrically opposite to those of their climate and soil.

The tubulous and driest plants, such as reeds, rushes, as well as the birch, whose bark, similar to leather overlaid with oil, is incorruptible by humidity, grow by the water sides, like boats provided for crossing over. On the contrary, plants with the richest juices, and the most humid, grow in the driest situations, such as the aloe, the taper of Peru, and the lianne impregnated with water; which are to be found only on the parched rocks of the torrid Zone, where Nature has placed them like so many vegetable fountains.

Even the instincts of animals appear to be less adapted to their own personal utility, than to that of Man; and are sometimes in harmony with the nature of the soil which they inhabit, and sometimes in opposition to it. The gluttonous hog delights to live in the mire, from which he is intended to purify the habitation of Man; and the
sober

sober camel, to force his way through the burning sands of Africa, impervious, but for him, to every effort of the traveller. The appetites of these animals do not grow out of the places which they inhabit; for the ostrich, who is a fellow-tenant of the same deserts with the camel, is still more voracious than the hog.

No one law of magnetism, of gravity, of attraction, of electricity, of heat, or of cold, governs the World. These pretended general laws, are nothing more than particular means. Our Sciences mislead us, by ascribing to Nature a false providence. They put the balance into her hand, it is true, but not of justice; no, it is only the balance of commerce. They weigh only the salts and the masses, but put aside the wisdom, the intelligence, and the goodness. They are not afraid of excluding from the heart of Man that sentiment of the divine qualities, which communicates to him so much force; and of accumulating on his mind, the weights and movements which oppress him. They put in opposition the squares of times and velocities, but they neglect those wonderful compensations with which Nature interposes for the relief of all beings, having bestowed the most ingenious on the most feeble, the most abundant on the poorest, and having united all for the relief of

the Human Race, undoubtedly, as being the most wretched species of all.

We can know that only which Nature makes us feel; and we can form no judgment of her Works but in the place, and at the time, she is pleased to display them. All that we imagine, beyond this, presents only contradiction, doubt, error, or absurdity. I do not except, from this description, even our imaginary plans of perfection. For example, it is a tradition common to all Nations, supported by the testimony of the Holy Scriptures, and founded on a natural feeling, that Man has lived in a better order of things, and that we are destined to another, which is still to surpass it. We are incapable, however, of saying any thing of either the one or the other. It is impossible for us to retrench any thing from that in which we live, or to add any thing to it, without rendering our condition worse. Whatever Nature has introduced into it, is necessary. Pain and death are among the proofs of her goodness. But for pain, we should be bruising ourselves, every step we took, without perceiving it. But for death, new beings could not be raised into existence; and supposing those which already are in the world could be rendered eternal, that eternity would involve in it the ruin of generations, of the configuration

ration of the two sexes, and of all the relations of conjugal, filial, and parental affection; that is to say, of the whole system of actual happiness.

In vain do we search, in our cradles, for the archives which our tombs deny us: the past, like the future, covers our mysterious destiny with an impenetrable veil. In vain do we apply to it the light which illumines us, and seek, in the origin of things, the weights, the times, and the measures, which we find in their enjoyment; but the order which produced them has, with relation to God, neither time, nor weight, nor measure. The divisions of matter and time were made only for circumscribed, feeble, transient Man. The Universe, said *Newton*, was produced at a single cast. We are seeking for youth in what was always old, for old age in what is always young, for germs in species, births in generations, epochs in nature; but when the sphere, in which we live, issued from the hand of its divine AUTHOR, all times, all ages, all proportions, manifested themselves in it at once.

In order that Etna might vomit out its fires, from the very first construction of these tremendous furnaces, lavas must have been provided which had not yet begun to flow. In order that

the Amazonian river might roll its stream across America, the Andes of Peru must have been, from the beginning, covered with the snows, which the winds of the East had not yet accumulated upon them. In the bosom of new-created forests, ancient trees must have sprung up, that insects and birds might find their proper aliment on the antique rind. Carrion must have been created for the support of carnivorous animals. There must have been produced, in all the kingdoms of Nature, beings young, old, living, dying, and dead. All the parts of this immense fabric must have appeared at the same instant; and if there was a scaffolding, to us it has disappeared.

Let others extend the boundaries of our Sciences, I shall consider myself as having rendered a more useful service to my fellow-creatures, if I am enabled to fix those of our ignorance. Our illumination, like our virtue, consists in descending: and our force in becoming sensible of our feebleness. If I do not pursue the road which Nature has reserved for herself, I shall, at least, walk in that which Man ought to take. It is the only one which presents him easy observations, useful discoveries, enjoyments of every description, without instruments, without a cabinet, without metaphysics, and without system.

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In order to be convinced how agreeable it is, let us construct, in conformity to our method, any group, with the sites, the vegetables, and the animals, most commonly to be found in our Climates. Let us suppose a soil the most obdurate, a craggy protuberance on the coast, where a river disgorges itself into the Ocean, presenting a steep toward the sea, and a gentle declivity toward the land: that, on the side turned toward the sea, the billows cover with foam rocks clothed with seaweed, fucuses, alga-marinas, of all colours, and of all forms, green, brown, purple, in tufts and garlands, as I have seen them on the coasts of Normandy, affixed to the rocks of white marl, which the sea detaches from the main shore. Let us farther suppose, that, on the side of the river, we see on the yellow sand, a scanty verdure, mixed with a little trefoil, and here and there a sprig of marine wormwood. Let us introduce some willows, not like those which grow in our meadows, but the native crop of the soil, and similar to those which are to be seen on the banks of the Sprée, in the vicinity of Berlin, with broad bushy tops, and rising to the height of more than fifty feet. Let us not forget, in this arrangement, the harmony of different ages, which it is so agreeable to meet, in every species of aggregation, but especially in that of vegetables. Let us observe, of these willows so smooth and full of moisture, some pushing

their young branches into the air, and others of an aged form, with pendent top and hollow trunk.

Let us add to these their auxiliary plants, such as the green mosses and gilded *lichen*, which marble their gray rind, and some of the convolvuluses, vulgarly called lady's-smock, which delight to scramble along their trunk, and to embellish the branches, which have no flowers of their own, with leaves in form of a heart, and flowers white as snow, hollowed into the shape of a spire. Let us, finally, introduce the inhabitants natural to the willow, and its accessory plants, their butterflies, their flies, their beetles, and other insects, together with the feathered animals which make war on them, such as the water-hen, polished like the burnished steel, which catches them in the air; the wag-tail, which pursues them on the land, making the movement from which he derives his name; and the king's-fisher, who hunts for them along the surface of the water; and you will see a multitude of agreeable harmonies arising out of one single species of tree.

They are, however, still imperfect. To the willow let us oppose the alder, which likewise affects the bank of the river, and which, by its form resembling that of a long tower, its broad foliage, its dusky verdure, its fleshy roots, formed
like

like cords running along the banks, and binding together the foil, forms a complete contrast with the extended mafs, the light foliage, the white-streaked verdure, and the trundling roots of the willow. Add to this the individuals of the alder, of different ages, rifing like fo many verdant obelisks, with their parasite plants, fuch as the maiden-hair fpreading into flars of verdure over the humid trunk, the long hart's-tongue hanging from the boughs down to the ground, and the other accessories of insects and fowls, and even of quadrupeds, which, probably, contrast as to form, colour, gait and inflinét, with thofe of the willow ; and we fhall have a delicious concert of vegetables and animals, compofed of two trees only, together with their accompaniments.

If we illuminate our little plantation with the firft rays of Aurora, we fhall behold, at once, fhades deep and fhades tranfparent, diffufed over the verdure ; a dusky and a filvered verdure interfeét each other, on the azure of the Heavens, and their foft reflexes, blended together, moving along the bofom of the waters. Let us, farther, fuppofe, what neither poetry nor painting can pretend to imitate, the odour of the plants, and even the fmell of the fea, the ruffling of leaves, the humming of insects, the matin-fong of the birds, the hollow murmuring noife, intermixed with filence,

of the billows breaking on the shore, and the repetitions of all these sounds, repercuſſed by the diſtant echos, which, loſing themſelves in the ſea, reſemble the voice of the Nereids: Ah! if Love, or Philoſophy, ſhould ever tempt you to ſuch a ſolitude, you will find in it an aſylum more delicious than the palaces of Kings can beſtow.

Would you wiſh that ſenſations of a different order ſhould be excited? Would you wiſh to hear the voice of paſſion and ſentiment burſt from the boſom of the rock? Let the tomb of a virtuous and unfortunate man ſtart up amidſt the weeping willows, preſenting this inſcription to the eye:—*Here reſts J. J. ROUSSEAU.*

Would you wiſh to ſtrengthen the impreſſion of this picture, without, however, doing violence to Nature, as to the ſubject? Change the time, the place, the monument; let this iſle be Samos; the trees of theſe groves, laurels and wild olives, and this tomb the tomb of *Philofetes*. Look at the grotto, which ſerved as a habitation to that great man, when abandoned by the Greeks, whoſe battles he had fought; his wooden pot, the tatters in which he was clothed, the bow and arrows of Hercules, which, in his hands, had ſubdued ſo many monſters, and with which he, at laſt, wounded himſelf: and you will be impreſſed with
two

two powerful sensations at once, the one physical, which increases in proportion as you approach the works of Nature; because their beauty discloses itself only to the eye which examines it; the other moral, which grows upon you, in proportion as you retire from the monuments of Virtue, because to do good to men, and to be no longer within their reach, is a resemblance to the DEITY.

What would it be then, were we to take a glance of the general harmonies of this Globe? To dwell only on those which are best known to us, behold how the Sun constantly encircles with his rays one half of the Earth, while Night covers the other with her shade. How many contrasts and concords result from their ever changing oppositions? There is not a single point in the two Hemispheres, in which there does not appear, by turns, a dawn, a twilight, an aurora, a noon, a setting of burnished gold, and a night sometimes studded with stars, sometimes clothed in a sable mantle.

The Seasons walk hand in hand under his eye, like the hours of the day. Spring, crowned with flowers, precedes his flaming car; Summer furrounds it with her golden sheaves; and Autumn follows it, bearing her cornucopia running over with glossy fruit. In vain would Winter and
Night,

Night, retiring to the Poles of the World, attempt to set bounds to his majestic career : In vain do they raise out of the bosom of the polar Seas of the North and of the South, new Continents with their vallies, their mountains, and their icy coruscations : the Father of Day, with his fiery shafts, overturns the fantastic fabric ; and without descending from his throne, resumes the empire of the Universe. . Nothing can screen itself from his prolific heat.

From the bosom of the Ocean, he raises into the Air, the rivers which are afterwards to flow through the Old and New Worlds. He gives commandment to the Winds to distribute them over islands and continents. These invisible children of the Air transport them, from place to place, under a thousand capricious forms. Sometimes they are spread over the face of Heaven like veils of gold and streamers of silk ; sometimes they are rolled up in the form of frightful dragons, and roaring lions, vomiting out torrents of fire and thunder. They pour them out on the mountains in as many different ways, in dews, in rains, in hail, in snow, in impetuous torrents.

However extravagant the mode of performing their services may appear, every part of the Earth annually receives from them neither more nor less, than

than it's accustomed portion of water. Every River fills his urn, and every Naiad her shell. In their progress, they impress on the liquid plains of the Sea, the variety of their characters. Some hardly ruffle the smooth expanse; others swell it into billows of azure; and others turn it up from the bottom with a dreadful noise, and dash it foaming over the rocky promontory.

Every place possesses harmonies peculiar to itself, and every place presents them in rotation. Run over, at pleasure, a Meridian, or a Parallel, you will find on it mountains of ice, and mountains of fire; plains of every kind of level, and hills of every curve; islands of all forms, and rivers of all currents; some spouting up, as if they issued from the centre of the Earth, others precipitating themselves down in cataracts, as if they were descending from the clouds. Nevertheless, this Globe, agitated with such a variety of convulsive movements, and loaded with such a variety of burdens, apparently so irregular, advances in a steady and unalterable course through the immensity of the Heavens.

Beauties of a different order decorate it's Architecture, and render it habitable to sensible beings. A girdle of palm-trees, to which are suspended the date and the cocoa, surrounds it between the
burning

burning Tropics ; and forests of mossy firs begird it under the Polar Circles. Other vegetables extend, like rays, from South to North, and, having reached a certain latitude, expire. The banana advances from the Line to the southern shore of the Mediterranean. The orange crosses that Sea, and embellishes, with it's golden fruit, the southern extremities of Europe. The most necessary plants, such as corn and the gramineous tribes, penetrate the farthest, and, strong from their weakness, stretch, in the shelter of the vallies, from the banks of the Ganges to the shores of the Frozen Ocean.

Others, more hardy, take their departure from the rude climates of the North, advance over the summit of Mount Taurus, and make their way, under favour of the snows, into the very bosom of the Torrid Zone. The fir and the cedar clothe the mountains of Arabia, and of the kingdom of Cachemire, and view at their feet the scorched plains of Aden and Lahor, where the date and the sugar-cane are reaped. Other trees, equally averse to heat and cold, have their centre in the Temperate Zones. The vine languishes in Germany and Senegal. The apple, the tree of my own country, never saw the Sun perpendicularly over it's head ; or describing round it the complete circle of the Horizon, to ripen it's beautiful fruit.

But

But every soil has it's Flora, and it's Pomona. The rocks, the morasses, the mire, the sand, have each vegetables peculiar to itself. The very shallows of the sea are fertile. The cocoa-tree thrives only on the strand, and suspends it's milky fruit over the billows of the briny Deep. Other plants are adapted to the winds, to the seasons, to the hours of the day, with such exact precision, that, by means of them, *Linnaeus* constructed botanical almanacks and time-pieces.

Who is capable of describing the infinite variety of their figure? What cradles, arches, avenues, pyramids of verdure, loaded with fruits, present the most enchanting habitations! What happy republics lodge under their tranquil shade! What delicious banquets are there prepared! Nothing of them is lost. The quadrupeds eat the tender foliage, the feathered race the seeds, and other animals the roots and the rind. The insects feed on the offal. Their infinite legions are armed with every kind of instruments for collecting it. The bees have their thighs furnished with spoons, lined with hair, for picking up the fine powder of their flowers: the fly is provided with a pump for sucking out the sap: the worm has an augre, a wimble, a file, to separate the solid parts; and the ant has pincers for carrying off the crumbs. On considering the diversity of form, of manners, of governments,

governments, of all these animals, and the continual wars which they wage, you would suppose them a multitude of foreign and hostile nations, who are on the point of destroying each other. From their constancy in love, the perpetuity of their species, their wonderful harmony with all the parts of the vegetable kingdom, you would receive the idea of a single people, which had it's hereditary nobility, it's carpenters, it's pump-makers, and other artifans.

Other tribes hold vegetables in contempt, and are adapted to the Elements, to Day, to Night, to Tempests, and to different parts of the Globe. The eagle trusts her nest to the rock which loses itself in the clouds; the ostrich, to the parched sands of the desert; the rose-coloured flamingo, to the mires of the Southern Ocean. The white bird of the Tropic, and the black frigate, take pleasure to sweep along, in company, over the vast extent of the Seas, to view, from the highest regions of the Atmosphere, the fleets of India toiling after them in vain; and to circumscribe the Globe from East to West, disputing rapidity of flight with the Sun himself.

In the same latitudes, the turtle dove and the parroquet, less daring, travel only from isle to isle, having their young ones in their train, and picking
up,

up, in the forests, the grains of spicery which they brush off as they hop from branch to branch. While fowls of this description preserve an equal temperature, under the same Parallels, others find it in the track of the same Meridian. Long triangles of wild-geese and of swans go and come every year from South to North, stop only at the hoary limits of Winter, hurry, without desire, or astonishment, over the populous cities of Europe, and look down with disdain on their fertile plains, presenting the furrows of green corn in the midst of snow : to such a degree does liberty appear preferable to abundance, even in the eyes of the animal creation !

On the other hand, legions of heavy quails cross the Sea, and go to the South, in quest of the Summer's heat. Toward the end of September, they avail themselves of a northerly wind to take their departure from Europe, and flapping one wing, while they present the other to the gale, half sail, half oar, they graze the billows of the Mediterranean, with their fattened rump, and bury themselves in the sands of Africa, to serve as food to the famished inhabitants of Zara.

There are animals which travel only by night. Millions of crabs, in the Antilles, descend from the mountains by the light of the Moon, clashing
their

their claws; and present to the Caraībs, on the sterile strand of their isles, innumerable shells replenished with exquisite marrow. At other seasons, on the contrary, the tortoise quits the Sea, and lands on the same shores, to accumulate layers of eggs in their barren sands.

The very ices of the Pole are inhabited. We find in their Seas, and under their floating promontories of crystal, the black enormous whale, with more oil on his back than a whole plantation of olives could produce. Foxes clothed in precious furs, find the means of living on shores abandoned by the Sun; herds of rein-deer there scratch up the snow in search of moss, and advance, braying, into those desolate regions of night, by the glimmering light of the *Aurora Borealis*. Through a Providence, worthy of the highest admiration, places the most unprolific, present to Man, in the greatest abundance, provisions, clothing, lamps, and firing, not of his own production.

How delightful would it be to behold the Human Race collecting all these various blessings, and communicating them to each other, in peace, from Climate to Climate! We look with expectation, every Winter, to the period when the swallow and the nightingale shall announce to us the return of
ferenity.

ferenity. How much more affecting would it be, to behold the People of distant Lands arrive, with the Spring, on our shores, not with the dreadful noise of artillery, like modern Europeans, but with the sound of the flute and the hautboy, as the ancient Navigators, in the earlier ages of the World! We should behold the tawny Indian of Southern Asia, forcing his way, as formerly, up it's mighty rivers, in his leathern canoe; penetrating, through the current of the Petzora, to the extremities of the North, and displaying, on the frozen shores of the Icy Sea, the riches of the Ganges. We should see the copper-coloured Indian of America, in his hollowed log, traversing the extended chain of the Antilles, conveying from isle to isle, from shore to shore, perhaps to our very Continent, his gold and emeralds. Numerous caravans of Arabs, mounted on camels and oxen, would arrive, following the course of the Sun, from pasture to pasture, recalling the memory of the innocent and happy life of the ancient Patriarchs.

Winter itself would be no interruption to the communication of mankind. The Laplander, covered with warm fur, would arrive, under favour of the snow, in his sledge drawn by the rein-deer, and expose for sale, in our markets, the sable skins

of Siberia. Did men live in peace, every Sea would be navigated, every region would be explored, all their productions would be collected. What a gratification of curiosity would it be to listen to the adventures of these foreign travellers, attracted to us by the gentleness of our manners! They would not be slow in communicating, to our hospitality, the secrets of their plants, of their industry, and of their traditions, which they will for ever conceal from our ambitious commerce.

It is among the members of the vast family of Mankind that the fragments of their History are scattered. How interesting would it be to learn that of our ancient separation, the motives which determined each tribe to choose a separate habitation, on an unknown Globe; and to traverse, as Chance directed, mountains which presented no path; and rivers which had not yet received a name?

What pictures would be presented to us in the descriptions of those countries, decorated with a pompous magnificence, as they proceeded from the hands of Nature, but wild, and unadapted to the necessities of Man destitute of experience! They would paint to us the astonishment of their forefathers, at sight of the new plants which every

new

new Climate exhibited to their view, and the trials which they made of them, as the means of subsistence; how they were aided, no doubt, in their necessitous circumstances, and in their industry, by some celestial Intelligence, who commiserated their distress; how they gradually formed an establishment; what was the origin of their laws, of their customs, and of their religions.

What acts of virtue, what instances of generous love have ennobled the deserts, and are unknown to our pride! We flatter ourselves, that we have got a clear insight into the History of foreign Nations, because we have collected a few anecdotes, picked up at random by travellers. But this is much the same, as if they were to compose ours from the tales of a mariner, or the artificial representations of a courtier, amidst the jealousies of war, or the corruptions of commerce. The knowledge and the sentiments of a Nation, are not deposited in books. They repose in the heads, and in the hearts, of it's sages; if there be on Earth such a thing as a secure asylum for Truth. We have already employed ourselves sufficiently in passing judgment on them; it would be of more importance for us, to submit to be judged by them, in our turn, and to profit by their expressions of astonishment, at sight of our Customs, of our Sciences, and of our Arts.

If it be delightful to acquire knowledge, it is much more delightful still to diffuse it. The noblest reward of Science is the pleasure of the ignorant man instructed. What a sublime satisfaction should it be to us, to enjoy their joy, to behold their dances in our public squares, and to hear the drums of the Tartar, and the ivory cornet of the Negro re-echo round the statues of our Kings! Ah, if we were good, I figure them, to myself, struck with astonishment and sorrow, at the excessive and unhappy populousness of our cities, inviting us to spread ourselves over their solitudes, to contract marriages with them, and by new alliances to re-unite the branches of the Human Race, which are unhappily separating farther and farther, and which national prejudices disunite still more than Ages and Climates!

Alas! blessings have been given us in common, and we communicate to each other only the ills of life. Man is every where complaining of the want of land, and the Globe is covered with deserts. Man alone is exposed to famine, while the animal creation, down to insects, are wallowing in plenty. Almost every where he is the slave of his equal, while the feeblest of animals maintain their liberty against the strongest. Nature, who designed him for love, denied him arms, and he has forged them for himself, to combat his fellow. She
presents

presents to all her children asylums and festivals; and the avenues of our cities announce our approach to them only by the sad spectacle of wheels and gibbets. The History of Nature exhibits blessings only, that of Man, nothing but robbery and madness. His heroes are the persons who have rendered themselves the most tremendous. Every where he despises the hand which spins the garment that clothes him, and which cultivates for him the fertile bosom of the Earth. Every where he esteems his deceiver, and reveres his oppressor. Always dissatisfied with the present, he alone of beings regrets the past, and trembles at the thought of futurity. Nature has granted to him alone, the knowledge of a DEITY, and swarms of inhuman religions have sprung up out of a sentiment so simple and so consolatory. What, then, is the power which has opposed barriers to that of Nature? What illusion has misled that marvellous reason, which has invented so many arts, except the art of being happy? O ye Legislators! boast no longer of your laws. Either Man is born to be miserable; or the Earth every where watered with his blood, and with his tears, accuses you all of having misunderstood those of Nature.

He who adapts not himself to his Country, his Country to Mankind, and Mankind to GOD, is no more acquainted with the laws of Politics, than

he who, forming a system of Physics for himself alone, and separating his personal relations from all connection with the Elements, the Earth, and the Sun, is acquainted with the Laws of Nature. To the investigation of these divine harmonies, I have devoted my life, and this Work. If, like so many others, I have gone astray, at least my errors shall not be fatal to my religion. It alone appears to me the natural bond of Mankind, the hope of our sublime passions, and the complement of our miserable destiny. Happy, if I have been able sometimes to prop, with my feeble support, that sacred edifice, assailed as it is, in these times, on every side! But its foundations rest not on the Earth, and to Heaven its stately columns rear their heads. However bold some of my speculations may be, they have nothing to do with bad people. But, perhaps, more than one Epicurean may discern in them, that Man's supreme pleasure is in Virtue. Good citizens will, perhaps, find in them new means of being useful. At least, I shall have the full recompense of my labour, if so much as one unfortunate wretch, ready to sink at the melancholy spectacle which the World presents, shall revive, on beholding, in Nature, a Father, a Friend, a Rewarder.

Such was the vast plan I proposed to execute. I had collected, in this view, more materials than I had

had occasion for. But a variety of obstacles has prevented my making a complete arrangement of them. I shall, perhaps, resume this employment in happier times. I have, meanwhile, selected as much as was sufficient to convey an idea of the harmonies of Nature. Though my labours are here reduced to simple *Studies* merely, I have, however, been careful to preserve so much order, as was necessary to unveil my original design. Thus, a peristyle, an arcade half in ruins, avenues of columns, simple fragments of walls, present still to travellers, in an isle of Greece, the image of an ancient temple, notwithstanding the ravages of time, and of the barbarians who demolished it.

In setting out, I change scarcely any thing of the *First Part* of my Work, the arrangement excepted. I there display, in the first place, the benefits conferred by Nature on our World, and on the Age we live in; and the objections which have been raised to the Providence of their AUTHOR. I, next, reply successively to those which are started from the disorder of the Elements, of Vegetables, of Animals, of Man; and to those which are levelled against the nature of GOD himself. I am bold to affirm, that I have treated these subjects, without any personal, or extraneous, consideration whatever. Having replied to these objections, I propose some, in my turn, to the

elements of human Science, which we deem infallible; and I combat that pretended principle of our knowledge, which we call *Reason*.

After having cleared the ground of our opinions, in my first Studies, I proceed, in those that follow, to rear the fabric of human Knowledge. I examine what may be the portion of our intelligence, at which the light of Nature fixes it's boundary; and what we understand by the terms Beauty, Order, Virtue, and their contraries. I deduce the evidence of it, from several laws, physical and moral, the sentiment of which is universal among all Nations of the Globe. I afterwards make application of the physical laws, not to the order of the Earth, but to that of Plants.

I balanced long, I acknowledge, between these two orders. The first would have exhibited, I confidently affirm, relations entirely new, useful to Navigation, to Commerce, and to Geography. But the second has presented me with relations equally new, equally agreeable, more easily demonstrable to the generality of Readers, of high importance to Agriculture, and, consequently, to the most numerous description of Mankind. Besides, some of the harmonic relations of this Globe are to be found displayed in my replies to the objections against Providence, and in the elementary relations

relations of Plants, in a manner sufficiently luminous to demonstrate the existence of this new order. The vegetable order has, moreover, furnished me with occasion to speak of the relations of the Globe, which extend directly to animals and to men; and, likewise, to suggest some hints respecting the earliest voyages of the Human Race, to the principal Quarters of the World.

I apply, in the following *Study*, the laws of Nature to Man. I establish the proofs of the immortality of the soul, and of the existence of the DEITY, not on the principles of our reason, which so frequently misleads us, but on an intimate feeling, which never deceives nor betrays. I refer to those physical and moral laws, the origin of our predominant passions, Love and Ambition, and even the causes which interrupt the enjoyment of them, and which render our joys so transient, and our melancholy so profound. I flatter myself with the belief, that these proofs will interest the Reader, both by their novelty, and by their simplicity.

I proceed, afterwards, from these notions, to propose the palliatives, and the remedies, adapted to the ills of Civil Society, the representation of which is delineated in the first Volume. It was not my wish to imitate the example of most Moralists, who satisfy themselves with lashing vice,
or

or with turning it into ridicule, without either assigning the principal causes, or indicating the remedies: much less shall I act the part of our modern Politicians, who foment vice, in order to make a gain of it. I am vain enough to hope, that this last *Study*, which has been a most agreeable one to myself, will exhibit some views, which may be rendered highly beneficial to my Country.

The rich and the great imagine, that every one is miserable, and out of the World, who does not live as they do; but they are the persons who, living far from Nature, live out of the World. They would find thee, O eternal Beauty! always ancient, and always new*; O life, pure and blissful, of all those who truly live, if they sought thee only within themselves! Wert thou a sterile mass of gold, or a victorious Prince, who shall not be alive to-morrow, or some attractive and deceitful female, they would perceive thee, and ascribe to thee the power of conferring some pleasure upon them. Thy vain nature would employ their vanity. Thou wouldst be an object proportioned to their timid and grovelling thoughts. But, because thou art too much within themselves, where they never choose to look, and too magnificent externally, diffusing thyself through infinite space,

* St. Augustin's *City of God*.

thou remainest to them an unknown GOD *. In losing themselves, they have lost thee.

The order, nay, the beauty, with which thou hast invested all thy creatures, to serve as so many steps by which Man may raise himself to thee, are transformed into a veil, which conceals thee from his sickly eyes. Men have no sight but for vain shadows. The light dazzles them. Mere nothings are to them every thing; and all-perfection passeth with them for nothing. Nevertheless, he who never saw thee, has never seen any thing; he who has no relish for thee is an utter stranger to true pleasure; he is as if he were not, and his whole life is only a miserable dream.

I myself, O my God, misled by the prejudices of a faulty education, pursued a vain felicity, in systems of Science, in arms, in the favour of the Great, sometimes in frivolous and dangerous pleasures. In all these agitations, I was hunting after calamity, while happiness was within my reach. At a distance from my native Land, I sighed for joys which it contained not for me; and, nevertheless, thou wert bestowing on me blessings innumerable, scattered by thy bountiful hand over the whole Earth, which is the Country of Mankind. I disquieted myself to think that I had no power-

* Fenelon, on *the Existence of God*.

ful protector, that I belonged to no corps; and by Thee I have been protected amidst a thousand dangers, in which they could have afforded me no assistance. It grieved me to think of living solitary, unnoticed, unregarded; and Thou hast vouchsafed to teach me, that Solitude is far preferable to the bustle of a Court, and Liberty to Grandeur. It filled me with many a painful reflection, that I had not the felicity of being directed to some fair spouse, to be the companion of my life, and the object of my affection; and thy wisdom invited me to walk to her habitation, and discovered to me, in each of her productions, an immortal Venus.

I never ceased to be happy, but when I ceased to trust in Thee. O my God! give to these labours of a man, I do not say the duration, or the spirit of life, but the freshness of the least of thy Works! Let their divine graces be transfused into my writings, and bring back a corrupted Age to Thee, as by them I myself have been brought back! Opposed to Thee, all power is weakness; supported by Thee, weakness becomes irresistible strength. When the rude northern blasts have ravaged the Earth, thou callest for the feeblest of winds; at the sound of thy voice, the zephyr breathes, the verdure revives, the gentle primrose, and the humble violet cover the bosom of the bleak rock with a mantle of gold and purple.

STUDY

STUDY SECOND.

BENEFICENCE OF NATURE.

MOST men, in policed Nations, look on Nature with indifference. They are in the midst of her Works, and they admire only human grandeur. What charm, after all, can render the History of Men so interesting? It has to boast of vain objects of glory alone, of uncertain opinions, of bloody victories, or, at most, of useless labours. If Nature, sometimes, finds a place in it, we are called upon to observe only the ravages which she has committed, and to hear her charged with a thousand calamities, which may be all traced up to our own imprudence.

With what unremitting attention, on the contrary, is this common Mother providing for us the means of happiness! She has diffused her benefits over the Globe, from Pole to Pole, entirely in the view of engaging us to unite in a mutual communication of them. She is incessantly recalling
us,

us, from the prejudices, which unhappily separate Mankind, to the universal laws of Justice and Humanity, by frequently putting our ills in the hands of the so highly vaunted conquerors, and our pleasures in those of the oppressed, whom we hardly deign to favour with so much as our pity.

When the Princes of Europe issued forth, with the Gospels in their hand, to ravage Asia, they brought back with them the pestilence, the leprosy, and the small-pox; but Nature pointed out to a Dervise the coffee plant, in the mountains of Yemen, and produced, at one and the same time, our plagues from our Croisades, and our delicious beverage from the cup of a Mahometan monk. The successors of these Princes subjugated the American Continent, and have transmitted to us, by means of this discovery and conquest, an inexhaustible succession of wars and venereal diseases. While they were exterminating the inoffensive inhabitants of it by their murderous artillery, a Caraiib, in token of peace, set the sailors a smoking his calumet; the perfume of tobacco dissipated their chagrin, and the use of it is disseminated over the whole Earth; and while the miseries of two Worlds are issuing from the cannon's mouth, which Kings call their *ULTIMA RATIO*, the consolations of the civilized States of Europe, stream from the pipe of a Savage.

To

To whom are we indebted for the use of sugar, of chocolate, of so many agreeable means of subsistence, and so many salutary medicines? To naked Indians, to poor Peasants, to wretched Negroes. The spade of slaves has done more good, than the sword of conquerors has done mischief. But in which of our great squares are we to look for the statues of our obscure benefactors? Our Histories have not vouchsafed so much as to preserve their names. We need not, however, to go so far, in quest of proofs of the obligations under which we lie to Nature; Is it not to the study of her laws, that Paris is indebted for such multiplied illumination, collected from every quarter of the Globe, combined a thousand different ways, and reflected over Europe in Sciences the most ingenious, and enjoyments the most refined, of every species?

Where is now the time, when our forefathers leaped for joy at finding a wild plumb-tree, on the banks of the Loire; or at catching a poor roe in the chace in the vast plains of Normandy? Our fields, now so richly clothed with harvests, and orchards, and flocks, did not then produce the common necessaries of life. They wandered up and down, living on the precarious supplies of hunting, and not daring to trust to Nature. Her simplest phenomena filled them with terror. They trembled at the sight of an eclipse, of an *ignis-fatuus*,

fatuus, of a branch of mistletoe on the oak. Not that they believed the affairs of the World to be surrendered to Chance. They recognized every where Gods possessed of intelligence; but not daring to believe them good, while cruel priests were their only instructors in religion, these unfortunate people imagined, that the Gods took pleasure only in tears, and immolated to them human victims, on the very spot, perhaps, on which now stands a receptacle for the wretched*.

Let

* Some Writers, of our own, have composed the elogium of the Druids. I shall oppose to them, among other authorities, that of the Romans, who, it is well known, were abundantly tolerant in matters of religion. Cesar, in his Commentaries, informs us, that the Druids, in honour of their Gods, burnt men in baskets of osier; and that when criminals were wanting for this horrible purpose, they sacrificed even the innocent. Suetonius, in his life of Claudius, gives this account of the matter: "The religion of the Druids, too cruel, it must be confessed, and which, from the time of Augustus had been simply forbidden, was by him entirely abolished." Herodotus had, long before, loaded them with the same reproach.

