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THE
ANIMAL KINGDOM

OF THE

BARON CUVIER,

ENLARGED AND ADAPTED TO THE PRESENT STATE OF
ZOOLOGICAL SCIENCE.

ILLUSTRATED AFTER THE ORIGINAL DRAWINGS

OF

AUDEBERT, BARABAND, CRAMER, D'ORBIGNY,
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EDINBURGH:

PUBLISHED FOR THE PROPRIETOR, 13, HILL STREET.

GLASGOW AND THE WEST OF SCOTLAND: JOHN SMITH AND SON, 70, ST VINCENT STREET; AND
JOHN McLEOD, 20, ARGYLE STREET. ABERDEEN: A. BROWN AND CO.

MANCHESTER: AINSWORTH AND SONS, 107, GREAT ANCOATS STREET. LEEDS: THOMAS AINSWORTH, JUNIOR,
50, QUEEN'S PLACE, COBURG STREET.

DUBLIN: GEORGE YOUNG, 9, SUFFOLK STREET.

PARIS: J. B. BALLIÈRE, RUE DE L'ÉCOLE-DE-MÉDECINE, 13, (BIS.)

LONDON: SMITH, ELDER, & CO., 65, CORNHILL.

M.DCCC.XXXIX.

PREFACE.

THE importance of Natural History, and that of Zoology in particular, being fully appreciated by all liberal minds, no apology is necessary on our part for presenting to the public a New Edition of the "Règne Animal;" with additions and alterations, corresponding to the more advanced state of the Science, since the publication of that celebrated Work. Indeed, the absence of any accurate or complete SPECIES ANIMALIUM, or SYSTEMATIC CATALOGUE OF ANIMALS, either in our own or any other language, will, it is hoped, render the present undertaking of the highest interest to the Scientific Zoologist.

The outline which the BARON CUVIER so ably sketched, as explanatory of his views of arrangement, he chiefly exemplified by noticing such animals as were best known to him, while the more rare, though not less interesting, species were merely alluded to by referring to the most expensive works on the subject. It will, accordingly, be our care to fill up his outline with descriptions of all the species which have ever been noticed in any work of authority, and these will either be drawn directly from the living animals, or by direct reference to the original works in our possession, wherein they were first described. Those valuable acquisitions which have been made to the science by the discoveries of AUDUBON, BÉLANGER, DIARD and DUVAUCEL, D'ORBIGNY, EHRENBERG, HARLAN, HORSFIELD, LESSON and GARNOT, LE VAILLANT, LICHTENSTEIN, The Prince MAXIMILIAN of Wied Neuwied, The Prince of MUSIGNANO, QUOY and GAIMARD, RICHARDSON, RÜPPEL, SPIX, SMITH, VIEILLOT, ALEXANDER WILSON, &c. &c., together with the accurate materials supplied by the able Monographs of AUDOUIN, BRONGNIART, FREDERIC CUVIER, DE BLAINVILLE, MILNE-EDWARDS, E. and I. GEOFFROY-ST-HILAIRE, The BARON VON HUMBOLDT, GOULD, GRAY, LAMARCK, LATREILLE, SAVIGNY, SWAINSON, TEMMINCK, VALENCIENNES, VIGORS, and others, will find their proper places in the system; while such new species as may be discovered during the progress of this publication will be described in supplementary sheets, paged so as to indicate their natural position. Throughout the work the utmost care will be taken to clear the system of all those doubtful and imaginary species, with which the inexperience of compilers has hitherto crowded our systematic catalogues. The introductory portion, containing the generalities of the Animal Kingdom, will be enlarged by a selection of the most approved physiological views, chiefly from the other writings of the BARON CUVIER, as well as those of the most distinguished British and Continental Writers.

But "a well-executed design," to use the words of M. TEMMINCK, "is always more valuable than the most minute description, especially in those classes of animals where the species are very numerous, and the characters of which are so difficult to define by words;" and it is accordingly our intention to illustrate this work in a manner worthy of the merits of its illustrious author. The original designs, which are widely scattered throughout numerous foreign works in all civilized languages, have been collected together at considerable expense, and most of these will be here introduced, with appropriate English names, for the first time, to the British Student, with scrupulous accuracy and at a moderate price, the whole arranged in generic groups, and with appropriate backgrounds. Original Drawings, made by our own Artists, after such undescribed living animals as we are able to meet with, will likewise appear.

THE ANIMAL KINGDOM.

INTRODUCTION.

SECT. I.—NATURAL HISTORY IN GENERAL, AND METHODS OF ARRANGEMENT.

Nature—Division of the Physical Sciences—Natural History—General Principles—Conditions of Existence, or Final Causes—Observation—Classification—Artificial or Natural—Subordination of Characters.

WE deem it necessary to commence our work by clearly defining the object of Natural History, and by establishing a precise line of demarcation, so as to separate this science from others, to which it is nearly allied. This is the more requisite, as confused and indistinct notions on the subject very generally prevail.

Various significations have been applied to the term *Nature*, in our language as well as in most others;—sometimes it denotes the qualities of a being derived from original constitution, as distinguished from those acquired by art;—sometimes it signifies the vast concourse of beings composing the universe;—and sometimes the laws which govern those beings. It is especially in this last sense that we are accustomed to personify Nature; and, from a proper feeling of respect, to use this term for the name of its divine Author. Physics, or Physical Science, may consider nature in any of these three points of view.

The name of the Supreme Being, which never ought to be pronounced without emotion, could not be introduced into philosophical discussions upon every occasion, without a violation of decorum. Accordingly, it has become an established practice to use the milder term *Nature*, as an appellation of similar import. This is done without any intention of deifying the powers of nature. On the contrary, the best and wisest natural philosophers agree with Dr Clarke in considering “that there is no such thing as what we commonly call the course of nature, or the power of nature. The course of nature, truly and properly speaking, is nothing else than the will of God, producing certain effects in a continued, regular, constant, and uniform manner, which course or manner of acting being in every moment perfectly arbitrary, is as easy to be altered at any time as to be preserved. So that all those things which we commonly say are the effects of the natural powers of matter and laws of motion, of gravitation, attraction, and the like, are indeed (if we will speak strictly and properly) the effects of God’s acting upon matter, *continually and every moment*, either immediately by himself, or mediately by some created intelligent being.” In these and following passages, the term *law* is used in a metaphorical sense. An ordinary law of civil society is addressed by an intelligent legislator to persons, capable both of understanding the meaning of the law, and of regulating their actions accordingly. But, when we use the phrases *law of vegetable life*, *law of gravitation*, it is evident that the word is used in a sense widely different from the former. Nature, that is, the Supreme Being, not only prescribes the law, but executes it; a *law of nature* being nothing more than that particular regular mode of acting which the Deity has prescribed to himself.

Physical Science is either general or particular.

When we deduce effects from causes, and, by explaining the various phenomena of nature, obtain the power of applying the materials she presents to purposes useful to mankind, it is termed *General Physics*, or *Natural Philosophy*; but, when we consider the various objects presented by Nature, simply for the purpose of obtaining a knowledge of their order, their arrangement, and the disposition of their parts, without referring effects to their causes, it is termed *Particular Physics*, or *Natural History*. It thus appears, that while Natural Philosophy is the ultimate object of science, Natural History is the source whence all science must necessarily arise. The former is unrivalled for sublimity of ideas and depth of investigation, the latter for variety of character and interest in its details. While Natural Philosophy is best fitted to occupy the mind in its severer moments, Natural History affords an agreeable relief, by the general beauty of its objects, the elegance of their forms, the richness of their colouring, the singularity of their habits and instincts, and the exquisite adaptation of all their parts. Both alike lead us to form elevated and enlightened conceptions of the power and beneficence of the Creator.

GENERAL PHYSICS examines, in an abstract manner, each of the properties of those movable and extended bodies, to which we apply the general term *matter*.

That branch called *Mechanics* considers the particles of matter as collected in masses, and deduces mathematically, from a very small number of experiments, the laws of equilibrium, of motion, and of its communication. Its several divisions take the names of Statics, Dynamics, Hydrostatics, Hydrodynamics, Aerostatics, &c. according to the nature of the bodies, the motions of which are under examination.* Optics considers solely the peculiar vibrations of light; but in this science various phenomena, ascertained entirely by experiment, are daily becoming more numerous.

Chemistry, the other division of General Physics, explains the laws, by which the elementary particles of bodies act on each other, at indefinitely small distances; the combinations or decompositions resulting from the affinity of their ultimate elements; and the manner in which the operation of affinity is modified by various circumstances, capable of increasing or diminishing its action. Being chiefly an experimental science, it cannot, on that account, be classed with others more exclusively mathematical.

The theories of heat and electricity may belong almost equally to Mechanics or to Chemistry, according to the point of view in which each of them is considered.

The mode of proceeding adopted in all the departments of General Physics is, to consider, either mentally or experimentally, only a small number of the properties of bodies at once, in order to reduce them to the greatest attainable simplicity; then, to calculate or discover the effects resulting therefrom; and finally, to generalize and incorporate the laws of these properties so as to form series of theorems; and, if possible, to resolve them into one universal principle, which will serve as a general expression for them all.

PARTICULAR PHYSICS, or Natural History (for both of these terms are used indiscriminately), may [be extended so as to] include the particular application of the laws, ascertained by the different branches of General Physics, to the numerous and diversified created beings existing in nature, in order to explain the phenomena which each exhibits. When used in this extensive signification, it also includes Astronomy; but this latter science, being fully elucidated by the light of Mechanics alone, is entirely subservient to its laws, and employs methods of investigation, too different from those admitted by Natural History, to be [extensively] cultivated by the same persons. It is usual, also, to include Meteorology among the branches of General Physics, and to confine Natural History to objects which do not admit of rigorous mathematical investigation, or precise measurement in all their parts.

Geology ranks next to Astronomy for the sublimity and depth of its investigations, and ought, logically, to be classed with Natural Philosophy. But the science is based upon so vast a mass of historical detail, and is still so much in its infancy, that it will long continue to be arranged with the branches of Particular Physics. It contrasts with Astronomy in this respect, that while the last-mentioned science leads us to explore the infinity of space, Geology unfolds the secrets of the infinity of past time. In the one, the *present place* of man is considered but as a point in the vast regions of space; in the other, the *present time* but as an instant in the middle of two infinities—time past and time to come.

NATURAL HISTORY properly considers only the inorganic bodies called Minerals, and the various kinds of living beings [called Animals and Plants,] almost all of which are under the influence of laws, more or less unconnected with those of motion, of chemical affinity, and of various others,

* In this, and in similar passages, we have thought it more agreeable to received usage to transmute the terms Mechanics and Dynamics from the position in which they stand in the original, the former being, as we conceive, the more general term.—*Translator.*

analysed in the several departments of General Physics. We ought, in treating of Natural History, to employ precisely the same methods as in the General Sciences; and, therefore, we endeavour to adopt them, whenever the subjects under examination become sufficiently simple to permit that mode of investigation. But as this is seldom practicable, there arises, hence, an essential difference between the General Sciences and Natural History. For, in the former, the phenomena are examined under circumstances completely within the reach of the inquirer, who arrives, by analysis, at general laws; while, in the latter, they are removed, by unalterable conditions, beyond his control. In vain, he attempts to disengage them from the influence of general laws, already ascertained. He cannot reduce the problem to its elements, and, like the experimental philosopher, withdraw successively each condition; but he must reason upon all its conditions at once, and only arrive, by conjecture, at the probable result of such an analysis. Let him seek to ascertain, by direct experiment, any one of the numerous phenomena essential to the life of an animal, though but slightly elevated in the scale of being,

“And ere he touch the vital spark—’tis fled.”

Thus, it appears that, while Mechanics has become a science chiefly of Calculation, and Chemistry of Experiment, Natural History will long remain, in most of its departments, a science wholly of Observation.

The latter part of this remark must, however, be restricted to the early stages of Natural History; because, in its more matured condition, it becomes a science of demonstration. Every branch of physics has one leading object in view, and that is, the discovery of the ultimate laws of Nature. Philosophy regards this as of primary importance; while utility is held only as of secondary rank. Science, in its most comprehensive sense, is a superstructure founded on facts, or acquired by experience; and hence, in its early stages, we consider it as entirely limited to observation: but when we have learned to generalize, and find that truths agree in their several relations, we have arrived at the demonstrative part of the science. It is not, therefore, from a mere knowledge of correct nomenclature, or from a capacity to recognize at sight a natural object, that we are entitled to apply the name of scientific knowledge to Natural History; but only when we have succeeded, by observation, in deducing the laws which regulate these objects, in their relations to surrounding beings.

These three terms, Calculation, Observation, and Experiment, express, with sufficient accuracy, the manner of cultivating the several branches of Physical Science; but, by exhibiting among them very different degrees of certainty, they indicate, at the same time, the ultimate point to which Chemistry and Natural History ought to tend, in order to rise nearer to perfection. Calculation, in a manner, sways Nature; it determines the phenomena more exactly than can be done by observation alone: Experiment obliges Nature to unveil: Observation watches when she is refractory, and seeks to surprise her.

Natural History employs with advantage, on many occasions, a principle of reasoning peculiar to itself, termed *the conditions of existence*, or, more commonly, *final causes*. As nothing can exist except it contains within itself all the conditions which render existence possible, it is evident, that there ought to be such a mutual adaptation of the various parts of each being among themselves, and such an accommodation of their structure to the circumstances of surrounding beings, as to render possible the existence of the whole. The analysis of these conditions often leads to the discovery of general laws, with a clearness of demonstration, surpassed only by the evidence of direct experiment or calculation.