All that can be opposed to the testimony of three Roman Emperors, and to that of the Father of History, is the silly evidence of the romance of *Astræa*. Have we not faults enough justly chargeable on ourselves, without undertaking the difficult task of justifying those of our ancestors? They were not, indeed, it must be allowed, more culpable than other Nations, who all presented human sacrifices to the DIVINITY. Plutarch reproaches the Romans themselves, with having immolated, in the earlier times of the Republic, two Gauls and two Greeks, whom they buried alive.

Is

Let me suppose, that a Philosopher, such as *Newton*, were, then, to have treated them with the spectacle of some of our natural Sciences, and to have shewn them, with the microscope, forests in moss, mountains in grains of sand, thousands of animals in drops of water, and all the wonders of Nature, which, in a downward progress to nothing, multiplies the resources of her intelligence, while the human eye becomes incapable of perceiving the boundary : Let me go on to suppose, that afterwards, discovering to them, in the Heavens, a progression of greatness equally infinite, he had shewn them, in the planets, hardly perceptible to the naked eye, Worlds much greater than ours, Saturn, three hundred millions of leagues distant ; in the fixed stars, infinitely more remote, Suns which, probably, illuminate other Worlds ; in the whiteness of the Milky Way, stars, that is Suns, innumerable, scattered about in the Heavens, as grains of dust on the Earth, without Man's knowing whether all this may not

Is it possible, then, that the first sentiment of Man, in a state of nature, could have been that of terror ; and that he must have believed in the Devil before he believed in God ? O ! no. It is Man who, universally, has misled Man. One of the great benefits for which we are indebted to the Christian Religion, has been the destruction, in a considerable part of the World, of these inhuman doctrines and sacrifices.

be more than the threshold of Creation merely ; with what transports would they have viewed a spectacle which we, at this day, behold without emotion ?

But I would rather suppose, that, unprovided with the magic of Science, a man like *Fenelon* had presented himself to them, in all the majesty of Virtue, and thus addressed the Druids: “ You
“ frighten yourselves, my friends, with the ground-
“ less terrors which you instil into the people.
“ God is righteous. He conveys to the wicked
“ terrible apprehensions, which recoil on those
“ who communicate them. But He speaks to all
“ men in the blessings which He bestows. Your
“ religion would govern men by fear ; mine draws
“ them with cords of love, and imitates his Sun
“ in the firmament, whom He causes to shine on
“ the evil and on the good.” Let me, finally, suppose, that, after this, he had distributed among them the simple presents of Nature, till then unknown, sheaves of corn, slips of the vine, sheep clothed with the woolly fleece : Oh ! what would have been the gratitude of our grandfathers ! They would, perhaps, have fled with terror from the Inventor of the telescope, mistaking him for a Spirit ; but, undoubtedly, they would have fallen down, and worshipped the Author of *Telemachus*.
These

These, after all, are only the smallest part of the blessings for which their rich descendants stand indebted to Nature. I say nothing of that infinite number of arts, which are employed at home, to diffuse knowledge and delight ; nor of that terrible invention of artillery, which secures to them the enjoyment of these, while the noise of it disturbs their repose at Paris, only to announce victories ; nor of that new, and still more wonderful, art of electricity, which screens * their hotels from
the

* On the subject of the effects of Electricity, a thought abundantly impious has been expressed, in a Latin verse, the import of which is, that Man has *disarmed the DEITY*. Thunder is by no means a particular instrument of divine Justice. It is necessary to the purification of the air, in the heats of Summer. God has permitted to Man the occasional disposal of it, as He has given him the power of using Fire, of crossing the Ocean, and of converting every thing in Nature to his advantage. It is the ancient Mythology, which, representing Jupiter always wielding the thunder, has inspired us with so much terror. We find, in the Holy Scriptures, ideas of the DIVINITY much more consolatory, and a much sounder Philosophy. I may, perhaps, be mistaken, but I do not believe there is a single passage in the Bible, in which thunder is mentioned as an instrument of divine Justice. Sodom was destroyed by showers of fire and brimstone. The ten plagues, with which Egypt was smitten, were the corruption of the waters, swarms of reptiles, lice, flies, the pestilence, ulcers, hail, caterpillars, thick darkness, and the death of the first-born. Corah, Dathan, and Abiram, were consumed by fire issuing out of the Earth. When the Israelites murmured in the wilderness of Paran ; *the fire of the LORD burnt among them,*

the thunder; nor of the privilege which they have, in this venal age, of presiding, in all States, over the happiness of men, when they believe they have nothing more to fear from the powers of Earth and Heaven.

But the whole world is engaged only in the pursuit of pleasure. England, Spain, Italy, the Archipelago, Hungary, all Southern Europe, is adding, every year, wools to their wools, wines to their wines, silks to their silks. Asia sends them diamonds, spices, muslins, chintzes, and porcelain; America, the gold and silver of her mountains, the emeralds of her rivers, the dye-stuffs of her forests, the cochineal, the sugar-cane, and the cocoa-nut of her fervid plains, which their hands did not cultivate; Africa, her ivory, her gold, her

and consumed them that were in the uttermost parts of the camp, Numb. xi. 1. In the threatenings denounced against the people in Leviticus, no mention is made of thunder. On the contrary, it was amidst the noise of thunder that GOD promulgated his law to his chosen people, from Mount Sinai. Finally, in that sublime piece of poetry, wherein David summons all the works of JEHOVAH, to praise him, he calls, among the rest, upon the thunder; and it is not foreign to our purpose to remark, that he includes, in his summons, all the meteors which enter into the necessary harmony of the Universe. He qualifies them with the majestic title of the *Angels*, and *Hofts* of the MOST HIGH. See *Pfalm* cxlviii.

very

very children, which serve them as beasts of burden all over the Globe.

There is not a spot of the Earth, or of the Sea, but what furnishes them with some article of enjoyment. The gulfs of the Ocean provide them pearls, it's shallows, ambergris, and it's icy promontories, furs. At home, they have reduced the rivers and mountains to a state of vassalage, in order to reserve to themselves feudal rights to fisheries and chases. But there was no occasion to put themselves to so much expense. The sands of Africa, where they have no game-keeper, send them, in clouds, quails, and other birds of passage, which cross the Sea in Spring, to load their table in Autumn. The Northern Pole, where they have no cruiser, pours on their shores, every Summer, legions of mackerel, of fresh cod, and of turbots, fattened in the long nights of Winter.

Not only the fowls and the fishes change, for them, their climate, but the very trees themselves. Their orchards, formerly, were transplanted from Asia, and, now, their parks from America. Instead of the chestnut and walnut, which surrounded the farms of their vassals, in the rustic domains of their ancestors, the ebony, the forb-apple of Canada, the great chestnut of India, the magnolium,

the tulip-bearing laurel, encircle their country palaces with the umbrage of the New World, and, ere long, of its solitudes. They have summoned the jafmin from Arabia, the orange from China, the pine-apple from Brazil, and a multitude of sweet-scented plants, from every region of the torrid Zone. They have no longer occasion for furs: they can difpofe of latitudes. They can convey, in their hot-houfes, the heats of Syria to exotic plants, at the very feafon when their hinds are perifhing with the cold of the Alps, in their hovels.

No one of the productions of Nature can efcape their avidity. What they cannot have living, they contrive to have dead. The infects, birds, fhell-fifh, minerals, nay, the very foil, of the moft diftant lands, enrich their cabinets. Painting and engraving prefent them with the profpect, and procure them the enjoyment, of the Glaciers of Switzerland, during the burning heat of the Dog-days; and of the Spring of the Canaries, in the midft of Winter. The intrepid Navigator brings them, from regions into which the Arts dare not to penetrate, journals of voyages, ftill more interefting than the productions of the pencil; and redouble the filence, the tranquillity, the fecurity of their nights, fometimes by a recital of the
horrible

horrible tempests of Cape-Horn, sometimes by that of the dances of the happy Islanders of the South-Seas.

Not only every thing that actually exists, but Ages past, all contribute to their felicity. Not for the Temple of Venus only did Corinth invent those beautiful columns, rising like palm-trees; no, but to support the alcoves of their beds. There voluptuous Art veils the light of the day through taffetas of every colour; and imitating, by softened reflexes, either of moon-light, or of sun-rising, represents the objects of their loves like so many Dianas or Auroras. The art of Phidias has for them produced a contrast to female beauty, in the venerable busts of a Socrates and a Plato.

Obscure scholars, by efforts of labour, which nothing can remunerate, have, for them procured the knowledge of the sublime geniuses, who were ornaments of the World, in times nearer to the Creation; Orpheus, Zoroaster, Esop, Lokman, David, Solomon, Confucius, and a multitude of others, unknown even to Antiquity. It was not for the Greeks, it is for them, that Homer still sings of Heroes and of Gods, and that Virgil warbles the notes of the Latin flute, which ravished the ears of the Court of Augustus, and there rekindled the love of Country and of Nature. For them it

is that Horace, Pope, Addison, La Fontaine, Gessner, have smoothed the rough paths of Wisdom, and have rendered them more accessible, and more lovely, than the treacherous steeps of Folly.

A multitude of Poets and Historians of all Nations, a Sophocles, an Euripides, a Corneille, a Racine, a Shakespear, a Taffo, a Xenophon, a Tacitus, a Plutarch, a Suetonius, introduce them into the very closets of those terrible Potentates, who bruised, with a rod of iron, the head of the Nations, whose happiness was intrusted to their care, and call them to rejoice in their happy destiny, and to hope for a better still, under the reign of another Antoninus. Those vast geniuses, of all Ages, and of all Countries, celebrating, without concert, the undecaying lustre of Virtue, and the Providence of Heaven, in the punishment of Vice, add the authority of their sublime reason to the universal instinct of Mankind, and multiply a thousand and a thousand times, in their favour, the hopes of another life, of much longer duration, and of more exalted felicity.

Does it not seem reasonable, that a chorus of praise should ascend, day and night, from the dome of every hotel, to the AUTHOR of Nature? Never did ancient King of Asia accumulate so many means of enjoyment, in Suza, or Ecbatana,

as our common tradesmen do in Paris. These Monarchs, nevertheless, every day paid adoration to the Gods; they would engage in no enterprize till the Gods were consulted; they would not so much as sit down to table, until the libation of religious acknowledgment was poured out. Would to GOD that our Epicureans were chargeable with indifference only to the hand which is continually loading them with benefits! But it is from the very lap of plenteousness and pleasure, that the voice of murmuring against Providence now arises. From their Libraries, stored with so many sources of knowledge, issue forth the black clouds which have obscured the hopes and the virtues of Europe.

STUDY THIRD.

OBJECTIONS AGAINST PROVIDENCE.

“ **T**HERE is no God,” say these self-constituted sages. . “ From the work form your judgment of the workman*. Observe, first of all, this Globe of ours, so destitute of proportion and symmetry. Here it is deluged by vast seas; there it is parched with thirst, and presents only wildernesses of barren sand. A centrifugal force, occasioned by its diurnal rotation, has heaved out its Equator into enormous mountains, while it flattened the Poles: for the Globe was originally in a state of softness; whether it was a mud covered from the empire of the Waters, or, what is more probable, a scum detached from the Sun. The volcanos, which are scattered over the whole Earth, demonstrate, that the fire which formed it is still under our feet. Over

* See replies to this objection in Study IV.

“ this scoria, so wretchedly levelled, the rivers run
 “ as chance directs. Some of them inundate the
 “ plains; others are swallowed up, or precipi-
 “ pitate themselves in cataracts, and no one of
 “ them presents any thing like a regular current.
 “ The Islands, are merely fragments of the Conti-
 “ nent, violently separated from it by the Ocean;
 “ and what is the Continent itself, but a mass of
 “ hardened clay? Here the unbridled Deep de-
 “ vours it's shores; there, it deserts them, and
 “ exhibits new mountains, which had been formed
 “ in it's womb. Amidst this conflict of contend-
 “ ing elements, this baked lump grows harder and
 “ harder, colder and colder, every day. The ices
 “ of the Poles, and of the lofty mountains, ad-
 “ vance into the plains, and insensibly extend the
 “ uniformity of an eternal Winter over this mass
 “ of confusion, ravaged by the Winds, the Fire,
 “ and the Water.

“ In the vegetable World, the disorder increases
 “ upon us *. Plants are a fortuitous production,
 “ of humid and dry, of hot and cold, the mould
 “ of the Earth merely. The heat of the Sun makes
 “ them spring up, the cold of the Poles kills
 “ them. Their sap obeys the same mechanical
 “ laws with the liquid in the thermometer, and in

* The reply is in Study V.

“ capillary

“ capillary tubes. Dilated by heat, it ascends
 “ through the wood, and re-descends through the
 “ rind, following in it’s direction the vertical co-
 “ lumn of the air which impresses that direction.
 “ Hence it is that all vegetables rise perpendicu-
 “ cularly, and that the inclined plane of a moun-
 “ tain can contain no more than the horizontal
 “ plane of it’s base, as may be demonstrated by
 “ Geometry. Besides, the Earth is an ill-afforded
 “ garden, which presents, almost every where,
 “ useless weeds, or mortal poisons.

“ As to the animals, which we know better,
 “ because they are brought nearer to us, by similar
 “ affections, and similar wants, they present still
 “ greater absurdities *. They proceeded, at first,
 “ from the expansive force of the Earth, in the
 “ first Ages of the World, and were formed out of
 “ the fermented mire of the Ocean and of the
 “ Nile, as certain Historians assure us; among
 “ others Herodotus, who had his information
 “ from the Priests of Egypt. Most of them are
 “ out of all proportion. Some have enormous
 “ heads and bills, such as the toucan; others long
 “ necks and long legs, like the crane: these have
 “ no feet at all, those have them by hundreds;

* The reply to this is in Study VI.

“ others

“ others have theirs disfigured by superfluous ex-
“ crencences, such as the meaningless spurs of the
“ hog, which, appended at the distance of some
“ inches from his feet, can be of no service to him
“ in walking.

“ There are animals scarcely capable of motion,
“ and which come into the World in a paralytic
“ state, such as the sloth or sluggard, who cannot
“ make out fifty paces a day, and screams out la-
“ mentably as he goes.

“ Our cabinets of Natural History are filled
“ with monsters; bodies with two heads; heads
“ with three eyes, sheep with six feet, &c. which
“ demonstrate that Nature acts at random, and
“ proposes to herself no determinate end, unless it
“ be that of combining all possible forms: and,
“ after all, this plan would denote an intention
“ which it's monotony disavows. Our Painters
“ will always imagine many more beings than can
“ possibly be created. Add to all this, the rage and
“ fury which desolate every thing that breathes:
“ the hawk devours the harmless dove in the face
“ of Heaven.

“ But the discord which rages among animals
“ is nothing, compared to that which consumes
“ the

“ the human race *. First, several different species
 “ of men, scattered over the earth, demonstrate
 “ that they do not all proceed from the same ori-
 “ ginal. There are some black, others white, red,
 “ copper-coloured, lead-coloured. There are some
 “ who have wool instead of hair ; others who have
 “ no beard. There are dwarfs and giants. Such
 “ are, in part, the varieties of the human species,
 “ every where equally odious to Nature. No
 “ where does she nourish him with perfect good-
 “ will. He is the only sensible being laid under
 “ the necessity of cultivating the earth, in order to
 “ subsist : and, as if this unnatural mother were
 “ determined to persecute, with unrelenting seve-
 “ rity, the child whom she has brought forth, in-
 “ fects devour the seed as he sows it, hurricanes
 “ sweep away his harvests, ferocious animals prey
 “ on his cattle, volcanos and earthquakes destroy
 “ his cities ; and the pestilence which, from time
 “ to time, makes the circuit of the Globe, threat-
 “ ens, at length, his utter extermination.

“ He is indebted to his own hands for his intel-
 “ ligence, his morality is the creature of climate,
 “ his governments are founded in force, and his
 “ religion in fear. Cold gives him energy ; heat
 “ relaxes him. Warlike and free in the North,

* The reply is in Study VII.

“ he is a coward and a slave between the Tropics.
“ His only natural laws are his passions. And,
“ what other laws should he look for? If they
“ sometimes lead him astray, is not Nature, who
“ bestowed them upon him, an accomplice, at
“ least, in his criminality? But he is made sensible
“ of their impulse, only as a warning never to gra-
“ tify them.

“ The difficulty of finding subsistence, wars,
“ impost, prejudices, calumnies, implacable ene-
“ mies, perfidious friends, treacherous females,
“ four hundred sorts of bodily distemper, those of
“ the mind, both more cruel and more numerous,
“ render him the most wretched of creatures that
“ ever saw the light. It were much better that he
“ had never been born. He is every where the
“ victim of some tyrant. Other animals are fur-
“ nished with the means of fighting, or, at least,
“ of flying; but Man has been tossed on the Earth
“ by chance, without an asylum, without claws,
“ without fangs, without velocity, without instinct,
“ and almost without a skin; and as if it were not
“ enough for him to be persecuted by all nature,
“ he is in a state of perpetual war with his own
“ species. In vain would he try to defend himself
“ from it. Virtue steps in, and binds his hands,
“ that vice, in safety, may cut his throat. He
“ has no choice but to suffer, and to be silent.

“ What

“ What, after all, is this virtue, about which
 “ such parade is made? A combination of his im-
 “ becility; a result of his temperament. With
 “ what illusions is she fed? Absurd opinions,
 “ founded merely on the sophisms of designing
 “ men, who have acquired a supreme power by
 “ recommending humility, and immense riches
 “ by preaching up poverty. Every thing expires
 “ with us. From experience of the past, let us
 “ form a judgment of the future; we were no-
 “ thing before our birth; we shall be nothing after
 “ death. The hope of our virtues is a mere hu-
 “ man invention, and the instinct of our passions
 “ is of divine institution.

“ But there is no GOD *. If there were, He
 “ would be unjust. What being, of unlimited
 “ power and goodness, would have exposed, to so
 “ many ills, the existence of his creatures; and
 “ laid it down as a law, that the life of some could
 “ be supported only by the death of others? So
 “ much disorder is a proof that there is no GOD.
 “ It is fear that formed him. How must the
 “ World have been astonished at such a metaphy-
 “ sical idea, when Man first, under the influence
 “ of terror, thought proper to cry out, that there

* The reply is in Study VIII.

“ was a GOD ! What could have made him
“ GOD ? Why should he be GOD ? What plea-
“ sure could he take in that perpetual circle of
“ woes, of regenerations, and deaths *.”

* The refutation of these objections will be found by the numeral characters, which correspond to each particular Study. All of them are there resolved directly, or indirectly : for it was not possible to follow, in a Work of this kind, the scholastic order of a system of philosophy.

STUDY FOURTH.

REPLIES TO THE OBJECTIONS AGAINST PROVIDENCE.

SUCH are the principal objections which have been raised, in almost every Age, against a Providence, and which no one will accuse me of having stated too feebly. Before I attempt a refutation of them, I must be permitted to make a few reflections on the persons who maintain them.

Did these murmurings proceed from some wretched mariners, exposed at sea to all the revolutions of the Atmosphere, or from some oppressed peasant, labouring under the contempt of that society whom his labour is feeding, my astonishment would be less. But our Atheists are, for the most part, well sheltered from the injuries of the Elements, and especially from those of Fortune. The greatest part of them have never so much as travelled. As to the ills of Civil Society, they most unreasonably complain; for they enjoy it's sweetest and most respectful homage, after

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having

having burst afunder all it's bands, by the propagation of their opinions. What have they not written on Friendship, on Love, on Patriotism, and on all the Human Affections, which they have reduced to the level of those of the beasts, while some of them could render human affection almost divine by the sublimity of their talents !

Are not they, in part, the very persons to whom many of our calamities may be justly imputed, for their flattering, in a thousand different ways, the passions of our modern tyrants, whilst a cross, rising in the midst of a desert, comforts the miserable ? It is a matter of no small difficulty to retain these last in a rational devotion ; and it is a moral phenomenon which appeared to me, for a long time, inexplicable, to behold, in every Age, atheism springing up among men who had most reason to cry up the goodness of Nature, and superstition among those who have the justest ground of complaint against her. It is amidst the luxury of Greece and Rome, in the bosom of the wealth of Indostan, of the pomp of Persia, of the voluptuousness of China, of the overflowing abundance of European Capitals, that men first started up, who dared to deny the existence of a DEITY. On the contrary, the houseless Tartars ; the Savages of America, continually pressed with famine ; the Negros, without foresight, and without
a police ;

a police; the inhabitants of the rude climates of the North, such as the Laplanders, the Greenlanders, the Esquimaux, see Gods every where, even in a flint.

I long thought that atheism, in the rich and luxurious, was a dictate of conscience. "I am rich, and I am a knave," must be their reasoning, "therefore there is no GOD." "Besides, if there is a GOD, I have an account to render." But these reasonings, though natural, are not general. There are atheists, who possess legitimate fortunes, and use them morally well, at least externally. Besides, for the contrary reason, the poor man ought to argue thus; "I am industrious, honest, and miserable; therefore there must be no Providence." But in Nature herself we must look for the source of this unnatural ratiocination.

In all countries, the poor rise early, labour the ground, live in the open air, and in the fields. They are penetrated with that active power of Nature which fills the Universe. But their reason, sinking under the pressure of calamity, and distracted by their daily occasions, is unable to support it's lustre. It stops short, without generalizing, at the sensible effects of this invisible cause. They believe, from a sentiment natural to weak

minds, that the objects of their religious worship will be at their disposal, in proportion as they are within their reach. Hence it is that the devotions of the common people, in every country, are presented in the fields, and have natural objects for their centre. It always attracts the religion of the peasantry. A hermitage on the side of a mountain, a chapel at the source of a stream, a good image of the Virgin, in wood, niched in the trunk of an oak, or under the foliage of a hawthorn, have, to them, a much more powerful attraction than the gilded altars of our Cathedrals. I except those, however, whom the love of money has completely debauched, for such persons must have saints of silver, even in the country.

The principal religious acts of the people in Turkey, in Persia, in the Indies, and in China, are pilgrimages in the fields. The rich, on the contrary, prevented in all their wants and wishes by men, no longer look up to GOD for any thing. Their whole life is passed within doors, where they see only the productions of human industry, lustres, wax-candles, mirrors, secretaries, parasites, books, wits. They come insensibly to lose sight of Nature; whose productions are, besides, almost always exhibited to them disfigured, or out of season, and always as an effect of the art of their gardeners, or artificers.

They

They fail not, likewise, to interpret her sublime operations, by the mechanism of the arts most familiar to them. Hence so many systems, which easily enable you to guess at the occupation of their authors. Epicurus, exhausted by voluptuousness, framed his world and his atoms, with which Providence has nothing to do, out of his own apathy; the Geometrician forms it with his compasses; the Chymist compounds it of salts; the Mineralogist extracts it from the fire; and they who apply themselves to nothing, and these are not few in number, suppose it, like themselves, in a state of chaos, and moving at random.

Thus, the corruption of the heart is the original source of our errors. Afterwards, the Sciences employing, in the investigation of natural things, definitions, principles, methods, invested with a great geometrical apparatus, seem, by this pretended order, to reduce to order what widely deviates from it. But supposing this order to exist, such as they present it to us, of what use could it be to Man? Would it be sufficient to restrain, and to console, the miserable; and what interest will they take in that of a society which tramples them under foot, when they have nothing to hope from that of Nature, who abandons them to the laws of motion?

I now proceed to answer, one after another, the objections, formerly stated, against Providence, founded on the disorders of the Globe; of vegetables, of animals, of Man, and on the nature of GOD himself.

Replies to the Objections against Providence, founded on the Disorders of the Globe.

Though my ignorance of the means employed by Nature, in the government of the World, is greater than I am able to express; it is sufficient, however, to throw one's eyes on a geographical chart, and to have read a little, to be enabled to demonstrate that those, by which her operations are pretendedly explained to us, have no foundation in truth. From human insufficiency spring the objections levelled at the divine Providence.

First, it appears, to me, no more natural to compose the uniform motion of the Earth through the Heavens, of the two motions of projection and attraction, than to attribute to similar causes, that of a man walking on the Earth. The centrifugal and centripetal forces seem, to me, no more to exist in the Heavens, than the two circles denominated the Equator and the Zodiac. However ingenious

genious these hypotheses may be, they are only scaffoldings imagined by men of genius, for rearing the fabric of Science, but which no more assist us in penetrating into the sanctuary of Nature, than those employed in the construction of our churches, can introduce us into the sanctuary of Religion. These combined forces are no more the moving principle of the course of the stars, than the circles of the sphere are their barriers. They are signs merely, which have, at last, usurped the place of the objects which they were intended only to represent, like every thing else of human establishment.

If a centrifugal force had swelled the mountains of the Globe, when it was in a state of fusion, there must have been mountains much more elevated than the Andes of Peru and Chili. That of Chimboraco, which is the highest of them, is only 3220, or 3350 fathoms in height, for the Sciences are not perfectly agreed, even in matters of observation. This elevation, which is nearly the greatest known on Earth, is less perceptible on it than the third part of a line would be on a globe of six feet diameter. Now, a mass of melted metal presents, in proportion to its size, scorias much more considerable. Look at the anfractuosities of a simple morsel of iron-drops. What frightful swellings, then, must have been formed on a globe, of heterogeneous

rogeneous and fermenting materials, more than three thousand leagues thick? The Moon, whose diameter is much less considerable, contains, according to *Cassini*, mountains three leagues high. But what would be the case if, with the action of the heterogeneousness of our terrestrial materials, all in fusion, we should besides suppose that of a centrifugal force, produced by the Earth's rotatory motion round it's axis? I imagine that this force must have been necessarily exerted in the direction of its Equator, and instead of forming it into a globe, must have flattened it out in the Heavens, like those large plates of glass which glass-blowers expand with their breath.

Not only the diameter of the Earth, at the Equator, is no greater than under it's Meridians, but the mountains there are not more elevated than elsewhere. The noted Andes of Peru have not their commencement at the Equator, but several degrees beyond it, toward the South; and coasting along Peru, Chili, and Magellan's land, stop at the fifty-fifth degree of Southern Latitude, in the Terra del Fuego, where they present to the Ocean a promontory of eternal ice, of a prodigious height. Through the whole extent of this immense track, they never open but at the Straits of Magellan, forming throughout, according to the testimony

testimony of *Garcillafo de la Véga* *, a rampart fortified with pyramids of ice, inaccessible to men, to quadrupeds, and even to birds.

The mountains of the isthmus of Panama, on the contrary, which are nearly under the Line, have an elevation so small, in comparison with the Andes, that Admiral *Anson*, who had coasted along the whole, relates, that on his arriving at these heights, he experienced stifling heats, because the air, says he, was not refreshed by the Atmosphere of the lofty mountains of Chili and Peru.

The highest mountains of Asia are entirely out of the Tropics. The chain, known by the names of Taurus and Imäus, commences, in Africa, at Mount Atlas, toward the thirtieth degree of northern latitude. It runs across all Africa and all Asia, between the thirty-eighth and fortieth degree of north latitude, having its summit covered, for the most part, through that immense extent, with snows that never melt; a proof, as shall afterwards be demonstrated, of a very considerable elevation.

Mount Ararat, which makes part of this chain, is, perhaps, more elevated than any mountain of

* History of the Incas. Book I. chap. 8.

the New World, if we form a judgment from the time which *Tournefort*, and other travellers, took to perform the distance from the basis of that mountain, up to the commencement of the snow which covers it's summit, and, which is less arbitrary, from the distance at which it may be seen, and that is, at least, six days journey of a caravan.

The Peak of Teneriff is visible forty leagues off. The mountains of Norway called Felices, and, by some, the Alps of the North, are visible at sea fifty leagues distant; and, if we may believe an ingenious Swedish Geographer, are three thousand fathoms high.

The peaks of Spitzberghen, of New-Zealand, of the Alps, of the Pyrennées, of Switzerland, and those on which ice is found, all the year round, are exceedingly elevated; though most of them very remote from the Equator. They do not even run in directions parallel to that circle, as must have been the case, on the supposition of the effect produced by the rotation of the Globe; for if the chain of Taurus, in the ancient Continent, runs from West to East, that of the Andes, in the new, runs from North to South. Other chains proceed in other directions.

But

But if the pretended centrifugal force had, once, the power of heaving up mountains, why does it not possess, at this day, the power of tossing up a straw into the air? It ought not to leave a single detached body on the surface of the Earth. They are affixed to it, I shall be told, by the centripetal force, or gravity. But if this last power, in fact, forces every body toward it, why have not the mountains too submitted to this universal law, when they were in a state of fusion? I cannot conceive what reply can be made to this twofold objection.

The Sea appears, to me, not more adapted to the formation of mountains, than the centrifugal force is. How is it possible to imagine the possibility of it's having thrown them out of it's womb? It is incontrovertible, however, that marbles, and calcareous stones, which are only pastes of madrépores and of shells amalgamated; that flints, which are concretions of these; that marles, which are a dissolution of them; and that all marine bodies, which are found in every part of both Continents, have issued out of the Sea. These matters serve as a basis to great part of Europe; hills of a very considerable height are composed of them, and they are found in many parts of both the Old and New Worlds, at an equal degree of elevation. But their strata cannot be explained by any of the
actual

actual movements of the Ocean. In vain would we ascribe to it revolutions from West to East; never will it have the power of raising any thing above it's level. If certain ports of the Mediterranean are produced as instances, which the Sea has actually left dry, it is no less certain, that there is a much greater number, on the same coasts, which the water has not deserted. Hear what is said on the subject by that judicious Observer *Maunderel*, in his journey from Aleppo to Jerusalem, in 1669: "In the Adriatic Gulf, the light-house of Arminium, or Rimini, is a league from the sea; but Ancona, built by the Syracusans, is still close to the shore. The arch of Trajan, which rendered it's port more commodious for merchants, is situated immediately upon it. Beritta, the favourite spot of Augustus, who gave it the name of *Julia Felix*, preserves no remains of it's ancient beauty, except it's situation on the brink of the Sea, above which it is elevated no higher than is necessary to secure it against the inundations of that element."

The testimony of travellers the most accurate, is conformable to that of this ingenious English gentleman. His compatriot, *Richard Pocock*, who travelled into Egypt in 1737, with less taste, but with still greater accuracy, attests, that the Mediterranean has gained fully as much ground as it has

has lost *, “ Nothing more is necessary,” says he, “ to produce a conviction of this, than to examine the coast; for you will see, under water, not only a variety of artificial productions, manufactured in the rock, but, likewise, the ruins of many edifices. About two miles from Alexandria are to be seen, under water, the ruins of an ancient temple.”

An anonymous English traveller, in the journal of a voyage stored with excellent observations, describes several very ancient cities of the Archipelago, such as Samos, the ruins of which are close to the Sea. Hear what he says of Delos, which is, as every one knows, in the centre of the Cyclades †. “ We found nothing else, all along the coast, but the remains of superb edifices, which had never been completed, and the ruins of others which have been destroyed. The Sea appears to have gained on the Isle of Delos; and the water being clear, and the weather calm, we had an opportunity of observing the remains of beautiful buildings, in places where now the fishes swim at their ease, and on which the small boats of these cantons row, to get at the coast.”

* Travels into Egypt. Vol. I. page 4 and 30.

† Voyage into France, Italy, and the Islands of the Archipelago, in 1763. Vol. iv. Letter cxxvii. page 256.

The ports of Marfeilles, Carthage, Malta, Rhodes, Cadiz, &c. are ftill frequented by Navigators, as they were in the remoteft Antiquity. The Mediterranean could not have funk at any one point of its fhores, without finking at every other, for water in the bafon always comes to it's level. This reafoning may be extended to all the coafts of the Ocean. If there are found any where tracks of land abandoned, it is not becaufe the Sea retires, but becaufe the Earth is gaining ground. This is the effect of allufions, occafioned frequently by the overflowing of rivers, and fometimes by the ill-advifed labours of Man. The encroachments of the Sea on the Land are equally local; and are the effect of earthquakes, which can be extended to no great diftance. As thefe reciprocal invafions of the two Elements are particular, and frequently in oppofition on the fame coafts, which have, in other refpects, constantly preferved their ancient level, it is impoffible to deduce from them any general law for the movements of the Ocean.

We fhall prefently examine, how fo many marine foffils could have been extracted from it's bed; and I confidently believe that, conformably to refpectable traditions, we fhall be able to advance fomething on this fubject, not unworthy of the Reader's attention. To return, then, to other mountains, fuch as thofe of granite, which are the
highest

highest on the Globe, and the formation of which has not been imputed to the Sea, because they contain no deposit to attest such transition, the same Naturalists employ another system to account for their origin. They suppose a primitive Earth, whose height equalled that of the present elevation of the highest peaks of the Andes, of Mount Taurus, of the Alps, &c. which remains so many evidences of the existence of that primeval soil: after this, they employ snows, rains, winds, and I know not what besides, to lower this original Continent down to the brink of the Sea; so that we inhabit only the bottom of this enormous quagmire. This idea has an imposing air; first, because it terrifies; and then, because it is conformable to that picture of apparent ruin which the Globe presents: but it vanishes away before this simple question, What has become of the earth and the rocks of this tremendous ridance?