It was by the knowledge of this principle, that the celebrated Dr William Harvey was enabled to discover the circulation of the blood in Man. The Honourable Robert Boyle relates his conversation with Dr Harvey on this subject, in the following words:—“I remember, that when I asked our famous Harvey, in the only discourse I had with him (which was but a little while before he died,) what were the things which induced him to think of a circulation of the blood? he answered me, that when he took notice that the valves in the veins of so many parts of the body were so placed, that they gave free passage to the blood towards the heart, but opposed the passage of the venal blood the contrary way, he was invited to think, that so provident a cause as Nature had not placed so many valves without design: and no design seemed more probable than that, since the blood could not well (because of the interposing valves,) be sent by the veins to the limbs, it should be sent through the arteries and return through the veins, whose valves did not oppose its course that way.” It is evident from this, and many other similar instances, that, in examining the subjects of Natural History, we shall best advance the science, by considering attentively the uses and ends designed by Nature in their formation, and the functions which their organs are destined to perform. This manner of investigation has been objected to by some philosophers, among whom is Des Cartes, as being a presumptuous attempt on the part of human reason, far above its powers, to penetrate into the secret designs of the Creator. The following passage, extracted from the works of Mr Boyle above quoted, forms a satisfactory answer to this objection:—“Suppose that a countryman, being in a clear day brought into the garden of some famous mathematician, should see there one of the curious gnomonic instruments, that show at once the place of the sun in the zodiac, his declination from the equator, the day of the month, the length of the day, &c. &c., it would indeed be presumptuous in him, being unacquainted both with

the mathematical disciplines, and the several intentions of the artist, to pretend or think himself able to discover *all the ends* for which so curious and elaborate a piece was framed: but when he sees it furnished with a style, with horary lines and numbers, and, in short, with all the requisites of a sun-dial, and manifestly perceives the shadow to mark from time to time the hour of the day, it would be no more a presumption than an error in him to conclude, that (whatever other uses the instrument was fit or was designed for,) it is a sun-dial, and was meant to show the hour of the day.” The whole science of Natural History teems with instances, showing the successful application of the general principle called the conditions of existence. Thus, when we see an animal, possessed of a capacious stomach, long intestines, and a massive structure, we may safely infer that it is *herbivorous*, or feeding on vegetables, slow in its movements, and of timid and gentle habits. On the contrary, when we find an animal with short intestines, straight stomach, and armed with weapons of offence, we immediately conclude it to be *carnivorous*, or feeding upon flesh, and of a fierce and active disposition.

It is further observed by the author, in his Lectures on Comparative Anatomy, that the construction of the alimentary canal determines, in a manner perfectly absolute, the kind of food on which the animal is nourished. For, if the animal did not possess, in its senses and organs of motion, the means of distinguishing the kinds of aliment suited to its nature, it is obvious that it could not exist. An animal, therefore, which can only digest flesh, must, to preserve its species, have the power of discovering its prey, of pursuing, of seizing, of overcoming, and of tearing it in pieces. It is necessary, then, that the animal should have a penetrating eye, a quick smell, a swift motion, address and strength in the jaws and talons. Agreeably to this necessity, a sharp tooth, fitted for cutting flesh, is never co-existent in the same species with a hoof covered with horn, which can only support the animal, but cannot grasp any thing: hence the law, according to which all hoofed animals are herbivorous, and also those still more detailed laws, which are but corollaries to the first, that hoofs indicate molar teeth or grinders with flat crowns, a very long alimentary canal, with a capacious and multiplied stomach.

It is only after having exhausted all the laws of general physics, and the conditions of existence, that we are compelled to resort to the simple laws of observation. The most effectual mode of deducing these is by comparison; by observing the same body successively in the various positions in which it is placed by Nature; and by comparing different bodies with each other, until we obtain a knowledge of some constant relations between their structure and the phenomena exhibited by them. These various bodies thus form a species of experiments, performed entirely by Nature’s hand, where different parts of each are supplied or abstracted, as we would desire to treat them in our laboratories; and the results of these additions or abstractions are presented to us spontaneously. We are thus enabled to deduce the invariable laws influencing these relations, and to apply them in a manner, similar to the laws determined by general physics. Could we but incorporate these laws of observation with the general laws of physics, either directly or by means of the principle called the conditions of existence, the system of natural science would be complete, and the mutual influence of all beings would be perceived throughout the whole. To approach this great end the efforts of naturalists should be steadily directed.

All researches of this kind presuppose that we have the means of distinguishing with certainty, and of describing to others with accuracy, the objects under investigation; otherwise, we shall be continually liable to fall into confusion, amidst the innumerable beings which surround us. Natural History ought, therefore, to have for its basis, what has been technically termed *a system of nature*, or a methodical and extensive catalogue, arranged with divisions and subdivisions, in which all beings shall bear suitable names and distinct *characters*.* That we may always be able to discover the character of any particular being from knowing its name, or the name from knowing its specific character, we must found this peculiar description upon some essential or permanent properties of the being. We must not derive the character from habits, or colour alone, as these properties are ever liable to be modified by external circumstances, but from INTERNAL ORGANIZATION OF COMPOSITION.

When Natural History was in its infancy, the objects were few and easily remembered. Systems of classification were either neglected as unnecessary, or confined only to those general divisions and subdivisions, which it was impossible to overlook. But ever since the days of Aristotle, A.C. 330, when Alexander the Great had increased the number of known species of animals by some of the productions of the conquered East, the necessity of a precise system of classification has been universally admitted; and now, the progress of geographical knowledge has enlarged the bounds of the science to so vast an extent, and disclosed a variety so inconceivable of forms hitherto unknown, that the naturalist would, without classification, be overwhelmed with endless details. Yet the different kinds of animals are daily becoming more numerous by the contributions of enlightened travellers. In 1750, the number of distinct species of insects was estimated at 20,000, and now it cannot be less than 100,000. And when it is considered how small a part of the globe has been

* The word *character*, in Natural History, denotes that peculiar description of an object which distinguishes it from all others. Thus we say, the character of *man* is, “Teeth of three kinds, posterior extremities furnished with feet, anterior with hands, &c. &c.”—*Translator*.

carefully examined, when there are vast tracts in the interior of Asia, Africa, America, and the isles of the Southern Ocean, which have never been trod by civilized man, while many portions, even of Europe, are but superficially explored, and when the depths of the vast ocean present insuperable barriers to investigation, we may reasonably expect, that the whole number of species will be found to be very much greater. Improved microscopes have disclosed myriads of animalcules previously unknown, and almost every fluid contains an enormous variety of distinct forms, many of them peculiar to each kind of liquid. All this apparent chaos is by the art of the naturalist reduced to a beautiful system, and immediately one universal principle of order may be traced throughout the whole.

Scarcely any object in nature is so peculiar in its formation, as to be at once defined by any single trait in its character. We are almost always under the necessity of combining many of these peculiarities, in order to distinguish an object from others to which it is nearly allied; especially when these allied objects possess some, though not all, of its peculiarities, or when these peculiarities are united to other properties of a different character. The more numerous the objects are which have to be distinguished, the more it becomes necessary to multiply the terms of their several characters; so that, without some contrivance, they would become descriptions of inconvenient length. To remove this objection, divisions and subdivisions are employed. A certain number of allied species are collected together into one group, and it then becomes necessary only to express, for their respective characters, the points wherein they differ, which, according to the above supposition, form but a small part of their description. The whole group is termed a *genus*. The same difficulty would be experienced in distinguishing the genera from each other, if we did not repeat the operation, by grouping the allied genera to form an *order*; and then assembling the allied orders to constitute a *class*. Subdivisions intermediate to these are established when necessary. This aggregation of divisions, in which the superior contain the inferior, is termed a *system* or *method*. It may be compared, in some respects, to a dictionary, wherein the properties of things are an index to their names, being the reverse of ordinary dictionaries, in which the names are given, as an index to their meanings or properties.

Thus it appears, that a collection of individuals of the same form constitute a species,
Of species..... a genus,
Of genera..... an order,
Of orders..... a class,
And of classes..... a kingdom.

To explain this arrangement more clearly, we shall take an example from the Animal Kingdom; suppose, the horse. This animal belongs to the class *Mammalia*, containing all which suckle their young; to the order *Pachydermata*, or thick-skinned animals, such as the elephant, boar, and rhinoceros; and to the genus *Equus*, composed of animals with solid hoofs, as the ass and zebra. From these allied species it is finally distinguished by the term *caballus*. Thus, the scientific name of the horse is *Equus caballus*, terms derived from its genus and species. But, as different naturalists often give different names to the same animal, it becomes necessary to add to these the name of the naturalist who first introduced the generic and specific names. In the above example, we therefore write *Equus caballus*, LINN. for the celebrated naturalist Linnæus. In the following pages, we shall give an extensive list of the various synonyms, or names belonging to the same animals, for facilitating reference to other works on the same subject.

Such is the method indispensably required, in framing the arrangement of the almost unbounded objects of Natural History.

We need scarcely caution our readers against the errors of the Realists, once the cause of so much contention in the schools. The individuals alone, or more properly the particles composing each individual, have a real existence in nature, while species, genera, &c. are but general words, invented by man, to express certain points of resemblance, which he perceives among their properties.

There are two different principles observed in the formation of systems of arrangement, according as they are intended to be *artificial* or *natural*. The design of an artificial system is to enable the student to find the *name* of an object, whose properties are known, and to this alone its utility is, in general, confined. Thus, Linnæus arranged plants, chiefly according to the number and situation of the stamens and pistils contained in their flowers. But, being founded on the comparison of only one single organ, the artificial method conveys no general knowledge of other properties, and frequently separates objects which ought never to be disjointed. It is altogether different with a *natural* method. Its divisions are not founded upon the consideration of a single organ, but are derived from characters presented by all the parts of the object. Accordingly, the objects are disposed in such a manner, that each bears a greater affinity to that which immediately precedes and follows it, than to any other.

When this method, therefore, is good, it is not confined to a mere list of names. If the subdivisions have not been selected arbitrarily, but rest upon real and permanent relations, and upon the essential points of resemblance in objects, the natural method is the means of reducing the properties of beings to general laws, of expressing them with brevity, and of fixing them permanently on the memory. To produce these results, objects must be assiduously compared under the guidance of another general principle, necessarily proceeding from that of the conditions of existence formerly explained, called *the subordination of characters*, which

we shall here briefly elucidate. The several parts of a being having a mutual adaptation, there are certain constitutional arrangements which are incompatible with others; again, there are some with which they are inseparably connected. When, therefore, certain peculiarities belong to an object, we may calculate with facility what can, and what cannot, co-exist with them. We, accordingly, distinguish by the terms *important* or *leading characters*, those parts, properties, or constitutional arrangements, having the greatest number of these relations of inconsistency, or of necessary co-existence; or, in other words, which exercise upon the whole being the most marked influence. Others of minor importance are termed *subordinate characters*. The superiority of characters is sometimes determined in a satisfactory manner, by considering the nature of the organs described in the character. When this is impracticable, we must resort to simple observation; and, from the nature of a character, must infer such to be the most decided as are found the least liable to vary, when traced through a long series of beings, differing in degrees of resemblance. For this reason, we should select for the grand divisions, those characters which are at once important and permanent; and may reserve, with propriety, the subordinate and variable characters for the minor subdivisions of our system.

There can be but one complete system, and that is, the natural method. Here species of the same genus, order, or class, resemble each other more than they do the species of any other corresponding division; the place of each object is decided by its relation to surrounding beings; [and the whole arrangement forms a type of that beautiful system of nature which, "changed thro' all, thro' all remains the same." Even Linnæus, who framed the best artificial system ever presented to the world, observes, in his *Philosoph. Bot.* § 77, that natural historians should regard the natural method of arrangement as the ultimate aim of their labours.

In a word, the natural method is the very soul of Natural History.

"Unerring nature, still divinely bright,
One clear, unchanged and universal light."]

SECT. II.—OF LIVING BEINGS, AND OF ORGANIZATION IN GENERAL.

Life—Its definition—Death—Organization—Generation—Spontaneous Generation—Reproduction—Species—Varieties—Permanence of Species—Pre-existence of Germs.

LIFE, being the most important of all the properties of created existence, stands first in the scale of characters. It has always been considered the most general principle of division; and, by universal consent, natural objects have been arranged into two immense divisions, ORGANIC beings [comprising animals and plants], and INORGANIC beings [comprising minerals.]

The word *Life* is used under two significations which are often confounded. It may be applied merely as a general term to express, with brevity, the various phenomena peculiar to living beings; or it may signify the *cause* of these phenomena. It is in the latter sense that the terms *vital principle*, or *principle of life*, are employed; being, in this respect, perfectly analogous to the terms gravity, heat, attraction, and electricity, which are used in the general sciences under a twofold signification,—the one physical,—the other metaphysical. But, it is with the phenomena alone, or the physical sense of these terms, that Natural Philosophy has any concern. The knowledge of causes is removed far beyond the reach of human reason; and, by neglecting to discriminate between these two senses, ancient philosophers before Lord Bacon, and too many modern ones since his time, have fallen into endless discussions, and obscured the light of real science. Yet, it is difficult, upon a subject so interesting as life, in which we all feel deeply concerned, to restrain curiosity within the bounds of reason and philosophy. A recent anonymous writer asks, "Who has not put to himself the question 'What is life?' Who would not receive a clear and just solution of the inquiry, with a feeling of interest, far beyond that afforded by the successful result of any ordinary scientific investigation? We can comprehend part of the mechanism by which life acts; we *feel* its result. We see that mechanism to be so delicate, so complicated, so fragile, so easily set wrong, while our interest is so deep that it should act well, and permanently well, that the exquisiteness of adjustment, the skill of contrivance, and the completeness with which the intended result is secured—all subjects of distinct and interesting investigation—only increase the earnestness of our wish, that we could see beyond the mechanism, and understand that, which it is permitted us to know only by examining its phenomena.

"We do not commonly consider *how much* is given us in life,—the daily enjoyment of the boon renders us insensible to the variety and plenitude of its richness. We shall become more sensible of it upon contemplating the various tissues of organic particles that have been formed; the number of properties that are attached to each; the number of organs that are constituted by their aggregation and arrangement; the number of functions that are exercised by those organs; and the number of adjustments by which all are combined, harmonized, and made effectual to the production of one grand result. It is then we perceive, how many things must exist, how many relations must be established, how many actions must be performed, how many

combinations of actions must be secured, before there can be sensation and motion, thought and happiness."

Many attempts have been made to account for the vital principle, but hitherto all these have proved abortive. It is possible, that various functions of the animal frame may hereafter be discovered to proceed from mechanical or from chemical laws; but, we believe, that the ultimate springs of the phenomena of life will ever remain concealed from human knowledge.

In order to form a just idea of the essential conditions of life, we must first examine those beings, which are the most simple in the scale of creation; and we shall readily perceive that these vital conditions consist, in a power possessed by certain bodies, for a period of time only, of existing in a determinate form; of continually drawing into their composition a part of the surrounding substances; and of returning back, to the influence of the general laws of matter, certain portions of their own materials.

These phenomena are exhibited by the *conferva rivularis*, a small bundle of green filaments, finer than hair, found in rivulets and stagnant pools. Being without root or leaves, it is simply attached by a broad surface to the margin of the water. While life exists, it increases in size and weight, throws out filaments like branches, assimilates the particles of water, and of other inorganic substances around it, into vegetable matter, and lays them down in an oblong cellular form. In animals and plants, nutrition is the effect of an internal power; their growth is a development from within. In minerals, on the contrary, growth goes on by the external deposition of successive strata or layers; whilst organized bodies, by means of their vital power, grow and increase by the assimilation of different substances. The *stalactite*, once supposed to be an exception, is now proved to be subject to the ordinary laws of inorganic matter.

Thus life may be compared to a whirlpool of variable rapidity and intricacy, drawing in particles of the same kind, and always in the same direction; but where the same individual particles are alternately entering and departing. The form of living bodies seems, therefore, to be more essentially their own, than the matter of which they are composed.

The matter forming the bones of animals has been ascertained to undergo a very considerable change in a few days; and from this fact the probability of a corresponding change in the other parts of the frame is inferred. The very singular rapidity with which this change is effected was accidentally discovered. Certain animals were fed with madder (*rubia tinctorum*), a plant cultivated for its red dye; and in twenty-four hours all their bones were found to be deeply tinged with its colour. On continuing the same food, the colour became very deep; but upon leaving it off, the colour was completely removed in a very few days. By alternately changing the food, the bones were found to be marked with concentric rings of the red dye, according to the number of times that the change was made. These phenomena, so far surpassing any thing that could have been anticipated, are well calculated to convey an idea of the extraordinary rapidity with which the particles of the animal frame are removed, while the form remains without any apparent alteration.

While this movement continues, the body wherein it takes place LIVES; when it entirely ceases, the body DIES. After death, the elements which compose the living frame, being surrendered to the influence of the ordinary chemical affinities, begin to separate; and the dissolution of the once living body speedily follows. It was, therefore, by the vital movement, that dissolution had been previously arrested, and that the elements of organized bodies were preserved in a state of temporary union. All bodies cease to live after a certain period of time, the duration of which is fixed for each species. Death appears to be a necessary effect of life; and the very exercise of the vital power gradually alters the structure of the body, so as to render its longer existence impossible. The frame undergoes a regular and continual change, as long as life remains. Its bulk first increases in certain proportions, and to certain limits, fixed for each species, and for the several organs of each individual; and then, in the course of time, many of its parts become more dense or solid. This last change appears to be the immediate cause of natural death.

If different living bodies be examined with attention, we shall find them to be composed of an organic structure, which is obviously essential to such a whirlpool, as that to which we have already compared the vital action. There must not only be solid particles to maintain the forms of their bodies, but fluids to communicate the motion. They are, therefore, composed of a tissue of network, or of solid fibres and thin plates (or laminae,) which contain the fluids in their interstices. It is among the fluid particles that the motion is most continuous and extensive. Foreign substances penetrate into the innermost parts of the body, and incorporate with it. They nourish the solids by interposing their particles; and, in detaching from the body its former parts, which have now become superfluous, traverse the pores of the living frame, and finally exhale under a liquid or gaseous form. During their course, the foreign substances enter into the composition of the solid framework, containing the fluids; and, by contracting, communicate a part of their motion to the liquid particles within them.

This mutual action of solids and liquids—this transition of particles from the one form to the other, presupposes a great chemical affinity in their elementary constituents; and we accordingly find, that the solid parts of organized bodies are composed chiefly of such elements as are capable of being readily converted into liquids or gases. The solids would also require to be endowed with considerable powers of bending and expanding, in order to facilitate the mutual action and reaction between the solids and the fluids; and hence, this is found to be a very general characteristic of the solid parts of organized bodies. This structure, common to all living bodies—this porous or spongy texture, whose fibres or laminae, ever varying in flexibility, intercept liquids, ever varying in quantity—constitutes what has been termed *organization*; and, from the definition we have already given of the term life, it necessarily follows that none but organized bodies are capable of enjoying life. Thus we see, that organization results from a great number of arrangements, all of which are essential conditions of life; and hence it follows, that if living bodies be endowed with the power of altering even one of these conditions, to such an extent as to obstruct or arrest any of the partial movements, composing the general action, they must possess within themselves the seeds of their own destruction.

Every organized body, besides the ordinary properties of its texture, possesses a form peculiar to its species; and this applies, not merely to its external arrangement in general, but even to the details of its internal structure. From this form is derived the particular direction of each of its partial movements; upon it depends the degree of intricacy in the general motion; and, in fact, it is this which constitutes the body a species, and makes it what it is.

Life is always attended by organization, just as the motion of a clock ever accompanies the clock itself; and this is true, whether we use the terms in a general signification, or in their application to each particular being. We never find life, except in beings completely organized and formed to enjoy it; and natural philosophers have never yet discovered matter, either in the act of organizing itself, or of being organized, by any external cause whatever. The elements forming, in succession, part of the body, and the particles attracted into its substance, are acted upon by LIFE, in direct opposition to the ordinary chemical affinities. It is impossible, therefore, to ascribe to the chemical affinities those phenomena, which are the result of the vital principle; and there are no other powers, except those of life, capable of re-uniting particles formerly separated.

The birth of organized beings is, therefore, the greatest mystery of organic arrangements, and indeed of all nature. We see organized bodies *develop* themselves, but they never *form* themselves; on the contrary, in all those cases where we have been able to trace them to their source, they are found to derive their origin from a being of similar form, but previously developed; that is, from a *parent*. The offspring is termed a *germ*, as long as it participates in the life of its parent, and before it has an independent existence of its own. In various species differences are found to exist in the place where the germ is attached to its parent; and also, in the occasional cause which detaches it, and gives it a separate existence; but, it is a rule which holds universally, without one single exception, that the progeny must have originally formed part of a being like itself. The separation of the germ is termed *generation*.

Many ancient, and some more recent philosophers, believed that certain organized beings could be produced without parents; and this opinion, though now completely exploded among the learned by the most convincing experiments, still maintains its ground with the ignorant. It originated, as most errors do, from hasty and inaccurate observation. Virgil gravely attempts, in a very elegant passage of the *Georgics*, to

Explain
The great discovery of the Areadian swain;
How art creates, and ead at will restore
Swarms from the slaughter'd bull's corrupted gore.

And Kircher, who lived in the seventeenth century, gives a recipe to make snakes; which, however, he does not appear to have tried.

In Scotland, the country people still believe that the hair-worm (*Gordius aquaticus*, Linn.) can be formed artificially by placing a horse's hair in water; and this unfounded opinion is, we understand, generally diffused throughout the kingdom.

The mites in cheese, the blight on plants, and the maggots in meat, seem at first sight to favour the belief in spontaneous generation; but in all these cases the insects have been demonstrated to proceed from eggs, deposited instinctively by the parent, upon a substance capable of affording nutriment to her young. The popular mistakes on this subject are generally, however, concerning the lower tribes of animals. But the ancients taught that even man could be produced without a parent. The newly-formed earth was supposed to have been originally covered with a green down, like that on young birds; and, soon afterwards, men, like mushrooms, rose from the ground. Lucretius (A. C. 60) relates, that even in his time, when the earth was supposed to be too old for generation, "many animals were conereted out of mud by showers and sunshine."

Every organized being produces others resembling it. Without this provision, all species would become extinct, since death is the necessary consequence of the continued action of life. Certain animals possess the power of reproducing some of their parts, after these have been removed. This power is termed REPRODUCTION, and it is found in various degrees of perfection, according to the species.

In general, this power of renovating mutilated parts is found to exist most perfectly in the lower species of organized beings. The head of the snail (*Limax*, Linn.) may be cut off, and the whole organ, including its elegant telescopic eyes, will be reproduced. The claws, feet, and feelers (or *antennæ*) of crabs and lobsters, as well as the limbs of spiders, when amputated, are completely restored by the fresh growth of new organs. When accident deprives a shark of its teeth, they are replaced with facility. If the fins of fishes be cut, they will reunite, and the rays themselves will be reproduced, provided only the small parts at their bases are left. The eyes of lizards, though possessed of an intricate apparatus of coats and humours, if removed, will be replaced by new eyes equal to the former. Even man and the higher animals possess the same power, only restricted within narrower limits. Injuries to various parts of our frame are speedily repaired, and the wounds heal. The effect of injury to a living bone is curious. A new bone is produced round the old one; which finally dies, and is absorbed or discharged. The new bone, which at first was spongy in its texture, and irregularly formed, assumes, in a few years, its natural dimensions, and all appearance of change is completely removed. Thus we see the bountiful provision of Nature, and the effect of that principle of reproduction, which restores most of the organs of the body to their natural form and action, when deranged by injury or by disease.

Organized beings are developed with greater or less rapidity and perfection, according as they are placed in favorable or unfavorable circumstances. Heat, the quantity or quality of their nutriment, and other causes, exercise considerable influence over them; and this influence may extend over the whole frame, or be confined only to certain organs. Hence, it follows, that the resemblance between the progeny and its parents can never be perfectly exact. These minor differences among organized beings are called *varieties*.

The different kinds of dog (*Canis familiaris*, Linn.), of horse (*Equus caballus*, Linn.), of sheep (*Ovis aries*, Desm.), are all varieties of the same species, and are produced by merely accidental causes, such as domestication, climate, &c. By cultivation, the sloe has been transformed into the plum, and the crab-tree into the apple-tree. The cauliflower and red cabbage, though apparently very different plants, are descended from the same parents,—the wild *Brassica oleracea*,—a weed growing near the sea. Mr Herbert relates, in the Horticultural Transactions, that he succeeded in raising, from the natural seed of a highly-manured red cowslip, a primrose, a cowslip, oxlips of the usual and other colours, a black polyanthus, a hose-in-hose cowslip, and a natural primrose, bearing its flower on a polyanthus stalk;—all these are instances of varieties, depending upon soil and situation.

There is, however, no real ground for supposing that *all* the differences observable in organized beings are the result of accidental circumstances. Every thing hitherto advanced in favour of this opinion is purely conjectural. On the contrary, experience clearly shows, that, in the actual state of the globe, species vary only within very narrow limits; and, as far as past researches have extended, these limits are found to have been in ancient times the same as at present.

The French naturalists, who visited Egypt with Bonaparte, found the bodies of the crocodile, the ibis, the dog, the cat, the bull, and the ape, which had been embalmed three thousand years ago by the Egyptians as objects of veneration, to be perfectly identical with the living species now seen in that country, even to the minutest bones and the smallest portions of their skins. The common wheat, the fruits, seeds, and other parts of twenty different species of plants, were also discovered, some of them from closed vessels in the sepulchres of the kings; and they resembled in every respect the plants now growing in the East. The human mummies, also, exactly corresponded with the men of the present day.

We are, therefore, compelled to admit that certain forms have been regularly transmitted to us from the first origin of things, without having transgressed the limits assigned to them, [except in a slight degree, when modified by certain accidental circumstances.] All beings, derived from the same original form, are said to constitute a *species*; and the *varieties* are, as has been stated, the accidental subdivisions of species.

Generation appears to be the only means of ascertaining the limits by which varieties are circumscribed; and we may therefore define a *species* to be—a group or assemblage of individuals, descended, one from another, or from common parents, or from others resembling them, as much as they resemble each other. However rigorous this definition may appear, its application in practice to particular individuals is involved in many difficulties, especially when we are unable to make the necessary experiments.

In conclusion, we shall repeat, that all living bodies are endowed with the functions of absorption [by which they draw in foreign substances]; of assimilation [by which they convert them into organized matter]; of exhalation [by which they surrender their superfluous materials]; of de-

velopment [by which their parts increase in size and density]; and of generation [by which they continue the form of their species.] Birth and death are universal limits to their existence: the essential character of their structure consists in a cellular tissue or network, capable of contracting; containing in its meshes fluids or gases, ever in motion: and the bases of their chemical composition are substances, easily convertible into liquids or gases; or, into proximate principles, having great affinity for each other. Fixed forms, transmitted by generation, distinguish their species, determine the arrangement of the secondary functions assigned to each, and point out the part they are destined to perform on the great stage of the universe. These organized forms can neither produce themselves, nor change their characters. Life is never found separated from organization; and, whenever the vital spark bursts into a flame, its progress is attended by a beautifully-organized body. The impenetrable mystery of the pre-existence of germs alike defies observations the most delicate, and meditations the most profound.

We trace an individual to its parents, and these again to their parents. After a few generations the clue is lost, and in vain we inquire, Whence arose the first animal of the species? and what produced the first germs from which have descended the innumerable tribes of animals and plants, that we see in constant succession rising around us? Whence did the species *MAN* arise? Philosophical inquiry fails to lead us through the labyrinth; and we feel the force of the same principle which inspired Adam, when he says, with Milton,

“Thou sun, fair light,
And thou enlightened earth, so fresh and gay,
Ye hills and dales, ye rivers, woods, and plains,
And ye that live and move, fair creatures, tell,
Tell if you saw, how came I thus, how here,
Not of myself?”

SECT. III.—DIVISION OF ORGANIZED BEINGS INTO ANIMALS AND PLANTS.

Animals and Plants—Irritability—Animals possess Intestinal Canals—Circulating System—their Chemical Composition—Respiration.

LIVING or organized beings have been subdivided by universal consent, from the earliest ages, into *ANIMALS* endowed with sensation and motion, and into *PLANTS* destitute of both, and reduced to the simple powers of vegetation.

Some plants retract their leaves when touched; and all direct their roots towards moisture, and their flowers or leaves towards air and light. Certain parts of plants even exhibit vibrations, unassignable to any external cause. Yet, these different movements, when attentively examined, are found to possess too little resemblance to the motions of animals, to authorize us in considering them as proofs of perception and of volition.

They seem to proceed from a power, possessed in general by all living substances, of contracting and expanding when stimulated,—a power to which the name of *irritability* has been assigned. The fibres composing the heart of animals alternately expand and contract, altogether independent of the will of the animal; and thick hair will grow on the skins of some animals, when removed into a cold climate. As we neither ascribe volition nor sensation to the heart or to the hair, so we cannot attribute these qualities to the heliotrope, to the sun-flower, or to the sensitive plant. The nice distinction of character must be cautiously observed, between sensation and mere irritability: like the higher powers of reason and instinct, they are

“For ever separate, yet for ever near.”

The power of voluntary motion in animals necessarily requires corresponding adaptations, even in those organs simply vegetative. Animals cannot, like plants, derive nourishment from the earth by roots; and hence they must contain within themselves a supply of aliment, and carry the reservoir with them. From this circumstance is derived the first trait in the character of animals. They must possess an intestinal canal, from which the nutritive fluid may penetrate, by a species of internal roots, through pores and vessels into all parts of the body. The organization of this cavity, and of the parts connected with it, ought to vary according to the nature of the aliments, and the transformations necessary to supply the juices proper to be absorbed; whilst the atmosphere and the earth have only to present to vegetables the juices already prepared, when they are immediately absorbed.