If it is said, they have been thrown into the Sea. We must suppose, prior to all degradation, the existence of the bed of the Sea, and its excavation would then present a great many other difficulties. But let us admit it. How comes it that these ruins have not, in part, accumulated? Why has not the Sea overflowed? How can it have happened, on the contrary, that it should have deserted such immense tracks of land, as are sufficient to form the
 VOL. I. M greatest

greatest part of two vast Continents? Our systems, therefore, cannot account for the steep elevation of mountains of granite, by any kind of degradation, because they know not how to dispose of the fragments; nor for the formation of calcareous mountains, by the movements of the Ocean, because, in it's actual state, it is incapable of covering them.

Besides, it is not an opinion of yesterday, that Philosophers have considered the Earth as a decaying edifice. Hear what Baron *Busbequius* says of the opinion of *Polybius*, in his curious and entertaining letters: “*Polybius* pretends to have
 “ proved, that the entrance of the Black Sea
 “ would, in process of time, be choked by the
 “ banks of sand, and by the mud, which the Da-
 “ nube and the Boristhenes were constantly forcing
 “ into it: and that, consequently, the Black Sea
 “ would be rendered inaccessible, and it's com-
 “ merce entirely destroyed. The sea of Pontus,
 “ nevertheless, is just as navigable at this hour as
 “ in the days of *Polybius* *.”

Bays, gulfs, and mediterranean seas, are no more the effects of irruptions of the Ocean into the Land, than mountains are productions of the cen-

* Letter I. page 131.

trifugal motion. These pretended disorders are necessary to the harmony of all the parts of the Earth. Let us suppose, for example, that the Straits of Gibraltar were closed, as it has been said was formerly the case, and that the Mediterranean existed no longer. What would become of so many rivers of Europe, Asia, and Africa, which are kept flowing by the vapours which ascend out of that Sea, and bring back their waters to it, in a wonderful exactness of proportion, as the calculations of many ingenious men have demonstrated? The North winds, which constantly refresh Egypt in Summer, and which convey the emanations of the Mediterranean as far as the mountains of Ethiopia, to supply the sources of the Nile, blowing, in this case, over a space destitute of water, would carry drought and barrenness over all the northern regions of Africa, and even into the interior of that Continent.

The southern parts of Europe would fare still worse; for the hot and parching winds of Africa, which load themselves with so many rainy clouds, as they cross the Mediterranean, now blowing over the dry bed of that Sea, without tempering the heat by humidity of any kind, would blast, with scorching sterility, all that vast region of Europe, which extends from the Straits of Gibraltar to the Euxine Sea, and utterly dry up all the countries

through which, at present, flow a multitude of rivers, such as the Rhone, the Po, the Danube, &c.

Besides, it is not sufficient to suppose, that the Ocean forced a passage into the bed of the Mediterranean, as a river spreads over a champaign country, after having overflowed it's banks; it must farther be supposed, that the track of land innundated was lower than the Ocean, a phenomenon not to be met with in any other part of the *terra-firma*, all of which is above the level of the Sea, those parts excepted which have been wrested from the Deep by means of human industry, as is the case in Holland.

It must still farther be supposed, that a lateral sinking of the Earth must have taken place all round the basin of the Mediterranean, to regulate the circuits, declivities, canals, and windings of so many rivers, which come from such a distance to empty themselves into it, and that this sinking must have been effected with admirable proportions: for these rivers, issuing, in many cases, from one and the same mountain, arrive, by the same declivities, to distances widely different, without their channel's ceasing to be full, or their water's flowing too fast or too slow, notwithstanding the difference of their courses and levels.

It

It is not, then, to an irruption of the Ocean that we are to ascribe the Mediterranean, but to an excavation of the Globe, more than twelve hundred leagues long, and above eight hundred broad, which has been executed with dispositions so happy, and so favourable to the circulation of so many lateral rivers, that if time permitted me to trace the course of any single one, it would be evident how destitute of all foundation the supposition is which I am combating. Earthquakes, indeed, produce excavations, but of small extent; and which, far from forming channels for rivers, sometimes absorb the course of rivulets, and change them into pools, or marshes. These hypotheses may be applied to all gulfs, bays, great lakes, and mediterranean seas; and we shall be convinced, that if these interior waters did not exist, not a fountain would remain in the greatest part of the habitable Globe.

If we would form a just idea of the order of Nature, we must give up our circumscribed ideas of human order. We must renounce the plans of our Architecture, which frequently employs straight lines, that the weakness of our sight may be enabled to take in the whole extent of our domain at a single glance; which symmetrizes all our distributions, and which, in constructing our houses, places wings to the right, and wings to the left,

that all the parts of our habitation may be comprehended in a single view, while we occupy the centre; and which levels, fits to the plummet, smooths, and polishes the stones employed in building, that the monuments we raise may be soft to the eye and to the touch. The harmonies of Nature are not those of a Sybarite; but they are those of Mankind, and of all beings. When Nature raises a rock, she introduces clefts, inequalities, points, perforations. She hollows and roughens it with the chisel of Time, and of the Elements; she plants herbs and trees upon it; she stores it with animals, and places it in the bosom of the Sea, in the very focus of storms and tempests, that it may there afford an asylum to the inhabitants of the Air and of the Waters.

When Nature, in like manner intended to scoop out basins to receive the Seas, she neither rounded the borders, nor applied the line to them; but contrived and produced deep bays, sheltered from the general currents of the Ocean, that, during stormy weather, the rivers might discharge themselves into it in security; that the finny legions might resort thither, for refuge, at all seasons, there lick up the alluvion of the earth, carried down by the fresh water; come thither to spawn, mounting upward and upward, many of them, toward the very source, where they can find both
food

food and shelter for their young. And for the preservation of these adaptations it is, that Nature has fortified every shore with long banks of sand, shelves, enormous rocks, and islands, which are arranged round them, at proper distances, to protect them from the fury of the Ocean.

She has employed similar dispositions in forming the beds of rivers, as we shall shew in the sequel of this Study, though we have room only to glance at a subject so new, and so fertile in observation. Accordingly, she has made the current of rivers to flow, not in a straight line, as they must have run, had the laws of Hydraulics been observed, because of the tendency of their motions toward a single point ; but she makes them wind about for a long time through the bosom of the Land, before they pour themselves into the Sea.

In order to regulate the course of these rivers, and to accelerate or retard it, conformably to the level of the countries through which they flow, she pours into them lateral rivers, which accelerate it in a flat country, when they form an acute angle with the source of the main river ; or which retard it in a mountainous country, by forming a right, and sometimes an obtuse, angle, with the source of the principal stream. These laws are so infallible, that a judgment may be formed, simply from

the map, whether the rivers which water any country are flow or rapid, and whether that country is flat or elevated, by the angle which the confluent rivers form with their courses.

Thus, most of those which throw themselves into the Rhone, form right angles with that rapid river, to check its impetuosity. Some of these confluent rivers are real dikes, which cross the main river from side to side, in such a manner, that the river crossed, which was running very rapidly above the confluence, flows very gently below it. This observation applies to many of the rivers of America, and remarkably to the Méchaffipi. From these simple perceptions, which I have, at present, only time to indicate, it may be concluded, that it is easy to retard, or accelerate the course of a river, by simply changing the angle of incidence of its confluent rivers. I produce this not as a matter of advice, but as a very curious speculation; for it is always dangerous for Man to derange the plans of Nature.

The rivers, on throwing themselves into the Sea, produce, in their turn, by the direction of their mouths, acceleration, or retardation, in the course of the tides. But I must not launch farther out into the study of these grand and sublime harmonies, I satisfy myself with having said enough

to

to convince the candid Reader, that the bed of the Seas was scooped out, expressly for receiving them.

Nevertheless, I must produce one argument more, calculated to remove every possibility of doubt on the subject. Had the bed of the Seas been formed, as is supposed, by a sinking down of the solid parts of the Globe, the shores of the Sea, under water, would have the same declivities with the adjoining Continent. Now, this is not found to be the case on any coast whatever. The declivity of the basin of the Sea is much steeper than that of the bounding lands, and by no means a prolongation of it. Paris, for example, is raised above the level of the Sea, about 26 fathoms, reckoning from the base of the bridge of *Notre-Dame*. The Seine, accordingly, from this point, to where it empties itself into the Sea, has a declivity of little more than 130 feet, in a distance of forty leagues; whereas, measuring from the mouth of the river, out into the sea, only a league and a half, you find, at once, an inclination of from 60 to 80 fathom, for this is the depth at which vessels anchor, in the road of Havre-de-Grace.

These differences of level at Land, from the level of the bed of the Sea, in the same line of direction, are to be met with on all coasts, more or less.

less. Dampier, an English Navigator, has, indeed, observed, that Seas which wash steep coasts are much deeper; and that along flat shores their depth is small; but this striking difference is universally observable, that along flat coasts, the bed of the Sea is much more inclined than the soil of the adjoining Continent, and that along high lands, sometimes, no bottom is to be found.

This clearly demonstrates, therefore, that the beds of the Seas were hollowed out expressly to contain them. The declivity of their excavations has been regulated by laws infinitely wise; for if it were the same with that of the adjacent Lands, the billows of the Sea, whenever the wind blew toward the shore, however lightly, would considerably encroach on the Land. This actually happens in the case of storms and extraordinary tides, the waves overflow their usual bounds; for then, meeting a declivity flat and gentle, compared to that of their bed, they sometimes inundate the Land to the distance of several leagues. This happens, from time to time, in the island of Formosa, the natural ramparts of which, such as the manglier, the inhabitants, it is probable, formerly destroyed. Holland, for nearly a similar reason, is exposed to inundations, because it has encroached on the very bed of the Sea.

It is principally on the shores of the Ocean that the invisible boundary is fixed, which the AUTHOR of Nature has prescribed to its waves. It is there you perceive, that you are at the intersection of two different planes, the one of which terminates the declivity of the Land, and the other commences that of the Sea.

It cannot be alleged, that it was by currents of the Sea the bed was hollowed out; for where could the earth that filled it before be deposited? They could raise nothing above their own level. It cannot even be alleged, that the channels of rivers have been excavated by the current of their own streams, for there are several which have found a subterraneous passage through masses of solid rock, so hard and so thick, as to bid defiance to the pick-axes and the mattocks of our labourers. Besides, on the supposition which we are examining, these rivers must have formed, at the place of their falling into the Ocean, banks of sand, and accumulations of earthy substances, of a magnitude proportional to the quantity of ground which they must have cleared away, in forming their channels. Most of them, on the contrary, as has been already observed, empty themselves at the bottom of bays, hollowed for the express purpose of receiving them.

How

How is it that they have not completely filled up these bays, as they are incessantly hurling down into them substances separated from the land? Why is not the very bed of the Ocean choked up, from the constant accumulation of the spoils of vegetables, sands, rocks, and the wreck of earth, which, on every shower that falls, tinge with yellow the rivers which fall into it? The waters of the Ocean have not risen a single inch since Man began to make observations, as might easily be demonstrated from the state of the most ancient sea-ports of the Globe, which are still, for the most part, at the same level.

Time permits me not to speak of the means employed by Nature for the construction, the support, and the purification, of this immense basin: they would suggest fresh subject of admiration. Enough has been said to prove, that what in Nature may appear to us the effect of ruin, or chance, is, in many cases, the result of intelligence the most profound. Not only, no hair falls from our head, and no sparrow from Heaven to the ground, but not a pebble rolls on the shore of the Ocean, without the permission of GOD: according to that sublime expression of Job: *Tempus posuit tenebris, & univerforum finem Ipse considerat, lapidem quoque caliginis, & umbram mortis* *. “ He setteth an end

* Job xxviii. 3.

“ to darkness, and searcheth out all perfection ;
“ the stones of darkness, and the shadow of death :”
He likewise knows the moment when that stone,
buried in darkness, must spring into light, to serve
as a monument to the Nations.

Independent of geographical proofs, without
number, which demonstrate, that the Ocean, by
it's irruptions, has not hollowed out one single bay
on the face of the Globe, nor detached any one
part of the Continent from the rest, there are still
many more which may be deduced from the vege-
table and animal kingdoms, and from Man.

This is not the proper place for dwelling on
the subject : but I shall quote, on my way, an
observation from the vegetable World, which
proves, for example, that Britain never was united
to the European Continent, as has been supposed,
but must have been, from the beginning, separated
by the Channel. It is a remark of Cæsar's, in his
Commentaries, that during his stay in that Island,
he had never seen either the beech tree or the
fir ; though these trees were very common in
Gaul, along the banks of the Seine, and of the
Rhine. If, therefore, these rivers had ever flowed
through any part of Britain, they must have car-
ried with them, the seeds of the vegetables, which
grew at their sources, or upon their banks. The
beech and the fir, which, at this day, thrive ex-
ceedingly

ceedingly well in Britain, must, of necessity, have been found growing there in the time of Julius Cæsar, especially as they would not have changed their Latitude, and being, as we shall see, in the proper place, of the genus of fluviatic trees, the seeds of which reſow themselves, through the assistance of the waters. Besides, from whence could the Seine, the Rhine, the Thames, and so many other rivers, whose currents are supplied from the emanations of the Channel, from whence, I say, could they have been fed with water? The Thames, then, must have flowed through France, or the Seine through England; or, to speak more conformably to truth and nature, the countries now watered by these rivers, would have been completely dry.

By our geographical charts, as by most other instruments of Science, we are misled. Observing in these so many retreadings and projections along the coasts of the Continent, we have been induced to imagine, that these irregularities must have been occasioned by violent Currents of the Sea. It has just been demonstrated, that this effect *was* not thus produced; I now proceed to shew, that it *could not possibly* have been the case.

The English *Dampier*, who is not the first Navigator that sailed round the Globe, but who is,
in

in my opinion, the best of the travellers who have made observations on it, says, in his excellent treatise on winds, and tides: * “ Bays scarcely have
“ any currents, or if there be such a thing, they
“ are only counter-currents running from one
“ point to another.” He quotes many observations, in proof of this, and many others, of a similar nature, are found scattered over the journals of other Navigators. Though he has treated only of the Currents between the Tropics, and even that with some degree of obscurity, we shall proceed to generalize this principle, and to apply it to the principal bays of Continents.

I reduce to two general Currents, those of the Ocean. Both of these proceed from the Poles, and are produced, in my opinion, by the alternate fusion of their ices. Though this be not the place to examine the cause of it, to me it appears so natural, so new, and of such curious investigation, that the Reader, I flatter myself, will not be angry with me, if I give him an idea of it, on my way.

The Poles appear to me the sources of the Sea, as the icy mountains are the sources of the principal rivers. It is, if I am not mistaken, the snow and the ice which cover our Pole, that annually

* Vol. ii. page 385.

renovate the waters of the Sea, comprehended between our Continent and that of America, the projecting and retreating parts of which have, besides, a mutual correspondence, like the banks of a river.

It may be remarked, at first sight, on a map of the World, that the bed of the Atlantic Ocean, becomes narrower and narrower toward the North, and widens toward the South; and that the prominent part of Africa corresponds to that great retreating part of America, at the bottom of which is situated the Gulf of Mexico; as the prominent part of South America corresponds to the vast Gulf of Guinea; so that this basin has, in its configuration, the proportions, the sinuosities, the source, and the mouth, of a vast fluvial channel.

Let us now observe, that the ices and snows form, in the month of January, on our Hemisphere, a cupola, the arch of which extends more than two thousand leagues over the two Continents, with a thickness of some lines in Spain, of some inches in France, of several feet in Germany, of several fathoms in Russia, and of some hundreds of feet beyond the sixtieth degree of Latitude, such as the ices which *Henry Ellis* *, and other Naviga-

* *Ellis's Voyage to Hudson's-Bay.*

tors of the North encountered there at Sea, even in the midst of Summer, and of which some, if *Ellis* is to be believed, were from fifteen to eighteen hundred feet above it's level; for their elevation must probably go on increasing, up to the very Pole, in conformity to the proportions observable in those which cover the summits of our icy mountains; which must give them, under the very Pole, a height which there is no possibility of determining.

From this simple outline, it is clearly perceptible what an enormous aggregation of water is fixed, by the cold of Winter, in our Hemisphere, above the level of the Ocean. It is so very considerable, that I think myself warranted to ascribe to the periodical fusion of this ice, the general movement of our Ocean, and that of the tides. We may apply, in like manner, the effects of the fusion of the ices of the South Pole, which are there still more enormous, to the movements of it's Ocean.

No conclusion has, hitherto, been drawn, relatively to the movements of the Sea, from the two masses of ice so considerable, alternately accumulated and dissolved at the two Poles of the World. They necessarily must, however, occasion a very perceptible augmentation of it's waters, on their

return to it, by the action of the Sun, which partly melts them once every year ; and a great diminution, on being withdrawn, by the effect of the evaporations, which reduce them to ice at the Poles, when the Sun retires.

I proceed to lay before the Reader, some observations and reflections on this subject, which I have the confidence to call highly interesting ; and shall submit the decision to those who have not got into the trammels of system and party. I shall endeavour to abridge them to the utmost of my power, and flatter myself with the hope of forgiveness, at least, in consideration of their novelty. I am going to deduce, merely from the alternate dissolution of the polar ices, the general movements of the Seas, which have hitherto been ascribed to gravitation, or to the attraction of the Sun, and of the Moon, on the Equator.

It is impossible to deny, in the first place, that the Currents and the Tides do not come from the Pole, in the vicinity of the polar Circle.

Frederic Martens, who, in his voyage to Spitzbergen, in 1671, advanced as far as to the eighty-first degree of northern Latitude, positively asserts, that the Currents, amidst the ices, set in toward the South. He adds, farther, that he can affirm
nothing

nothing with certainty respecting the flux and reflux of the Tides. Let this be carefully remarked.

Henry Ellis observed with astonishment, in his voyage to Hudson's-Bay, in 1746, and 1747, that the Tides there came from the North, and that they were accelerated, instead of being retarded, in proportion as the Latitude increased. He assures us that these effects, so contrary to their effects on our coasts, where they come from the South, demonstrate that the Tides, in those high Latitudes, do not come from the Line, nor from the Atlantic Ocean. He ascribes them to a pretended communication between Hudson's-Bay and the South-Sea: a communication which, with much ardor, he sought for, and which was, indeed, the object of his voyage; but now we have complete assurance that it does not exist, from the fruitless attempts lately made by *Captain Cook* to find it by the South-Sea, to the north of California, in conformity to the advice, long before given respecting it, by the illustrious Navigator *Dampier*, whose sagacity and observations have, by the by, greatly assisted *Captain Cook* in all his discoveries.

Ellis farther observed, that the course of these northern Tides of America, was so violent, at *Wager's Strait*, which is about $65^{\circ} 37'$ North Latitude, that it run at the rate of from eight to ten

leagues an hour. He compares it to the sluice of a mill. He remarked that the surface of the water was there very smooth, which puzzled him exceedingly, by damping his hope of a communication between this Bay and the South-Sea. He remained, nevertheless, convinced of the existence of such a passage; such is the pertinacity of Man in favour of pre-conceived opinions, in the very face of evidence.

John Huguez de Linfchotten, a Dutchman, had made nearly the same remarks on the currents of the northern Tides of Europe*, when he was at Waigats Strait, at $70^{\circ} 20'$ North Latitude. In the two voyages which that exact Observer made to this Strait, in 1594 and 1595, undertaken in the view of discovering a passage to China by the North of Europe, he repeated the same observations: "We observed," says he, "once more, "from the course of the tide, what we had already remarked with much exactness, that it "comes from the East." He likewise observed, that there the water was brackish, or half salt; this he ascribes to the fusion of a prodigious quantity of floating ice, which stopped his passage at Waigats Strait; for the ice formed even of sea-

* See the first and second Voyages to *Waigats*, by *H. J. Linfchotten*. Voyages to the North, vol. iv. page 204.

water is fresh. But *Linschöten* draws no conclusion, any more than *Ellis*, from these tides of water half fresh, which descend from the North; and full of his object, like the English Navigator, he ascribes them to a Sea, which he supposes open to the East, beyond Waigats Strait, through which he proposed to find his way to China.

His compatriot, the unfortunate *William Barents* *, who made the same voyages in the same fleet, but in another vessel, and who ended his days on the northern coasts of Nova Zembla, where he had wintered, found, to the North and to the South of that island, a perpetual current of ice, setting in from the East, with a rapidity, which he compares, as *Ellis* does, to a sluice. Some of these ices were to 36 fathoms of depth under water, and 16 fathoms high above the surface. This was at Waigats Strait, in the months of July and August. He found there some Russian fishermen from Petzolah, who navigated these Seas, covered with floating rocks of ice, in a boat made of the bark of trees sewed together. These poor people made presents of fat geese to the Dutch mariners, with strong demonstrations of friendship; for calamity

* Consult the second and third Voyages of the Dutch by the North, in the first volume of the Voyages of the East-India Company:

has, in all Climates, a powerful tendency to conciliate affection between man and man. They informed him, that this same Strait of Waigats, which was then disgorging such immense quantities of ice, would be entirely shut up toward the end of October, and that it would be possible to go into Tartary over the ice, by what they called the Sea of Marmara.

It is incontrovertible, that all these effects which I have been relating, can proceed only from the effusions of the ices which surround the Pole. I shall here remark, by the way, that these ices, which flow with such rapidity to the north of America and of Europe, towards the months of July and August, greatly contribute to our high equinoctial tides, in September; and that when their effusions are stopped in the month of October, like those of Waigats, this too is the time when our Tides begin to diminish.

I may now be asked, Why the tides come from the North and the East to the north of America, and of Europe; and from the South, on our coasts, and on those of America which are under the same Latitudes?

I might satisfy myself with having said enough to demonstrate, that all the Tides do not proceed
from

from the pressure, or the attraction of the Sun, and of the Moon, on the Equator; I should have proved the imperfection of our scientific systems which ascribe them to these causes: but I proceed to repair what I have been pulling down, by other observations; and to demonstrate, that there is no one Tide, on any coast whatever, but what owes it's origin to polar effusions.

An observation of *Dampier's* * will serve, at first, as a basis to my reasonings. That careful and ingenious observer distinguishes between Currents and Tides. He lays it down as a principle, founded on many experiments, of which he gives the history, that *Currents are scarcely ever felt but out at Sea, and Tides upon the Coasts*. This being laid down: the polar effusions, which are the Tides of the North and of the East, to those who are in the vicinity of the Poles, or of bays which have a communication with it, take their general course to the middle of the channel of the Atlantic Ocean, attracted toward the Line by the diminution of the waters, which the Sun is there incessantly evaporating. They produce, by their general Current, two contrary Currents, or collateral Whirlpools, similar to those which rivers produce on their banks.

* See *Dampier's Treatise on Winds and Tides*.

I am not taking for granted, without any foundation, the existence of these counter-currents, or *vortices*, after the manner of System-makers, who create new causes, in proportion as Nature presents them with new effects. These *vortices* are hydraulic re-actions, the laws of which Geometry explains, and the reality of which is completely ascertained by experience. If you look at a small running brook, you will frequently see straws floating along the brink, and carried upward in a direction opposite to the general current of the stream; and on arriving at the points, where the counter-currents cross the general, you observe them agitated by these two opposed powers turning and spinning round a considerable time, till they are at last carried down the general current.

These counter-currents are still more perceptible, when such a rivulet flows through a basin which has itself no flux; for the re-action is, in that case, so considerable round the whole circumference of the basin, that the counter-currents carry about all bodies floating in it, to the very place where the rivulet disengages itself

These lateral counter-currents are so perceptible on the banks of rivers, that the watermen frequently take the advantage of them, to make their way in the direction opposite to the general course.

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They are still more decidedly remarkable on the banks of lakes. Father *Charlevoix*, who has given us many judicious observations respecting Canada, informs us, that when he embarked on Lake Michigan, he made out eight good leagues a day, by the assistance of these lateral counter-currents, though the wind was contrary. He supposes, and with good reason, that the rivers which throw themselves into this lake, produce, in the middle of it's waters, strong contrary currents: "But these strong currents," says he,* "are perceptible only in the middle of the channel, and produce on the banks, *vortices*, or counter-currents, of which those avail themselves who have to coast along the shore, as is the case with persons who are obliged to take the water in canoes made of bark."

Dampier's Work is filled with observations on the counter-currents of the Ocean, which are very common, especially in the straits of islands situated between the Tropics. He speaks frequently of the extraordinary effects produced by the meeting of the particular currents which occasions them; but as he does not consider the Tides themselves, as *vortices* of the general Current of the Atlantic Ocean; and as I believe he did not so

* *Charlevoix*, History of New France. Vol. vi. page 2.

much as suspect the existence of its general Current, though he has thoroughly investigated the two Currents, or Monsoons, of the Indian Ocean, I shall proceed to adduce certain facts, which establish the most perfect conformity between the Atlantic Current and those which he himself observed in the Indian Ocean, and in the South Sea.

These facts will farther prove, to a demonstration, the existence of these polar effusions: for, universally, wherever these effusions happen to meet, in their progress southward, their own counter-currents which are setting in toward the North, they produce, by their collision, Tides the most tremendous, and whose direction is diametrically opposite.

Let us consider them only at their point of departure to the North of Europe, where they begin to leave our coasts, and to stretch out into the open Sea. *Pont Oppidan* says, in his History of Norway, that there is above Berghen a place called *Malestrom*, very formidable to mariners, where the Sea forms a prodigious vortex of several miles diameter, in which a great many vessels have been swallowed up. *James Beverell* * says positively, that there are in the Orkney islands two opposite

* See *James Beverell*, Beauties of Scotland, vol. vii. page 1405.

Tides, the one running from the North-West, and the other from the South-East ; that they dash their roaring billows up to the clouds, and convert the separating strait into an enormous mass of foam. The Orkneys lie a little under the Latitude of Berghen, and in the prolongation of the northern coast of Norway, that is, at the confluence of the polar effusions and of their counter-currents.

Other islands of the Sea are in similar positions, as we could prove, did room permit. The channel of Bahama, for example, which runs with so much rapidity to the North, between the Continent of America and the Lucayo islands, produces, round those islands, by its encountering the general Current of that Sea, Tides the most tumultuous, and similar to those of the Orkneys.

These counter-currents to the course of the Atlantic Ocean produce, then, our European and American Tides, which set in to the North on the coast, while its general Current runs southward, at least in the Summer time. I could adduce a thousand other observations respecting the existence of these contrary Currents ; but a single one, more general than those which I have quoted, will be sufficient for my purpose, both from its importance and its authenticity, being the first of all those
which

which have been made in Europe, and perhaps the only one: it is that of *Christopher Columbus*, setting out on the discovery of the New World.

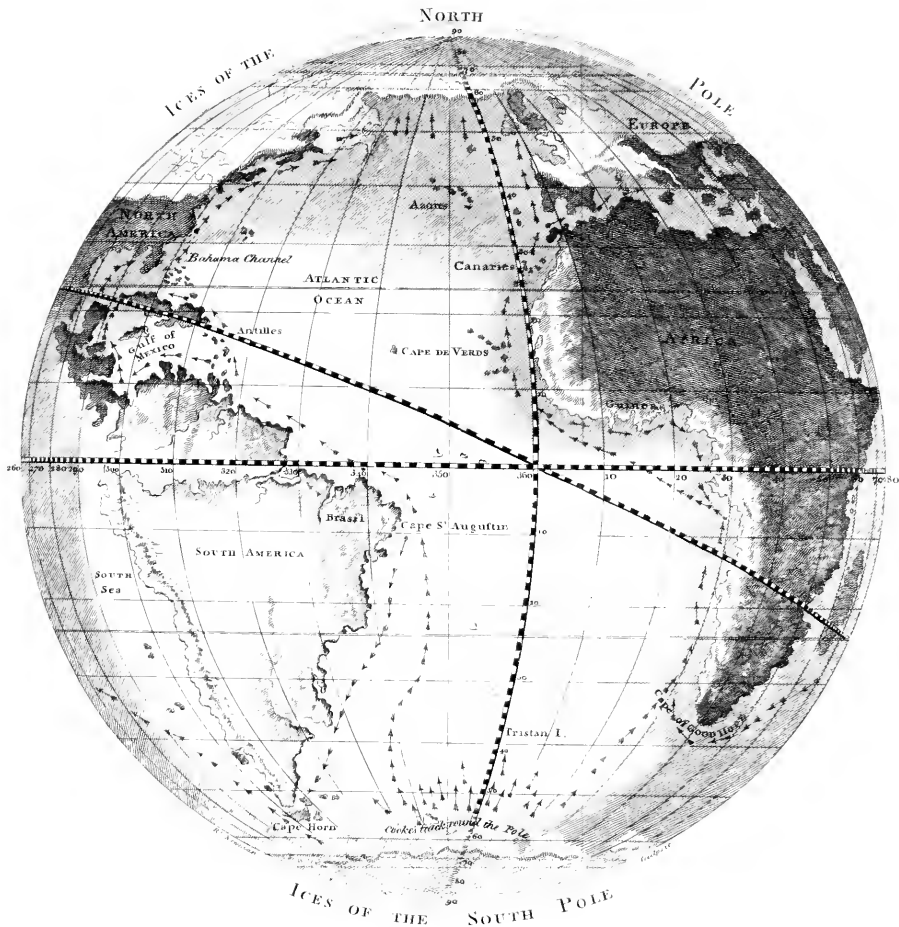
He set sail from the Canaries about the beginning of September, and steered to the West. He found, during the first days of his voyage, that the currents carried him to the North-East. When he had advanced two or three hundred leagues from land, he perceived that their direction was southward. This greatly terrified his companions, who believed that the Sea was there driving to a precipice. Finally, as he approached the Lucayo Islands, he again found the currents setting in northward. The journal of this important voyage may be found in *Herrera*.

My opinion is, that this general Current, which flows from our Pole, in Summer, with so much rapidity, and which is so violent toward its source, according to the experience of *Ellis* and *Linschotten*, crosses the equinoctial Line, in as much as its flux is not stemmed by the effusions of the South Pole, which, at that season are consolidated into ice. I presume, for the same reason, that it extends beyond the Cape of Good Hope, from whence it is directed toward the torrid Zone, to which it is attracted by the diminution of the waters, which the Sun is there incessantly pumping up ;

ATLANTIC HEMISPHERE.

Vol. II. Plate 108.

with the Channel, its Loss, its Currents, & its Tides, in the Months of January & February



up; and that being directed eastward by the position of Africa and of Asia, it forces the Indian Ocean into the same direction, contrary to its usual motion. I consider it, therefore, as the prime mover of the westerly Monsoon, which takes place in the Seas of India, in the month of April, and ends not till the month of September.

I am likewise of opinion, that the general Current which issues, during our Winter, from the South Pole, at that time heated by the rays of the Sun, restores the Indian Ocean to its natural motion westward, which is besides determined, on this side, by the general impulsions of the easterly winds, which usually blow in the torrid Zone, when nothing deranges their course. I, farther, presume, that this current, in its turn, penetrates into our Atlantic Ocean, directs its motion northward by the position of America, and produces various other changes in our Tides.

In fact, *Froger* says that, in Brasil, the Currents follow the Sun. They run southward when he is in the South, and northward when he is to the North*. Those who have had experience of these effusions of the South Pole, beyond Cape Horn, have found, that, in the Summer of the

* Voyage to the South Sea.

Southern Hemisphere, the Tides set in northward, as was observed by *William Schouten*, who, in January 1661, discovered Maires Strait. But such, on the contrary, as have gone thither in the Winter of those regions, have found that the Tides run southward, and came from the North, as was observed by *Frazer* in the month of May of the year 1712.

It now seems, to me, possible to explain the principal phenomena of our Tides, from these popular effusions. It will be evident, for example, why those of the evening should be stronger, in Summer, than those of the morning; because the Sun acts more powerfully by day than by night, on the ices of the Pole, which are on the same Meridian with ourselves. This effect resembles the intermittance of certain fountains which are supplied from mountains of ice, and flow more abundantly in the evening than in the morning. It will, farther be evident, how it happens that our morning Tides, in Winter, rise higher than those of the evening; and why the order of our Tides changes, at the end of every six months, as *Bouguer* * has well remarked, who thought the fact astonishing, but without assigning any reason for it; because the Sun being alternately toward both

* *Bouguer*, Treatise of Navigation, page 153.

Poles, the effects of the Tides must necessarily be opposite, like the causes which produce them.

But I beg leave to suggest harmonies, between the Ocean and the Poles, still more extensive and more striking. At the Solstices the Tides are lower than at any other season of the year; and these, likewise, are the seasons when there is most ice on the two Poles, and, consequently, least water in the Sea. The reason is obvious. The Winter Solstice is, with respect to us, the season of the greatest cold; there is, accordingly, at that time, on our Pole, and on our Hemisphere, the greatest possible accumulation of ice. It is, indeed, at the South Pole, the Summer Solstice; but there is little ice melted on this Pole, because the action of the greatest heat is not felt there, as with us, but when the Earth has an acquired heat, superadded to the actual heat of the Sun, which takes place only in the six weeks that follow the Summer Solstice; and these give us, likewise, in our Summer, the hottest season of the year, which we call the Dog-Days.

At the Equinoxes, on the contrary, we have the highest Tides. And these are precisely the seasons when there is the least ice at the two Poles, and, of course, the greatest mass of water in the Ocean. At our autumnal Equinox, in September,
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the greatest part of the ices of the North Pole, which has undergone all the heats of Summer, is melted, and those of the South Pole begin to dissolve. It is farther remarkable, that the tides at our vernal Equinox, in March, rise higher than those of September, because it is the end of Summer to the South Pole, which contains much more ice than ours, and, consequently, sends to the Ocean, a much greater mass of water. And it contains more ice, because the Sun is six days less in that Hemisphere, than in ours. If I am asked, Why the Sun does not communicate his light and heat, in exactly equal proportions, to both Poles? I shall leave it to the learned to assign the *cause*, but shall ascribe the *reason* of it to the Divine Goodness, which has been pleased to bestow the larger share of these blessings, on that half of the Globe which contains the greatest quantity of dry land, and the greatest number of inhabitants.

I shall say nothing of the intermittance of these polar effusions, which produce, on our coasts, two fluxes and two refluxes, nearly in the same time that the Sun, making the circuit of the Globe, over our Hemisphere, alternately heats two Continents and two Oceans, that is, in the space of twenty-four hours, during which his influence twice acts, and is twice suspended. Neither shall I speak of their retardation, which is nearly three
quarters

quarters of an hour from one day to another, and which seems to be regulated by the different diameters of the polar cupola of ice, the extremities of which, melted by the Sun, diminish and retire from us every day, and whose effusions must, consequently, require more time to reach the Line, and to return from the Line to us. Neither shall I dwell on the other relations which these polar periods have to the phases of the Moon, especially when she is at the full; for her rays possess an evaporating heat, as the late experiments, made at Rome and at Paris, have demonstrated: for this would lay me under the necessity of detailing a series of observations and facts, which might carry me too far.

Much less shall I involve myself in a discussion of the Tides of the South Pole, which, in the Summer of that Pole, in the open Sea, come immediately from the South and South-west, in vast surges, conformably to the experience of the Dutch Navigator, *Abel Tasman*, in the months of January and February 1692; and of their irregularity on the coasts of that Hemisphere, such as those on the coasts of New Holland, where *Dampier*, in the month of January 1688, found, to his great astonishment, that the highest Tide, which set in from east-quarter-north, did not come till three days after full moon, and where his ship's com-

pany, struck with consternation, were, for several days together, under the apprehension that their vessel, which they had hauled up on the beach to be refitted, could never be got afloat again*. I shall say nothing of those of New Guinea, where, toward the end of April, the same Navigator experienced several, on the contrary, in the space of a single night, which extended, in direct opposition to ours, from North to South, and came from the West in very rapid swells, tumultuous, and preceded by enormous surges, which did not break; nor of the inconsiderable elevation of these Tides on the coast of Brasil, and in most of the islands of the South-Sea, and of the East-Indies, where they rise only to 5, 6, 7, feet, whereas *Ellis* found them 25 feet high at the entrance of Hudson's-Bay, and the *Chevalier Narbrough*, 20 feet at the entrance of Magellan's Straits.

Their course toward the Equator in the South-Sea, their retardations and accelerations on these shores, their directions, sometimes eastward, sometimes westward, according to the Monsoons; finally, their rise, which increases in proportion as we approach the Pole, and diminish in proportion to our distance from it, even between the Tropics,

* *Dampier's Voyages: Treatise on Winds and Tides*, pages 378 and 379.

demonstrate,

demonstrate, that their focus is not under the Line. The cause of their motions depends not on the attraction, or the pressure, of the Sun and of the Moon, on that part of the Ocean ; for these forces would, undoubtedly, act there with the greatest energy, and in periods as regular as the course of these two luminaries ; but it seems to depend entirely on the combined heat of these same luminaries, on the Poles of the Globe, the irregular effusions of which, not being narrowed in the southern Hemisphere, as in ours, by the channel of two adjacent Continents, produce, on the shores of the Indian Ocean and South Sea, expansions vague and intermitting.

It is sufficient, therefore, to admit these alternate effusions of the polar ices, which it is impossible to call in question, to explain, with the greatest facility, all the phenomena of the Tides, and of the Currents of the Ocean. These phenomena present, in the journals of Navigators the most enlightened, a perpetual obscurity, and a multitude of contradictions, as often as these same Navigators persist in ascribing the causes of them to the constant pressure of the Moon and of the Sun on the Equator, without paying attention to the alternate Currents from the Poles, which direct their course to that same Equator ; to their counter-currents, which returning toward the Poles,

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produce

produce Tides; and to the revolutions which Winter and Summer effect on these two movements.

It has been supposed, indeed, in modern times, that the Sea must be clear of ice under the Poles, and this is founded on the groundless assertion, that the Sea freezes only along the shore; but this supposition is the creature of men in their closets, in contradiction to the experience of the most celebrated Navigators. The efforts of Captain *Cook*, toward the South Pole, demonstrate it's erroneousness. That intrepid mariner, in the month of February, the Dog-Days of the Southern Hemisphere, never could approach nearer to that Pole, where there is no land, than the 70th degree of Latitude, that is, no nearer than five hundred leagues, though he had coasted round it's cupola of ice for a whole Summer; besides this distance did not compose half the magnitude of the cupola, for he was permitted to advance so far only under favour of a bay, opened in a part of it's circumference, which every where else was of much greater extent.

These bays, or openings, are formed in the ice, merely by the influence of the nearest adjacent lands, where Nature has distributed sandy zones, to assist in accelerating the fusion of the polar ices, at the proper season. Such are, to throw it out
only

only on our way, for time permits me not here to unfold all the plans of this wonderful Architecture; such, I say, are those long belts of sand which encompass South America, in Magellan's Land; and those of Tartary, which commence in Africa, at Zara, or the Desert, and proceed forward till they terminate in the north of Asia. The winds, in Summer, convey the igneous particles, with which those Zones are filled, toward the Poles, where they accelerate the action of the Sun upon the ices.

It is easy to conceive, independent of experience, that the sands multiply the heat of the Sun, by the reflections of their specular and brilliant parts, and preserve it a long time in their interstices. It is certain, at least, that the greatest openings in the polar ices are always to be found in the direction of the warm winds, and under the influence of these sandy tracks of land, as I could easily demonstrate, were this the proper place. But we may see examples of it, without quitting our own Continent, nay, in our very gardens. In Russia, the rivers and lakes always begin to thaw at the banks, and the fusion of their ices is accelerated, in proportion as the strand is more or less gravelly, and as they meet, relatively to the strand, in the direction of the South wind.

We observe the same effects in our own gardens, toward the close of Winter. The ice which covers the gravel on the alleys, melts first; afterward that which is on the earth, and last of all, that which is in the basons. The fusion of this, too, begins at the brink, and the length of time necessary to complete it, is in proportion to the extent of the bason; so that the central part, or that which is farthest from the earth, is, likewise, the last that dissolves.

There can remain, therefore, not the slightest shadow of doubt, that the Poles are covered with a cupola of ice, conformably to the experience of Navigators, and the dictates of natural reason. We have taken a glance of the icy dome of our own Pole, which covers it, in Winter, to an extent of more than two thousand leagues over the Continents. It is not so easy to determine its elevation at the centre, and under the very Pole; but the height must be immense.

Astronomy sometimes presents, in the Heavens, an image of it so considerable, that the rotundity of the Earth seems to be remarkably affected by it.

I take the liberty of quoting, what I find, on this subject, in an English Author of note,
Childrey.

Childrey *. This Naturalist supposes, as I do, that the Earth, at the Poles, is covered with ice, to such a height, that it's figure is thereby rendered sensibly oval. This he proves by two very curious astronomical observations. "What obliges me, "besides," says he, "to embrace this paradox, is, "that it serves to resolve admirably well, a difficulty of no small importance, which has greatly "embarrassed *Tycho Brhaë* and *Kepler*, respecting "central eclipses of the Moon, which take place "near the Equator; as that was which *Tycho* observed in the year 1588, and that observed by "*Kepler* in the year 1624: of which he thus "speaks: *Notandum est hanc Lunæ eclipsim (instar "illius quam Tycho, anno 1588, observavit totalem, " & proximam centrali) egregiè calculum fefellit; nam "non solum mora totius Lunæ in tenebris brevis fuit, "sed et duratio reliqua multò magis; perindè quasi "tellus elliptica esset, demetientem breviorè habens "sub Æquatore, longiorè a polo uno ad alteram.* "That is, It is worthy of remark, that this eclipse "of the Moon," (he is speaking of that of the 26th "September, 1624) like the one which *Tycho* observed, in the year 1588, which was total, and very "nearly central, differed widely from the calculation; "for not only was the duration of total darkness extremely short, but the rest of the duration, previous,

* Natural History of England, pages 246 and 247.

“ and posterior, to the total obscuration, was still shorter; as if the figure of the Earth were elliptical, having the smaller diameter under the Equator, and the greater, from Pole to Pole.”

The detached masses, half melted, which are every year torn from the circumference of this cupola, and which are met with, floating at sea, prodigiously distant from the Pole, about the 55th degree of Latitude, are of such an elevation, that *Ellis*, *Cook*, *Martens*, and other Navigators of the North, and of the South, the most accurate in their details, represent them as, at least, as lofty as a ship under sail: nay, *Ellis*, as has already been mentioned, does not hesitate to assign to them an elevation of from 1500 to 1800 feet. They are unanimous in affirming, that these vast fragments emit coruscations, which render them perceptible before they come to the Horizon. I shall remark, by the way, that the *Aurora Borealis*, or Northern Light, may, very probably, owe it's origin to similar reflections from the polar ices, the elevation of which may, perhaps, one day be determined by the extent of these very lights.

Whatever may be in this, *Denis*, Governor of Canada, speaking of the ices which descend, every Summer, from the North, upon the great bank of Newfoundland, says that they are higher than the turrets

turrets of Notre-Dame, and that they may be seen at the distance of from 15 to 18 leagues. Their cold is felt on ship-board at a similar distance. "They are," according to his account *, "sometimes in such numbers, being all carried forward by the same wind, that there have been vessels, making toward the land to fish, which fell in with some of them, in a series of a hundred and fifty leagues in length, and upward; which coasted along them for a day or two, the night included, with a fresh breeze, and every sail set, without being able to reach the extremity. In this manner they keep on under way, looking for an opening through which the vessel may pass; if they find one, they cross it, as through a strait; otherwise, they must get on, till they have outailed the whole chain, in order to make good their passage; for the way is throughout blocked up with ice. These ices do not melt, till they meet the warm water toward the South, or are forced by the wind on the land side. Some of them run aground in from 25 to 30 fathoms of water; judge of their height, exclusive of what is above water. The fishermen have assured me, that they saw one aground, on the great bank, in 45 fathom water, and

* Natural History of North-America. Vol. ii. chap. 1: page 44 and 45.

which

“ which was, at least, ten leagues round. It must
“ have been of a great height. Ships do not
“ come near these ices, for there is danger lest
“ they should overturn, according as they dissolve
“ on the side exposed to the greatest heat.”

It is to be observed, that the ices in question are already more than half melted by the time they reach the banks of Newfoundland; for, in fact, they scarcely go any farther. It is the Summer's heat which detaches them from the North, and they are enabled to make even such a progress southward, only by means of their floating down the current, which carries them toward the Line, where they arrive, in a state of dissolution, to replace the waters which the Sun is continually evaporating in the torrid Zone.

These polar ices, of which our mariners see only the borders and the crumbs, must have, at their centre an elevation proportioned to their extent. For my own part, I consider the two Hemispheres of the Earth as two mountains with their bases applied to each other at the Line, the Poles as the icy summits of these mountains, and the Seas as rivers flowing from these summits.

If, then, we represent to ourselves the proportions which the glaciers of Switzerland have to their
their

their mountains, and to the rivers which flow from them, we shall be able to form some faint idea of those proportions which the glaciers of the Poles bear to the whole Globe and to the Ocean. The Cordeliers of Peru, which are only mole-hills, compared to the two Hemispheres, and the rivers, which issue from them, only rills of water compared to the Sea, have selvages of ice, from twenty to thirty leagues broad, bristled, at their centre, with pyramids of snow from twelve to fifteen hundred fathoms high. What, then, must be the elevation of these two domes of polar ice, which have, in Winter, bases of two thousand leagues in diameter? I can have no doubt, that their thickness, at the Poles, must have represented the Earth as oval, in central eclipses of the Moon, conformably to the observations of *Kepler* and *Tycho Brhaë*.

I deduce another consequence from this configuration. If the elevation of the polar ices is capable of changing in the Heavens the apparent form of the Globe, their weight must be sufficiently considerable to produce some influence on it's motion in the Ecliptic. There is, in fact, a very singular correspondence between the movement, by which the Earth alternately presents it's two Poles to the Sun, in one year, and the alternate effusions of the polar ices, which take place in the course of the same year. Let me explain
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my conception of the way in which this motion of the Earth is the effect of these effusions.

Admitting, with Astronomers, the laws of Attraction among the heavenly bodies, the Earth must certainly present to the Sun, which attracts it, the weightiest part of it's Globe. Now, this weightiest part must be one of it's Poles, when it is surcharged with a cupola of ice, of an extent of two thousand leagues, and of an elevation superior to that of the Continents. But as the ice of this Pole, which it's gravity inclines toward the Sun, melts in proportion to it's vertical approximation to the source of heat, and as, on the contrary, the ice, of the opposite pole, increases in proportion to it's removal, the necessary consequence must be, that the first Pole becoming lighter, and the second heavier, the centre of gravity passes alternately from the one to the other, and from this reciprocal preponderancy must ensue that motion of the Globe in the Ecliptic, which produces our Summer and Winter.

From this alternate preponderancy, it must likewise happen, that our Hemisphere, containing more land than the southern Hemisphere, and being, consequently, heavier, it must incline toward the Sun for a greater length of time; and this, too, corresponds to the matter of fact, for our
Summer

Summer is five or six days longer than our Winter. A farther consequence is, that our Pole cannot lose it's centre of gravity, till the opposite Pole becomes loaded with a weight of ice superior to the gravity of our Continent, and of the ices of our Hemisphere; and this, likewise, is agreeable to fact, for the ices of the South Pole are more elevated, and more extensive than those of the northern; for mariners have not been able to penetrate farther than to the 70th degree of South Latitude, whereas they have advanced no less than 82° North.

Here we have a glimpse of the reasons by which Nature was determined to divide this Globe into two Hemispheres, of which the one should contain the greatest quantity of dry land, and the other the greatest quantity of water; to the end that this movement of the Globe should possess, at once, consistency and versatility. It is farther evident, why the South Pole is placed immediately in the midst of the Seas, far from the vicinity of any land; that it might be able to load itself with a greater mass of marine evaporations, and that these evaporations accumulated into ice around it, might balance the weight of the Continents with which our Hemisphere is surcharged.

And here I lay my account with being opposed by a very formidable objection. It is this. If the
polar

polar effusions occasion the Earth's motion in the Ecliptic, the moment would come in which, it's two Poles being in equilibrio, it could present to the Sun the Equator only.

I acknowledge that I have no reply to make to that difficulty, unless this be one ; We must have recourse to an immediate will of the AUTHOR of Nature, who is pleased to destroy the instant of this equilibrium, and who re-establishes the balancing of the Earth on it's Poles, by laws with which we are unacquainted. Now, this concession no more weakens the probability of the hydraulic cause, which I apply to it, than that of the principle of the attraction of the heavenly bodies, which attempts to explain it, I am bold to say, with much less clearness. This very attraction would soon deprive the Earth of all manner of motion, if it alone acted in the stars. If we would be sincere, it is in the acknowledgment of an intelligence, superior to our own, that all the mechanical causes, of our most ingenious systems, must issue. The will of GOD is the *ultimatum* of all human knowledge.

From this objection, however, I shall deduce consequences, which will diffuse new light on the ancient effects of polar effusions, and on the manner

ner in which they might have produced the Deluge*.

* The Priests of Egypt maintain, according to Herodotus, that the Sun had several times deviated from his course, accordingly our hypothesis has nothing new in it. They had, perhaps, deduced the same consequences from this, that we have done. One thing is certain; they believed that the Earth would, one day, perish by a general conflagration, as it had been overwhelmed by an universal deluge. Nay, I believe it was one of their Kings, who, as a security against either one or the other of these calamities, had two pyramids built, the one of brick, a preservative against fire; the other of stone, a preservative against an inundation. The opinion of a future conflagration of Nature is diffused over many nations. But effects so terrible, which would speedily result from the mechanical causes, by which Man endeavours to explain the laws of Nature, can take place only by an immediate order of the DEITY. He preserves his works conformably to the same Wisdom with which they were created. Astronomers have, for many Ages, been observing the annual motion of the Earth in the Ecliptic, and never have they seen the Sun so much as a single second short of, or beyond, the Tropics. GOD governs the World by variable powers, and deduces from these, harmonies which are invariable. The Sun neither moves in the circle of the Equator, which would set the Earth on fire, nor in that of the Meridian, which would produce an inundation of water; but his course is traced in the Ecliptic, describing a spiral line between the two Poles of the World. In this harmonious course, he dispenses cold and heat, dryness and humidity, and derives from these powers, each of them destructive by itself, Latitudes so varied, and so temperate, all over the Globe, that an infinite number of creatures, of an extreme delicacy, find in them, every degree of temperature adapted to the nature of their frail existence.

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On the supposition, then, of the re-establishment of the equilibrium between the Poles, and of the Earth's constantly presenting it's Equator to the Sun, it is extremely probable, that, in this case, it would be set on fire. In fact, on this hypothesis, the waters which are under the Equator, being evaporated by the unremitting action of the Sun, would become irrevocably fixed in ice at the Poles, where they would receive, without effect, the influence of that luminary, which would be to them constantly in the Horizon. The Continents being thus dried up, under the torrid Zone, and inflamed by a heat every day increasing, would quickly catch fire. Now, if it be probable that the Earth would perish by fire, were the Sun's motion confined to the Equator, it is no less probable, that it must be deluged with water, if the course of the Sun were in the direction of the Meridian. Opposite means produce contrary effects.

We have just seen, that the alternate effusions of part of the polar ices merely, are sufficient for renewing all the waters of the Ocean, for producing all the phenomena of the Tides, and for effecting the balancing of the Earth in the Ecliptic. We believe them capable of entirely inundating the Globe, were the fusion to take place all at once. Let it but be remarked, that the effusion of only a part of the ices of the Cordeliers, in Peru, is sufficient

to produce an annual overflow of the Amazon, of the Oronoko, and of several other great rivers of the New World, and to inundate a great part of Brasil, of Guiana, and of the *Terra Firma* of America; that the melting of part of the snows on the mountains of the Moon in Africa, occasions every year the inundations of Senegal, contributes to those of the Nile, and overflows vast tracks of country in Guinea, and the whole of Lower Egypt; and that similar effects are annually reproduced in a considerable part of southern Asia, in the kingdoms of Bengal, of Siam, of Pegou, and of Cochin-China, and in the districts watered by the Tigris, the Euphrates, and many other rivers of Asia, which have their sources in chains of mountains perpetually covered with ice, namely, Taurus and Imaüs. Who, then, can entertain a doubt, that the total fusion of the ices of both Poles, would be sufficient to swell the Ocean above every barrier, and completely to inundate the two Continents?

The elevation of these two cupolas of polar ice, vast as Oceans, must it not far surpass the height of the highest land, when the simple fragments of their extremities, after they are half dissolved, are as high as the turrets of Notre-Dame; nay, rise to the height of from fifteen to eighteen hundred feet above the Sea? The ground on which Paris stands,

at forty leagues distance from the shore of the Sea, is only twenty-two fathom above the level of neap-tides, and no more than eighteen above the highest spring-tides. A great part of both the Old and New World is of an elevation much inferior even to this.

For my own part, if I may venture to declare my opinion, I ascribe the general Deluge to a total effusion of the polar ices, to which may be added that of the icy mountains, such as the ices of the Cordeliers and of Mount Taurus, the chains of which extend from twelve to fifteen hundred leagues in length, with a breadth of twenty or thirty leagues, and an elevation of from twelve to fifteen hundred fathom. To these may be still farther added the waters diffused over the Atmosphere, in clouds, and imperceptible vapours, which would not fail to form a very considerable mass of water, were they collected on the Earth.

My supposition then is, that, at the epocha of this tremendous catastrophe, the Sun, deviating from the Ecliptic, advanced from South to North*, and

* I find an historical testimony in support of this hypothesis, in the History of China by Father *Martini*, Book I. “ During the reign of *Tais*, the seventh Emperor, the Annals of the Country relate, that for six days together the Sun never set,
“ fo

and pursued the direction of one of the Meridians which passes through the middle of the Atlantic Ocean and of the South-Sea. In this course he heated only a Zone of water, frozen as well as fluid, which, through the greatest part of the circumference has a breadth of four thousand five hundred leagues. He extracted long belts of land and sea fogs, which accompany the melting of all ices, of the chain of the Cordeliers, of the different branches of the icy mountains of Mexico, of Taurus, and of Imaüs, which like them run South and North; of the sides of Atlas, of the summits of Teneriff, of Mount Jura, of Ida, of Lebanon, and of all the mountains covered with snow, which lay exposed to his direct influence.

He quickly set on fire, with his vertical flame, the Constellation of the Bear, and that of the Cross of the South; and, presently, the vast cupolas of ice, on both Poles, smoked on every side. All these vapours, united to those which arose out

“so that a general conflagration was apprehended.” The result, on the contrary, was a deluge which inundated the whole of China. The epoch of this Chinese deluge, and that of the Universal Deluge, are in the same century. *Yais* was born 2307 years before CHRIST, and the Universal Deluge happened 2348 years before the same epoch, according to the Hebrew computation. The Egyptians, likewise, had traditions respecting these ancient alterations of the Sun’s course.

of the Ocean, covered the Earth with an universal rain. The action of the Sun's heat was farther augmented by that of the burning winds of the sandy Zones of Africa and Asia, which blowing, as all winds do, toward the parts of the Earth where the air is most rarefied, precipitated themselves, like battering rams of fire, toward the Poles of the World, where the Sun was then acting with all his energy.

Innumerable torrents immediately burst from the North Pole, which was then the most loaded with ice, as the Deluge commenced on the 17th of February, that season of the year, when Winter has exerted its full power over our Hemisphere. These torrents issued all at once from every flood-gate of the North; from the straits of the Sea of Anadir, from the deep gulf of Kamtschatka, from the Baltic Sea, from the strait of Waigats, from the unknown fluices of Spitzbergen and Greenland, from Hudson's-Bay, and from that of Baffin, which is still more remote. Their roaring currents rushed furiously down, partly through the channel of the Atlantic Ocean, hurled it up from the abysses of its profound basin, drove impetuously beyond the Line, and their collateral counter-tides forced back upon them, and increased by the Currents from the South Pole, which had been set a flowing at the same time, poured upon
our

our coasts the most formidable of Tides. They rolled along, in their surges, a part of the spoils of the Ocean, situated between the ancient and the new Continent. They spread the vast beds of shells which pave the bottom of the Seas at the Antilles and Cape-Verd Islands, over the plains of Normandy; and carried even those which adhere to the rocks of Magellan's Strait, as far as to the plains which are watered by the Saône. Encountered by the general Current of the Pole, they formed at their confluences horrible counter-tides, which conglomerated, in their vast funnels, sands, flints, and marine bodies, into masses of indigested granite, into irregular hills, into pyramidal rocks, whose protuberances variegate the soil in many places of France and Germany. These two general Currents of the Poles happening to meet between the Tropics, tore up, from the bed of the Seas, huge banks of madrépores, and tossed them, unseparated, on the shores of the adjacent islands, where they subsist to this day*.

In

* I have seen in the Isle of France, some of these great beds of madrépores, of the height of seven or eight feet, resembling ramparts, left quite dry, more than three hundred paces from the shore. The Ocean has left, on every land, some traces of it's ancient excursions. There have been found, on the steep strand of the district of Caux, some of the shells peculiar to the Antilles Islands, particularly a very large one, called the *Tbuilké*;

In other places, their waters, slackened at the extremity of their course, spread themselves over the surface of the ground in vast sheets, and deposited, by repeated undulations, in horizontal layers,

in the vineyards of Lyons, that which they call the cock and hen, which is caught alive in no Sea whatever but the Straits of Magellan; the teeth and jaws of sharks, in the sands of Estampes. Our quarries are filled with the spoils of the Southern Ocean. On the other hand, if we may believe the Memoirs of Father *le Comte*, the Jesuit, there are in China strata of vegetable earth from three to four hundred feet deep. This Missionary ascribes to these, and with good reason, the extreme fertility of that country. Our best soils in Europe are not above three or four feet deep. If we had Geographical Charts which should represent the different layers of our fossil shells, we might distinguish in them the directions and the focuses of the ancient currents which lodged them. I shall pursue this idea no further; but here is another, which may present new objects of curiosity to the learned, who put greater value on the monuments raised by Man, than on those of Nature. It is this, As we find in the fossils of these western regions, a multitude of the monuments of the Sea, we might, perhaps, be able to trace those of our ancient Continent, in those strata of vegetable earth, of three and four hundred feet depth, in the countries of the East. First, it is certain, from the testimony of the Missionary above quoted, that pit-coal is so common in China, that most of the Chinese make use of no other fuel. Now, it is well known that pit-coal owes its origin to the forests which have been buried in the bowels of the Earth. It might be possible, therefore, to find amidst these wrecks of the vegetable creation, those of terrestrial animals, of men, and of the first arts of the World, such, at least, as possessed some degree of solidity.

the

the wreck and the vicidities of an infinite number of fishes, sea-urchins, sea-weeds, shells, corals, and formed them into strata of gravel, pastes of marble, of marle, of plaster and calcareous stones, which constitute, to this day, the soil of a considerable part of Europe. Every layer of our fossils was the effect of an universal Tide. While the effusions of the polar ices were covering the westerly extremities of our Continent with the spoils of the Ocean, they were spreading over it's easterly extremities those of the Land, and deposited on the soil of China, strata of vegetable earth, from three to four hundred feet deep.

Then it was that all the plans of Nature were reversed. Complete islands of floating ice, loaded with white bears, run aground among the palm-trees of the torrid Zone, and the elephants of Africa were tossed amidst the fir-groves of Siberia, where their large bones are still found to this day. The vast plains of the Land, inundated by the waters, no longer presented a career to the nimble courser, and those of the Sea, roused into fury, ceased to be navigable. In vain did Man think of flying for safety to the lofty mountains. Thousands of torrents rushed down their sides, and mingled the confused noise of their waters with the howling of the winds, and the roaring of the thunder. Black tempests gathered round their summits, and

diffused a night of horror in the very midst of day. In vain did he turn an eager eye toward that quarter of the Heavens where Aurora was to have appeared : he perceives nothing in the whole circuit of the Horizon but piles of dark clouds heaped upon each other ; a pale glare here and there furrows their gloomy and endless battalions ; and the Orb of Day, veiled by their lurid conuscations, emits scarcely light sufficient to afford a glimpse, in the firmament, of his bloody disk, wading through new Constellations.

To the disorder reigning in the Heavens, Man, in despair, yields up the safety of the Earth. Unable to find in himself the last consolation of Virtue, that of perishing free from the remorse of a guilty conscience, he seeks, at least, to conclude his last moments in the bosom of Love, or of Friendship. But in that age of criminality, when all the sentiments of Nature were stifled, friend repelled friend, the mother her child, the husband the wife of his bosom. Every thing was swallowed up of the waters : cities, palaces, majestic pyramids, triumphal arches, embellished with the trophies of Kings : and ye, also, which ought to have survived the ruin even of a World, ye peaceful grottos, tranquil bowers, humble cottages, the retreats of innocence ! There remained on the Earth no trace of the glory and felicity of the Human Race,
in

in those days of vengeance, when Nature involved in one ruin all the monuments of her greatness.

Such convulsions, of which traces without number still remain, on the surface, and in the bowels of the Earth, could not possibly have been produced simply by the action of an universal rain.

I am aware that the letter of Scripture is express in respect to this ; but the circumstances which the Sacred Historian combines, seem to admit the means which, on my hypothesis, effected that tremendous revolution.

In the book of Genesis it is said, that it rained, over the whole Earth, for forty days and forty nights. That rain, as we have alleged, was the result of the vapours produced by the melting of the ices, both of the Land and of the Sea, and by the Zone of Water which the Sun passed over, in the direction of the Meridian. As to the period of forty days, that quantity of time appears to me abundantly sufficient to the vertical action of the Sun on the polar ices, to reduce them to the level of the Seas, as scarcely more than three weeks are necessary, of the proximity of the Sun to the Tropic of Cancer, to melt a considerable part of those on our Pole. Nay, at that season, nothing more seems to be wanting but a few puffs of southerly,
or

or fourth-west wind, for a few days, to disengage from the ice the southern coast of Nova-Zembla, and to clear the strait of Waigats, as has been observed by *Martens*, *Barents*, and other Navigators of the North.

It is farther said, in the Book of Genesis, “ all “ the *fountains of the great Deep* were broken up, “ and the *windows of Heaven* were opened.” The expression, *the fountains of the great Deep*, can, in my opinion, be applied only to an effusion of the polar ices, which are the real sources of the Sea, as the effusions of the ice on mountains are the sources of all the great rivers. The expression, *the windows*, or cataracts, *of Heaven*, denotes likewise, if I am not mistaken, the universal resolution of the waters diffused over the Atmosphere, which are there supported by the cold, the focuses of which were then destroyed at the Poles.

It is afterwards said, in Genesis, that after it had rained for forty days, GOD *made a wind to blow*, which caused the waters that covered the Earth to disappear. This wind, undoubtedly, brought back to the Poles the evaporations of the Ocean, which fixed themselves a-new in ice. The Mosaic account, finally, adds circumstances which seem to refer all the effects of this wind to the Poles of the World, for it is said Gen. viii. 2, 3. “ The foun-
“ tains

“ rains also of the Deep, and the windows of
 “ Heaven, were stopped, and the rain from Hea-
 “ ven was restrained ; and the *waters returned from*
 “ *off the Earth continually*, and after *the end of the*
 “ *hundred and fifty days* the waters were abated.”

The agitation of these waters from side to side continually, perfectly agrees to the motion of the Seas, from the Line to the Poles, which must then have been performed without any obstacle, the Globe being, on that occasion, entirely aquatic ; and it being possible to suppose that it's annual balancing in the Ecliptic, of which the polar ices are at once the moving powers and the counterpoise, had degenerated, at that time, into a diurnal titubation, a consequence of it's first motion. These waters retired, then, from the Ocean, when they came to be converted a-new into ice upon the Poles ; and it is worthy of remark, that the space of a hundred and fifty days, which they took to fix themselves in their former station, is precisely the time which each of the Poles annually employs, to load itself with it's periodical congelations.

We find, besides, in the sequel of this historical account of the Deluge, expressions analogous to the same causes : “ GOD said again to Noah,
 “ while the Earth remaineth, seed time and har-
 “ vest

“veft, and cold and heat, and Summer and Winter, and day and night, fhall not ceafe *.”

There muft be nothing fuperfluous in the *Words* of the AUTHOR of Nature, as there is nothing of this defcription in his *Works*. The Deluge, as has been already mentioned, commenced on the feventeenth day of the fecond month of the year, which was among the Hebrews, as with us, the month of February. Man had by this time caft the feed into the ground, but reaped not the harveft. That year, cold fucceeded not to the heat, nor Summer to Winter, becaufe there was neither Winter nor cold, from the general fuſion of the polar ices, which are their natural focufes; and the night, properly fo called, did not follow the day, becaufe then there was no night at the Poles, where there is alternately one of fix months, becaufe the Sun, purfuing the direction of a Meridian, illuminated the whole Earth, as is the cafe now, when he is in the Equator.

To the authority of Genesis, I fhall ſubjoin a very curious paſſage from the Book of Job †, which describes the Deluge, and the Poles of the World, with the principal characters of them which I have juſt been exhibiting.

* Gen. ch. viii. ver. 22.

† Ch. xxxviii.

4. Ubi eras quando ponebam fundamenta Terræ? Indica Mihi, si habes intelligentiam.

5. Quis posuit mensuras ejus, si nôsti? Vel quis tetendit super eam, lineam?

6. Super quo bases illius solidatæ sunt? Aut quis demisit lapidem angularem ejus,

7. Cum manè laudarent simul Astra matutina, & jubilarent omnes Filii DEI?

8. Quis conclusit ostiis * Mare, quando erumpebat quasi ex utero procedens :

* Though the sense which I affix to this passage, does not greatly differ from that of M. de Sacy, in his excellent translation of the Bible, there are, at the same time, several expressions, to which I assign a meaning rather opposite to that of this learned Gentleman.

1st. *Ostium*, properly speaking, signifies an opening, a disgorging, a sluice, a flood-gate, a mouth; and not a barrier, according to Sacy's Translation. Observe how admirably the sense of this verse, and of that which follows, is adapted to the state of constraint and inactivity to which the Sea is restricted at the Poles, surrounded with clouds and darkness, like a child in swaddling clothes in his cradle. They are, likewise, expressive of the thick fogs which surround the basis of the polar ices, as is well known to all the mariners of the North.

2dly. The preceding epithets of *the foundations of the Earth*; of *the fastening of the foundations*; of *stretching the line upon it*; of *the Sea's breaking forth*, as if issuing from the womb, determine particularly the Poles of the World, from whence the Seas flow over the rest of the Globe. The epithet of *corner stone*, seems, likewise, to denote more particularly the North Pole, which, by its magnetic attraction, distinguishes itself from every other point of the Earth.