Animal bodies, having thus to perform more numerous and varied functions than plants, ought to possess a much more complicated organization; and, in consequence of their several parts having the power of changing their position relatively to each other, it becomes necessary that the motion of the fluids should be produced by internal causes, and not be altogether dependent on the external influences of heat and of the atmosphere. This is the reason that animals are endowed with a *circulating system*, or

organs for circulating their fluids, being the second characteristic peculiar to animals. It is not so essential, however, as the digestive system, for it is not found in the more simple species.

The complicated functions of animals require organized systems, which would be superfluous in vegetables; such as, the muscular system for voluntary motion, and the nerves for sensation. It was also necessary that the fluids should be more numerous and varied in animals, and possessed of a more complicated chemical composition than in plants, in order to facilitate the action of these two systematic arrangements. Therefore, another essential element was introduced into the composition of animals, of which plants, excepting some few tribes, are generally deprived; and while plants usually contain only three elements, oxygen, hydrogen, and carbon, animals add to these a fourth, namely, azote or nitrogen. This difference in chemical composition forms the third trait in the character of animals.

Plants derive their nourishment from the soil and atmosphere, and thence obtain water, composed of oxygen and hydrogen; also, carbonic acid, which is a compound of carbon and oxygen; while the atmosphere yields an unlimited supply of air, composed of oxygen and nitrogen [with a slight mixture of carbonic acid.] From these materials, the supplies necessary to preserve their own composition unaltered, are obtained; and, while hydrogen and carbon [with a certain portion of oxygen] are retained, they exhale the superfluous oxygen [untainted.] The nitrogen, on the contrary, is [either absorbed in very small quantities, or] altogether rejected. Such is the theory of vegetable composition; in which one of the most essential parts of the process, namely, the exhalation of oxygen, can only be performed by the assistance of light.

When plants are deprived of light, an opposite effect ensues. Instead of giving off oxygen gas, and absorbing carbonic acid, the reverse takes place; and carbonic acid is disengaged, while oxygen is absorbed. The effect of plants upon the air is, therefore, to increase its purity during day-light, but to deteriorate its quality during the darkness of night.

Animals require for their nutriment, directly or indirectly, the same substances which enter into the composition of vegetables, namely, hydrogen, carbon, [and a certain portion of oxygen.] But, in addition to these, it is essential, for the preservation of their peculiar constitution, that they accumulate a much larger portion of nitrogen, and disengage any excess of hydrogen, and especially any superfluity of carbon. This is performed by RESPIRATION, or breathing, in which process the oxygen contained in the atmosphere combines with the [excess of] hydrogen and carbon in the blood; with the former of these, it forms watery vapour, and with the latter carbonic acid. The nitrogen, to whatever part of the system it may penetrate, seems chiefly (though not altogether) to remain there.

The quantity of nitrogen retained in the system varies with the seasons, being greater in summer, and less in winter. The degree of variation is different for animals of different species: in some it is very small in quantity, while in others it is equal to their entire bulk.

The effects produced upon the atmosphere by plants and animals, are of an opposite kind; the former decompose water and carbonic acid, while the latter reproduce them. Respiration forms the fourth characteristic of animals, and is the most distinguishing function of the animal frame; namely, that which forms its essential difference from all other beings, and in a manner constitutes it an animal. So important is its influence over the whole body, that we shall presently be able to show, that animals perform the functions of their nature with greater or less perfection, according as their respiration is more or less perfect.

Thus we perceive that animals are distinguished from plants by the following characteristics:—1st, They are possessed of an intestinal canal; 2dly, Of a circulating system; 3dly, Nitrogen enters largely into their composition; and finally, They are endowed with organs adapted for respiration.

SECT. IV.—THE ORGANIC FORMS OF THE ANIMAL BODY, AND THE PRINCIPAL CHEMICAL ELEMENTS OF ITS COMPOSITION.

Cellular Tissue—Membranes—Gelatin—Medullary Substance—Muscular Fibre—Fibrin—Blood—Albumen—Secretion—Nutrition.

A porous tissue of network, and at least three chemical elements (carbon, hydrogen, and oxygen), are essential to all living bodies, while a fourth element (nitrogen) may be almost considered peculiar to animals. We shall now proceed to describe the various kinds of meshes, of which the network is composed, and the different combinations into which these four elements are found to enter.

There are three kinds of organized principles, or forms of network; the *cellular tissue*, the *medullary substance*, or marrow, and the *muscular fibre*. To each of these forms is attached a peculiar combination of chemical elements, as well as a particular function.

The *cellular substance* is composed of an indefinite number of small laminae, without any apparent arrangement, crossing so as to form very small cells, communicating with each other. It may be compared to a species of sponge, similar in form to the entire body; while all other animal particles either occupy its cells, or traverse its substance. It possesses the property of contracting indefinitely when the causes, which preserved it in a state of extension, are removed. This power retains the body within the limits, and in the form, assigned to it by Nature.

The cellular substance, or tissue, enters into the composition of every part, forming regular series of cells. We find it equally in the brain, the eye, and the nerves, only somewhat finer in its texture than in the bones and muscles. Its cells move with facility, and accommodate themselves to the motions of the body, being moistened, at the points of contact with the adjacent cells, by a liquid, which lubricates them like the synovia, or oily fluid of joints, so as to facilitate their motion.

When the cellular substance is compressed into compact plates, it forms laminae of various extent, called *membranes*. These membranes, when united into cylindrical tubes, more or less ramified, receive the name of *vessels*. The filaments, called *fibres*, are entirely composed of cellular substance; and the bones are nothing more than cellular substance, rendered hard by the deposition of earthy particles.

The general matter of which the cellular substance is composed, consists in the proximate principle or combination, called *gelatine*; the distinguishing character of which is, that it can be dissolved by boiling water, and, upon cooling, takes the form of a tremulous jelly.

Gelatine, when analyzed by Gay-Lussac and Thenard, was found to contain in 100 parts, by weight—carbon, 48; hydrogen, 8; oxygen, 27; and nitrogen, 17; very nearly.

The *medullary substance* cannot be resolved into any simpler organic structure. It appears to the eye as a soft whitish pulpy matter, composed of an infinite number of very minute globules. No peculiar motions can be observed in it; but it possesses that most wonderful of all properties, the power of transmitting to the mind the impressions made on the external organs of sense, and of rendering the muscles subservient to the determinations of the will. The brain and spinal marrow are almost entirely composed of medullary substance; and the nerves, which are distributed through all the organs capable of sensation, are, in respect to their composition, nothing but bundles (or fasciculi) of this substance.

The *muscular*, or *fleshy fibre*, is composed of a particular kind of filaments, having the peculiar property, during life, of contracting or folding themselves up, when touched or injured by any external body; or when acted upon, through the medium of the nerves, by the will.

The muscles are the immediate organs of voluntary motion, and are composed entirely of bundles of fleshy fibres. All the membranes and vessels, which are required to exercise any compressive force, are armed with these fibres. They are always united intimately with the nervous filaments, or threads; but certain muscles are observed to execute motions, altogether independent of the will, especially in the exercise of functions possessed in common with plants. Thus, although the will is frequently the cause of muscular motion, yet its power is neither general nor uniform in its action.

Fleshy fibre has, for the basis of its composition, a particular principle, named *fibrin*, which is [nearly] insoluble in boiling water, and seems naturally to assume a filamentous arrangement.

It consists of white solid fibres, inodorous and insipid. When analysed by Gay-Lussac and Thenard, 100 parts were found to contain about 53 parts of carbon, 7 of hydrogen, 20 of oxygen, and 20 of nitrogen.

The nutritive fluid, or blood, when recently extracted from the circulating vessels, may not only be ultimately resolved, for the most part, into the general elements of the animal body, carbon, hydrogen, oxygen, and nitrogen; but it already contains fibrin and gelatine, prepared to contract their substance, and to assume respectively the forms of filaments or of membranes, according to circumstances, whenever a slight repose enables them to exhibit this tendency. In addition to these, the blood contains another proximate principle, called *albumen*, [composed very nearly of 53 parts of carbon, 7 of hydrogen, 24 of oxygen, and 16 of nitrogen.] Its character is to coagulate in boiling water, [like the white of eggs, composed almost entirely of albumen.] We also find in the blood nearly all the other elements, which enter into the composition of each animal body in small quantities; such as, the lime and phosphorus deposited in the bones of the higher animals; the iron, which seems essential to the colour

of the blood and other parts; and the fat, or animal oil, placed in the cellular tissue to render it flexible. In fact, all the solids and fluids of the animal body are composed of chemical elements contained in the blood. It is only by possessing some elements, of which the others are deprived, or by a difference in the proportions in which they combine, that [in general] they can be distinguished. From this it appears that it only requires, for their formation in the body, to abstract the entire, or a part, of one or more elements of the blood; or, in a few cases, to add a foreign element, procured from another source.

Some substances, differing very much in character, seem, however, to possess nearly the same chemical composition; we must therefore consider the peculiar arrangement of the particles as an essential distinction among animal fluids and solids, as well as their composition, and the proportions of their elements.

We might, without impropriety, assign the term *secretion* to denote the various operations by which the blood nourishes and renovates the solid and fluid parts of the body. But, we shall restrict the term to the production of *fluids* only; while, we shall apply the term *nutrition*, to signify the production and deposition of the materials, necessary for the growth and maintenance of the *solids*. To each solid organ, and to every fluid, is assigned that peculiar composition which is suited to its place in the system; and, by the renovating power of the blood, their composition is preserved during health, and the continual waste repaired. Thus, by affording continual supplies of nutriment, the blood would undergo a perpetual deterioration, were it not restored by the new matter obtained from the digestion of the food; by respiration, which relieves it of the superfluous carbon and hydrogen; by perspiration, and various other means, which deprive it of any excess of other principles.

These continual changes in the chemical composition of the several parts, are as essential to the vital action, as the visible motions of the old particles, and the constant influx of new ones: indeed, they seem to be the final object for which the latter motions were designed.

SECT. V.—ACTIVE FORCES OF THE ANIMAL BODY.

Muscular Fibre—Nerves—Hypothesis of a Nervous Fluid.

The muscular fibre is not confined, in its functions, to be merely the organ of voluntary motion. We have shown, that it is one of the most powerful agents employed by Nature, in effecting such necessary motions and transference of particles in the bodies of animals, as are possessed by them in common with vegetables. Thus, the muscular fibres of the intestines produce the peristaltic motion, which renders these canals pervious to the aliment; and the muscular fibres of the heart, with the arteries, are the agents in the circulation of the blood; and thus, ultimately, of all the secretions.

The Will contracts certain portions of the muscular fibre through the medium of the nerves. Certain other fibres, such as those to which we have just alluded, are independent of the Will, and yet are animated by nerves extending through them. We may therefore conclude, from analogy, that these nerves are the causes of their involuntary contraction.

The nerves are composed of several distinct filaments, resembling each other in every respect; and they appear to be formed of the same soft pulpy material, commonly called marrow, or medullary substance, surrounded by a cellular membrane. The filaments are again enveloped in a tube of this membrane, forming a continued nerve, extending from the brain to various parts of the muscles and skin. Yet the functions of the several filaments of the same nerve are very different. One filament is designed for voluntary muscular motion, another for sensation, and a third for involuntary motion. Sir Charles Bell, to whom we owe this remarkable discovery, divides all the nervous filaments of the body into four general systems; namely, of voluntary motion, of sensation, of respiration, and of involuntary motion. The last of these performs the functions of nutrition, growth, and ultimately, of decay. Besides these, there are nerves destined to particular functions of sensation; such as sight, smell, and hearing.

When the sensitive filament of a nerve is injured in any part of its course, pain and not motion is the result; and the pain is referred by the animal to that part of the skin where the remote extremity of the filament is distributed into minute fibres. A patient, whose leg has been amputated, will feel a pain, which long-continued habit has taught him to refer to the extremity of the toes; when, in reality, the injury has been inflicted upon that portion of the nervous filament which terminates at the stump.

In the remainder of this section, our author proposes to explain the phenomena of the nerves upon the hypothesis of a *nervous fluid*, acted upon by certain chemical affinities. We are aware that several, almost insurmountable, objections may be urged against this theory, and indeed against every other which attempts to explain the complicated functions of life. Yet, if an hypothesis correspond pretty accurately with observed facts, it may have its uses, by fixing the phenomena in the

memory, provided we always recollect, that it is but an hypothesis, to be modified as knowledge extends. Thus the phenomena of heat are referred to the imponderable fluid *caloric*; of light, to the vibrations of a highly elastic medium; of electricity, to the electric fluid;—none of which can be demonstrated to have a real existence in nature. But, in adopting an hypothesis, we must never forget that it is a temporary, not a final, theory;—a motive for seeking further analogies, or, as Dr Thomas Brown rightly observes, “a reason for making one experiment rather than another.”

HYPOTHESIS OF A NERVOUS FLUID.

Every contraction, and, in general, every change in the dimensions of inorganic matter, is occasioned by a change of chemical composition; either, by the absolute addition or abstraction of some solid matter, or by the flux or reflux of an imponderable fluid, such as caloric. In this way the most violent convulsions of nature arise, such as explosions, conflagrations, &c.

It is therefore probable that the nerve acts similarly upon the muscular fibre, by means of an imponderable fluid, especially as it has been proved that the impulse is not mechanical.

The medullary matter of the entire nervous system is formed throughout of the same material; and, blood-vessels accompanying all its ramifications, it is thus enabled to exercise, in every part, the functions belonging to its nature.

All the animal fluids being secreted from the blood, there is every reason to infer that the nervous fluid is derived from a similar source, and that the medullary substance is the agent in the secretion. On the other hand, it is certain that the medullary substance is the sole conductor of the nervous fluid; all the other organic elements are non-conductors, and arrest it, as glass opposes the progress of the electric fluid.

All the external causes, capable of producing sensation, or of occasioning contractions in the muscular fibre, are chemical agents, possessing a power of decomposing, such as light, caloric, salts, odorous vapours, &c. It is therefore extremely probable, that these causes act in a chemical manner upon the nervous fluid, by altering its composition; and this view appears to be confirmed by the fact, that the action of the nerves is enfeebled by long continuance, as if the nervous fluid required a supply of new materials to restore its composition, and enable it to undergo a further alteration.