9. Cum

9. Cum ponerem nubem vestimentum ejus, & caligine, illud, quasi pannis infantia, obvolverem?

10. Circumdedi illud terminis meis, & posui vectem & ostia :

11. Et dixi : usque huc venies, sed non procedes amplius ; & hinc confringes tumentes fluctus tuos.

12. Numquid post ortum tuum præcepisti diliculo, & ostendisti Auroræ *, locum suum ?

13. Et tenuisti concutiens extrema Terræ, & excussisti impios ex ea ?

14. Restituetur ut lutum † signaculum, & stabit sicut vestimentum.

15. Auferetur ab impiis lux sua, & brachium excelsum confringetur.

* *Auroræ locum suum*, the place of the Aurora. The *Aurora Borealis* is, perhaps, here intended. The cold of the Poles produces the Aurora, for there is scarce any such thing between the Tropics. The Pole is, accordingly, properly speaking, the natural place of the Aurora. In the verse following, the expression, *tenuisti concutiens extrema Terræ*, evidently characterizes the total effusions of the polar ices, situated at the extremities of the Earth, which occasioned the Universal Deluge.

† *Restituetur ut lutum signaculum*. This verse is very obscure in the Translation of *M. de Sacy*. It appears to me here descriptive of the fossil shells, which, over the whole Earth, are monuments of the Deluge.

16. Numquid ingreſſus es profunda Maris, & in noviffimis Abyſſi * deambulâſti ?

17. Numquid apertæ ſunt tibi portæ Mortis †, & oftia tenebroſa vidifti ?

18. Numquid confiderâſti latitudinem Terræ ‡ ? Indica Mihi, ſi nôſti omnia.

* *In noviffimis Abyſſi, in the ſearch (at the ſources) of the Depth. Saci tranſlates it, in the extremities of the Abyſs.* This verſion deſtroys the correſpondence, of the expreſſion under review, with that of the other polar characters, ſo clearly explained before; and the antitheſis of *noviffima*, with that of *profunda Maris*, which goes before, by affixing the ſame meaning to it. Antitheſis is a figure in frequent uſe among the Orientals, and eſpecially in the Book of Job. *Noviffima Abyſſi*, literally denote, the places which renovate the Abyſs, the ſources of the Sea, and, conſequently, the polar ices.

† *Portæ Mortis, & oftia tenebroſa; the gates of Death, and the doors of the ſhadow of Death, or, the gates of Darkneſs.* The Poles, being uninhabitable, are, in reality, the gates of Death. The epithet *dark* here denotes the nights of fix months duration, which hold their empire at the Poles. This ſenſe is farther confirmed by what is ſubjoined in the following verſes; the *locus tenebrarum*, place of darkneſs, and the *theſaurus nivis*, treaſures of the ſnow. The Poles are, at once, the place of darkneſs, and that of the Aurora.

‡ *Latitudinem Terræ.* Literally: *Haſt thou perceived the breadth (the Latitude) of the Earth?* In truth, all the characters of the Pole could be known only to thoſe who had courſed over the Earth in it's Latitude. There were, in the times of Job, many Arabian travellers who went eaſtward, and weſtward, and ſouthward, but very few who had travelled northward, that is to ſay, in Latitude.

19. In quâ viâ lux habitet, & tenebrarum quis locus fit.

20. Ut ducas unumquodque ad terminos suos, & intelligas femitas domûs ejus.

21. Sciebas tunc quòd nasciturus esses? Et numerum dierum tuorum noveras?

22. Numquid ingressus es thesauros nivis, aut thesauros grandinis aspexisti?

23. Quæ preparavi in tempus hostis, in diem pugnae & belli.

*Common Version of the
Bible.*

4. Where wast thou, when I laid the foundations of the Earth? Declare, if thou hast understanding.

5. Who hath laid the measures thereof, if thou knowest? Or who hath stretched the line upon it?

6. Whereupon are the foundations thereof fastened? Or who laid the corner-stone thereof?

7. When the morning stars sang together, and all the Sons of GOD shouted for joy.

*Translation of
Saint-Pierre's Version.*

4. Where wast thou, when I laid the foundations of the Earth? Tell it Me, if thou hast any knowledge.

5. Knowest thou who it is that determined it's dimensions, and who regulated it's levels?

6. On what are it's bases secured; and who fixed it's corner-stone?

7. When the Stars of the morning praised Me all together, and when all the Sons of GOD were transported with joy.

8: Or,

8. Or who shut up the Sea with doors, when it brake forth, as if it had issued out of the womb?

9. When I made the cloud the garment thereof, and thick darkness a swaddling band for it,

10. And brake up for it my decreed place, and set bars and doors,

11. And said, Hitherto shalt thou come, but no farther: and here shall thy proud waves be staid.

12. Hast thou commanded the morning since thy days? and caused the day-spring to know his place,

13. That it might take hold of the ends of the Earth, that the wicked might be shaken out of it?

14. It is turned as clay to the seal, and they stand as a garment.

8. Who appointed gates to the Sea, to shut it up again, when it inundated the Earth, rushing as from it's mother's womb;

9. When I gave it the clouds for a covering, and wrapped it up in darkness, as a child is wrapped up in swaddling-clothes?

10. I shut it up within bounds well-known to me; I appointed for it a bulwark and sluices,

11. And said to it, Thus far shalt thou come, but farther thou shalt not pass, and here the pride of thy billows shall be broken.

12. Is it thou who, in opening thine eyes to the light, hast given commandment to the dawning of the day to appear, and hast shewn to Aurora the place where she ought to arise?

13. Is it thou who, holding in thy hands the extremities of the Earth, hast convulsed it, and shaken the wicked out of it?

14. A multitude of minute monuments of this event shall remain impressed in the clay, and shall subsist as the memorials of that devastation.

15. And from the wicked their light is with-holden, and the high arm shall be broken.

16. Haft thou entered into the springs of the Sea? or haft thou walked in the search of the Depth?

17. Have the gates of Death been opened unto thee? or haft thou seen the doors of the shadow of Death?

18. Haft thou perceived the breadth of the Earth? Declare if thou knowest it all.

19. Where is the way where light dwelleth? and as for darknes, where is the place thereof?

20. That thou shouldest take it to the bound thereof, and that thou shouldest know the paths to the house thereof?

21. Knowest thou it, because thou wast then born? or, because the number of thy days is great?

22. Haft thou entered into the treasures of the snow? Or haft thou seen the treasures of the hail?

15. The light of the wicked shall be taken from them, and their lifted-up arm shall be broken.

16. Haft thou penetrated to the bottom of the Sea, and walked over the sources which renovate the Abyss?

17. Have these gates of Death been opened to thee; and haft thou surveyed the dark disgorgings of the Depth?

18. Haft thou observed where the breadth of the Earth terminates? If thou knowest all these things, declare them unto Me.

19. Tell me where the light inhabits, and what is the place of darknes,

20. That thou mayest conduct each to its destination, seeing thou knowest their habitation, and the way that leads to it.

21. Didst thou know, as these things already existed, that thou thyself wert to be born; and hadst thou then discovered the fleeting number of thy days?

22, 23. Haft thou, I say, entered into the treasures of the snow, and surveyed those tremendous reservoirs of hail,

23. Which

which

23. Which I have reserved which I have prepared against
 against the time of trouble, the time of the adversary, and
 against the day of battle and for the day of battle and war?
 war?

The Reader, I flatter myself, will not be displeased at my having deviated somewhat from my subject, that I might exhibit to him the agreement between my hypothesis and the traditions of the Holy Scriptures; and especially between it and those, though not free from obscurity, of a Book, perhaps, the most ancient that exists. Our most learned Theologians agree in thinking, that Job wrote prior to Moses. Whether this be the case or not, surely no one ever painted Nature with greater sublimity.

We may, farther, arrive at complete assurance of the general effect of the polar effusions on the Ocean, from the particular effects of the icy effusions of mountains, on the lakes and rivers of the Continent. I shall here relate some examples of these last; for the human mind, from its natural weakness, loves to particularize all the objects of its studies. And this is the reason why it apprehends, much more quickly, the laws of Nature, in small objects, than in those which are great.

Addison, in his remarks on *Misson's* Tour to Italy, page 322, says, that there is in the Lake of Geneva, in Summer, towards evening, a kind of flux and reflux, occasioned by the melting of the snows, which fall into it in greater quantities after noon, than at other seasons of the day. He explains, besides, with much clearness, as he generally does, from the alternate effusions of the ices on the mountains of Switzerland, the intermittance of certain fountains of that country, which flow only at particular hours of the day.

If this digression were not already too long, I could demonstrate, that there is no one fountain, nor lake, nor river, subject to a particular flux and reflux, but what is indebted for it to icy mountains, which supply their sources. I shall subjoin but a very few words more respecting those of the Euripus; the frequent and irregular movements of which so much embarrassed the Philosophers of Antiquity, and which may be so easily explained from the icy effusions of the neighbouring mountains.

The Euripus, it is well known, is a strait of the Archipelago, which separates the ancient Beotia from the island of Eubœa, now Negropont. About the middle of this strait, where it is most narrow, the water is known to flow, sometimes to the
North,

North, sometimes to the South, ten, twelve, fourteen times a day, with the rapidity of a torrent. These multiplied, and, very frequently, unequal movements, cannot possibly be referred to the tides of the Ocean, which are scarcely perceptible in the Mediterranean. A Jesuit quoted by *Spon**, endeavours to reconcile these to the phases of the Moon; but supposing the table of them, which he produces, to be accurate, their regularity and irregularity will always remain a difficulty of no easy solution. He refutes *Seneca*, the Tragic Poet, who ascribes to the Euripus but seven fluxes, in the day time only :

Dùm lassâ Titan mergat Oceano juga.

Till Titan's tired feeds in th' Ocean plunge.

He adds farther, I know not after whom, that in the Sea of Persia the flux never takes place but in the night-time; and that under the Arctic Pole, on the contrary, it is perceptible twice in the day-time, without being ever observed in the night. It is not so, says he, with the Euripus.

I shall observe, by the way, that his remark with respect to the Pole, supposing it true, evinces that it's two diurnal fluxes are the effects of the

* Voyage to Greece and the Levant, by *Spon*, vol. ii. page 340.

Sun, who acts, only during the day, on the two icy extremities of the Continents of the New World, and of the Old. As to the Euripus, the variety, the number, and the rapidity of it's fluxes, prove that they have their origin, in like manner, in icy mountains, situated at different distances, and under different aspects of the Sun. For, according to that same Jesuit, the Island of Eubea, which is on one side of the strait, contains mountains covered with snow for six months of the year; and we know equally well, that Beotia, which is on the other side, contains several mountains of an equal elevation, and even some which are crowned with ice all the year round, such as Mount Oëta. If these fluxes and refluxes of the Euripus take place as frequently in Winter, which is not affirmed, the cause of them must be ascribed to the rains which fall, at that season of the year, on the summits of these lofty collateral mountains.

I shall enable the Reader to form an idea of these, not very apparent, causes of the movements of the Euripus, by here transcribing what *Spon* relates, in another place*, of the Lake of Livadia, or Copaide, which is in it's vicinity. This lake receives the first fluxes of the icy effusions of

* Voyage to Greece and the Levant, by *Spon*, vol. ii. pages 88 and 89.

the mountains of Beotia, and communicates them, undoubtedly, to the Euripus, through the mountain which separates them. "It receives," says he, "several small rivers, the Cephissus and others, "which water that beautiful plain, whose circumference is about fifteen leagues, and abounds "in corn and pasture. Besides, it was formerly "one of the most populous regions of Beotia. "But the water of this lake, sometimes, swells so "violently, by the rains and melted snows, that it "once inundated two hundred villages of the plain. "It would even be capable of producing a regular "annual inundation, if Nature, assisted, perhaps, by Art *, had not contrived for it an outlet,

* *Spon*, undoubtedly, did not consider what he was saying, when he suggested an idea of the possibility of Art assisting Nature in the construction of five subterranean canals, each ten miles long, through a solid rock. These subterranean canals are frequently met with in mountainous countries, of which I could produce a thousand instances. They contribute to the circulation of waters, which could not otherwise force a passage through extended chains of mountains. Nature pierces the rocks, and sends rivers through the apertures, just as she has pierced several of the bones of the human body, for the purpose of transmitting certain veins. I leave to the Reader the prosecution of this new idea. I have said enough to convince him, that this Globe is not the production of disorder or chance.

I shall conclude these observations, with a reflection respecting the two Travellers, whom I have been quoting: it may, perhaps, have a good moral effect. *Spon* was a Frenchman, and

“ let, by five great canals, under the adjacent
 “ mountain of the Euripus, between Negropont
 “ and Talanda, through which the water of the

George Wheeler English. They travelled in company over the Archipelago. The former brought home with him a great collection of Greek inscriptions and epitaphs; and the literati of the last age cried him up highly. The other has given us the names and characters of a great many very curious plants, which grow on the ruins of Greece, and which, in my opinion, convey a very affecting interest into his relations. He is little known among us.

According to the descriptive titles which each of these Gentlemen assumed, *Jacob Spon* was a Physician associate of Lyons, and an eager investigator of the monuments of men. *George Wheeler* was a Country Gentleman, and enthusiastically attached to those of Nature. Their tastes, to judge from situations, ought to have been reversed; and that the Gentleman should have been fond of monumental inscriptions, and the Physician of plants; but, as we shall have occasion to observe, in the sequel of these Studies, our passions spring out of contrarieties, and are, almost always, in opposition to our conditions. It was from an effect of this harmonic law of Nature, that, though these Travellers were, the one English, and the other French, they lived in the most perfect union. I remark, to their honour, that they quote each other in terms of the highest respect and approbation.

Ministers of State, would you form Societies which shall be cordially united among themselves, do not assort Academicians with Academicians, Soldiers with Soldiers, Merchants with Merchants, Monks with Monks, but associate Men of opposite conditions, and you will behold harmony pervade the association; provided, however, that you exclude the ambitious, which is, indeed, no easy task, ambition being one of the first vices which our mode of education instils.

“ lake

“ lake is gulped up, and throws itself into the Sea
 “ on the opposite side of the mountain. The
 “ Greeks call this place *Catabathra*: (the whirl-
 “ pools.) Strabo, speaking of this lake, says,
 “ nevertheless, that there appeared no outlet in his
 “ time, unless it be, that the Cephissus, sometimes,
 “ forced a passage under ground. But it is only
 “ necessary to read the account which he gives of
 “ the changes that take place in this morass, not
 “ to be surpris'd at what he has affirmed of it's
 “ outlets. Mr. *Wheeler*, who went to examine
 “ this spot after my departure from Greece, says
 “ it is one of the greatest curiosities in the coun-
 “ try, the mountain being near ten miles broad,
 “ and almost entirely one mass of solid rock.”

I have no doubt that several objections may be
 started against the hasty explanation which has
 been given of the course of the Tides, of the
 Earth's motion in the Ecliptic, and of the Univer-
 sal Deluge, by the effusions of the polar ices; but,
 I have the courage to repeat it, these physical
 causes present themselves with a higher degree of
 probability, of simplicity, and of conformity to the
 general progress of Nature, than the astronomical
 causes, so far beyond our reach, by which at-
 tempts have been made to explain them. It be-
 longs to the impartial Reader to decide. If he is
 on his guard against the novelty of systems, which
 are

are not yet supported by puffers, he ought to be no less so, against the antiquity of those which have many such supporters.

Let us now return to the form of the great basin of the Ocean. Two principal Currents cross it from East to West, and from North to South. The first, coming from the South Pole, puts in motion the Seas of India, and, directed along the eastern extent of the Old Continent, runs from East to West, and from West to East, in the course of the same year, forming, in the Indian Ocean, what are called the Monsoons. This we have already remarked ; but what has not been hitherto brought forward, though it well deserves to be so, is, that all the bays, creeks, and mediterraneans of southern Asia, such as the gulfs of Siam and Bengal, the Persian Gulf, the Red Sea, and a great many others, are directed, relatively to this Current, North and South, so as not to be stemmed by it.

The second Current, in like manner, issuing from the North Pole, gives an opposite movement to our Ocean, and, inclosed between the Continent of America and ours, proceeds from North to South, and returns from South to North in the same year, forming, like that of India, real Monsoons, though not so carefully observed by Navigators.

gators. All the bays and mediterraneans of Europe, as the Baltic, the Channel, the Bay of Biscay, the Mediterranean properly so called; and all those on the eastern coast of America, as the Bay of Baffin, Hudson's-Bay, the Gulf of Mexico, as well as many others which might be mentioned, are directed, relatively to this Current, East and West; or, to speak with more precision, the axes of all the openings of the Land in the Old and New Worlds, are perpendicular to the axes of these general Currents, so that their mouth only is crossed by them, and their depth is not exposed to the impulsions of the general movements of the Ocean.

It is because of the calmness of bays, that so many vessels run thither in quest of anchoring ground; and it is for this reason that Nature has placed, in their bottoms, the mouths of most rivers, as we before observed, that their waters might be discharged into the Ocean, without being driven furiously back by the direction of its Currents. She has employed similar precautions for the security of even the smallest streams which empty themselves into the Sea. There is not a single experienced seaman who does not know, that there is scarcely a creek but what has its little rivulet. But for the Wisdom apparent in these dispositions, the

the streams, destined to water the Earth, must frequently have deluged it.

Nature employs still other means for securing the course of rivers, and especially for protecting their discharges into the Sea. The chief of these are islands. Islands present, to the rivers, channels of different directions, that if the Winds, or the Currents of the Ocean, should block up one of their outlets, the waters might have a free passage through another. It may be remarked, that she has multiplied islands at the mouths of rivers the most exposed to this twofold inconveniency; such as, for example, at that of the Amazon, which is for ever attacked by the East wind, and situated on one of the most prominent parts of America. There they are so many in number, and form with each other channels of such different courses, that one outlet points North-east, and another South-east, and from the first to the last the distance is upward of a hundred leagues.

Fluviatic islands are not formed, as has been currently believed, of solid substances washed down by rivers, and aggregated: they are, on the contrary, for the most part, very much elevated above the level of these rivers, and many of them contain rivers and mountains of their own. Such
elevated

elevated islands are, besides, frequently found at the confluence of a smaller and a greater river. They serve to facilitate their communication, and to open a double passage to the current of the smaller river. As often then as you see islands in the channel of a great river, you may be assured there is some lateral inferior river, or rivulet, in the vicinity.

There are, in truth, many of these confluent rivulets which have been dried up by the ill-advised labours of men, but you will always find, opposite to the islands which divided their confluence, a correspondent valley, in which you may trace their ancient channel. There are, likewise, some of these islands in the midst of the course of rivers, in places exposed to the winds. I shall observe, by the way, that we recede very widely from the intentions of Nature, in re-uniting the islands of a river to the adjoining Continent; for its waters, in this case, flow in only one single channel, and when the winds happen to blow in opposition to the current, they can escape neither to the right nor to the left; they swell, they overflow, inundate the plains, carry away the bridges, and occasion most of the ravages which, in modern times, so frequently endamage our cities.

We

We do not, then, find bays or gulfs at the extremities of the Currents of the Ocean ; but, on the contrary, islands. At the extremity of the great eastern Current of the Indian Ocean is placed the Island of Madagascar, which protects Africa against it's violence. The islands of the Terra-del-Fuego defend, in like manner, the southern extremity of America, at the confluence of the eastern and western Currents of the South Seas. The numerous archipelagos of the Indian Ocean and South Sea are situated about the Line, where the two general Currents of the North and South Seas meet.

With Islands, too, it is that Nature protects the inlets of bays and mediterraneans. Great Britain and Ireland cover that of the Baltic ; the islands of Welcom and Good-fortune cover Hudson's-Bay ; the island of St. Laurence protects the entrance of the gulf which bears that name ; the chain of the Antilles, the gulf of Mexico ; the isles of Japan, the double gulf formed by the peninsula of Gorée with the country adjacent. All currents bear upon islands. Most of these are, for this reason, noted from their prodigious swells, and their gusts of wind : such are the Azores, the Bermudas, the island of Trifan, of Acunhab, &c. Not that they contain within themselves the
causes

causes of such phenomena, but from their being placed in the focuses of the revolutions of the Ocean, and even of the Atmosphere, for the purpose of weakening their effects. They are in positions nearly similar to those of Capes, which are all celebrated for the violent tempests which beat upon them : as Cape Finisterre, at the extremity of Europe ; the Cape of Good-Hope, at that of Africa ; and Cape Horn, at that of America. Hence comes the sea proverb to *double the Cape*, to express the surmounting of some great difficulty. The Ocean, accordingly, instead of bearing upon the retiring parts of the Continent, sets in upon those which are most prominent ; and it must speedily have destroyed these, had not Nature fortified them in a most wonderful manner.

The western coast of Africa is defended by a long bank of sand, on which the billows of the Atlantic Ocean are continually breaking. Brasil, in the whole extent of its shores, opposes to the winds, which blow continually from the East, and to the Currents of the Sea, a prodigious rampart of rocks, more than a thousand leagues long, twenty paces broad at the summit, and of an unknown thickness at the base. It is a musket-shot distant from the beach. It is entirely covered at high-water, and on the retreating of the tide, it exhibits the elevation of a peak. This enormous dike is
composed

composed of one solid mass lengthwise, as has been ascertained by repeated borings; and it would be impossible for a vessel to get into Brasil, were it not for the several inlets which Nature has formed*.

Go from South to North, and you find similar precautions employed. The coast of Norway is provided with a bulwark nearly resembling that of Brasil. *Pont Oppidan* tells us, that this coast, which is nearly three hundred leagues in length, is, for the most part, steep, angular, and pendant; so that the Sea, in many places, presents a depth of no less than three hundred fathoms close in-shore. This has not prevented Nature from protecting these coasts, by a multitude of isles, great and small. “By such a rampart,” says that Author, “consisting of, perhaps, a million, or more, of “massy stone pillars, founded in the very depth “of the Sea, the chapiters of which rise only a few “fathoms above the surface, all Norway is de- “fended to the West, equally against the enemy, “and against the Ocean.” There are, however, some coast-harbours behind this species of sea-bulwark, of a construction so wonderful. But as there is frequently great danger, adds he, of ships being driven ashore, before they can get into port,

* See History of the Troubles of Brasil, by *Peter Morcau*.

from the winds and currents which are very violent in the straits of these rocks and isles, and from the difficulty of anchoring in such a vast depth of water, Government has been at the expence of fastening several hundreds of strong iron rings in the rocks, more than two fathoms above water, by which vessels may be safely moored.

Nature has infinitely varied these means of protection, especially in the islands themselves which protect the Continent. She has, for example, surrounded the Isle of France with a bank of madrépores, which opens only at the places where the rivers of that island empty themselves into the Sea. Other islands, several of the Antilles in particular, were defended by forests of mangliers which grow in the sea-water, and break the violence of the waves, by yielding to their motion. To the destruction, perhaps, of these vegetable fortifications, we ought to ascribe the irruptions of the Sea, now so frequent in several islands, particularly that of Formosa. There are others which consist of pure rock, rising out of the bosom of the waves, like huge moles; such is the Maritimo, in the Mediterranean. Others are volcanic, as the Isle of Fuego, one of the Cape de Verd islands, and several others, of the same description, in the South Sea, rise like pyramids with fiery summits, and answer the purpose of light-houses to mariners, by

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their flame in the night time, and their smoke by day.

The Maldivia islands are defended against the Ocean, by precautions the most astonishing. In truth, they are more exposed than many others, being situated in the very midst of that great Current of the Indian Ocean, of which mention has been already made, and which passes and repasses them twice a year. They are, besides, so low, as hardly to rise above the level of the water; and they are so small, and so numerous, that they have been computed at twelve thousand, and several are so near each other, that it is possible to leap over the channel which divides them. Nature has first collected them into clusters, or archipelagos, separated from each other by deep channels which go from East to West, and which present various passages to the general Current of the Indian Ocean. These clusters are thirteen in number, and extend, in a row, from the eighth degree of northern to the fourth degree of southern Latitude, which gives them a length of three hundred of our leagues of 25 to a degree.

But let us permit the interesting and unfortunate *Francis Pyrard*, who there passed the flower of his days, in a state of slavery, to describe the architecture of them; for he has left us the best description

description which we have of these islands, as if it were necessary that, in every case, things the most worthy of the esteem of Mankind should be the fruit of some calamity. “It is wonderful,” says he, “to behold each of these clusters encompassed round and round with a great bulwark of stone, such as no human art can pretend to equal in securing a spot of ground within walls*. These clusters are all roundish, or oval, and are about thirty leagues each in circumference, some a very little more, others a very little less, and are all in a series, and end to end, without any contact whatever. There are, between every two, channels of the Sea, some broad, others very narrow. When you are in the centre of a cluster, you see, all around, that great bulwark of stone, which, as I have said, encompasses it, and defends the isles against the impetuosity of the Ocean. But it is truly frightful, even to the boldest, to approach this bulwark, and to behold the billows coming from afar, to burst with fury on every side: for then, I assure you, as a thing I have seen a thousand and a thousand times, the perturbation, or bubbling over, exceeds the size of a house, and is whiter than a fleece of cotton: so that you seem surrounded with a wall

* Voyage to the Maldivias, chap. x:

“ of brilliant whiteness, especially when Ocean is
“ in his majesty.”

Pyrrard farther observes, that most of the isles, inclosed in these subdivisions, are surrounded, each in particular, by a particular bank, which farther defends them against the Sea. But the Current of the Indian Ocean, which passes through the parallel channels of these clusters of islands, is so violent, that it would be impossible for Mankind to keep up a communication between one and another, had not Nature arranged all this in her own wonderful manner. She has divided each of these clusters by two particular channels, which intersect them diagonally, and whose extremities exactly terminate at the extremities of the great parallel channels which separate them. So that if you wish to pass from one of these archipelagos to another, when the current is easterly, you take your departure from that where you happen to be, by the diagonal canal of the East, where the water is calm, and committing yourself afterward to the current which passes through the parallel channel, you proceed, in a deflecting course, to land on the opposite cluster, into which you enter by the opening of its diagonal channel, which is to the West. The mode of proceeding is reversed, when the current changes six months afterwards. Through these

these interior communications the islanders, at all seasons, can make excursions from isle to isle, the whole length of the chain, from North to South, notwithstanding the violence of the currents which separate them.

Every isle has its proper fortification, proportioned, if I may say so, to the danger to which it is exposed from the billows of the Ocean. It is not necessary to suppose the water roused into a tempest, in order to form an idea of their fury. The simple action of the trade-winds, however uniform, is sufficient to give them, unremittingly, the most violent impulsion. Each of these billows, joining, to the constant velocity impressed upon it every instant by the wind, an acquired velocity, from its particular movement, would form, after running through a considerable space, an enormous mass of water, were not its course retarded by the currents which cross it, by the calms which slacken it, but, above all, by the banks, the shallows, and the islands which break it.

A very perceptible effect of this accelerated velocity of the waves is visible on the coasts of Chili and Peru, which undergo, however, only the simple concussion and repercussion of the waters of the South Sea. The shores are inaccessible through their whole extent, unless at the bottom

of some bay, or under the shelter of some island situated near the coast. All the islands of that vast Ocean, so peaceful as to have obtained the distinctive appellation of Pacific, are unapproachable on the side which is exposed to the Currents occasioned by the Trade-winds only, unless where shelves or rocks break the impetuosity of the billows. In that case, it is a spectacle at once magnificent and tremendous, to behold the vast fleeces of foam, which incessantly rise from the bosom of their dark and rugged windings; and to hear their hoarse roaring noise, especially in the night-time, carried by the winds to several leagues distance.

Islands, then, are not fragments separated by violence from the Continents. Their position in the Ocean, the manner in which they are there defended, and the length of their duration, constitute a complete demonstration of this. Considering how long the Sea has been battering them with its utmost fury, they must have been, by this time, reduced to a state of total ruin. Scylla and Caribdis, nevertheless, emit to this day their ancient roarings, so as to be heard at the extremities of Sicily.

This is not the proper place to indicate the means which Nature employs to preserve the islands, and to repair them; nor the other proofs
from

from the vegetable and animal kingdoms, and from Man, which evince that they have existed, such as we now see them, from the very origin of the Globe: it will be sufficient for me to give an idea of their construction, in order to produce perfect conviction in every candid mind, that they are in no one respect the work of chance. They contain, as Continents themselves do, mountains, peaks, rivers, and lakes, proportioned to their magnitude. For the purpose of demonstrating this new truth, I shall be still under the necessity of saying somewhat respecting the distribution of the Globe; but I shall not be long, and shall endeavour to introduce nothing but what is absolutely needful to make myself understood.

It is, first, to be remarked, that the chains of mountains in both Continents, are parallel to the Seas which wash their coasts: so that if you see the plan of one of these chains, with its different branches, you are able to determine the shore of the Sea which corresponds to them; for, as I have just said, the mountains and these are always parallel. You may, in like manner, on seeing the sinuosities of a shore, determine those of the chains of mountains which are in the interior of a country; for the gulfs of a Sea always correspond to the valleys of the mountains of the lateral Continent.

These correspondencies are perceptible in the two great chains of the Old, and of the New Worlds. The long chain of Taurus runs East and West, as does the Indian Ocean, the different gulfs of which it incloses by branches prolonged as far as to the extremities of most of their Capes. On the contrary, the chain of the Andes, in America, runs North and South, like the Atlantic Ocean. There is, besides, another thing worthy of remark, nay, I venture to say, of admiration, it is, that these chains of mountains are opposed to the regular winds which cross those Seas, and which convey the emanations from them; and that their elevation is proportioned to the distance at which they are placed from such shores: so that the farther they are removed from the Sea, the greater is their elevation into the Atmosphere.

For this reason it is, that the chain of the Andes is placed along the South Sea, where it receives the emanations of the Atlantic Ocean, wafted by the East wind over the vast Continent of America. The broader that Continent becomes, the greater is the elevation of that chain. Toward the isthmus of Panama, where the Continent has no great breadth, and, consequently, the distance from the Sea is small, the elevation of the mountains is inconsiderable: but they suddenly rise, precisely in proportion as the American Continent widens.

It's

It's highest mountains look over the broadest expansion of America, and are situated in the Latitude of Cape Saint Augustin.

The situation, and the elevation, of this chain were equally necessary to the fertility of this grand division of the New World. For, if this chain, instead of extending lengthwise, by the coast of the South Sea, had extended along the coasts of Brasil, it would have intercepted all the vapours conveyed over the Continent by the East wind; and if it were not elevated to a region of the Atmosphere, to which no vapour could ascend, because of the subtilty of the air, and of the intenseness of the cold, all the clouds borne by the East wind would be carried beyond it, into the South Sea. On either of these two suppositions, most of the rivers of South America would remain dry.

The same reasoning may be applied to the chain of Taurus. It presents to the Northern and Indian Oceans a double ridge, with opposite aspects, from which flow most of the rivers of the ancient Continent, some to the North, and others to the South. It's branches are disposed in like manner: they do not coast along the peninsulas of India, by their shores; but cross them through the middle at their full length; for the winds of these Seas do not blow always from one and the same quarter,

as

as the East wind in the Atlantic Ocean ; but six months in one direction, and six in another. It was proper, accordingly, to divide to them the land which they were intended to water.

It remains that I subjoin some farther observations respecting the configuration of these mountains, to confirm the use to which they are destined by Nature. They are crowned, from distance to distance, by long peaks similar to lofty pyramids. These peaks, as has been well observed, are of granite, at least most of them. I do not know the component parts of granite ; but I know well, that these peaks attract the vapours of the Atmosphere, and fix them around in such a quantity, that they themselves frequently disappear. This is a remark which I have made times without number, with respect to the peak of Piterboth, in the Isle of France, where I have seen the clouds driving before the South-east wind, turn aside perceptibly from their direction, and gather around it, so as sometimes to form a very thick cap, which rendered the summit totally invisible.

I had the curiosity to examine the nature of the rock of which it is composed. Instead of being formed of grains, it is full of small holes, like the other rocks of the island ; it melts in the fire, and when melted, you may perceive on it's surface
small

small grains of copper. It is impossible to doubt that it must be impregnated with that metal; and to the copper we must, perhaps, ascribe the virtue which it possesses of attracting the clouds. For it is known by experience, that this metal, as well as iron, has the property of attracting thunder. I do not know of what materials other peaks are composed; but it is very remarkable, that at the summit of the Andes, and on their ridges, are found the gold and silver mines of Chili and Peru, and that in general, all mines of iron and copper are found at the source of rivers, and in elevated situations, where they discover themselves by the fogs which surround them. Whatever may be in this, whether this attractive quality be common to granite, and to rocks of a different nature, or whether it depends on some metal which is amalgamated with them, I consider all the peaks in the world as real electric needles.

But it was not sufficient that clouds should collect and fix on the tops of mountains, the rivers which have their sources there, could have only an intermittent course. As soon as the rainy season was at an end, the rivers must have ceased to flow. Nature, in order to remedy this inconveniency, has contrived, in the vicinity of their peaks, lakes, which are real reservoirs, or cisterns, of water, to furnish a regular and constant supply to their expenditure.

penditure. Most of those lakes are of an incredible depth; they answer several other purposes, such as that of receiving the melted snows of the adjacent mountains, which would otherwise flow with too great rapidity. When they are once full, it requires a very considerable time to exhaust them. They exist, either internally or externally, at the source of all regular currents of water; but when they are external, they are proportioned, either by their extent, or by their depth and their discharges, to the size of the river which they are designed to emit, as well as the peaks which are in the vicinity. These correspondencies must have undoubtedly been known to Antiquity; for I think I have seen some very ancient medals, in which rivers were represented by figures leaning on an urn, and stretched along at the basis of a pyramid; which was probably designed to denote at once their source and their discharge.