An external organ of sense may be compared to a kind of sieve, which only permits those agents to pass through it, and act upon the nerve, that it is fitted to receive at that place; but it often accumulates the nervous fluid so as greatly to increase its effect. Thus, the tongue has spongy papillæ, which imbibe saline solutions; the ear is furnished with a gelatinous pulp, violently agitated by the sonorous vibrations of the air; and the eye is supplied with transparent lenses, which concentrate the rays of light.

Those substances which have obtained the name of *irritants*, from their power of occasioning contractions in the muscular fibre, probably exercise this action through the medium of the nerves; and they influence them in the same manner as the Will does, that is, by affecting the nervous fluid, in the manner necessary to alter the dimensions of the muscular fibre under its influence. Yet the Will is not concerned in producing these effects; often the mind is totally unconscious of their action. Even when the muscles are separated from the body, they are susceptible of being irritated, so long as that portion of the nerve, which accompanies them, retains its power of acting. In this case, the phenomena are totally removed from the influence of the Will. The state of the nervous fluid is altered by muscular irritation, as well as by sensation and voluntary motion: there exists, therefore, the same necessity for restoring its original composition. Irritants occasion those movements and transferences of particles necessary to the functions possessed in common by animals and plants; thus, the aliment stimulates the intestine; the blood irritates the heart. These motions are all performed independent of the influence of the Will, and, in general, while health continues, without the consciousness of the animal. To effect these objects, the nerves which produce the motion have, in most cases, an arrangement entirely different from those affected by sensation or controlled by the Will.

The nervous functions, by which we mean sensation and muscular irritability, are exercised with more or less vigour upon every point, in proportion as the nervous fluid is more or less abundant there; and as this fluid is produced by secretion, its quantity ought to depend jointly upon the quantity of the medullary matter secreting it, and upon the supplies of blood received by this medullary substance. In animals possessing a circulating system, the blood is distributed to all parts of the body, through the arteries, by means of their irritability and the action of the heart.

If these arteries be irritated in an unusual degree, they act more forcibly and propel a greater quantity of blood; the nervous fluid becoming more abundant, increases the local sensibility; and, reacting upon the irritability of the arteries, carries their mutual action to a high degree. This is called nervous excitement, or *orgasm*; when it becomes painful and permanent, it is termed *inflammation*.

This mutual influence of the nerves and muscular fibres, whether in the intestinal or arterial systems, is the true source of those involuntary actions, common both to plants and animals.

Each internal organ is susceptible of irritation only from its peculiar irritant, to which it is in a manner especially adapted, just as an external sense can be affected only by its particular objects. Thus mercury irritates the salivary glands, and cantharides, the *vesica*. These agents have been called *specifics*.

As the nervous system is continuous and of uniform structure, local irritations, and frequently repeated sensations, fatigue it throughout the whole extent; so that any function, when excessively exercised, may enfeeble all the others. Thus, too much food impedes the action of the intellectual powers, and long protracted study impairs the powers of digestion.

An excessive local irritation may affect the whole body, just as if all the vital energies were concentrated upon one single point. But a second irritation, in another place, will diminish the first, or, as it has been called, *determine* the first into another part; such is the effect of blisters, laxatives, and other counter-irritants.

We have thus shown, in the above brief sketch, that it is possible to account for all the phenomena of physical life; if we merely assume hypothetically the existence of a nervous fluid, possessed of certain properties, which are deduced from generalizing the phenomena of the vital system.

SECT. VI.—THE ORGANS OF ANIMAL BODIES, THEIR APPROPRIATE FUNCTIONS, WITH THEIR VARIOUS DEGREES OF COMPLICATION.

Sensation—Touch—Taste—Smell—Sight—Hearing—Muscular Sense—Head—Brain—Voluntary Motion—Muscles—Bones—Tendons—Ligaments—Nutrition—Stomach—Gastric Juice—Chyme—Chyle—Lacteals—Arteries—Veins—Lymphatics—Respiration—Lungs—Gills—Tracheæ—Capillary Vessels—Secretory Glands—Generation.

AFTER having considered the organic elements of the animal body, the chemical elements of its composition, and the active forces which prevail in it, nothing now remains to complete a general view of the animal system, excepting a summary account of the several functions of which life is composed, with a description of their appropriate organs.

The functions of the animal body may be divided into two classes—the animal functions, which are peculiar to animals—and the vital or vegetative functions; common to animals and plants. The former comprise sensation and voluntary motion, the latter nutrition and generation.

We shall commence with *SENSATION*, which resides in the nervous system.

The sense of touch is the most extensively diffused of all the external senses. It is seated in the skin, a membrane enveloping the entire body, and traversed in every part by nerves. Their extreme fibres are expanded at the surface of the skin into minute *papillæ*, or small projecting filaments, where they are protected by the outer skin, and by other insensible coverings, such as hair or scales.

The degree of perfection in which different animals possess this sense varies considerably; but its exercise, in a high degree, is always accompanied by certain conditions. The organ must be supplied with numerous nerves and papillæ, under a very fine cuticle; with a soft cellular substance, like a cushion; and with a hard resisting base. It must also be endowed with a considerable degree of flexibility, as a close contact with the surfaces of bodies is indispensable. Most animals are possessed of some particular organ, in which the sense of touch is developed in a high degree. In the hand of man, and particularly at the extremities of the fingers, we find all the necessary requisites of this sense, combined in their most perfect form. The proboscis, or trunk, of the elephant seems to rank next to the human hand; and, among the higher orders of animals, either the snout or the lip is endowed with much sensibility. This quality is particularly observable in the nose of the tapir, and of the hog, in the lips of the mole, and in the upper lip of the rhinoceros. The seal, and animals of the cat kind, such as the lion and tiger, have whiskers, possessed, near their roots, of considerable delicacy, which renders them of important use to these animals as feelers. Certain species of monkeys have delicate prehensile tails, which they use with surprising agility. In birds, the nerves of touch seem chiefly developed in the feet and toes, and most of the aquatic species are endowed with bills of considerable feeling. Serpents use their slender tongues as instruments of touch; and the great flexibility of

their bodies renders them well adapted for the exercise of this sense. The snouts of fishes have some nicety; but, with this exception, these animals seem nearly destitute of delicate sensation. Insects feel chiefly by means of their antennæ; and the several tribes of annelida, actinæ, and polypi, by their tentacula. Several animals are covered with a dense integument, in many of their parts, which are thus wholly unfitted for this sense. The thick hides of the elephant and rhinoceros, the feathers of birds, the scales, horny coverings, and shells of the lower animals, are evidently inconsistent with the necessary conditions of touch. Bats are enabled to fly in the darkest places, by the extreme acuteness of their tactual nerves.

Taste and smell are merely more delicate modifications of this sense, for the exercise of which the membranes of the tongue and nostrils are specially organized.

In most of the lower animals the sense of taste is very imperfect, or it is altogether wanting. The tongue of man is supplied with numerous papillæ, of a conical form and spongy texture, projecting in a manner visible even to the naked eye. Taste seems in him to attain its most perfect state; and he not only enjoys the natural varieties of an omnivorous animal, but also a number of acquired tastes, which other species are wholly denied. The tongues of birds, of reptiles, and of fishes, are often covered with a hard and horny cuticle, which renders them altogether unfit for the delicate exercise of this sense. Many animals swallow their food without mastication; and they must be thereby effectually deprived of the enjoyments of taste, as a certain degree of contact between the food and the organ is essentially necessary for its exercise.

The sense of smell resides in an organ, rendered susceptible by the extreme delicacy and extent of its ever humid surface.

Very minute particles of an odoriferous substance are darted forth in every direction, and are received upon the extensive and complex membrane, which lines the internal parts of the nasal cavity. Matter is thus perceived, when in a state of great subdivision, with a degree of acuteness far surpassing any of the other senses. The extreme minuteness of these particles may be inferred from the fact, that musk, and many other substances, will exhale odour for several years, and yet no loss in their weight can be detected, even by the most delicate balances. Carnivorous animals, in general, possess a more acute sense of smell than those living upon vegetable food; and the structure of their nasal cavities is consequently much more intricate. This power was obviously given to facilitate the discovery of their food. In man the sense of smell seems best adapted for vegetable effluvia. A dog, though surpassing him in detecting the most minute effluvia of another animal, will derive no pleasure from the finest vegetable odours. M. Audubon is of opinion that birds of prey are not endowed with an acute sense of smell. The degree in which this sense is enjoyed by the lower tribes of animals has not yet been completely determined, but it is observed to exist in bees and snails.

The beauty of the eye, and the unbounded sphere which it exposes to observation, give to the sense of sight a decided pre-eminence. Light, when emitted from the sun or any luminous body, strikes upon the external covering of the eyeball. By means of the crystalline lens, it is then refracted or bent from its original direction to a focal point, from which the rays of light are again distributed on the expanded extremity of the optic nerve, prepared to receive them. The size of the eyes in quadrupeds, and the intensity of their vision, bear a constant relation to the nature of their food. Herbivorous animals, such as the elephant and the rhinoceros, have very small eyes in comparison with their entire bulk. The eyes of the whale, when viewed singly, are very large; but they seem disproportionately small, if we contrast them with the enormous mass of the entire body. But quadrupeds and birds feeding on flesh, require powers of vision of very great intensity. In these animals we accordingly find the organ large, and highly developed, so as commonly to impart a peculiar expression of ferocity to their countenances. The animals which are the objects of pursuit are frequently supplied with acute vision, thereby enabling them to escape or avoid danger; and this is particularly exemplified in the squirrel, the rat, the deer, and the hare. Animals which burrow under ground, as the mole and the shrew-mouse, have, in general, exceedingly small eyes; while in some they have been found nearly wanting, as in the blind rat (*Mus typhlus*, Linn.) The cat, the lemur, and other animals which pursue their prey during the night, are peculiarly adapted, by the construction of their eyes, for acutely perceiving objects, when illuminated by a very small quantity of light. The eyes of reptiles and fish are accommodated to the medium in which they reside. The chameleon can move one eye with rapidity, and in various directions, while the other remains fixed. Reptiles residing generally in the water, also fish, and the cetacea, such as the dolphin and seal, have their eyes covered with a dense skin, and the lens is more convex than in other animals. The arachnides, or spiders, possess generally eight eyes, arranged upon the upper part of the head in a symmetrical form; and there are not less than twenty-eight in the common millepede (*Julus terrestris*.) The insect tribes enjoy great variety and intensity in their visual organs; but the precise limits of this sense among the lowest animals in the scale of creation is not yet clearly ascertained.

The organ of hearing is excited by vibrations or undulations of air, of water, or of some solid medium, recurring at intervals, with different degrees of frequency. These impulses are received upon the tympanum or ear-drum; thence they are communicated to the acoustic nerve, and are finally transmitted to the brain. When the vibrations are not performed in equal times, or do not occur more frequently than seven or eight in a second, there is heard merely a *noise*. But when they rise much above this velocity, a very low or grave musical note is first heard. By an increase of velocity, the note becomes higher or more acute, and the ear is finally capable of perceiving sounds resulting from 31,000 impulses in a second. There is a regular gradation among animals in the perfection of the organ of hearing, but none of them eon- rival the delicacy with which the practised ear in man perceives minute changes of tone, alterations in the quality or expression of sound, and varieties in its intensity and loudness. Feeble and timid quadrupeds generally have their ears directed backwards, to warn them of approaching danger; while, in the predaceous tribes, the ears are

placed forwards, to aid in discovering their prey. Animals, though seldom susceptible of musical notes, sometimes exhibit an aversion for the low or grave sounds. This is remarkably the case with the lion. In bats, the sense of hearing is surprisingly acute.

L'organe de la génération est doué d'un sixième sens, qui est dans sa peau intérieure.

Perhaps a greater claim to the right of being termed the *sixth* sense, may be established in favor of that feeling of resistance, or *muscular* sense, by which we perceive the degree of force exercised by particular muscles. The mouth and lips of a newborn animal are directed by this sense to their proper function; and the adult would be in danger of a fall while engaged in walking, leaping, or other active exercises, if he were for a moment unconscious of the present state of the muscles appropriated to those actions. Shooting, bounding, and taking aim, presuppose a consciousness of the degree of muscular exertion sufficient to produce a certain effect; and instances are not wanting of its surprising accuracy. Thus, the Indian fresh water fish called the *Chatodon rostratus*, will hit an insect with a small drop of water at a distance of several feet, and the encumbered insect speedily falls an easy prey. When the elephant is annoyed by flies, he will discharge a large quantity of water upon the part attacked, with sufficient accuracy and force to dislodge them. The deadly spring of the lion and tiger exhibits the instantaneous result of the muscular sense in its most tremendous form. Dr Yellowley mentions the case of a woman who was afflicted with the disease called *anæsthesia*, where the muscular sense of her hands was lost, although the muscular power remained. On turning her eyes aside, she used to drop glasses, plates, &c., which were held in safety as long as another sense supplied the place of the lost one.

The stomach and intestines are possessed of certain peculiar sensations which declare the state of these viscera; and indeed every part of the body is susceptible of sensations, more or less painful, when affected by accident or disease.

Pain teaches an animal to avoid hurtful objects, and is wisely given as a safeguard to his frame; accordingly, its seat is mostly at the surface. The deep parts of the body have but little sensation, as it would there be only a useless encumbrance. The animal is continually warned, by uneasy sensations, to change his posture frequently, to avoid high degrees of heat, and, in general, to accommodate his frame to surrounding circumstances.

Many animals are defective both as to ears and nostrils, several are destitute of eyes, and some are reduced solely to the sense of touch, which is never wanting.

In the higher animals, impressions made upon the external organs of sense are transmitted by the nerves to the brain and spinal marrow, which form the central masses of the nervous system. The elevation of an animal in the scale of creation may [frequently] be determined by the volume of its brain, and the degree in which the power of sensation is concentrated there. Animals of a lower grade have the medullary masses much dispersed; and in the more simple genera, all trace of nerves seems to be lost in the general substance of the body. That part which contains the brain and principal organs of sense is called the *head*.

We now proceed to consider the second animal function—namely VOLUNTARY MOTION.

When the animal wills to move, in consequence of a sensation upon an external organ, or any other cause, the motion is transmitted to the muscles by means of the nerves.

This power of originating motion, residing in the nervous system of living animals, is one of the most wonderful properties of their nature. Every machine, however complicated or varied in its structure, can only be set in motion by some external power already existing in nature, or produced by art, whether it be the expansive force of steam, the descent of weights, the action of running water, or the recoil of a spring. No perpetual motion can ever be preserved by any arrangement of the parts of a machine among themselves; they must rest ultimately upon a prime mover. But the exquisite arrangement of the animal frame surpasses, in this respect, the highest mechanical skill. The mind wills—the muscle contracts. How much soever we may desire to unravel the mystery, the process is inexplicable, and seems for ever removed beyond the reach of human ingenuity. The only fact hitherto ascertained is, that if the nerve be separated, seriously injured, or even tightly compressed, the motion of the muscle will not follow the volition of the mind.

The muscles are bundles of fleshy fibres, by the contraction of which the animal body performs all its motions. The extension and lengthening of the limbs are equally the result of muscular contraction with their bending and drawing in. They are arranged in number and in direction to suit the motions which each animal is destined to perform; and when it becomes necessary to execute these motions with vigour, the muscles are inserted upon hard parts, which are so articulated, one over the other, as to constitute them so many levers. These parts, in the vertebrated animals, are called bones. They are situate internally, and are formed of a gelatinous mass [of cellular substance, the pores of which are] penetrated by particles of phosphate of lime. In some of the lower tribes of animals, such as the Mollusca, the Crustacea, and the Insects, these hard parts are external, and composed either of calcareous or of horny sub-

stances, called shells, crusts, or scales, all of which are secreted between the skin, and the epidermis or cuticle.

A considerable difference is found between the chemical composition of the bones belonging to the higher orders of animals and the external coverings of crustaceous animals. Human bones, when analyzed by Berzelius, were found to contain in 100 parts nearly as follows: of animal matters, (being chiefly gelatine, cartilage, and marrow) 34 parts; of phosphate of lime, 51 parts; of carbonate of lime, 11 parts; of fluat of lime, 2 parts; of phosphate of magnesia, 1 part; and of soda, muriate of soda and water, 1 part. Here the principal ingredient is *phosphate* of lime; but in the hard parts of crustaceous animals, such as crabs and lobsters, the *carbonate* of lime is considerably in excess. The shells of the mollusca, such as muscles and oysters, are almost entirely formed of the carbonate of lime. On the contrary, the horny coverings of insects contain a very minute portion of earthy matter, and are mostly composed of animal substances. The same proximate elements enter into the composition of horns, nails, and hoofs, being gelatine, with a membranous substance, resembling the white of eggs boiled hard. The scales of fish are composed of layers of membrane alternately with those of phosphate of lime, which arrangement is the cause of their brilliancy; but the scales of serpents contain no phosphate of lime, and very much resemble, in their constitution, the horny coverings of insects.

The fleshy fibres are inserted upon the hard parts, by means of other fibres of a gelatinous nature, called *tendons*, which seem to be a continuation of the first.

These tendons exercise the same office as straps or ropes in ordinary machinery, when it is required to transfer motion from one part to another. By this means a moving power can be exercised, in a spot where its immediate presence would be highly inconvenient. Thus, the hand is moved by tendons communicating with muscles, fixed at a considerable distance upon the arm; and the velocity and delicacy of its movements are not obstructed by their presence. Often these tendons are strapped down by cross cords, and pass along grooves in the bones, or through a pulley formed by a ligament. By these mechanical contrivances, the direction in which the muscular power acts may be changed; the forces of different muscles are compounded, and altered in intensity; and the velocity of the resulting motions modified according as circumstances may require. This arrangement also permits the accumulation of force upon one point; for a great number of muscular fibres are employed to contract one tendon, in the same manner as several horses may be employed to draw the same rope.

The peculiar shape observable in the articulated surfaces of the hard parts confine the motions of the tendons within certain limits, and they are still further restrained by cords or envelopes, usually called *ligaments*, attached to the sides of the articulations. Animals become enabled to execute the innumerable motions involved in the exercise of walking or leaping, flying or swimming, according as the bony and muscular appendages are adapted for these various motions; and also, according to the relative forms and proportions which the limbs, in consequence, bear among themselves.

NUTRITION, which we shall now explain, forms the first of the vegetative functions.

The muscular fibres connected with digestion and circulation are not influenced by the will, but, on the contrary, as we have already explained, their principal arrangements and subdivisions appear to be specially intended to render the animal completely unconscious of their exercise. It is only when the mind is disturbed by violent passions, or paroxysms, that its influence is extended beyond the ordinary limits, and that it agitates these functions common to vegetable life. Sometimes, when the organs are diseased, their exercise is accompanied by sensation; but, in ordinary cases, digestion and circulation are performed without the consciousness of the animal.

The aliment is first masticated, that is, minutely divided by the jaws and teeth, or sucked in, when taken by the animal in a liquid form. It is then swallowed entirely by the muscular action of the back parts of the mouth and throat, and deposited in the first portions of the alimentary canal, which are usually expanded into one or more stomachs, where the food is penetrated and dissolved by corrosive juices.

This gastric juice possesses the very remarkable property of dissolving most animal and vegetable matters, when deprived of life, and some mineral substances. It more especially acts upon such as yield nutriment to the animal, and are adapted to its general habits and formation. When recently procured from the stomach of a healthy animal, it appears as a clear mucilaginous fluid, slightly salt to the taste. Substances, when undergoing fermentation or putrefaction, are immediately checked in their action by the gastric juice, and are formed by its corrosive influence into a new fluid, possessed of entirely different properties, called *chyme*. But most mineral substances are indigestible. Certain tribes of savages, as the Otomacs, will, however, swallow daily large quantities of earth to allay the cravings of hunger. But this substance does not appear to be dissolved; it merely acts mechanically in distending the stomach.

The higher region of the alimentary canal is occupied by the stomach, which receives the food conveyed to it through the œsophagus or gullet. The form and structure of the stomach bears a constant relation to the nature of the food. In herbivorous animals, it is composed of a complicated system of reservoirs, where, by a slow and intricate process, the small quantity of nutriment contained in vegetable matter is abstracted and conveyed into the system. In carnivorous animals, the stomach

is comparatively simple; and a supply of abundant nourishment is readily procured from animal food.

After passing through the stomach, the food is received into the remaining part of the canal, where it is acted upon by other juices destined to complete its preparation.

The chyme formed in the stomach having passed into the intestine, comes in contact with the bile and the pancreatic juice. An immediate change takes place. The chyme acquires the yellow colour and bitter taste of bile, and at length divides into two portions; the one, a white tenacious liquid called *chyle*, and the other, a yellow pulp.

The coats of the intestinal canal are supplied with pores, which imbibe that portion of the alimentary mass adapted for the nutrition of the body [being the chyle], while the useless residue is finally conveyed away and ejected.

The canal in which this first function of nutrition is performed, appears to be a continuation of the skin, and it is composed, in a similar manner, of laminae. Even the surrounding fibres are analogous to those adhering to the internal surface of the skin, and called the fleshy pannicle. A mucous secretion takes place throughout this canal, which seems to have some connexion with the perspiration from the surface of the skin; for, when the latter is suppressed, the former becomes more abundant. The skin exercises a power of absorption very much resembling that possessed by the intestines.

The whole length of the intestinal canal is much greater in herbivorous, than in carnivorous animals.

It is only in the very lowest tribes of animals that the same orifice is applied to the double purpose of receiving fresh supplies of aliment, and of ejecting the substances unfitted for nutrition. Their intestines assume the appearance of a sack with only one entrance. But in a far greater number of animals, having the intestinal canal supplied with two orifices, the nutritive juice [or chyle] is absorbed through the coats of the intestines, and immediately diffused [by the lacteals] through all the pores of the body. This arrangement appears to belong to the entire class of insects.

If we commence from the arachnides [or spiders] and the worms, and then examine all animals higher in the scale of creation, it will be found that the nutritive fluid circulates through a system of cylindrical vessels; and that it only supplies the several parts requiring nourishment by means of their ramified extremities [or lacteals], through which the nutriment is deposited in the places requiring sustenance. These vessels, which distribute the nutritive fluid or blood to all parts of the body, receive the name of *arteries*. Those, on the contrary, are called *veins*, which restore the blood to the centre of the circulating system. This motion of the nutritive fluid is sometimes performed simply in one circle; often there are two circular motions, and even three, if we include that of the *vena-porta* [which collects the blood of the intestines, and conveys it to the liver.] The velocity of its motion is frequently assisted by certain fleshy organs called *hearts*, which are placed at some one centre of circulation, often at both.

In the vertebrated and red-blooded animals, the nutritive fluid, or chyle, leaves the intestines either white or transparent; and is conveyed into the venous system, by means of particular vessels called lacteals, where it mixes with the blood. Other vessels similar to the lacteals, and composing with them one arrangement, called the lymphatic system, convey into the venous system those nutritive particles which have either escaped the lacteals, or have been absorbed through the entire or outer skin.

Before the blood is fitted to renovate the substance of the several parts of the body, it must receive, from the surrounding element, through the medium of respiration, that modification which we have already noticed. One part of the vessels belonging to those animals, which possess a circulating system, is destined to convey the blood to certain organs, where it is distributed over a large extent of surface, in order that the action of the surrounding element may be the more energetic. When the animal is adapted for breathing the air, this organ is hollow, and called *lungs*. But when the animal only breathes [the air dissolved] in water, the organ projects, and is called *branchiæ*, or *gills*. Certain organs of motion are always arranged so as to draw the surrounding element either within or upon the organ of respiration.

In animals which do not possess a circulating system, the air penetrates into every part of the body, through elastic vessels called *tracheæ*; or else water acts upon them, either by penetrating, in a similar manner, through vessels, or simply by being absorbed through the surface of the skin.

In Man, respiration is performed by means of the pressure and elastic force of the air,

which rushes into the lungs, where a vacuum would otherwise have been formed by the elevation of the ribs, and the depression of the diaphragm. Muscular force then expels the air, after the necessary purification of the blood existing in the lungs has been performed; and the same actions are again repeated. The blood, which was of a dark purple colour, while slowly travelling from all parts of the body to the heart, has no sooner been purified by yielding its excess of carbonic acid to the surrounding air, and by absorbing oxygen, than its colour changes into a bright vermilion.

In Birds, it was necessary to combine lungs of small bulk with an extensive aeration of the blood; and, accordingly, the blood not only passes into the lungs, but through them into capacious air cells; from which, by the action of the chest, it is again expelled. The lungs thus act twice upon the same portion of air.

The change of the tadpole into the frog is accompanied by extraordinary alterations in its respiratory organs, which will be more fully explained hereafter. In the first, or tadpole state, the organs are branchial, in the frog they are pulmonary. The arrangements are striking and singular.

All respiration must be either *aquatic* or *atmospheric*. In the former case, the respiration is said to be *cutaneous* or *branchial*, according as it is performed through the *skin* or through *gills*. On the other hand, atmospheric respiration may be either *tracheal* or *pulmonary*, according as it is performed through the air-tubes called *tracheæ*, or by means of *lungs*.

After the blood has been purified by respiration, it is fitted to restore the composition of all parts of the body, and to execute the function of nutrition properly so called. The wonderful property, possessed by the blood, of decomposing itself so as to leave precisely, at each point, those particular kinds of particles which are there most wanted, constitutes the mysterious essence of vegetative life. We lose all traces of the secret process by which the restoration of the solids is performed, after having arrived at the ramified extremities of the arterial canals. But in the preparation of fluids we are able to trace appropriate organs, at once varied and complicated. Sometimes the minute extremities of the vessels are simply distributed over extended surfaces, from which the liquid exudes; and sometimes the liquid runs from the bottom of minute cavities. But the more general arrangement is, that the extremities of the arteries, before changing into veins, form particular vessels called *capillary*, which produce the requisite fluid at the exact point of union between these two kinds of vessels. The blood-vessels, by interlacing with the capillary vessels which we have just described, form certain bodies called *conglomerate* or *secretory glands*.

With all animals destitute of a circulation, and especially with Insects, the nutritive fluid bathes the solid parts of the body; and each of them imbibes those particles necessary for its sustenance. If it become requisite that any particular fluid should be secreted, capillary vessels, adapted for this purpose, and floating in the nutritive fluid, imbibe, through their pores, the elements necessary for the composition of the fluid to be secreted.

It is thus that the blood continually renovates all the component parts of the body, and repairs the incessant loss of its particles, resulting necessarily from the continued exercise of the vital functions. The general idea which we are able to form of this process is sufficiently distinct, although the details of the operations performed at each particular point are involved in obscurity, from our ignorance of the precise chemical composition of each part, and our consequent inability to determine the exact conditions necessary for their reproduction.

In addition to the secretory glands necessary for performing a part in the internal economy of the system [such as the liver and the pancreas], there are others which secrete fluids destined to be rejected, either as being superfluous, or for some purpose useful to the animal. Of the latter we may mention the black fluid secreted by the Cuttle fish [with which, when pursued, he obscures the water to cover his retreat], and the purple matter of several Mollusca.

The function of *GENERATION* is involved in much greater obscurity and difficulty than that of simple secretion; and this difficulty attaches chiefly to the production of the germ. We have already explained the insuperable difficulties attending the pre-existence of germs; yet, if once we assume their existence, no particular difficulty remains attached to generation [which is not equally applicable to ordinary secretion.] While the germ adheres to the mother, it is nourished as if it formed a part of her own body; but when the germ detaches itself, it possesses a distinct life of its own, essentially similar to that of an adult animal.

The form of the germ, in its passage through the several progressive states of development, successively termed the embryo, the fœtus, and, finally, the new-born animal, never exactly resembles that of the parent; and the difference is often so very great that the change has received the name of *metamorphosis*. Thus, no person could ever anticipate that the caterpillar would finally be transformed into the butterfly, until he had either observed or been informed of the fact.

These remarkable changes are not peculiar to Insects, for all living beings are more or less metamorphosed during the period of their growth; that is to say, they lose certain parts altogether, and develop others which were formerly less considerable. Thus, the antennæ, the wings, and all the parts of the butterfly, were concealed under the skin of the caterpillar; and, when the insect cast off its skin, the jaws, the feet, and other organs, which belong not to the butterfly, ceased to form a part of its body. Again, the feet of the frog are inclosed within the skin of the tadpole; and the tadpole, in order to become a frog, loses its tail, mouth, and gills or branchiæ.