If, then, we come to apply these general dispositions of Nature to the particular conformation of islands, we shall see that they have, like Continents, mountains with branches parallel to their bays; that these mountains are of an elevation corresponding to their distance from the Sea; and that they contain peaks, lakes, and rivers, proportional to the extent of their territory. Like Continents, too, they have their mountains disposed in
a suit-

a fuitablenefs to the winds which blow over the Seas whereby they are furrounded. Thofe which are in the Indian Ocean, as the Moluccas, have their mountains toward the centre; fo as to receive the alternate influence of the two atmospheric Monfoons. Thofe, on the contrary, which are under the regular influence of the Eaft winds, in the Atlantic Ocean, as the Antilles, have their mountains thrown to the extremity of the ifland which is under the wind, precisely as the Andes with refpect to South America. The part of the ifland that is toward the wind, is, in the Antilles, called *cabfterre*, as who fhould fay *caput terræ* (the head of the land); and that which is from the wind *baffèterre* (low land); though, for the moft part, fays Father *du Terre* *, this laft is higher, and more mountainous than the other.

The ifland of Juan Fernandez, which is in the South Sea, but very far beyond the Tropics, being in $33^{\circ} 40'$ of South Latitude, has it's northern part formed of rocks very lofty and very fteep, and it's South fide flat and low, to receive the influences of the South wind, which blows there almoft all the year round. The defcription of it is to be found in *Anfon's Voyage* round the World.

* Natural History of the Antilles, page 12.

The

The islands which deviate from these dispositions, and which are but few in number, have remote relations still more wonderful, and certainly well worthy of being studied. They furnish, besides, in their vegetable and animal productions, other proofs, that they are small Continents in miniature. But this is not the place to bring them forward. If they were, as is pretended, the remains of a great Continent swallowed up by the Ocean, they would have preserved part, at least, of their ancient and vast fabric. We should see arise immediately out of the middle of the Sea, lofty peaks, like those of the Andes, from twelve to fifteen hundred fathom high, without the mountains which support them. In other places, we should see these peaks supported by enormous mountains, proportioned to their magnitude, and which should contain in their cavities great lakes, like that of Geneva, with rivers issuing from them, such as the Rhône, and precipitating themselves at once into the Sea, without watering any land. There should be, at the bottom of their majestic protuberances, no plains, nor provinces, nor kingdoms. These grand ruins of the Continent, in the midst of the Ocean, would have some resemblance to those enormous pyramids reared in the sands of Egypt, which present to the eye of the traveller only so many frivolous and unmeaning structures; or to those vast royal palaces, which the hand of
time

time has demolished, of which you perceive turrets, columns, triumphal arches; but the habitable parts of which are entirely destroyed. The sage productions of Nature are not useless and transitory, like the works of Men. Every Island has it's champaign country, it's vallies, it's hills, it's hydraulick pyramids, and it's Naiads, in proportion to it's extent.

Some islands, it is true, but they are very few, contain mountains more elevated than the extent of their territory may seem to require. Such is that of Teneriff: it's peak is so high, as to be covered with ice a great part of the year. But that island contains mountains of no great elevation, which are proportioned to it's bays: that of the mountains which support the peak, swells up amidst the others in form of a dome, not unlike the dome of the Invalids rising above the adjacent buildings. I myself observed it with particular attention, and made a drawing of it, on my way to the Isle of France. The lower mountains are an appertenance to the island, and the peak to Africa.

This peak, covered with ice, is situated directly opposite to the entrance of the great sandy desert, called Zara, and contributes, undoubtedly, to refresh the shores and Atmosphere of it, by the effusion of it's snows, which takes place in the midst
of

of Summer. Nature has placed other glaciers besides, at the entrance of this burning desert, such as Mount Atlas. Mount Ida, in the Island of Crete, with it's collateral mountains, covered at all seasons with snow, is situated, according to the observation of *Tournefort*, precisely opposite to the burning desert of Barca, which coasts along Egypt from North to South. These observations will furnish a farther opportunity of making some reflections on the chains of icy mountains, and of the Zones of sand scattered over the Globe.

I ought to beg forgiveness of the Reader, for these digressions, into which I have been insensibly drawn ; but I will render them as short as I possibly can, though, by abridging them, their clearness is considerably diminished.

The icy mountains appear to be principally designed to convey coolness to the shores of the Seas situated between the Tropics ; and the Zones of sand, on the contrary, to accelerate, by their heat, the fusion of the polar ices. We can indicate, only in a cursory manner, these most wonderful harmonies ; but it is sufficient to peruse the journals of Navigators, and to study geographical charts, to be convinced, that the principal part of the Continent of Africa is situated in such a manner, that it is the wind of the North Pole which
blows

blows most constantly on it's coasts; and that the shore of South America projects, beyond the Line, so as to be cooled by the wind of the South Pole. The Trade-winds, which prevail in the Atlantic Ocean, always participate of the influence of both Poles; that which is on our side draws considerably toward the North; and that which is beyond the Line depends greatly on the South Pole. These two winds are not oriental, as has been erroneously imagined, but they blow nearly in the directions of the channel which separates America from Africa.

The warm winds of the torrid Zone blow, in their turn, the most constantly toward the Poles; and it is singularly remarkable, that as Nature has placed icy mountains in it's vicinity to cool it's Seas, conjointly with those of the Poles, as Taurus, Atlas, the Peak of Teneriff, Mount Ida, &c. she has, likewise, extended a long Zone of sand, in order to increase the heat of the South-wind on it's way to warm the Seas of the North. This Zone commences beyond Mount Atlas, and encompasses the Earth like a belt, extending from the most westerly point of Africa to the most easterly extremity of Asia, in a reduced distance of more than three thousand leagues. Some branches of it deviate from the general direction, and advance directly toward the North.

We have already remarked, that a region all sand is so hot, even in our Climates, from the multiplied reflection of it's brilliant particles, that we never find the snow covering it for any considerable time together, even in the middle of our severest Winters. Those who have crossed the sands of Estampes, in Summer, and in the heat of the day, know well to what a violent degree the heat is there reverberated. It is so ardent certain days in Summer, that, about twenty years ago, four or five paviors, who were at work on the great road leading to that City, between two banks of white sand, were suffocated by it. Hence it may be concluded, from facts so obvious, that but for the ices of the Pole, and of the mountains in the vicinity of the torrid Zone, a very considerable portion of Africa and Asia would be absolutely uninhabitable, and that but for the sands of Africa and Asia, the ices of our Pole would never melt.

Every icy mountain, too, has, like the Poles, it's sandy girdle, which accelerates the fusion of it's snows. This we have occasion to remark, in the description of all mountains of this species, as of the Peak of Teneriff, of Mount Ararat, of the Cordeliers, &c. These Zones of sand surround not only their bases, but there are some of them on the higher regions of the mountains, up to the
very

very peaks ; it frequently requires several hours walking to get across them.

The sandy belts have a still farther use, that of contributing to the repair of the waste, which the territory of the mountain, from time to time, undergoes : perpetual clouds of dust issue from them, which rise, in the first instance, on the shores of the Sea, where the Ocean forms the first deposits of these sands, which are there reduced to an impalpable powder by the incessant dashing of the waves upon them ; we afterwards find these clouds of dust in the vicinity of lofty mountains. The conveyance of the sands is made from the shores of the Sea into the interior of the Continent, at different seasons, and in various manners. The most considerable happens at the Equinoxes, for then the Winds blow from the Sea into the Land. See what *Corneille le Bruyn* says of a sandy tempest, in which he was caught, on the shore of the Caspian Sea. These periodical conveyances of the sand form a part of the general revolution of the Seasons. But as to the interior of different countries, partial transits take place every day, which are very perceptible toward the more elevated regions of the Continents.

All travellers who have been at Peking, are agreed, that it is not possible to go abroad, during

a part of the year, into the streets of that City, without having the face covered with a veil, on account of the sand with which the air is loaded.

When *Isbrand-Ides* arrived on the frontiers of China, at the extremity of the outlet of the mountains in the neighbourhood of *Xaixigar*, that is, at that part of the crest of the Asiatic Continent, which is the most elevated, from which the rivers begin their courses, some to the North, others to the South, he observed a regular period of these emanations. “Every day,” says he *, “at noon
 “regularly, there blows a strong gust of wind,
 “for two hours together, which, joined to the
 “sultry heat of the Sun by day, parches the ground
 “to such a degree, that it raises a dust almost in-
 “supportable. I had observed this change in the
 “air some time before. About five miles above
 “*Xaixigar*, I had perceived the Heavens cloudy,
 “over the whole extent of the mountains; and
 “when I was on the point of leaving them, I saw
 “perfect serenity. I even remarked at the place
 “where they terminate, an arch of clouds, which
 “swepted from West to East, as far as the moun-
 “tains of *Albafé*, and which seemed to form a se-
 “paration of climate.” Mountains, accordingly, possess, at once, nebulous and fossil attractions.

* Journey from Moscow to China, chap. xi.

The first furnish water to the sources of the rivers which issue from them, and the second supply them with sand, for keeping up their territory and their minerals.

The icy and sandy Zones are found, in a different harmony, on the Continent of the New World. They run, like it's Seas, from North to South, whereas those of the Old Continent are directed, conformably to the lengthwise direction of the Indian Ocean, from West to East.

It is very remarkable, that the influence of icy mountains extends farther over the Ocean than over the Land. We have seen those of the two Poles take the direction of the channel of the Atlantic Ocean. The snows which cover the long chain of the Andes, in America, serve, in like manner, to cool the whole of the South Sea, by the action of the East-wind which passes over it; but as part of that Sea, and of it's shores, which is sheltered from this wind, by the very height of the Andes, would have been exposed to an excessive heat, Nature has formed an elbow westward, at the most southerly part of America, which is covered with icy mountains, so that the fresh breezes, which perpetually issue from them, may graze along the shores of Chili and Peru. These breezes, denominated the southerly, prevail there all the

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year

year round, if we may believe the testimony of every Navigator. They do not, in truth, come from the South-Pole; for if it were so, no vessel could ever double Cape Horn; but they come from the extremity of Magellan's Land, which is evidently bent backward, with relation to the shores of the South Sea.

The ices of the Poles, then, renovate the waters of the Sea, as the ices of mountains renovate those of the great rivers. These effusions of the polar ices press toward the Line, from the action of the Sun, who is incessantly pumping up the waters of the Sea, in the torrid Zone, and determines, by this diminution of bulk, the waters of the Poles to rush thitherward. This is the first cause of the motion of the South Seas, as has been already observed. It would appear highly probable, that the polar effusions are proportioned to the evaporations of the Ocean. But without losing sight of the leading object of our enquiry, we shall examine for what reason Nature has taken still greater care to cool the Seas, than the Land, of the torrid Zone: for it merits attention, that not only the polar Winds which blow there, but most of the rivers which empty themselves into the South Seas, have their sources in icy mountains, such as the Zara, the Amazon, the Oroonoko, &c.

The

The Sea was destined to receive, by means of the rivers, all the spoils of vegetable and animal productions over the whole Earth; and as it's course is determined toward the Line, by the daily diminution of it's waters, which the Sun is there continually evaporating, it's shores, within the torrid Zone, would have been quickly liable to putrefaction, had not Nature employed these different methods to keep them cool. It is for this reason, as certain Philosophers allege, that the Sea is salt between the Tropics. But it is likewise so to the North; nay, more so, if we may rely on the recent experiments of the interesting *M. de Pages*. It is the saltest, and the heaviest, in the World, according to the testimony of an English Navigator, Captain *Wood*, in 1676.

Besides, the saltness of the Sea does not preserve it's waters from corruption, as is vulgarly believed. All who have been at Sea know well, that if a bottle, or a cask, is filled, in hot climates, with sea-water, it soon becomes putrid. Sea-water is not a pickle; it is, on the contrary, a real lixivial, which very quickly dissolves dead bodies. Though salt to the taste, it takes out salt sooner than fresh water, as our common sailors know, from daily experience, who employ no other, in freshening their salt provisions. It blanches, on the shore, the bones of all animals, as well as the *madrépores*,

which, when in a state of life, are brown, red, and of various other colours, but which, being rooted up, and put into sea-water, on the brink of the shore, in a little time become white as snow. Nay more, if you fish in the sea for a crab, or a sea-urchin, and have them dried, to preserve them, unless you first wash them in fresh water, all the claws of the crab, and all the prickles of the urchin, will fall off. The joints by which the limbs are attached, dissolve in proportion as the sea-water, with which they were moistened, evaporates. I myself have made this experiment to my cost. The water of the Sea is impregnated not only with salt, but with bitumen, and other substances besides, which we do not know; but salt is in it, in such a proportion, as to assist the dissolution of cadaverous bodies floating in it, as that which we mingle with our food assists digestion. Had Nature made it a pickle, the Ocean would be covered with all the impurities of the Earth, which would thus be kept in a state of perpetual preservation.

These observations will indicate to us the use of volcanos. They do not proceed from the internal fires of the Earth, but they derive their origin, and the materials which keep them up, from the waters. In order to be convinced of this, you have only to remark, that there is not a single volcano

cano in the interior of Continents, unless it be in the vicinity of some great lake, such as that of Mexico. They are situated, for the most part, in islands, at the extremity, or at the confluence of the Currents of the Sea, and in the counter-tide of their waters. This is the reason why we find them in such numbers toward the Line, and along the shore of the South Sea, where the South-wind, which perpetually blows there, brings back all the substances swimming about in a state of dissolution.

Another proof that they owe their support to the Sea is this, that, in their eruptions, they frequently vomit out torrents of salt water. *Newton* ascribed their origin, and their duration, to caverns of sulphur, inclosed in the bowels of the Earth. But that great man had not reflected on the position of volcanos in the vicinity of water, nor calculated the prodigious quantity of sulphur, which the magnitude, and the duration, of their fires must have required. Vesuvius alone, which burns night and day, from time immemorial, would have consumed a mass of it larger than the whole kingdom of Naples. Besides, Nature does nothing in vain. What purpose could be answered by such magazines of sulphur in the interior of the Earth? We should find them completely entire in places, where they are not consumed by the fire. Mines
of

of sulphur are no where found but in the vicinity of volcanos. What, besides, could renovate them when exhausted? A supply so constant, for keeping up volcanos, is not in the Earth, but in the Sea. It is furnished by the oils, the bitumens, and the nitres of vegetables and animals, which the rains and the rivers convey off from every quarter into the Ocean, where the dissolution of all bodies is completed by its lixivial water. To these are joined metallic dissolutions, and especially those of iron, which, as is well known, abounds all over the earth. Volcanos take fire, and feed themselves with all these substances.

Lemery, the Chymist, has imitated their effects, by a composition consisting of filings of iron, sulphur, and nitre, moistened with water, which caught fire of itself. If Nature had not kindled these vast furnaces on the shores of the Ocean, it's waters would be covered with vegetable and animal oils, which could never evaporate, for they resist the action of the air. You may have frequently observed them, when stagnated in some undisturbed basin, from their colour resembling the pigeon's neck. Nature purifies the waters by the fire of volcanos, as she purifies the air by those of thunder; and as storms are more common in hot countries, she has in these, likewise, multiplied volcanos, and for the same reason. She burns on the
shores

shores the impurities of the Sea, as a Gardener burns, at the end of Autumn, the refuse of his garden.

We find lavas, indeed, in the interior of countries; but a proof that they are indebted to the water for their original is this, that the volcanos which produced them, became extinct whenever the waters failed them. These volcanos were kindled, like those which still subsist, by vegetable and animal fermentations, with which the Earth was covered after the Deluge, when the spoils of so many forests, and of so many animals, whose trunks and bones are still found in our quarries, floated on the surface of the Ocean, and formed prodigious deposits, which the currents accumulated in the cavities of the mountains. It cannot be doubted, that, in this state, they caught fire by the effect of fermentation merely, just as we see stacks of damp hay catch fire in our meadows. It is impossible to call in question these ancient conflagrations, the traditions of which are preserved in Antiquity, and which immediately follow those of the Deluge. In the ancient Mythology, the history of the serpent Python, produced by the corruption of the waters, and that of Phaëton, who set the world on fire, immediately follow the history of Philemon and Baucis *, escaped from

* The Author, undoubtedly, means Deucalion and Pyrrha.

waters of the Deluge, and are allegories of the pestilence, and of the volcanos, which were the first results of the general dissolution of animals and vegetables.

All that now remains is, to refute the opinion of those who maintain, that the Earth is a secretion from the Sun. The chief arguments by which they support it are it's volcanos, it's granites, the vitrified stones scattered over it's surface, and it's progressive refrigeration from year to year. I respect the celebrated Author who has advanced this opinion, but I venture to affirm, that the grandeur of the images which this idea presented to him, has seduced his imagination.

We have said enough respecting volcanos, to demonstrate that they do not proceed from the interior of the Earth. As to granites, they do not present, in the aggregation of their grains, the remotest vestige of the action of fire. I do not know their origin ; but certainly there is no foundation for referring it to that element, because it cannot be ascribed to the action of water, and because shells are not found in them. As this assertion is destitute of all proof, it is unnecessary to undertake a refutation of it. I shall observe, however, that granites do not appear to be the production of fire, on a comparison with the lavas of volcanos ;

nos; the difference of their substances supposes different causes in their formation.

Agates, flints, and every species of the flint, seem to be analogous to vitrifications, from their half-transparency, and from their being usually found in beds of marl, which resemble banks of lime extinguished; but these substances are not the productions of fire, for lavas never present any thing similar. I have picked up, on the flinty hills of lower Normandy, oyster-shells perfectly complete, amalgamated with black flints, which they call *bifets*. Had these bifets been vitrified by fire, they would have calcined, or, at least, altered the oyster-shells which adhered to them; but these were as found as if just taken out of the water. The shelving sea-coast along the district of Caux, are formed of alternate strata of marl and bifets, so that, as they are cut perpendicularly, you would call it a great wall, of which the layers had been regulated by an Architect; and with so much the greater appearance of probability, that the people of the country build their houses of the same materials, disposed in the self-same order.

These banks of marl are from one to two feet broad, and the rows of flints which separate them, are three or four inches thick. I have reckoned seventy or eighty of such horizontal strata from
the

the level of the Sea up to that of the Land. The thickest are undermost, and the smaller a-top, which, from the sea-mark, makes the aggregate appear higher than it really is ; as if Nature intended to employ a certain degree of perspective to increase the apparent elevation : but, undoubtedly, she has been determined to adopt this arrangement from reasons of solidity, which are perceptible in all her Works. Now, these banks of marl and flint are filled with shells, which have undergone no alteration from the force of fire, and which would be in perfect preservation, had not the pressure of that enormous mass broken in pieces the largest of them. I have seen fragments extracted of that which is called the *tuilée*, which is found alive only in the Indian Ocean, and the broken pieces of which, when put together, formed a shell much more considerable than those of the same species which are used for holding the holy water, in the church of Saint-Sulpice, at Paris.

I have, likewise, remarked there a bed of flints completely amalgamated, and forming a single table, the section of which was perceptibly about one inch thick by more than thirty feet in length. Its depth in the cliff I did not ascertain ; but, with a little art, it might be detached, and fashioned into the most superb agate table in the world. Wherever these marls and flints are found,
shells

shells are likewise found in great quantities, so that as marl has been evidently formed of their wreck, it appears to me extremely probable, that the flints have been composed of the very substance of the fishes which were there inclosed.

This opinion will appear less extraordinary, if we observe that many of the *cornes d'amon*, and of single-shelled fossils, which, from their form, have resisted the pressure of the ground, and not being compressed by it, have not ejected, like the double-shelled, the animal matter which they contained, but exhibit it within them, under the form of crystals, with which they are usually filled, whereas the two-shelled are totally destitute of it.

The animal substances of these last, I presume, confounded with their crushed fragments, have formed the different coloured pastes of marble, and have communicated to them the hardness and polish of which these marbles are susceptible. This substance presents itself, even in shell-fish when alive, with the characters of agate, as may be seen in several kinds of mother-of-pearl, and among others, in the half transparent, and very hard knob, which terminates what is called the *barp*. Finally, this stony substance is found, besides, in land animals; for I have seen, in Silesia, the eggs of a species of the woodcock, which are highly prized in
that

that country, not only because they are a great delicacy for the table, but because the white, when dried, becomes hard as a flint, and susceptible of a polish so beautiful, that they are cut and set as rings and other trinkets.

I could easily swell this article, by demonstrating the geometrical impossibility that our Globe should have been detached from that of the Sun, by the transit of a Comet, because it must have, on the very hypothesis of this impulsion, been hurried along in the Sphere of the Comet's attraction, or carried back into that of the Sun. It has, in truth, remained in the sphere of the Sun's attraction; but it is not easy to conceive how it never came to approach nearer, and how it comes to maintain the distance of nearly thirty-two millions of leagues, while no Comet prevents it's returning to the place from which it set out. The Sun, it is said, has a centrifugal force. The Globe of the Earth, therefore, must be retiring from it. No, it is alleged, because the Earth has a constant tendency toward that Luminary. It must, accordingly have lost the centrifugal force, which should adhere to it's very nature, as being a portion of the Sun.

I could go on to swell the article, by farther demonstrating the physical impossibility, that the Earth should contain in it's bowels so many heterogeneous

rogeous substances, on the supposition of it's being a separation from a body so homogeneous as the Sun; and I could make it appear, that it is impossible they should be, in any respect, considered as the wreck of solar and vitrified substances (if it be possible for us to have an idea of the substances from which light issues), seeing some of our terrestrial Elements, such as Water and Fire, are absolutely incompatible. But I shall confine myself to the refrigeration ascribed to the Earth, because the evidence on which this opinion rests, is level to the comprehension of all men, and is of importance to their security.

If the Earth is getting colder and colder, the Sun, from which it is said to have been separated, must be getting cold in proportion; and the mutual diminution of the heat in these two Globes, must become perceptible in a course of ages, at least on the surface of the Earth, in the evaporations of the Seas, in the diminution of rains, and especially in the successive destruction of a great number of plants, which are killed every day, merely from the diminution of only a few degrees of heat, when the Climate is changed upon them. Not a single plant, however, has been lost of all those which were known to Circé, the most ancient of Botanists, whose Herbal Homer has, in some measure, preserved for us. The plants cele-

brated in song by Orpheus, and their virtues, subsist to this day. There is not even a single one which has lost any thing of its ancient attitude. The jealous Clytia still turns toward the Sun; and the beautiful son of Liriope, Narcissus, continues to admire himself on the brink of the fountain.

Such are the testimonies adduced from the vegetable kingdom, respecting the uniformity and constancy of the temperature of the Globe; let us examine those of the Human Race. There are some of the inhabitants of Switzerland, it is alleged, who have perceived a progressive accumulation of the ices on their mountains. I could oppose to this evidence, that of other modern Observers, who, in the view of ingratiating themselves with the Princes of the North, pretend, with as little foundation, that the cold is diminishing there, because these Princes have thought proper to cut down the forests of their States; but I shall adhere to the testimony of the Ancients, who could not possibly intend to flatter any one on a subject of this nature.

If the refrigeration of the Earth is perceptible in the life of one man, it must be much more so in the life of Mankind; now, all the temperatures described by the most ancient Historians, as that of Germany by Tacitus, of Gaul by Cæsar, of Greece

Greece by Plutarch, of Thrace by Xenophon, are precisely the same at this day, as they were at the time when these several Historians wrote. The Book of Job the Arabian, which, there is reason to believe, is more ancient than the Writings of Moses, and which contains views of Nature much more profound than is generally imagined, views, the most common whereof were unknown to us two centuries ago, makes frequent mention of the falling of the snows in that country, that is, toward the thirtieth degree of North Latitude. Mount Lebanon, from the remotest antiquity, bears the Arabian name of *Liban*, which signifies white, on account of the snows with which its summit is covered all the year round. Homer relates that it snowed in Ithaca when Ulysses arrived there, which obliged him to borrow a cloak of the good Eumeus.

If, during a period of three thousand years, and more, the cold had gone on increasing from year to year, in all these Climates, their Winters must now have been as long and as severe, as in Greenland. But Lebanon, and the lofty provinces of Asia, have preserved the same temperature. The little Isle of Ithaca is still covered in Winter with the hoar frost; and it produces, as in the days of Telemachus, the laurel and the olive.

STUDY FIFTH.

REPLY TO THE OBJECTIONS AGAINST PROVIDENCE,
FOUNDED ON THE DISORDERS OF THE
VEGETABLE KINGDOM.

THE Earth is, say the Objectors, a garden very injudiciously laid out. Men of wit, who never travelled, have amused themselves with painting it, proceeding from the hand of Nature, as if the giants had been a fighting in it. They represent it's rivers flowing at random; it's morasses as vast collections of mud; the trees of it's forests turned upside down; it's plains buried under rocks, or overspread with briars and thorns; all it's high ways rendered unpassable; all it's culture the puny efforts of human genius. Such representations, though picturesque, have, I acknowledge, sometimes afflicted me, because they inspired me with distrust of the AUTHOR of Nature. To no purpose could it be supposed that, in other respects, He had loaded Man with benefits; one of

our first and most pressing necessities had been overlooked, if He had neglected to care for our habitation.

The inundations of rivers, such as those of the Amazon, of the Oronoko, and a great many others, are periodical. They manure the lands which they inundate. It is well known, besides, that the banks of these rivers swarmed with populous nations, before any European had formed a settlement there. The inhabitants derived much benefit from these inundations, partly from the abundance of the fisheries, partly from the fertility communicated to the lands. So far from considering them as convulsions of Nature, they received them as blessings from Heaven, just as the Egyptians prized the overflowings of the Nile. Was it, then, a mortifying spectacle to them, to see their deep forests intersected with long alleys of water, which they could without trouble traverse, in all directions, in their canoes, and pick the fruits at their ease? Nay, certain tribes, such as those of the Oronoko, determined by these accommodations, had acquired the singular habit of dwelling on the tops of trees, and of seeking under their foliage, like the birds, an habitation, and food, and a fortress. Whatever may be in this, most of them inhabited only the banks of the rivers, and
preferred

preferred them to the vast deserts with which they are surrounded, though not exposed to inundations.

We see order only where we can see corn grow. The habit which we have acquired of confining the channels of our rivers within dikes and mounds, of gravelling, and paving our high roads, of applying the straight line to the alleys in our gardens, and to our basins of water, of squaring our parterres, nay, our very trees, accustoms us insensibly to consider every thing which deviates from our rectangles, as abandoned to confusion. But it is in places with which we have been tampering, that we frequently see real disorder. We set fountains a playing on the tops of mountains; we plant poplars and limes upon rocks; we throw our vineyards into valleys, and raise our meadows to the declivities of hills.

Let these laborious exertions be relaxed ever so little, and all these petty levellings will presently be confounded under the general levelling of Continents, and all this culture, the work of Man, disappears before that of Nature. Our sheets of water degenerate into marshes; our hedge-row elms burst into luxuriance; every bower is choked, every avenue closes: the vegetables natural to each soil declare war against the strangers; the

starry thistle and vigorous verbascum, stifle under their broad leaves the English short grassy sod; thick crops of rye-grass and trefoil gather round the trees of Palestine; the bramble scrambles along their stem, with its prickly claws, as if mounting a breach; tufts of nettles take possession of the urn of the Naiads, and forests of reeds, of the forges of Vulcan; greenish scales of minium corrode the faces of our Venuses, without paying any respect to their beauty. The trees themselves lay siege to the castle; the wild cherry, the elm, the maple, mount upon its ridges, plunge their long pivots into its lofty pediments, and, at length, obtain the victory over its haughty cupolas. The ruins of a park no less merit the reflections of the Sage, than those of an empire: they equally demonstrate how inefficient the power of Man is, when struggling against that of Nature.

I have not had the felicity, like the primitive Navigators, who discovered uninhabited islands, to contemplate the face of the ground as it came from the hand of the CREATOR; but I have seen portions of it which had undergone alterations sufficiently small to satisfy me, that nothing could then equal their virgin beauties. They had produced an influence on the first relations which were formed by them, and had diffused over these a freshness, a colouring, a native grace inexpressible,

sible, which will ever distinguish them to advantage, notwithstanding their simplicity, from the learned descriptions which have been given of them in modern times.

To the influence of these first aspects, I ascribe the superior talents of the earliest Writers who have painted Nature, and the sublime enthusiasm which a Homer and an Orpheus have transfused into their poetry. Among the Moderns, the Historian of *Anson's* expedition, *Cook*, *Banks*, *Solander*, and some others, have described several of these natural sites, in the islands of Tinian, Maffo, Juan Fernandez, and Taiti, which have delighted all persons of real taste, though these islands had been, in part, degraded by the Indians and Spaniards.

I have seen only countries frequented by Europeans, and desolated by war, or by slavery : but I shall ever recollect with pleasure two of these sites, the one on this side the Tropic of Capricorn ; the other beyond the sixtieth degree of North Latitude. Notwithstanding my inability, I am going to attempt a sketch of these, in order to convey, as well I can, an idea of the manner in which Nature disposes her plans in Climates so very opposite.

The first was a part, then uninhabited, of the Isle of France, of fourteen leagues extent, which
appeared

appeared to me the most beautiful portion of it, though the black free-booters, who take refuge there, had cut down, on the sea-shore, the lataniers with which they fabricate their huts, and on the mountains, the palmettos, whose tips they use as food, and the liannes, of which they make fishing-nets. They likewise degrade the banks of the rivulets, by digging out the bulbous roots of the nymphæa, on which they live, and even those of the Sea, of which they eat, without exception, every species of the shelly tribes, and which they leave here and there on the shore, in great piles burnt up. Notwithstanding these disorders, that part of the island had preserved traces of its ancient beauty. It is perpetually exposed to the South-east wind, which prevents the forests that cover it from extending quite down to the brink of the Sea; but a broad selvage of turf, of a beautiful sea-green, which surrounds it, facilitates the communication all around, and harmonizes, on the one side, with the verdure of the woods, and, on the other, with the azure of the billows.

The view is thus divided into two aspects, the one presenting land, the other water. The land-prospect presents hills flying behind each other, in the form of an amphitheatre, and whose contours, covered with trees in pyramids, exhibit a majestic profile on the vault of Heaven. Over these forests
rises,

rises, as it were, a second forest of palmettos, which balance, above the solitary valleys, their long columns, crowned with parti-coloured plumes of palms, and surmounted with a spiral peak. The mountains of the interior present, at a distance, oval-shaped rocks, clothed with great trees, and pendent liannes, floating, like drapery, by every breath of the wind. Above these rise lofty pinnacles, round which are continually collected the rainy clouds; and when these are illuminated by the rays of the Sun, you see the colours of the rainbow painted on their peaks, and the rain-water flowing over their dusky sides in brilliant sheets of crystal, or in long fillets of silver. No obstacle prevents your perambulating the borders which embellish their sides and their bases, for the rivulets which descend from the mountains, present, along their banks, slips of sand, or broad plates of rock, from which they have washed the earth clean away. Besides, they clear away a free passage from their source, to the place of their discharge, by undermining the trees which would grow in their channel, and by fertilizing those which do grow on their margin; and they expand over these, through their whole course, great arches of verdure which fly off in perspective, and which are visible from the shore of the Sea. The liannes interweave themselves along the circumference of these

these arches, secure their arcades against the winds, and decorate them most beautifully, by opposing to their foliage other foliages, and to their verdure garlands of glossy flowers, or pods of various colours. If a tree, wasted by age, happens to fall down, Nature, which universally hastens on the destruction of all useless beings, covers it's trunk with maiden-hair of the most beautiful green, and agarics undulated with yellow, saffron, and purple, which feed on it's spoils.

Toward the sea side, the turf which borders the island, is up and down sowed with thickets of latanier, whose palms, formed into a fan, and attached to pliant membranes, radiate in the air, like so many verdant fans. These lataniers advance even into the Sea, on the capes of the island, with the land fowls which inhabit them; while the small bays, swarming with multitudes of sea-fowl which swim in the water, and which are paved, if I may be allowed the expression, with madrépores of the colour of the peach-blossom; the black rocks covered with rose-coloured nerits, and shells of every kind, penetrate into the island, and reflect, like so many mirrors, all the objects of the Land and of the Heavens. You would imagine that you saw the birds flying in the water, and the fishes swimming among the trees, and you would
be

be tempted to say, Here is the marriage of *Terra* and *Oceanus*, who thus blend and confound their domains.

In the greatest part even of uninhabited islands, lying between the Tropics, when the discovery of them was made, the banks of sand which surround them were found to be filled with turtle, which came thither to lay their eggs, and with the scarlet flamingos, which, as they sit on their nests, resemble burning torches. They had, besides, a border of mangliers, covered with oysters, which opposed their floating foliage to the violence of the waves, and of cocoa-trees loaded with fruit, which advancing into the very sea, along the breakers, presented, to the mariner's eye, the aspect of a city with its ramparts and its avenues, and announced to them from afar the asylum prepared for them by the God of the Seas. These different kinds of beauty must have been common to the Isle of France, with many other islands, and were, in all probability, destroyed by the craving necessities of the first mariners who landed upon them. Such is the very imperfect representation of a country, the Climate of which, according to ancient Philosophers, was uninhabitable, and the soil of which modern Philosophers consider as a scum of the Ocean, or of volcanos.