Even the infant, before its birth, at that period, and during its progress to maturity, undergoes several metamorphoses. In the earlier periods of development, the embryo corresponds, in some of its parts, with certain of the lower animals. At first, it seems destitute of a neck, and the heart is situate in the place where a neck afterwards appears, an arrangement which is found to exist permanently in fish. There is also a striking resemblance between the lower extremity of the vertebral column in the embryo, and the tail of the fish. About the end of the fifth month, it is covered all over with a yellowish white silk, like the down of a young duck, which entirely disappears in six or seven weeks. The limbs are formed under the skin, and reaching it, gradually shoot out into their permanent position; yet, even when fully developed in other respects, the shoulders and thighs are still concealed under the skin. In this respect, the embryo resembles the horse and other animals, which have the shoulders and thighs permanently enveloped under a thick covering of muscle. The fingers, when first formed, are surrounded by a skin, which entirely covers them, like the mitten-gloves used for an infant. This covering is gradually absorbed, when it takes the form of a duck's web, and finally disappears. M. Tieddeman and M. Serres, have shown that the brain of the fœtus, in the highest class of animals, assumes in succession the various forms which belong to Fishes, Reptiles, and Birds, before it acquires those additions and modifications which are peculiar to the Mammalia. "If you examine the brain of the Mammalia," says M. Serres, "at an early stage of uterine life, you perceive the cerebral hemispheres consolidated, as in Fish, in two vesicles isolated one from the other; at a later period, you see them affect the configuration of the cerebral hemispheres of Reptiles; still later again, they present you with the forms of those of Birds; finally, they acquire, at the era of birth, and sometimes later, the permanent forms which the adult Mammalia present."

As the infant grows towards manhood it loses, at a certain age, the thymus gland; by degrees it acquires hair, teeth, and beard; the relative size of its organs changes; the body increases at a much greater rate than the head, and the head more rapidly than the internal part of the ear.

Le lieu où les germes se montrent, l'assemblage de ces germes se nomme l'ovaire; le canal, par où les germes une fois détachés se rendent au dehors, l'oviductus; la cavité où ils sont obligés, dans plusieurs espèces, de séjourner un temps plus ou moins long avant de naître, la matrice ou l'utérus; l'orifice extérieur par lequel ils sortent, la vulve. Quand il y a des sexes, le sexe mâle est celui qui féconde; le sexe femelle celui dans lequel les germes paraissent. La liqueur fécondante se nomme sperme; les glandes qui la séparent du sang, testicules; et, quand il faut qu'elle soit introduite dans le corps de la femelle, l'organe qui l'y porte s'appelle verge.

SECT. VII.—A BRIEF NOTICE OF THE INTELLECTUAL FUNCTIONS OF ANIMALS.

Mind—Matter—Sensation—Illusions—Perception—Memory—Association of Ideas—Abstraction—Judgment—Faculties of Man and other animals compared—Instinct—Connexion between the Brain and Intellectual Faculties.

We have already explained, when treating of the nervous system, that before the mind can perceive an object, an impression must be made upon an organ of sense, either immediately, or through some material medium; and that this impression must be transmitted through the nerves to the brain.

But the manner in which sensation, and its consequent perception, are produced, is a mystery impenetrable to the human understanding; and, since philosophy is unable to *prove** the existence of matter, it is only hazarding a gratuitous hypothesis to attempt to explain mind by materialism, [or by analogies borrowed from the qualities of matter. The consideration of the Physiology of the Human Mind, or Metaphysics, forms the subject of another science.] But it is the province of the naturalist to ascertain the conditions of the body attendant on sensation,—to trace the extreme gradations of intellect in all living beings,—to investigate the precise point of perfection attainable by each animal,—and, finally, to ascertain whether there be not certain modifications of the intellectual powers, occasioned by the peculiar organization of each species, or by the momentary state of each individual body.

It has been already explained, that, to enable the mind to perceive,

there must be an uninterrupted communication of nerves between the external organ of sense, and the central masses of the nervous system. The mind is, therefore, conscious only of some impression made upon these central masses. It follows, then, that the mind may be conscious of real sensations, without any corresponding affection of the external organ; and these may be produced either in the nervous chain of communication, or in the central masses themselves. This is the origin of dreams, and visions, and of several casual sensations.

The various kinds of spectral illusions proceed from impressions, which, being made on the retina, are thence communicated to the brain, and are referred by the mind to an object in actual existence. "When the eye or the head receives a sudden blow, a bright flash of light shoots from the eyeball. In the act of sneezing, gleams of light are emitted from each eye, both during the inhalation of the air, and during its subsequent protrusion; and in blowing air violently through the nostrils, two patches of light appear above the axis of the eye and in front of it, while other two luminous spots unite into one, and appear as it were about the point of the nose, when the eyeballs are directed to it. In a state of indisposition, the phosphorescence of the retina appears in new and more alarming forms. When the stomach is under a temporary derangement, accompanied by headache, the pressure of the blood-vessels upon the retina shows itself, in total darkness, by a faint blue light floating before the eye, varying in its shape, and passing away at one side. The blue light increases in intensity—becomes green and then yellow, and sometimes rises to red; all these colours being frequently seen at once; or the mass of light shades off into darkness. When we consider the variety of distinct forms which, in a state of perfect health, the imagination can conjure up when looking into a burning fire, or upon an irregularly shaded surface, it is easy to conceive how the masses of coloured light which float before the eye may be moulded, by the same power, into those fantastic and unnatural shapes which so often haunt the couch of the invalid, even when the mind retains its energy, and is conscious of the illusion under which it labours. In other cases, temporary blindness is produced by pressure upon the optic nerve, or upon the retina; and under the excitation of fever or delirium, when the physical cause which produces spectral forms is at its height, there is superadded a powerful influence of the mind, which imparts a new character to the phantasms of the senses."*

Many circumstances render it extremely probable, that the pictures drawn in the mind by memory, or created by imagination, do not merely exist "in the mind's eye," but are actually figured on the retina. During health, and in ordinary cases, these images are faint, and are easily distinguished from the sensations resulting from real perception. It is only when the body is affected by certain diseases, or during sleep, that the impressions on the retina appear to proceed from objects in actual existence.

Several instances might be brought forward to illustrate the illusions of the senses. By the well-known experiment of making a galvanic circuit through the tongue, a piece of zinc and one of silver, there is produced a pungent metallic taste, in the same manner as would have followed the real application of a sapid substance. Thus it may be seen that, if we communicate an impression to the nerve on its passage to the central mass, the mind will be affected in the same manner as if the impression had been made on the external organ.

By the terms *central masses*, we understand a certain portion of the nervous system, which is always more circumscribed as the animal is more perfectly constructed. In Man it is exclusively a limited portion of the brain. On the contrary, in Reptiles the central mass may include either the brain, the entire marrow, or any portion of them taken separately; so that the absence of the entire brain does not deprive them of sensation. The extension of the term, when applied to lower classes of animals, is much greater, as their sensitive power is still more widely diffused.

We are hitherto completely ignorant of the nature of the changes which take place in the nerves and brain during perception, and of the manner in which the process is carried on. Analogies derived from matter, sensible species, images, and vibrations, obscure rather than explain this mysterious subject.

A certain state of mind follows a certain impression upon an external organ. We refer the cause of the sensation to some external object. This constitutes *perception*; and the mind is said to form an *idea* of the object. By a necessary law involved in the constitution of the mind, all the ideas of material objects are in time and in space.

When an impression has once been made through the medullary masses upon the mind, it possesses the power of recalling the impression after the exciting cause has been removed. This is *memory*, a faculty which varies much with the age and health of the individual.

During childhood, and in youth, the memory is very vivid. Accordingly, this period of life is most favorable to the acquisition of knowledge, especially of those subjects involving a great extent of detail, such as languages, geography, civil history, and natural history. The memory fails with increasing years.

Vivid perceptions and sensations are easily conceived; but the memory of a former mental impression is in general more faint.

Certain diseases, such as apoplexy, destroy the memory, either entirely or partially. A disordered state of the stomach will deprive the mind of the power of following a continued train of deep thought. This is also the case in the first stages of fevers.

* First truths do not admit of proof; they are assumed. We cannot *prove* the existence of mind, but we are conscious of its existence; and we cannot *prove* the existence of matter, for we perceive it.

* Letters on Natural Magic, by Sir David Brewster.

Blows and other injuries of the head will often affect the memory in a manner altogether incredible and surprising; and similar effects are sometimes produced by a high degree of nervous excitement.

Ideas which resemble [which contrast], or which were produced at the same time [or in the same place], have the power of recalling each other. This is termed the *association of ideas*. The order, the extent, and the quickness in which this power is exercised, constitutes the perfection of the memory.

Every object presents itself to the memory with all its qualities, and all the ideas associated therewith. The understanding possesses the power of separating these associated ideas from the objects, and of combining all the properties resembling each other in different objects under one general idea. This power of generalization, by which an object is imagined to be divested of certain properties, which in reality are never found separate, is termed *Abstraction*.

The power of abstraction appears to belong exclusively to Man; who, by the invention of general terms, is enabled to reason concerning entire classes of objects and events, and to arrive at general conclusions, comprehending a multitude of particular truths.

Every sensation being more or less agreeable, or disagreeable, experience and repeated trials readily point out the movements necessary to procure the one, or to avoid the other. The understanding thence deduces general rules for the direction of *the Will* relatively to pleasure and pain.

An agreeable sensation may produce unpleasant consequences; and the foresight of these consequences may react upon the first sensation, and thus produce certain modifications of the abstract rules framed by the understanding. This is *prudence* or *self-love*.

The lower animals seem influenced only by their present or very recent sensations, and they invariably yield to the impulse of the moment. Man alone appears able to form the general idea of *happiness*, and, by taking a comprehensive view of things, to lay down a plan for the regulation of his future conduct, and the attainment of his favourite objects.

But an inseparable barrier is placed between man and inferior intelligences, by the power of perceiving those qualities of actions which are termed *right* and *wrong*, and the emotions which attend their perception. The supremacy of conscience, and its claim to be considered an original faculty of the mind, are clearly pointed out by Bishop Butler. "Virtue," he elsewhere observes, "is that which all ages and all countries have made profession of in public—it is that which every man you meet puts on the show of—it is that which the primary and fundamental laws of all civil constitutions over the face of the earth make it their business and endeavour to enforce the practice of upon mankind, such as justice, veracity, or a regard for the common good."

By applying terms to express our general ideas, we obtain certain formulæ or rules, which are easily adapted to particular cases. This is *judgment* or *reasoning* [which may be either *intuitive* or *deductive*.]

When original sensations and associations forcibly recur to the memory [the mind possesses the power of combining and arranging them, to form a new creation of its own], this is called *imagination*, and it may be accompanied by agreeable or painful associations.

Man being endowed with superior privileges, possesses the faculty of connecting his general ideas with particular signs. These are more or less arbitrary, easily fixed in the memory, and serve to suggest the general ideas, which they were intended to represent. We apply the term *symbols* to designate these signs when associated with our general ideas, and they form a *language* when collectively arranged. Language may be addressed either to the ear or to the eye; in the former case it is termed *speech*, in the latter, *hieroglyphics*. *Writing* is a series of images, by which the elementary sounds are represented to the eye [under the form of *letters*.] By combining them [into *words*], the compound sounds of which speech is composed are readily suggested. Writing is therefore an indirect representation of our thoughts.

This power of representing general ideas by particular signs or symbols, which are arbitrarily associated with them, enables us to retain an immense number of distinct ideas in the memory, and to recal them with facility. Innumerable materials are thus readily supplied to the reasoning faculty and to the imagination. The experience of individuals is also communicated by written signs to the whole human species, and by this means the foundation is laid for their indefinite improvement in knowledge through the course of ages.

The art of printing, by multiplying copies, has ensured the permanence of knowledge, and has afforded a powerful aid to the intellectual progress of the species.

This capacity for indefinite improvement forms one of the distinguishing characters of human intelligence.

The most perfect animals are infinitely below Man, in respect to the

degrees of their intellectual faculties; but it is nevertheless certain that their understandings perform operations of the same kind. They move in consequence of sensations received; they are susceptible of lasting affections; and they acquire by experience a certain knowledge of external things, sufficient to regulate their motions, by actually foreseeing their consequences, and independently of immediate pain and pleasure. When domesticated, they feel their subordination. They know that the being who punishes them may refrain from doing so if he will, and they assume before him a supplicating air, when conscious of guilt, or fearful of his anger. The society of man either corrupts or improves them. They are susceptible of emulation and of jealousy; and, though possessed among themselves of a natural language, capable of expressing the sensations of the moment, they acquire from man a knowledge of the much more complicated language through which he makes known his pleasure, and urges them to execute it.

We perceive, in fact, a certain degree of reason in the higher animals, and consequences resulting from its use and abuse, similar to those observed in Man. The degree of their intelligence is not far different from that possessed by the infant mind, before it has learned to speak. But, in proportion as we descend in the scale of creation to animals far below man in organization, these faculties become more languid; and, in the lowest classes, they are reduced to certain motions obscurely indicating some kind of sensation, and the desire of avoiding pain. The degrees of intellect between these extremes are infinite.

Dogs, cats, horses, birds, and other animals, may have their original faculties modified by personal experience; and they are accordingly trained to the performance of those extraordinary feats, which in all countries form a favourite amusement of the people. "By experience," says Mr Hume, "animals become acquainted with the more obvious properties of external objects; and gradually, from their birth, treasure up a knowledge of the nature of fire, water, stones, earth, heights, depths, &c. The ignorance and inexperience of the young are here plainly distinguishable from the cunning and sagacity of the old, who have learned by long observation to avoid what hurt them, and pursue what gave ease and pleasure. A horse that has been accustomed to the field, becomes acquainted with the proper height he can leap, and will never attempt what exceeds his force and ability. An old greyhound will trust the more fatiguing part of the chase to the younger, and will place himself so as to meet the hare in her doubles; nor are the conjectures which he forms on this occasion founded on any thing but his observation and experience. This is still more evident from the effects of discipline and education on animals, who, by the proper application of rewards and punishments, may be taught any course of action the most contrary to their natural instincts and propensities. Is it not experience which renders a dog apprehensive of pain, when you menace him, or lift up the whip to beat him? Is it not even experience which makes him answer to his name, and infer, from such an arbitrary sound, that you mean him rather than any of his fellows, and intend to call him when you pronounce it in a certain manner and with a certain accent?"