The

The second rural scenery, which I surveyed with rapture, and of which I am going to attempt a description, was in Ruffian Finland, when I was employed, in 1764, on a vifitation of it's fortreffes with the Generals of the corps of Engineers, in which I then served. We were travelling between Sweden and Ruffia, through a country fo little frequented, that the firs had encroached on the great line of demarkation which feparates the boundaries of the two countries. It was impoffible to get through in a carriage, and we were under the neceffity of employing the country people to cut down the trees, that our equipages might follow us. We were able, however, to penetrate, in every direction, on foot, and frequently on horfeback, though we were obliged to inspect the windings, the fummits, and the fmalleft receffes of a great number of rocks, in order to ascertain their natural capability of defence, and though Finland is fo covered with thefe, that ancient Geographers have given it the furname of *Lapidofa* (ftony.)

Not only are thofe rocks fcattered about in great blocks, over the furface of the earth, but the vallies, and entire hills, are there, in many places, formed of a fingle mafs of folid rock. This rock is a foft granite which exfoliates, and whose fcurf fertilizes the plants, at the fame time that the enormous

enormous mass shelters them from the North-wind, and reflects on them the rays of the Sun, by their curves, and the particles of mica with which it is filled. The bottoms of these vallies were skirted with long borders of meadow, which every where facilitate the communication. At the places where they were pure rock, as in their original state, they were covered with a plant, called, by the natives, *Kloukva*, which thrives on the rock. It comes out of the clefts, and seldom rises higher than a foot and a half; but it spreads in all directions, and extends far and wide. Its leaves and verdure resemble those of the box, and its boughs are loaded with a red berry, good to eat, resembling the strawberry.

The fir, the birch, and the service-tree vegetated wonderfully well on the sides of those hills, though, in many places, they found scarcely earth sufficient in which to insert their roots. The summits of most of them were rounded in form of a scull-cap, and rendered quite glistening by the water which oozed across the long crevices that furrowed them. Many of these scull-caps were perfectly bare, and so slippery, that it was difficult to walk over them. They were crowned, round and round, with a broad belt of moss of an emerald green, out of which started here and there an
infinite

infinite multitude of mushrooms of every form, and of every colour. Some of them were shaped like large scarlet-coloured tweezer-cases, studded with dots of white; others were orange-coloured and formed like a parasol; others yellow as saffron, and of the oblong form of an egg. Some were of the purest white, and so well rounded, that you would have taken them for ivory draughts-men.

These mosses and mushrooms spread along the threads of water which flowed from the summits of the rocky hills, extended in long rays across the woods with which their sides were covered, and proceeded to skirt their extremities, till they were confounded with a multitude of strawberry and raspberry plants. Nature, to indemnify this country for the scarcity of apparent flowers to please the eye, of which it produces but few, has bestowed their perfumes on several plants, such as the *calamus aromaticus*, the birch which, in Spring, exhales a kind of odour of roses, and the fir, the apple of which is sweet-scented. She has, in like manner, diffused colours the most agreeable, and the most brilliant, of flowers, on the most common of vegetables, such as on the cones of the larch, which are of a beautiful violet, on the scarlet grains of the forb-apple, on mosses and mushrooms, and even on turnip-radishes.

On

On the subject of this last vegetable, hear what the accurate *Corneille le Bruyn* says, in his Voyage to Archangel *: “ During our residence among
 “ them (the Samoiédes), they brought us several
 “ sorts of turnips, of various colours, and ex-
 “ tremely beautiful. Some of them were violet-
 “ coloured, like our plumbs, gray, white, yel-
 “ lowish, all of them streaked with red, like ver-
 “ million, or the finest laca, and as grateful to the
 “ eye as a pink. I painted some of them on paper
 “ in water-colours, and sent some to Holland, in
 “ a box filled with dry sand, to one of my friends,
 “ who is fond of such curiosities. I carried those
 “ which I had painted to Archangel, where no one
 “ would believe they were copied after Nature,
 “ till I produced the turnips themselves: a proof
 “ that no great attention is paid there, to the
 “ rarest and most curious productions of Nature.”

I take these turnips to be of the radish sort, the bulb of which grows above ground. At least I presume so, from the drawing itself of *Corneille le Bruyn*, and from having seen such in Finland; they are in taste superior to that of our colewort, and have a flavour similar to the artichoke bottom. I have produced these testimonies of a Painter, and that Painter a Dutchman, respecting the beauty of

* Vol. iii. page 21.

these coloured vegetables, to correct the prejudice with which so many are hurried away, that in the Indies only the Sun gives a magnificent colouring to plants. But nothing, in my opinion, equals the beautiful green of the plants of the North, in Spring. I have frequently admired, in particular, that of the birch, of the turf, and of the mosses, some of which are glazed with violet and purple. The solemn firs themselves, then burst into festoons of the most delicate green; and when they come to throw, from the extremity of their branches, the yellow tufts of stamina, they appear like vast pyramids, loaded all over with little lamps.

We encountered no obstacle in traversing their forests. Sometimes there lay in the way an aged birch, laid low by the hand of Time, and internally consumed by the worm; but in stepping on the rind, it supports you like a piece of thick leather. The wood of these birches decays very fast, and their bark, which no humidity is able to corrupt, is carried away, on the melting of the snows, into the lakes, where it swims about all in one piece. As to the firs, when they fall, humidity and the mosses consume them in a very little time. This country is intersected with great lakes, which every where present new means of communication, as they penetrate far into the
land

land by their branching gulfs, and exhibit a new species of beauty, by reflecting, in their still waters, the openings of the vallies, the mossy hills, and the pendent firs bending from the promontories over their shores.

It would be no easy matter to describe the hospitable reception which we found in the solitary mansions of these northern regions. Their masters exerted themselves in every possible way, to detain us among them for many days together. They sent to the distance of ten, of fifteen leagues, invitations to their friends and relations, to come and assist them to entertain us. The days and the nights passed away in dancing and festivity. In the cities, the principal inhabitants regaled us by turns. Amidst this hospitable conviviality, we made the tour of the cities of poor Finland, Wiburg, Villemanstrand, Fredericksham, Nislot, &c. The castle of this last town is situated on a rock at the discharge of Lake Kiemen, which surrounds it with two cataracts. From it's platforms you perceive the vast extent of that lake. We dined in one of it's four towers, in a small apartment illuminated by windows like gun-ports. It is the very apartment in which the unfortunate *Ivan* was so long confined, who descended from the Throne of the Russian Empire, at the age of two years and a half. But this is not the place to expatiate on the

influence which moral ideas may diffuse over Landscapes.

Plants, then, are not scattered about at random over the Earth; and though nothing has been hitherto said respecting their general arrangement in different Climates, this simple sketch is sufficient to demonstrate, that there is order in their combination. If we examine, in like manner, however superficially, their expansion, their attitude, their magnitude, and proportions, we shall find that there is as much harmony in the aggregation of their parts, as in that of their species. It is impossible, in any one respect, to consider them as mere mechanical productions of heat and cold, of dryness and humidity. Our scientific Systems have brought us back precisely to the opinions which precipitated barbarous Nations into idolatry, as if it were necessary that the perfection of our illumination should be the recommencement and return of our darkness; conformably to the well-grounded censure of the Author of the Book of Wisdom: *Aut ignem, aut spiritum, aut citatum ærem, aut gyrum stellarum, aut nimiam aquam, aut solem & lunam, rectores orbis terrarum Deos putaverunt* * : “ They
 “ could not out of the good things that are seen,
 “ know him that is; neither, by considering the

* Wisdom of Solomon, chap. xiii. ver. 2.

“ works,

“ works, did they acknowledge the Work-master:
“ but deemed either fire, or wind, or swift air, or
“ the circle of the stars, or the violent water, or
“ the lights of Heaven, to be the Gods which
“ govern the world.”

All these physical causes, united, could not have determined the part of one single moss. In order to be convinced of this, let us begin with examining the circulation of plants. It has been laid down as an indubitable principle, that their saps ascend through the wood, and re-descend through the rind. To the experiments which have been detailed in proof, I shall oppose only the instance of a great chestnut-tree, in the garden of the Thuilleries, near the terrace of the Feuillants, which, for twenty years past, has had no bark round it's under part, and which, notwithstanding, is in perfect vigor. Many elms on the Boulevards are in the same state. On the other hand, we have seen old hollowed willows, which have not a bit of good wood left. Besides, how is it possible to apply this principle of vegetation to a multitude of plants, some of which are composed entirely of tubes, and to others which have no rind, being enclosed only in dry pellicles ?

Neither is there more truth in the supposition that they rise in a perpendicular line, and that to

this direction they are determined by the action of columns of air. Some, it must be allowed, do follow this direction, as the fir, the stalk of corn, the reed. But a much greater number deviate from it, such as creeping plants of every species, vines, liannes, French-beans, &c.... Others ascend vertically, and having arrived at a certain height, in an air perfectly unobstructed, fork off in various tiers, and send out their branches horizontally, as the apple-tree; or incline them toward the earth, like firs; or hollow them in form of a cup, like the saffraſas; or round them into a mushroom's head, like the pine; or straighten them into a pyramid, like the poplar; or roll them as wool on the distaff, like the cypress; or let them float at the discretion of the winds, like the birch.

All these attitudes may be seen under the same bearing of the wind. Nay, there are some which assume forms, that all the art of the gardener could hardly impress upon them. Such is the badamier of the Indies, which grows up into the form of a pyramid, and carries it divided into stories, like the king of the chefs-board. There are plants uncommonly vigorous, which, far from pursuing the vertical line, recede from it the very moment that they get above ground. Such is the false potatoe of India, which loves to crawl along the sand of the shores, in hot countries, covering whole acres in
it's

it's progress. Such, too, is the ratan of China, which frequently grows in similar situations. These plants do not crawl from weakness. The scions of the ratan are so strong, that the Chinese make cordage of them for their shipping; and when they are on the ground, they serve as a trap for the deer, who find it impossible, with all their force, to disengage themselves. They are nets spread out by the hand of Nature.

I should never have done were I to run over, ever so hastily, the different parts of vegetables; what I have said is evidence sufficient, that there is not a single one whose direction is determined by the vertical column of the air. This error has gained currency, from it's being taken for granted that plants affected the greatest volume of air; and this error in Physics has produced another in Geometry; for, on this supposition, they must all precipitate themselves to the Horizon, because there the column of air is much more considerable than in the Zenith. We must, in like manner, reject the consequences which have been deduced from it, and laid down, as principles of Jurisprudence for the division of lands in our boasted mathematical treatises; such is the following, *That no more wood, or corn, or grass, can grow on the declivities of a mountain, than what would grow on the area of it's basis.* There is not a wood-cutter,

nor hay-maker, in the world, who could not demonstrate the contrary from his experience.

Plants, it has been said, are mechanical bodies. Well then, try to construct a body so slim, so tender, so fragile, as that of a leaf, which shall for whole years resist the winds, the rains, the keenest frost, the most ardent Sun. A spirit of life, independent of all Latitudes, governs plants, preserves them, re-produces them. They repair the injuries which they may have sustained, and skin over their wounds with a new rind. The pyramids of Egypt are crumbled into powder; but the grasses which clothed the soil, while the Pharaoh's filled the throne, subsist to this day. How many Greek and Roman sepulchral monuments, the stones of which were rivetted with iron, have, one after another, disappeared! Nothing remains around their ruins, except the cypresses which shaded them.

It is the Sun, say they, who gives existence to vegetables, and who maintains that existence. But that great agent of Nature, all-powerful as he is, must not be considered as the only and determining cause even of their expansion. If his heat invites most of those of our Climates to open their flowers, it obliges others to shut them. Such are, of this last description, the great nightshade of Peru, and the *arbor tristis* (the sad tree) of the Moluccas,

lucas, which flower only in the night-time. Nay, his remoteness from our Hemisphere does not destroy in it the power of Nature. At that season vegetate most of the mosses which clothe the rocks with an emerald-coloured green; and then the trunks of trees cover themselves, in humid situations, with plants imperceptible to the naked eye, called *Mnium* and *Lichen*, which give them the appearance, in frosty weather, of columns of green bronze. These vegetations, in the very severity of Winter, overturn all our reasonings, respecting the universal effects of heat, as plants, of an organization so extremely delicate, seem to need, in order to their expansion, a temperature the most gentle.

Again, the fall of the leaf itself, which we have been taught to consider as an effect of the Sun's absence, is not occasioned by the cold. If the palm retains its foliage, all the year round, in the South, the fir is equally an evergreen in the North. The birch, it is true, the larch, and several other species of trees, shed their leaves in northern Climates, on the approach of Winter; but a similar depredation is likewise made on other trees, to the Southward. It is the resinous substance, we are told, which preserves the foliage of the fir in the North: but the larch, which is likewise a resinous plant, is stripped of its verdure in Winter; whereas the filaria, the ivy, the privet, and many other species,
which

which are not resinous, continue with us, in full verdure, at all seasons.

Without having recourse to mechanical causes, the effects of which always contradict themselves, whenever you attempt to generalize them, why not recognize, in these varieties of vegetation, the steady and uniform direction of a Providence? That Providence has assigned to the South, trees always green, and has clothed them with a broad foliage, to shelter the animal creation from the heat. In another respect, likewise, have the animals of hot climates been tenderly cared for, in being provided with clothing denuded of hair, consequently, light and cool; and in having their habitations garnished with green ferns and lianes, ever fresh and ever comfortable. Neither has bountiful Nature neglected the animals of the North. She has spread as a roof over their heads, the ever green firs, whose lofty and tufted pyramids ward off the snow from their roots, and whose branches are so well furnished with long gray mosses, that the trunk is rendered almost invisible; for a bed, she has accumulated a bank of moss on the ground, in many places more than a foot in thickness; and the soft and dry leaves of many trees, which fall precisely at the approach of the inclement season: finally, their provision, too, is laid up in store, namely, the fruits of those very trees,

trees, which have then arrived at full maturity. To these she has added, here and there, the scarlet clusters of the forb-apple, which, sparkling afar over the whiteness of the snows, invite the birds to an asylum; so that the partridge, the moorcock, every species of snow-bird, the hare, the squirrel, frequently find, under the shelter of the same fir, a lodging, food, and the means of warmth.

But one of the greatest blessings of Providence to the animals of the North, is, the clothing of them with furred garments of long and thick hair, which regularly grow in Winter, and fall off in Summer. Naturalists, who consider the hair of animals as a species of vegetation, are at pains to account for this growth and decay, from the influence of heat. They pretend to support their system by the instance of the human hair and beard, which grow rapidly in Summer. But I would ask them, how it comes to pass that, in cold countries, horses which, in Summer, are sleek and smooth, assume, in Winter, a long and shaggy coat, like the fleece of a sheep? To this they reply, It is the internal heat of their body, increased by the external action of the cold, which produces this wonderful phenomenon.

This is all very well. But I am under the necessity of objecting, that cold does not produce
this

this effect on the human beard and hair, for it retards their growth; that, besides, in the case of animals on which Providence bestows a clothing peculiarly warm, the hair is much longer and thicker on those parts of their body that have the least natural heat, such as the tail, which is very bushy in horses, martens, foxes, and wolves; that this hair is short and thin on the parts which have most natural heat, as the belly. Their backs, their ears, and frequently their very paws, are the parts most amply furnished with hair. But I satisfy myself with merely proposing this last objection; the external and internal heat of an African lion ought, surely, to be, at least, as ardent as that of a Siberian wolf; whence is it, then, that the first is smooth, as if newly shaven, whereas the other is shagged up to the eyes?

The cold, which we have been taught to consider as one of the greatest obstacles of vegetation, is as necessary to certain plants as heat is to others. If those of the South could not thrive in the North, those of the North would not succeed better in the South. The Dutch have made many a vain attempt to make the fir grow at the Cape of Good Hope, in order to find a supply of ships-masts, which sell at a very high price in India. Many planters, in the Isle of France, have made attempts, equally fruitless, to raise in that island the
lavender,

lavender, the daisy, the violet, and other plants of our temperate climates. Alexander, who transplanted whole nations at his pleasure, could not, with all his efforts, make the ivy of Greece grow in the vicinity of Babylon*, though he was very ambitious of acting, in India, the character of Bacchus in complete style.

I am persuaded, however, that it might be possible to succeed in effecting these vegetable transigrations, by employing ice, in the South, for the propagation of northern plants as we employ stoves, in the North, in the propagation of the plants of hot Climates. I do not believe there is a single spot on the Globe, in which we could not, with a little address and industry, procure ice, as easily as we can procure salt. In the whole course of my travels, I have never met with a temperature more sultry than that of the Island of Malta, though I have twice crossed the Line, and have passed a considerable part of my life in the Isle of France, where the Sun is vertical twice a year. The soil of Malta consists of little hills of white stone, which reflect the rays of the Sun with so much force, that the eye-sight is sensibly affected by it; and when the wind from Africa, known by the name of *Syroco*, which issues

* See Plutarch and Pliny.

from the sands of Zara, on it's way to melt the ices of the North, comes to pass over that Isle, the air is as hot as the breath of an oven. I recollect, at that season, a figure of Neptune in bronze, on the sea-shore, the metal of which was heated to such a degree, that you could scarcely apply your hand to it. They, however, imported into the island snow from Mount Etna, which is sixty leagues distant; they kept it for months together, laid on straw in vaults, and it was to be bought for a farthing a pound weight, even when farmed out. Since, then, it is possible to have ice in Malta, during the Dog-Days, I think it might be procured in every country of the Globe. Nature, besides, as we have seen, multiplies icy mountains in the vicinity of hot countries. I may, perhaps, be here reproached with indicating the means of promoting the increase of luxury; but as the commonalty now live only on the luxury of the rich, my suggestion may tend to promote, at least, the extension of the science of Nature.

So far is cold from being the enemy of all plants, that it is in the North we find forests of the tallest growth, and of the greatest extent in the World. It is only at the foot of the eternal snows of Mount Lebanon, that the cedar, the king of vegetables, rises in all his majesty. The fir, which is, next to him, the greatest tree of our forests, ar-
rives

rives at a prodigious size only on icy mountains, and in the cold climates of Norway and Russia. Pliny tells us, that the largest piece of timber which had ever been seen at Rome, up to his time, was a vast log of fir, a hundred and twenty feet long, and two feet square at both ends, which Tiberius had conveyed from the cold mountains of Voltolino, in Piedmont, and which Nero employed in his amphitheatre. You may judge, says he, what must have been the length of the tree as it grew when a cutting of it had such dimensions. However, as I believe that Pliny means Roman feet, which are of the same dimension with those of the Rhine, we must subtract from this measurement about a twelfth part nearly. He quotes, besides, the fir mast of the vessel which brought from Egypt the obelisk that Caligula ordered to be set up in the Vatican; this mast was four fathoms in circumference. I know not where it might have grown. But I myself have seen firs in Russia, compared to which those of our temperate climates are mere twigs. Among others I remember to have seen, between Petersburg and Moscôw, two logs which exceeded in size the largest of our masts for ships of war, though these consist of several pieces. They were cut from the same tree, and served as mounting blocks at the gate of a peasant's farm-yard. The boats which convey provisions from Lake Ladoga to Petersburg are not
not

not much smaller than those which ply between Rouen and Paris. They are constructed of fir planks from two to three inches thick, sometimes two feet broad, and whose length is that of the whole barge. The Russian carpenters of the cantons where they are built, make only a single plank out of one tree, timber being in such plenty there, that they do not take the trouble to saw it.

Before I had travelled into northern countries, I took it for granted, in conformity to the laws of our Physics, that the earth must there be stripped of every thing like vegetation, by the rigor of the cold. I was very much astonished to find there the largest trees I had ever seen in my life, and growing so near each other, that a squirrel could easily scamper over great part of Russia, without touching the ground, by springing from branch to branch. This vast forest of fir covers Finland, Ingria, Estonia, the whole space comprehended between Petersburg and Moscow, and thence extends over a great part of Poland, where oaks begin to appear, as I know from actual observation, having travelled through these countries. But what I have seen is a very small part only of these immense forests, for it is well known that they extend from Norway all the way to Kamtschatka, some sandy deserts excepted; and from Breslau to the shores of the Frozen Ocean.

I shall

I shall conclude this article with refuting an error alluded to in the preceding Study; namely, that cold is diminished in the North, in proportion as the forests are cut down. As this position has been advanced by some of our most celebrated Writers, and afterwards retailed, as the custom is, by a multitude of others; it is of importance to overturn it, as being highly prejudicial to rural economy. I had long adopted it as incontestably certain, on the faith of History; but I was at length cured of my mistake, not, however, by books, but by simple peasants.

One day in Summer, about two o'clock after noon, being about to cross the forest of Ivry, I saw some shepherds with their flocks, who kept at a considerable distance from it, reposing under the shade of some trees that were scattered up and down through the country. I asked them why they did not go, with their flocks, to take shelter in the forest, from the heat of the Sun. They told me it was too hot there at that time of the day, and that they never drove their sheep thither, except in the morning and evening. Being desirous, however, of traversing, in broad day, the woods in which *Henry IV.* had hunted, and of arriving betimes at Anet, to take a view of the country-palace of *Henry II.* and of the tomb of *Diana of Poitiers*, his mistress, I engaged a lad belonging

to one of the shepherds to attend me as a guide, which was a very easy matter to him, for the great road leading to Anet crosses the forest in a straight line; and it is, on that side, so little frequented, that I found it covered in many places, with tufts of grass and strawberry plants. I felt all the way, as I walked along, a stifling heat, and much more ardent than was at that hour felt in the open country. I did not begin to respire freely, till I had got fairly clear of it, and had made my escape from the edge of the forest more than the distance of three musket shot. In other respects, those shepherds, that solitude, that silence of the woods, blended with the recollection of *Henry IV.* appeared to me much more affecting and sublime, than the emblems of the chace in bronze, and the cyphers of *Henry II.* interwoven with the crescents of Diana, which embellish, on all sides, the domes of the Castle of Anet. This royal residence, loaded with ancient trophies of love, inspired, at first, a mixed emotion of pleasure and melancholy, which gradually subsided into profound sorrow, on recollecting that this love was illicit; but this was followed, at last, by sentiments of veneration and respect, which took complete possession of my mind, on being informed that, by one of those revolutions to which the monuments of men are so frequently subjected, the castle was then inhabited by the virtuous Duke of *Penthièvre.*

I have

I have since reflected on what the shepherds told me, respecting the heat of the woods, and on what I myself had experienced; and I have, in fact, remarked that, in the Spring, all plants are more forward in the vicinity of woods, and that you find violets in flower on their borders much earlier than you gather them on the open plain, or on a naked hill. Forests, then, shelter the land from cold, in the North; but what is equally wonderful, they shelter it likewise from the heat in warm countries. These two opposite effects are produced entirely from the different forms and disposition of their leaves. In the North, those of the fir, the larch, the pine, the cedar, the juniper, are small, glossy, and varnished; their delicacy, their varnish, and the endless variety of their direction, reflect the heat around them a thousand different ways: they produce nearly the same effects as the hair of the animals of the North, whose furs are warm in proportion as the hair is fine and glossy. Besides, the leaves of some species, as of the fir and of the birch, are perpendicularly suspended from the branches by long moveable membranes, so that with every breath of the wind they reflect all around the rays of the Sun, like so many mirrors.

In the South, on the contrary, the palms, the tallipot, the cocoa, the banana, bear large leaves,

which, on the side next the ground, are rather rough than glossy, and which, spreading horizontally, form a deep shade below, where there is not the least reflection of heat. I admit, at the same time, that the clearing away of forests dispels the coldness occasioned by humidity ; but it increases the dry and sharp colds of the North, as has been found on the lofty mountains of Norway, which were formerly cultivated, but are now uninhabitable, because they are completely stripped of their woods.

This clearing of the ground likewise increases the heat in warm countries, as I have had occasion to observe in the Isle of France, on several parts of the coast, which are become so parched, since every species of tree has been swept away, that they are at this day absolutely uncultivated. The very grafs which pushes away during the rainy season, is in a short time quite burnt up by the Sun. What is still worse, there results from this parchedness of the coasts, the drying up of a great many rivulets ; for the trees, planted on the heights, attract thither the humidity of the air, and fix it there, as we shall see in the Study on Plants. Besides, by destroying the trees which are on the high grounds, you rob the vallies of their natural manure, and the plains of the pallifades which shelter them from the high winds. These winds desolate,

to

to such a degree, the cultivation in many places, that nothing can be made to grow. I ascribe to this last piece of mismanagement the sterility of the heaths in Brittany. In vain has the attempt been made to restore their ancient fertility: it never can succeed, till you begin with recalling their shelter and their temperature, by re-fowing the forests. But there is a requisite prior even to this; you must render the peasantry happy. The prosperity of a country depends, before, and above all things, on that of its inhabitants.

STUDY SIXTH.

REPLY TO OBJECTIONS AGAINST PROVIDENCE,
FOUNDED ON THE DISORDERS OF THE
ANIMAL KINGDOM.

WE shall continue to display the fecundity of Northern Regions, in order to overturn the prejudice, which would ascribe this principle of life, in plants and animals, only to the heat of the South. I could expatiate on the numerous and extensive chaces of elks, rein-deer, water-fowls, heath-cock, hares, white bears, wolves, foxes, martens, ermines, beavers, &c. which the inhabitants of the northern districts annually carry on, the very peltry of which, above what they employ for their own use, supplies them with a very considerable branch of commerce for the markets of all Europe. But I shall confine myself entirely to their fisheries, because these precious gifts of the Waters are presented to all Nations, and are no where so abundant as in the North.

From the rivers and lakes of the North are extracted incredible multitudes of fishes. *John Schaeffer*, the accurate Historian of Lapland, tells us*, that they catch annually at Torneo, no less than thirteen hundred boat-loads of salmon; that the pike there grow to such a size, that some are found as long as a man, and that every year they salt as many as are sufficient for the support of four kingdoms of the North. But these fisheries, however productive, fall far short of those of the Seas †. From the bosom of these is dragged the enormous whale, which is usually about sixty feet in length, twenty feet broad over the body and at the tail, eighteen feet high, and which yields up to a hundred and thirty barrels of oil. The fat is two feet thick, and in cutting it off, they are under the necessity of using great knives, six feet long.

From the Seas of the North, annually take their departure innumerable shoals of fishes, which enrich the fishers of all Europe; such as cod, anchovies, sturgeon, dory, mackerel, pilchers, herrings, sea-dogs, belugas, sea-calves, porpoises, sea-horse, puffers, sea-unicorns, saw-fish, &c.....The size of them all is considerably larger than in tem-

* History of Lapland, by *John Schaeffer*.

† Consult *Frederic Martens* of Hamburg.

perate Latitudes, and they are divided into much more numerous species. There are computed as high as twelve species of the whale tribe; and plaice are caught in those seas of the enormous weight of four hundred pounds. But I shall farther confine myself to those fishes which are best known to us, herrings, for example. It is an incontestable fact, that the Seas of the North every year send out a quantity more than sufficient to feed all the inhabitants of Europe.

We are in possession of Memoirs which prove, that the herring fishery was carried on so far back as the year 1163, in the Straits of Sunda, between the Islands of Schonon and Seeland. *Philip de Méfières*, Governor to *Charles VI.* relates, in the *Old Pilgrim's Dream*, that in the year 1389, during the months of September and October, the quantity of herrings in those Straits was so prodigious, that, "For several leagues together you might," says he, "have cut them with a sword; and it is credibly reported, that there are forty thousand boats which are employed in nothing else, for two months, but in catching herrings; each boat containing, at least, six persons, and many not less than ten; and besides these, there are five hundred great and small vessels of burden, employed wholly in picking, salting, and barrelling up the herrings." He makes the
number

number of persons engaged in this fishery amount to three hundred thousand, Prussians and Germans.

In 1610, the Dutch, who carry on the herring-fishery still farther to the North, where the fish is better, employed in it three thousand boats, fifty thousand fishermen, without reckoning nine thousand other vessels employed in barrelling, and conveying them to Holland, and a hundred and fifty thousand persons, partly at sea, partly on shore, engaged in the carrying trade, in preparing and felling. At that period they derived a revenue from it, of two millions, six hundred and fifty thousand pounds sterling. I myself have witnessed in Amsterdam, in 1762, the joy of the populace, expressed by displaying streamers and flags over the shops where that fish was exposed to sale, on the first arrivals; and in every street this was the case. I have been informed in that city, that the Company established for carrying on the herring-fishery was richer, and fed more mouths, than the East-India Company. The Danes, the Norwegians, the Swedes, the Hamburgers, the English, the Irish, and some traders of the ports of France, particularly of Dieppe, fitted out vessels for this fishery, but in too small a number for a fall of manna so plentiful, and so easily gathered.

In

In 1782, at the mouth of the Gothela, a small river which washes the walls of Gottenburg, one hundred and thirty-nine thousand barrels were cured by salt, three thousand seven hundred were smoked, and two thousand eight hundred and forty-five casks of oil were extracted from what could not be preserved. The Gazette of France *, which contains an account of this fishery, remarks that, previous to 1752, these fishes had entirely disappeared for 72 years together. I ascribe their desertion of this coast to some naval engagement, which had chased them away by the noise of the artillery, as is the case with the turtle of the island of Ascension, which forsake the road for weeks together, when vessels passing that way discharge their great guns. It may, perhaps, be likewise accounted for, from a conflagration of the forests, which might have destroyed the vegetables that attracted them to the coast.

The good Bishop of Berghen, *Pont-Oppidan*, the *Fenelon* of Norway, who introduced into his popular sermons, complete tracts of Natural History, as being excellent articles of Theology, relates †, that when the herrings coasted along the shores of Norway, “ The whales, which pursue

* Friday the 11th October, 1782.

† *Pont-Oppidan's* Natural History of Norway.

“ them

“ them in great numbers, and which dart their
 “ water-spouts into the air, give to the Sea, at a
 “ distance, the appearance of being covered over
 “ with smoking chimnies. The herrings, in order
 “ to elude the pursuit, throw themselves close in-
 “ shore into every little bay and creek, where the
 “ water, before tranquil, forms considerable swel-
 “ lings and surges, wherever they crowd to make
 “ their escape. They branch off in such quan-
 “ tities, that you may take them out in baskets-
 “ full, and the country people can even catch
 “ them by the hand.” After all, however, that
 the united efforts of all these fishers can effect,
 hardly any impression is made on their great general
 column, which coasts along Germany, France,
 Spain, and stretches as far as the Straits of Gibralt-
 ar; devoured, the whole length of their passage,
 by an innumerable multitude of other fishes, and
 sea-fowls, which follow them night and day, till
 the column is lost on the shores of Africa, or re-
 turns, as other Authors tells us, to the Climates
 of the North.

For my own part, I no more believe that her-
 rings return to the Seas from which they came,
 than that fruits re-ascend the trees from which they
 have once dropped. Nature is so magnificent in the
 entertainments which she provides for Man, that she
 never serves up the same dishes a second time.

I presume

I presume, conformably to an observation of Father *Lamberti*, a missionary in Mingrelia, that these fishes accomplish the circuit of Europe by going up the Mediterranean, and that the extreme boundary of their emigration is the extremity of the Black Sea; and this is the more probable, that the pilchers, which take their departure from the same places, follow the same track, as is proved by the copious fisheries of them carried on along the coasts of Provence and Italy. “Many herrings,” says Father *Lamberti**, “are sometimes seen in
 “the Black Sea; and in the years when this happens, the inhabitants of the adjacent countries
 “draw a flattering prognostic of a plentiful sturgeon-fishing season; and they deduce the opposite conclusion from the non-appearance of herrings. There was seen in 1642 a quantity so
 “prodigious of them, that the Sea having thrown them on the shallows which separate Trebisond
 “from the country of the Abchasses, the whole was covered and surrounded with a bank of herrings,
 “which was, at least, three hand-breadths high. The people of the country were under dreadful
 “apprehensions, that the air would be poisoned by the corruption of these fishes; but they were
 “presently followed by enormous flocks of crows and rooks, which eat up the herrings, and cured

* Account of Mingrelia, Thevenot's Collection.

“ the honest folks of their terror. The natives
 “ talk of a similar appearance before that period,
 “ only the quantity was much inferior.”

This immense glut of herrings is, undoubtedly, matter of astonishment; but how is that astonishment increased, when it is considered, that this column is not the half of what annually issue from the Seas of the North! It separates at the northern extremity of Iceland, and while one division proceeds to diffuse plenty over the shores of Europe, the other pushes forward to convey similar benefits to the shores of America. *Anderson* informs us, herrings are in such abundance on the coasts of Iceland, that a shallop can with difficulty force it's way through the shoal by dint of rowing. They are accompanied by an incredible multitude of pilchers and cod, which renders fish so plenty in the island, that the inhabitants have them dried, and reduced to meal with a grind-stone, to become food for their oxen and horses.

Father *Rale*, a jesuit, and an American missionary, speaking of the Savages who inhabit between Acadia and New-England, tells us*, “ That
 “ they resort, at a certain season, to a river not far
 “ distant, where, for the space of a month, the

* Instructive Letters, vol. xxiii. page 199.

“ fishes force their way upward in such quantities,
 “ that, with hands sufficient, fifty thousand bar-
 “ rels might be filled in a single day. These are
 “ a species of very large herrings, most agreeable
 “ to the taste when fresh. They are pressed upon
 “ each other to the thickness of a foot, and are
 “ taken out by pails-full, like water. The Sa-
 “ vages dry them for eight or ten days, and live
 “ on them during their whole feed-time.”

This testimony is confirmed by a great many others, and particularly by a Gentleman of English extraction, but a native of America, who has favoured us with a History of Virginia. “ In
 “ Spring,” says he *, “ herrings push upwards,
 “ in such quantities, along the rivulets and fords
 “ of rivers, that it is almost impossible to pass on
 “ horseback without trampling on those fishes.....
 “ Hence it comes to pass, that at this season of the
 “ year, those parts of the rivers where the water
 “ is fresh, are rendered fetid by the fish which they
 “ contain. Besides herrings, may be seen an in-
 “ finite number of shads, roach, sturgeon, and a
 “ few lampreys, which find their way from the Sea
 “ up the rivers.”

It would appear, that another column of those fishes issues from the North Pole, to the eastward

* History of Virginia, page 202.

of our Continent, and passes through the channel which separates America from Asia, for we are informed, by a missionary, that the inhabitants of the land of Yaffo go to Japan, to sell, among other dried fishes *, herrings also. The Spaniards, who have been attempting discoveries to the north of California, find all the nations of those regions to be fish-eaters, and unacquainted with every kind of cultivation. Though they landed there only in the middle of Summer, before, perhaps, the fishing season had commenced, they found pilchers in the greatest abundance, the native country and emigrations of which are the same, for vast quantities of a smaller size, are taken at Archangel. I have eaten of them in Russia, at the table of Mareschal Count *Munich* who called them the anchovies of the North.

But as the Northern Seas, which separate America from Asia, are not much known to us, I shall pursue this fish no further. I must, however, observe, that more than half of those herrings are filled with eggs, and if the propagation were to go on, to it's full extent, for three or four generations only, without interruption, the Ocean itself would be unable to contain them. It is obvious

* Ecclesiastical History of Japan, by Father *F. Soliar*. Book xix. chap. xi.

to the first glance of the eye, that the herring produces, at least, as many eggs as the carp. M. *Petit*, a celebrated practitioner in Surgery and Medicine, has found, by experiment, that the two parcels of eggs, of a carp eighteen inches long, weighed eight ounces two drachms, which make four thousand, seven hundred and fifty-two grains; and that it required seventy-two of these eggs to make up the weight of one grain; which gives a product of three hundred forty-two thousand, one hundred and forty-four eggs, contained in one roe weighing eight ounces and two drachms.

I have been somewhat diffuse on the subject of this particular species of fish, not in the view of promoting our commerce, which, by its offices, its bounties, its privileges, its exclusions, renders every article scarce with which it intermeddles, but in compassion to the poorer part of the community, reduced, in many places, to subsist entirely on bread, while Providence is bestowing on Europe, in the richest profusion, the most delicate fish, perhaps, that swims in the Sea*. We are not to form our judgment from those that are brought to Paris, after the season is over, and which are caught

* More than one epicure has already made this observation: but here is another, on which few are disposed to dwell, it is this, that in all cases, and in all countries, *the most common things are the best.*

on our coasts; but from those which are caught far to the North, known, in Holland, by the name of *pickled herrings*, which are thick, large, fat, with the flavour of a nut, so delicate and juicy, that they melt away in the cooking, and are eaten raw from the pickle, as we do anchovies.

The South Pole is not less productive of fishes than the North. The Nations which are nearest to it, such as the inhabitants of the islands of Georgia, of New Zealand, of Maire's Strait, of the Terra-del-Fuego, of Magellan's Strait, live on fish, and practice husbandry of no kind. That honest Navigator, Chevalier *Narbrucht*, says, in his Journal of a Voyage to the South Seas, that Port-Defire, which lies in $47^{\circ}.48'$ South Latitude, is so filled with pinguins, sea-calves, and sea-lions, that any vessel touching there, may find provisions in abundance. All these animals, which are there uncommonly fat, live entirely on fish. When he was in Magellan's Strait, he caught, at a single draught of the net, more than five hundred large fishes, resembling the mullet, as long as a man's legs; smelts twenty inches long; a great quantity of fish like the anchovy: in a word, they found, of every sort, such an abundant profusion, that they ate nothing else during their stay in those parts. The beautiful mother-of-pearl shells, which enrich our cabinets, under the name of the Magellan-oyster,

oyster, are there of a prodigious size, and excellent to eat. The lempit, in like manner, grows there to a prodigious magnitude. There must be, continues he, on these shores, an infinite number of fishes to support the sea-calves, the pinguins, and the other fowls, which live solely on fish, and which are all equally fat, though their number is beyond computation. They one day killed four hundred sea-lions, in the space of half an hour. Of these some were eighteen feet long. Those which are only fourteen swarm by thousands. Their flesh is as tender and as white as lamb, and excellent food when fresh, but still better when it has been some time in salt. On which I must make this observation, that the fish of cold countries only take in salt easily, and retain, in that state, part of their flavour. It seems as if Nature intended thus to communicate to all the Nations of the Globe the abundance of the fisheries which issue from the frigid Zones.

The western coast of America, in that same Latitude, is not less amply supplied with fish. “Along the whole sea-coast,” says the Peruvian *Garcilaso de la Vega* *, “from Aréquipa to Tarapaca, a track of more than two hundred leagues in length, they employ no other manure to dung

* History of the Incas, book v. chap. iii.

“ the land, except the excrement of certain fowls,
 “ called sea-sparrows, of which there are flocks so
 “ numerous, as to exceed all belief. They inhabit
 “ the desert islands on the coast, and by the accu-
 “ mulation of their ordure, they whiten them to
 “ such a degree, that, at some distance, they might
 “ be taken for mountains covered with snow. The
 “ Incas reserved to themselves the right of dis-
 “ posing of those islands, as a royal boon to such
 “ and such a favourite province.” Now this dung
 was entirely the produce of the fishes on which
 those fowls constantly fed.

“ In other countries, on the same coast,” says
 he *, “ such as that of Atica, of Atitipa, of Villa-
 “ cori, of Malla, and Chilca, they dung the land
 “ with the heads of pilchers, which they sow there
 “ in great quantities. They put them in the
 “ ground at small intervals from each other, along
 “ with two or three grains of maize. At a parti-
 “ cular season of the year, the Sea throws upon the
 “ shore such quantities of live pilchers, that they
 “ have an abundant supply for food, and for ma-
 “ nure, and this to such a degree, that after these
 “ demands were satisfied, they could easily load
 “ whole ships with the overplus.”

* Consult the same Work.

It is obvious that the coast of Peru is nearly the boundary of the emigration of the pilchers which set out from the South Pole, as the coasts of the Black Sea are the boundary of that of the herrings which issue from the North Pole. The continuation and direction of these two bands, the pilchers of the South, and the herrings of the North, are nearly of the same length, and their destinies are, at last, similar. It would appear as if certain Nereïds were annually commissioned to conduct, from the Poles, those innumerable swarms of fishes, to furnish subsistence to the inhabitants of the temperate Zones ; and that, having arrived at the termination of their course, in the hot Latitudes, where fruits are produced abundantly, they empty the gleanings of their nets upon the shore.

It will not be so easy a task, I confess, to refer to the beneficence of Nature the wars which animals wage with each other. Why should beasts of prey exist? Supposing me incapable of resolving this difficulty, Nature must not be accused of cruelty because I am deficient in mental ability. She has arranged what we do know, with such consummate wisdom, that we are bound to give her credit for the same character of wisdom, in cases where we cannot find her out unto perfection. I will have the courage, however, to declare my opinion, and to offer a reply to this question ;

and so much the rather, as it affords me an opportunity of presenting some observations which I consider as at least new, if not worthy of attention.

First of all, Beasts of prey are necessary. What otherwise would become of the carcases of so many animals, which perish both on the land and in the water, and which they would, consequently, poison with infection. Several species of carnivorous animals, it must be allowed, devour their prey while yet living. But who can tell whether, in this, they do not transgress the law of their nature? Man knows very little of his own History. How is it possible he should know that of the beasts? Captain Cook observed, in a desert island of the Southern Ocean, that the sea-lions, the sea-calves, the white bears, the fots, the eagles, the vultures, lived in perfect concord, no one tribe giving the least disturbance to another. I have observed a similar good agreement among the fool and the frigate of the Island of Ascension. But, after all, we must not compliment them too highly on their moderation. It was merely an association of plunderers; they lived peaceably together, that they might devour, unmolested, their common prey, the fishes, which they all gulped down alive.

Let us revert to the great principle of Nature. She has made nothing in vain. She destines few
animals

animals to die of old age; nay, I believe, that she permits Man alone to complete his career of life, because his old age alone can be useful to his fellow-creatures. To what purpose would serve, among the brute creation, grandfathers destitute of reflection, to progeny brought into existence in the maturity of their experience? On the other hand, what assistance could decrepit parents find among children, which abandon them, the instant they have learned to swim, fly, or walk? Old age would be to them a burthen from which they are delivered by the ferocious animals. Besides, from their unobstructed generations would arise a posterity without end, which the Globe is not sufficient to contain. The preservation of individuals would involve the extinction of species.

Animals might always live, I shall be told, in a proportion adapted to the places which they inhabit; but in that case they must cease to multiply; and from that moment farewell the loves, the nests, the alliances, the foresight, and all the harmonies which subsist among them. Every thing that is born is doomed to die. But Nature, in devoting them to death, takes from them that which could render the instant of it cruel. It is usually in the night-time, and in the hour of sleep, that they sink under the fangs and the teeth of their destroyers. Twenty strokes, sent home in one instant to the

sources of life, afford no leisure to reflect that they are going to lose it. That fatal moment is not embittered to them, by any of the feelings which render it so painful to most of the Human Race, regret for the past, and solicitude about futurity. Their unanxious spirits vanish into the shades of night, in the midst of a life of innocence, and frequently during the indulgence of the fond illusions of love.

Unknown compensations may, perhaps, farther sweeten this last transition. I shall observe at least, as a circumstance deserving the most attentive consideration, that the animal species, whose life is sacrificed to the support of that of others, such as that of insects, do not appear possessed of any sensibility. If the leg of a fly happens to be torn away, she goes and comes as if she had lost nothing; the cutting off a limb so considerable is followed by no fainting, or convulsion, or scream, or symptom of pain whatever. Cruel children amuse themselves with thrusting straws into their anus; they rise into the air thus empaled; they walk about, and perform all their usual motions, without seeming to mind it. Others take lady-birds, tear off a large limb, run a pin through the nerves and cartilages of the thigh, and attach them with a slip of paper to a stick. These unfeeling insects fly humming round and round the stick, unweariedly, and
without

without any appearance of suffering pain. *Reaumur* one day cut off the fleshy and muscular horn of a large caterpillar, which continued to feed as if no mutilation had taken place. Is it possible to think, that beings so tranquil in the hands of children and philosophers, endure any feeling of pain when they are gobbled down in the air by the birds?

These observations might easily be extended much farther: particularly to that class of fishes, which have neither bone nor blood, and of these consist the greatest number of the inhabitants of the Seas, and they appear to be equally void of sensibility. I have seen, between the Tropics, a tunny, from the nape of whose neck one of the sailors scooped out a large slice of the flesh, with a stroke of the harpoon, which was forced backward to his head, who followed the ship for several weeks, and was outdone by no one of his companions, either in speed or in friskiness. I have seen sharks, after being struck with musket bullets, return to bite at the hook from which they had just before escaped, with their mangled throat.

We shall find, besides, a greater analogy between fishes and insects, if we consider that neither have bones nor blood; that their flesh is impregnated with a glutinous liquid, and which likewise appears to be the same in both, from it's emitting the

the same odour when burnt ; that they do not respire by the mouth, but by the sides, insects by the trachea, fishes by the gills ; that they have no auditory organ, but hear by means of the nervous impression made on their bodies by the commotion of the fluid element in which they live ; that they see all round the horizon from the disposition of their eyes ; that they equally run to the light ; that they discover the same avidity, and are, for the most part, carnivorous ; that, in both genera, the female is larger than the male ; that these throw out their eggs, to an infinite number, without sitting on them : that most fishes pass, on their birth, through the state of insects, issuing from their eggs, in form of worms, and even some in that of frogs, such as a species of fish in Surinam ; that both are cased in scales ; that many fishes are provided with beards and horns, like insects ; that both the one and the other contain, in their categories, an incredible variety of forms, peculiar to themselves ; finally, that their constitutions, their metamorphoses, their manners, their fecundity, being the same, there is a powerful temptation to ascribe to these two numerous classes, the same insensibility.

As to animals which have blood, let *Mallebranche* say what he pleases, they are sensible. They express a sense of pain by the same signs which we do.

do. But Nature has fenced them with thick hides, with long hair, with a plumage, which protect them against external blows. Besides, they are little, if at all, exposed to cruel treatment, except from the hands of bad men.

Let us now proceed to consider the generation of animals. We have seen that the greatest and most numerous species of the Globe, in the animal and vegetable kingdoms, are produced in the North, independently of the heat of the Sun. Let us now enquire, whether the prolific power of fermentation be greater in the South. Certain Egyptians told Herodotus, that particular species of animals were formed of the fermented mires of the Ocean, and of the Nile. Whatever respect I have for the Ancients, I absolutely reject their authority in Physics. Most of their Philosophers have a sufficiently striking resemblance to our own. They observed sparingly, and reasoned copiously. If some of them, in the view of speaking peace to voluptuous Princes, have advanced that every thing proceeded from corruption, and returned to corruption again, others more honest and sincere have refuted them, even in the earliest times.

It is not only certain, that corruption produces no one living body, but is fatal to all, especially to those which have blood, and chiefly to Man.

No

No air is unwholesome but where there is corruption. How could such a principle have generated, in animals, feet provided with toes, nails, and claws; skins clothed with so many sorts of hair and plumage; jaws palisaded with teeth cut out into a form adapted, some for cutting, and others for grinding; heads adorned with eyes, and eyes furnished with lids to defend them from the Sun? How could the principle of corruption have collected these scattered members; unite them by nerves and muscles; support them by bony substances, fitted with pivots and hinges; feed them with veins filled with a blood which circulates, whether the animal be in motion or at rest; cover them with skins so admirably provided with hairy furs, precisely adapted to the Climates which they inhabit; afterwards, make them move by the combined action of a heart and a brain, and give to all these machines, produced in the same place, and formed of the same slime, appetites and instincts so entirely different? How could it have inspired them with the sensation of themselves, and kindled in them the desire of reproducing themselves by any other method than that which originally gave them existence?

Corruption, so far from conferring life on them, must have deprived them of it, for it generates tubercles, inflames the eyes, dissolves the blood, and
produces

produces an infinite number of diseases in most animals which respire it's emanations *. The fermentation of any substance whatever could have formed

* Of all corruptions, that of the human flesh is most noxious. Of this a very singular instance is related by *Garcillafo de la Vega*, in his History of the Civil Wars of the Spaniards, in the Indies. Vol. i. Part ii. Chap. xlii. He observes, first, that the Indians, of the Islands of Barlovento, poison their arrows, by plunging the points of them into dead bodies; and then adds, " I shall relate what I myself saw happen in
 " the case of one of the quarters of the dead body of Carvajal,
 " which was exposed on the great road to Collasuyu, to the
 " south of Cusco. We set out a walking one Sunday, ten or
 " twelve school-fellows of us, all mongrels, that is, the pro-
 " geny of Spanish men by Indian women, the oldest not above
 " twelve years of age. Having observed, as we went along in
 " the open country, one of the quarters of Carvajal's body, we
 " took a fancy to go and look at it, and having come up, we
 " found it was one of his thighs, the fat of which had dropped
 " to the ground. The flesh was greenish, and entirely corrupted.
 " While we were examining this mournful spectacle, a forward
 " boy chanced to say, I could wager no one here dares to touch
 " it; another replied, he would. At last the stoutest of all,
 " whose name was Bartholomew Monedero, imagining he was
 " going to perform an act of courage, plunged the thumb
 " of his right hand into this putrid limb, which it easily pene-
 " trated. This bold action astonished every one, to such a de-
 " gree, that we all run away from him, for fear of infection,
 " calling out, ' O abominable! Carvajal will make you pay
 " dear for this rashness. He went, however, instantly to the
 " brook, which was close by the spot, washed his hand several
 " times, rubbing it over with clay, and so returned home. Next
 " day he returned to school, where he shewed us his thumb,
 " which

formed no one animal, nor even the egg from which it issued. We find in the dunghills of our great towns, where so many substances ferment,
 organic

“ which was swollen prodigiously ; but towards evening the
 “ whole hand had become inflamed up to the wrist ; and next
 “ day, which was Tuesday, the arm had swelled up to the elbow,
 “ so that he was reduced to the necessity of disclosing the case
 “ to his father. Professional men were immediately called in,
 “ who had the arm tightly bandaged, above the swelling, and
 “ applied every remedy which art and experience could suggest
 “ as a counter-poison. After all, notwithstanding, it nearly
 “ cost the patient his life ; and he recovered not without suffering
 “ intolerable pain, after having been for four months so en-
 “ feebled, as to be incapable of holding the pen.”

From this anecdote it may be concluded, how dangerous the putrid emanations from our church-yards must be to the inhabitants of cities. Parish Churches in which so many corpses are interred, become impregnated with an air so corrupted, especially in Spring, when the ground begins to grow warm, that I consider this as one of the chief sources of the small-pox, and of the putrid fevers which are prevalent at that season. An unfavourable smell then issues from it which makes the stomach rise. I have felt this to an insufferable degree in some of the principal Churches of Paris. This smell is extremely different from that produced by a croud of living people, for we are affected with no such sensation in the Churches of Convents, where few only are interred.

It would be a curious subject of enquiry to Anatomists, Why the putrefaction of dead bodies should destroy the animal economy of most beings, while it makes no derangement in that of carnivorous animals. Many species of insects and fishes live on carrion. I remark that the greatest part of these have no blood,
 which

organic particles of every species; entire bodies of animals, blood, plants, salts, oils, excrements, spirits, minerals, substances more heterogeneous, and more combined by Man in a state of society, than ever the waves of the Ocean accumulated and confounded on it's shores: there was never found there, however, a single organized body.

It must not be affirmed, that the heat necessary to their expansion is there wanting, for it exists in every possible degree, from ice up to fire. Salts crystallize in them, and sulphurs are formed. There was picked up in Paris itself, some years ago, sulphur formed by Nature, in ancient dung-hills of the time of *Charles IX.* We see, every day, that fermentation may be excited in dung to such a degree, as to catch fire. Nay, it's moderate heat is so favourable to the expansion of germs, that it is employed for the hatching of chickens. But the combinations of all these substances never produced any thing living, or organized. What do I say? The first operations of Nature, which we wish to explain, are covered in so many mysteries, that an egg with an aperture ever so small loses it's

which is the first fluid that corruption lays hold of, and that the apertures through which they breathe are not the same with those by which they take in their food. But these reasons, it must be allowed, are inapplicable to vultures, ravens, and other birds of prey.

prolific

prolific power. The slightest contact with the exterior air, is sufficient to extinguish in it the radical principles of life. It is neither matter, then, nor degrees of heat, which are wanting to Man, to imitate Nature in the pretended creation of beings ; and this power, ever young and active, has by no means wasted itself, as it is always exerting itself in their re-production ; a display of omnipotence equally wonderful with that of conferring existence at the first.

The wisdom with which she has settled their proportions, is not less worthy of admiration. On a careful examination of animals, we shall find no one deficient in it's members, regard being had to it's manners, and the situation in which it is destined to live. The large and long bill of the toucan, and his tongue formed like a feather, were necessary to a bird who hunts for insects, scattered about over the humid sands of the American shores. It was needful that he should be provided, at once, with a long mattock wherewith to dig, with a large spoon to collect his food, and a tongue fringed with delicate nerves, to enjoy the relish of it. Long legs and a long neck were necessary to the heron, to the crane, to the flamingo, and other birds, which have to walk in marshy places, and to seek their prey under the water. Every animal has feet, and a throat, or a bill, formed in a most wonderful

wonderful manner, to suit the foil which they have to tread, and the food by which they are to be supported. From the different configurations of these, Naturalists derive the characters which distinguish beasts of prey from such as live on vegetable substances.

These organs have never been wanting to the necessities of animals, and are themselves indelible as their instincts. I have seen, up in the country, ducks brought up at a distance from water, for several generations, which, nevertheless, retained on their feet the broad membranes of their species, and which, on the approach of rain, clapped their wings, screamed aloud, called upon the clouds, and seemed to complain to Heaven of the injustice of Man, who had banished them from their element. No animal wants any one necessary member, or is encumbered with one that is superfluous. Some philosophers have considered the spurs appended to the heels of the hog as useless, because they do not bear upon the ground; but this animal, destined to live in swampy places, where he delights to wallow, and to make, with his snout, deep trenches in the mire, would frequently sink under the impulse of gluttony, had not Nature placed above his heels two prominent excrescences, which assist him in getting out again. The ox, who frequents the marshy banks of rivers,

is provided with nearly similar weapons. The hippopotamus, who lives in the water, and upon the banks of the Nile, is furnished with a cloven foot, and, above the pastern, with two small horny substances, which bend backward as he walks, so that he leaves on the sand an impression, which seems to have been made by the pressure of four paws. The description of this amphibious animal may be seen toward the end of *Dampier's Voyages*. ;

How was it possible for enlightened men to misunderstand the use of these accessory members, the form of which is imitated by some of our country clowns, in stilts; which, from this very resemblance, they call *hogs-feet*, and which they employ in wading through marshy ground? These same clowns have, in like manner, imitated that of the pointed and divergent spurs of the goat's-foot, which assist them in scrambling over the rocks, in their pikes shod with two iron points, contrived to prevent the backward motion of loaded carriages, on the declivity of mountains.

Nature, who varies her means with the obstacles to be surmounted, has bestowed the appendix excrescences on the heels of the hog, for the same reason that she has clothed the rhinoceros with a hide rolled up in several folds, in the midst of the torrid Zone. This clumsy animal has the appearance

ance of being invested with a threefold mantle : but, being destined to live in the miry morasses of India, where he grubs up with his horny snout the long roots of the bamboo, he would have been in danger of sinking, from his enormous weight, had he not been endowed with the strange faculty of extending, by blowing himself up, the multiplied folds of his skin, and of rendering himself lighter, by occupying a larger space.

What to us appears, at first sight, a deficiency in animals, is, you may rest perfectly assured, a most wonderful compensation of Providence ; and it would be, in many cases, an exception from her general laws, if she had any other than the utility and happiness of the beings which she has formed. Hence she has given to the elephant a proboscis, which serves him, like a hand, as he scrambles over the roughest mountains, where he delights to live, in picking up the grass of the field, and the foliage of the trees, which the thickness and inflexibility of his neck would not permit him otherwise to reach.

She has infinitely varied, among the animal creation, the means of defence, as well as those of subsistence. It is impossible to suppose that those which move slowly, or which scream violently, are in a state of habitual suffering : for how could a race of

creatures always sickly perpetuate itself, nay, become one of the most universally diffused of the whole Globe? The fluggard, or sloth, is found in Africa, in Asia, and in America. His tardiness is no more a paralytic affection, than that of the turtle and of the snail. The cries which he utters, when you go near him, are not the cries of pain. But among animals, some being destined to roam about over the face of the Earth, others to remain fixed on a particular post, their means of defence are varied with their manners. Some elude their enemies by flight; others repel them by hissings, by hideous figures, by poisonous smells, or lamentable cries. There are some which deceive the eye, such as the snail, which assumes the colour of the walls, or of the bark of trees, to which he flees for refuge; others, by a magic altogether inconceivable, transform themselves, at pleasure, into the colour of surrounding objects, as the cameleon.

O, how sterile is the imagination of Man, compared to the intelligence of Nature! He has produced no one thing, in any line whatever, of which he has not borrowed the model from her Works. Genius itself, about which such a noise is made, this creative genius, which our wits fondly imagine they brought into the world with them, and have brought to perfection in learned circles, or by the assistance of books, is neither less nor
more

more than the art of observing. Man cannot forsake the path of Nature, even when he is determined to go wrong. We are wise only with her wisdom: and we play the fool only in proportion as we attempt to derange her plans.

The graver of *Callot*, so prolific of monsters, never patched up so many frightful demons, as the ill assorted members of different animals, the beak of the owl, the jaws of the crocodile, the body of the horse, the wings of the bat, the fangs and the paws which he has united to the human figure, to render his contrasts more hideous. Our female friends, too, who, sweetly capricious, amuse themselves with embroidering fancy-flowers on the various articles of their dress, are reduced to the necessity of borrowing their patterns from the garden. Examine, on their gowns and handkerchiefs, the sportive productions of their imagination: there you have the flower of the pink, on the foliage of the myrtle; roses on the stalk of the reed; pomegranates in the place of ears of corn. Nature alone produces none but rational harmonies; and assort, in both animals and plants only parts adapted to the places, to the air, to the elements, to the uses, for which she has destined them. Never was a race of monsters beheld issuing from the sublimity of her conceptions.

I have frequently heard living monsters announced for exhibition at our fairs; but I never had the fortune to see a single one, whatever trouble I could take to that effect. One day a placard was displayed, at the fair of Saint Ovide, "a cow with three eyes, and a sheep with six feet." I had a curiosity to see these animals, and to examine into the use which they made of organs and members, to my apprehension, entirely superfluous. How, said I to myself, Nature plant six legs under the body of a sheep, when four were amply sufficient to support it? At the same time, I began to recollect, that the fly, who is much lighter than the sheep, had six; and this reflection, I acknowledge, staggered me. But having one day observed a fly which had alighted on the paper before me, I found she frequently employed herself in alternately brushing her head and wings with the two fore and the two hinder feet. I then evidently perceived, that she had occasion for six feet, in order to have the support of four, while the other two were applied to the brushing service, especially on a perpendicular plane. Having caught, and examined her by the microscope, I discovered that the two middle feet had no brush, but that the other four had. I farther observed, that her body was covered over with particles of dust, which adhere to it, in the atmosphere through
which

which she flies; and that her brushes were double, furnished with fine hairs, between which she emitted, and drew back, at pleasure, two claws, similar to those of a cat, but incomparably sharper. These claws enable the fly to lay hold of the most polished surfaces, such as the glass of mirrors, along which you see them march upward and downward, without sliding.

I was very curious to see in what manner Nature had attached two new legs to the body of a sheep, and how she had formed, in order to put them in motion, new nerves, new veins, and new muscles, with their insertions. The third eye of the cow perplexed me still more. I had nothing for it, then, but, like other simpletons, to part with my money for the gratification of my curiosity. The people were coming out in crowds, from the repository of those wonders, delighted and astonished with their pennyworth. At last, I too had the satisfaction of contemplating the marvellous sight. The two superfluous legs of the sheep were nothing but two shrivelled pieces of skin, cut out like thongs, and hanging down from the breast, but without touching the ground, and incapable of being of any use whatever to the poor animal. The pretended third eye of the cow, was a kind of oval wound in the middle of the forehead, without orbit, without apple, without a lid, and without any

membrane which presented one single organized part of an eye. I withdrew, without examining whether these accidents were natural or artificial, for, in truth, it was not worth the trouble.

The monsters which are preserved in crystal globes filled with spirit of wine, such as pigs with the proboscis of an elephant; children double bodied, or with two heads, which are exhibited in cabinets, with a philosophic mysteriousness, prove much less a laboured production of Nature than the interruption of it. No one of those beings could possibly have attained a complete expansion: and so far from demonstrating, that the intelligence which produced them had fallen into a blunder, they attest, on the contrary, the immutability of Supreme Wisdom, which has rejected them from its plan, by refusing them life.

There is a benignity, in the conduct of Nature toward Man, which challenges the highest admiration: it is this, that in defying him, on the one hand, to infringe the regularity of her laws, to gratify caprice; on the other, she frequently permits him to derange the course of some of them, to relieve his necessities. For instance, she connives at the production of the mule from the copulation of the ass and the mare, because that animal is so serviceable in mountainous countries,

tries, but positively forbids the re-production to proceed, in order to preserve the primitive species, which are of more general utility.

It is easy to discern, in most of her works, these maternal condescensions, and, may I call them so? regal provisions. They manifest themselves particularly in the productions of the garden. We find them in those of our flowers which have a profusion of *corollæ*, as in the double rose, which is not reproduced by seeds, and which, for this reason, certain Botanists have dared to brand with the name of monster, though it be the finest of flowers, in the estimation of all persons of taste and sensibility. Naturalists pretend, that it deviated from the laws of Nature, because it scorned to conform to their Systems: as if the first of laws, which governs the World, had not for its object the happiness of Man! But if roses, and other flowers, which have a superabundance of *corollæ*, are monsters, fruits which have a superabundance of pulpy flesh, and sugary pastes, of no use toward the expansion of their seeds, such as apples, pears, melons, and fruits which have no seeds at all, as the pine-apple, the banana, the bread-fruit, all these must likewise be monsters. The roots which become so plump in our kitchen-gardens, and which are converted into large balls, into succulent glands, into bulbs farinaceous, and of no effect
toward

toward the expansion of their stems, must, forsooth, be all monsters.

Nature feeds the human race, in part, only with this vegetable superabundance, and bestows it only as the reward of Industry. However fertile the soil may be, the vegetables of the same species with those which are produced in the garden, degenerate in the uncultivated plain, grow wild, and spend themselves in foliage and branches. Is it not, therefore, an instance of wonderful complaisance on the part of Nature, that she should transform, under the hand of Man, into pleasant and wholesome aliment, the same juices which would be converted, in the forest, into lofty stems, and tough roots? Were this condescension withheld, in vain would man say to the sap of trees, you shall flow into the fruit, and you shall go no further. To no purpose would he, in the most fertile region, prune, crop, nip; the almond-tree would refuse to cover it's nut with a fleshy melting pulp, like that of the peach.

Nature, from time to time, makes Man a present of varieties both useful and agreeable, which she extracts from the same genus. All our fruit-trees come originally from the forest, and no one there re-perpetuates itself in it's species. The pear called Saint-Germain was found in the forest
of

of that name, with its well-known flavour. Nature culled it, like the other fruits of our orchards, from the table of the animal, to serve it up on that of Man; and that it might be impossible for us to doubt respecting her bounty and its origin, it is her sovereign will that the seeds should re-produce crabs only. Ah! if she were to suspend her particular laws of beneficence in the gardens of our miscreants, in order to establish in them her pretended general laws, what would be their astonishment to find nothing re-produced in their kitchen-gardens and orchards, but some miserable wild carrots, pitiful dog-roses, harsh pears, and unfavoury fruits of every sort, such as she produces, on the mountains, for the coarse palate of the wild boar! They would, in truth, find stems of trees lofty and vigorous. Their orchards would be doubled in size, and the crops reduced to one half.

The same metamorphosis would take place in the animals of their farm-yards. The hen, which lays eggs much too large in proportion to her size, and that for nine months uninterruptedly, contrary to all the laws of incubation among the feathered race, would then fall back into the general order, and would produce, at farthest, twenty eggs in the course of a year. The hog would, in like manner, lose his superfluous fat. The cow, which
yields,

yields, in the rich pastures of Normandy, up to twenty-four quarts of milk a day, would give no more than a bare sufficiency to suckle her calf.

To this it is replied, that this profusion of eggs, of fat, and of cream, from our domestic animals, is the effect of their copious feeding. But neither does the mare give as much milk as the cow, nor does the duck lay as many eggs as the hen, nor does the ass clothe himself with fat like the hog, though these animals all feed as plentifully the one as the other. Besides, the mare, the she-goat, the ewe, the she-ass, have only two teats, whereas the cow has four.

The cow, in this respect, deviates, in a very remarkable manner, from the general laws of Nature ; who has adjusted, in every animal species, the number of teats in the mother to that of the young ; she, however, is furnished with four paps, though she produces but one calf, and very rarely two ; because the two supernumeraries were destined to be nurses to the Human Race. The sow, it is granted, has only twelve teats, though she is intended to bring up, sometimes, a litter of fifteen or more. Here the proportion seems defective. But if the first has more teats than are requisite to the number of her family, and the second too few for her's, it is because the one is ordained to pre-
sent

sent Man with the surplus of her milk, and the other with that of her brood. In all countries, pork is the poor man's meat, unless religion, as in Turkey, or political considerations, as in the islands of the South Sea, deprive him of the benefit of this gift of Nature. I shall observe, with Pliny, that of all flesh it is by far the most savoury. There may be distinguished in it, says he, up to fifty different relishes. It is employed in the kitchens of the rich to give flavour to every species of aliment. In every country, I repeat it, that which is best is always most common.

Is it not passing strange that, when so many plants and animals exhibit proportions so beautiful, adaptations so wonderful to our necessities, and proofs so evident of a Divine Benevolence, we should set about collecting shapeless abortions, pigs with a long proboscis, as if our yards teemed with young elephants, and ceremoniously arrange them in our cabinets, designed to exhibit a display of Nature? Those who preserve them as invaluable curiosities, and deduce from them consequences and doubts respecting the intelligence of their AUTHOR, do they not discover as much want of taste, and act as unfairly, as one who should go into the workshop of a Founder, and pick up the figures which had been accidentally mutilated, the bubbings over of the melting-pot, and the mere
metallic

metallic moulds which might lie scattered about, and triumphantly display them as a proof of the Artift's blundering ignorance ?

The Ancients burnt monfters, the Moderns preferve them in fpirit of wine. They refemble thofe ungracious children, who watch their mother, in the hope of furprizing her in a fault, that they may arrogate to themfelves a right to do what they please. Oh ! if the Earth were indeed abandoned to diforder, and that after an infinity of combinations, there fhould at laft appear, amidft the monfters which covered it, a fingle body well proportioned, and adapted to the neceffities of Man, what a fource of fatifaction would it be to creatures at once fenfible and unhappy, to catch but a glimmering of an INTELLIGENCE, fome- where, who took an intereft in their deftiny ? ✓

END OF THE FIRST VOLUME.