There exists, however, in a great number of animals, a faculty different from intelligence, called *instinct*. This power causes them to perform certain actions necessary to the preservation of the species, but often altogether removed from the apparent wants of the individual. These are often so very complicated and refined, that it is impossible to suppose them the result of foresight, without admitting a degree of intelligence in the species performing them, infinitely superior to what they exhibit in other respects. The actions proceeding from instinct are still less the effect of imitation, for the individuals executing them have sometimes never seen them performed by others. The degree of instinct is by no means proportioned to the general intelligence of the species; but it is in those animals which, in their other actions, manifest the utmost stupidity, that instinct appears most singular, most scientific, and most disinterested. It is so much the property of each entire species, that all individuals exercise it in precisely the same manner, without ever attaining to higher degrees of cultivation.

"Every other animal, but Man, from the first outset of the species and of the individual, is equal to his task; proceeds in the shortest way to the attainment of his purpose, and neither mistakes the end nor the means by which it is to be obtained. In what he performs, we often justly admire the ingenuity of the contrivance and the completeness of the work. But it is the ingenuity of the species, not of the individual; or rather it is the wisdom of God, not the deliberate effect of invention or choice, which the created being is fitted to employ for himself. His task is prescribed, and his manner of performing it secured. Observe the animals most remarkable for a happy choice of materials, and for the curious execution of their works. The bird, how unvaried in the choice of the matter she employs in the structure, or in the situation, she has chosen for her eyrie or nest! Insects, most exquisitely artful in the execution of their little works, for the accommodation of their swarms, and the lodgment of their stores; how accomplished in their first and least-experienced attempts; how uniform and unchangeable in the last! Nature appears to have given to the other animals a specific direction to the means they are to employ, without any rational conception of the end for which they are to employ them."

Thus, the working bees, from the creation of the world, have always constructed edifices of great ingenuity, upon principles deduced from the highest branches of geometry, for the purpose of lodging and nourishing a posterity which is not even their own.

"It is a curious mathematical problem," observes Dr Reid, "at what precise angle three planes which compose the bottom of a cell in a honey-comb ought to meet, in order to make the greatest saving, or the least expense, of material and labour; and this is the very angle in which the three planes in the bottom of a cell do actually meet. Shall we ask here, who taught the bee the properties of solids, and to resolve the problems of *maxima* and *minima*? We need not say that bees know none of these things. They work most geometrically, somewhat like a child, who, by turning the handle of an organ, makes good music, without any knowledge of music. The art is not in the child, but in HIM who made the organ. In like manner, when a bee makes its comb so geometrically, the geometry is not in the bee, but in that Great Geometrician who made the bee, and made all things in number, weight, and measure."

The solitary bees and wasps construct very complicated nests for the reception of their eggs. From each egg there proceeds a worm which has never seen its mother, which knows not the structure of the prison enclosing it; and yet, after it has undergone its metamorphosis, will construct another nest, precisely similar, to contain its own egg.

No satisfactory explanation can be given of the phenomena of instinct, except we admit that these animals possess some innate and constant internal power, which determines them to act, in the same manner as when they are influenced by ordinary and accidental sensations. Instinct haunts them like a perpetual reverie or vision; and all the actions proceeding therefrom may be compared to those of a man walking in his sleep.

Instinct has been wisely bestowed upon animals by the Creator, to supply the defects of their understandings, the want of bodily force or fecundity; and thus the continuation of each species is secured to the proper extent.

There is no visible mark, in the conformation of an animal, by which we can ascertain the degree of instinct which it possesses. But so far as observation has hitherto extended, the degree of intelligence seems proportioned to the relative size of the brain, and especially of its hemispheres.

Without venturing to decide upon this point, we must remark that the latter assertion has been controverted by many recent observers, especially by Dr Herbert Mayo, in his valuable *Outlines of Human Physiology*. "It does not appear," he remarks, "that an increase in the absolute weight of the brain confers a superiority in mental endowments. Were this the case, the intellects of the whale and of the elephant should excel the rational nature of man. Neither does the relative weight of the brain to the whole body appear the measure of mental superiority. The weight of the human brain is but one thirty-fifth part, while that of a canary bird is one-fourteenth part. Nor in conjunction with parity of form, and structure even, does this relation appear of any value. The eagle is probably as sagacious as the canary bird; but the weight of the brain is but one two-hundred-and-sixtieth part of its entire weight.

"We may next inquire," he proceeds, "whether an increasing number and complication in the parts of the brain is essentially connected with improved mental functions. The first instances which occur to the mind are in favour of the affirmative of this supposition. It may be inferred, from their docility and surprising capability of receiving instruction, that birds have higher mental endowments than fish; and accordingly, in place of the nodules of the fishes' brain, which are scarcely more than tubercles to originate nerves, birds possess an ample cerebrum and cerebellum (or lobes of their brain). But in pursuing this argument, if we compare, on the other hand, the brain of birds with those of alligators and tortoises, we find no striking difference or physical superiority in the former over the latter; yet in mental development, the tortoise and alligator are probably much nearer to fish than to birds. The *instantia crucis* (or decisive experiment), however, upon this question, is found in the comparison of the brain of the cetaceous mammalia (such as whales or dolphins), with the human brain on the one hand, and with that of fish on the opposite.

"The cetaceous mammalia," he observes, "have brains which, besides being of large size, are nearly as complicated as those of human beings; they might therefore be expected, if the opinion which I am combating were true, to manifest a remarkable and distinguishing degree of sagacity. Endowed with a brain approaching nearly in complexity and relative size to that of man, the dolphin should resemble in his habits one of the transformed personages in eastern fable, who continued to betray, under a brute disguise, his human endowments. Something there should be, very marked in his deportment, which should stamp his essential diversity from the fishes, in whose general mould he is cast. His habits too, not shunning human society, render him especially open to observation; and the class of men who have the constant opportunity of watching his gambols in the deep, are famed for their credulity, and delight to believe in the mermaid, the sea-snake, and the kraken. Yet the mariner sees nothing in the porpoise or the dolphin but a fish, nor distinguishes him, except by his unwieldy bulk, from the shoal of herrings he pursues. The dolphin shows, in truth, no sagacity or instinct above the carp, or the trout, or the salmon. It is probable even that the latter, which have but the poorest rudiment of a brain, greatly exceed him in cunning and sagacity. I am afraid that the instance which I have last adduced is sufficient to overthrow most of the received opinions respecting the relation of the size, shape, and organization of the brain to mental development; nor is it easy to find a resting-place for conjecture upon this subject."

SECT. VIII.—ON THE CLASSIFICATION OF THE ANIMAL KINGDOM.

General Distribution of the Animal Kingdom into Four Great Divisions.

1. *Vertebrata*—2. *Mollusca*—3. *Articulata*—4. *Radiata*.

AFTER the observations which have already been made concerning systems of classification in general, we have now to ascertain those leading characters of animals, upon which we must found the primary divisions of the Animal Kingdom. It is evident that these must be derived from the animal functions, that is, from sensation and motion; for not only do these functions constitute them animals, but they point out the rank which they hold in the animal world.

Observation confirms the correctness of this reasoning, by showing that their development and intricacy of structure correspond in degree with those of the organs performing the vegetative functions.

The heart and the organs of circulation form a kind of centre for the vegetative functions, in the same manner as the brain and the trunk of the nervous system are the centres of the animal functions; for we see these two systems become gradually more imperfect, and finally disappear together. In the very lowest classes of animals, where nerves can no longer be discovered, all traces of muscular fibres are obliterated, and the organs of digestion are simply excavated in the uniform mass of their bodies. The vascular system [or systematic arrangement of vessels] in insects, disappears even before the nervous; but, in general, the medullary masses are dispersed in a degree corresponding to the agents of muscular motion. A spinal marrow, on which are various knots or ganglions, representing so many brains, corresponds exactly to a body divided into numerous annular [or ring-like] segments, supported upon pairs of limbs, distributed along its entire length.

This general agreement in the construction of animal bodies, resulting from the arrangement of their organs of motion, the distribution of the nervous masses, and the energy of the circulating system, ought, then, to form the basis of the primary divisions of the Animal Kingdom. We shall now proceed to examine what the characters are, which ought to succeed immediately to the above, and give rise to the first subdivisions.

If we divest ourselves of the popular prejudices in favor of long established divisions, and consider the Animal Kingdom upon the principles already laid down, without reference to the size of the animals, their utility, the greater or less knowledge we may have of them, or to any of these accidental circumstances, but solely in reference to their organization and general nature, we shall find that there are four principal forms, or (if we may use the expression) four general plans, upon which all animals appear to have been modelled. The minor subdivisions, by whatever titles they may be ornamented by Naturalists, are merely slight modifications of these great divisions, founded upon the greater development or addition of some parts, while the general plan remains essentially the same.

I. VERTEBRATA—*Vertebrated Animals.*

In the first of these forms, which is that of Man, and of the animals most resembling him, the brain and the principal trunk of the nervous system are enveloped in a bony covering, composed of the cranium [or skull], and the vertebrae [or bones of the neck, back, and loins.] To the sides of this medial column are attached the ribs, and the bones of the limbs, forming collectively the framework of the body. The muscles, in general, enclose the bones which they set in motion, and the viscera are contained within the head and trunk.

Animals possessed of this form are called *Vertebrated Animals* (*Animalia vertebrata*), [from their possessing a *vertebral* column, or spine.]

They are all supplied with red blood, a muscular heart, a mouth with two jaws, one being placed either above or before the other, distinct organs of sight, hearing, smell, and taste, in the cavities of the face, and never more than four limbs. The sexes are always separate, and the general distribution of the medullary masses, with the principal branches of the nervous system, are nearly the same in all.

Upon examining attentively each of the parts of this extensive division of animals, we shall always discover some analogy among them, even in species apparently the most removed from each other; and the leading features of one uniform plan may be traced from man to the lowest of the fishes.

The following are examples of *Vertebrated Animals*: Man, quadrupeds, whales, birds, serpents, frogs, tortoises, herrings, carps, &c.

2. MOLLUSCA—*Molluscous Animals.*

In the second form of animals we find no skeleton. The muscles are attached solely to the skin, which forms a soft envelope, capable of con-

tracting in various ways. In many species earthy laminae or plates, called shells, are secreted from the skin, and their position and manner of production are analogous to those of the mucous bodies. The nervous system is placed within this covering along with the viscera; and the former is composed of numerous scattered masses, connected by nervous filaments. The largest of these masses are placed upon the œsophagus, or gullet, and are distinguished by the term *brain*. Of the four senses which are confined to particular organs, we can discover traces only of taste and of sight, but the latter is very often found wanting. In only one family, however, there are exhibited the organs of hearing. We always find a complete circulating system, and particular organs for respiration. The functions of digestion and of secretion are performed in a manner very nearly as complicated as in the vertebrated animals.

Animals possessed of this second form are called Molluscous Animals (*Animalia mollusca*), [from the Latin, *mollis*, soft.]

Although the general plan adopted in the organization of their external parts is not so uniform as in the vertebrated animals, yet, in so far as regards the internal structure and functions, there is at least an equal degree of mutual resemblance.

The cuttle-fish, oyster, slug, and garden-snail, are familiar instances of this class of animals.

3. ARTICULATA—Articulated Animals.

The third form is that which may be observed in Insects and Worms. Their nervous system consists of two long cords, extending the entire length of the intestinal canal, and dilated at intervals by various knots, or ganglions. The first of these knots, placed upon the œsophagus or gullet, and called the brain, is scarcely larger than any of the others, which may be found arranged along the intestinal canal. It communicates with the other ganglions by means of small filaments, or threads, which encircle the œsophagus like a necklace. The covering of their body is divided into a certain number of ring-like segments, by transverse folds, having their integuments sometimes hard, sometimes soft, but always with the muscles attached to the interior of the envelope. Their bodies have frequently articulated limbs attached to the sides, but they are also very frequently without any.

We shall assign the term Articulated Animals (*Animalia articulata*) to denote this numerous division, in which we first observe the transition from the circulating system in cylindrical vessels of the higher animals, to a mere nutrition, by imbibing or sucking in the alimentary substances; and the corresponding transition, from respiration through particular organs, to one performed by means of tracheæ, or air cells, dispersed throughout the body. The senses most strongly marked among them are those of taste and sight. One single family exhibits the organ of hearing. The jaws of the Articulated Animals are always lateral, but sometimes they are altogether wanting.

As instances of this form, we may mention the earth-worm, leech, crabs, lobsters, spiders, beetles, grasshoppers, and flies. From the circumstance of their coverings, or limbs, being divided, or jointed, they derive the name of "articulated," from the Latin *articulus*, a little joint.

4. RADIATA—Radiated Animals.

To the fourth and last form, which includes all the animals commonly called Zoophytes, may be assigned the name of Radiated Animals (*Animalia radiata*.) In all the other classes the organs of motion and of sensation are arranged symmetrically on both sides of a medial line or axis; while the front and back are quite dissimilar. In this class, on the contrary, the organs of motion and of sensation are arranged like rays around a centre; and this is the case even when there are but two series, for then both faces are similar. They approach nearly to the uniform structure of plants; and we do not always perceive very distinct traces of a nervous system, nor of distinct organs for sensation. In some we can scarcely find any signs of a circulation. Their organs for respiration are almost always arranged on the external surface of their bodies. The greater number possess, for intestines, a simple bag or sac, with but one entrance; and the lowest families exhibit nothing but a kind of uniform pulp, endowed only with motion and sensation.

The following are instances of this singular class of animals:—The sea-nettle, polypus, hydra, coral, and sponge. The name zoophyte is derived from two Greek words, ζῷον (*zoon*), an animal; φυτον (*phyton*), a plant; while that of *radiata*, derived from the Latin, evidently points out the radiated or ray-like arrangement of their parts.

"Before my time," says the Baron Cuvier in a note to his first edition, "modern naturalists divided all Invertebrated Animals into two classes—Insects and Worms. I was the first who attacked this view of the subject, and proposed another division, in a paper read before the Society of Natural History at Paris, the 21st Floreal, year iii.

(or 10th May 1795), and which was afterwards printed in the "*Decade Philosophique*." In this paper, I pointed out the characters and limits of the Mollusca, the Crustacea, the Insects, the Worms, the Echinodermata, and the Zoophytes. The red-blooded worms, or Annelides, were not distinguished until a later period, in a paper read before the Institute, on the 11th Nivose, year x. (or 31st December 1801.) I afterwards distributed these several classes into three grand divisions, analogous to that of the *Animalia Vertebrata*, in a paper read before the Institute in July 1812, and afterwards published in the *Annales du mus. d'Histoire Nat. tome xix.*"

SECT. IX.—GENERAL REVIEW OF LIVING BEINGS.

Life—Animals and Plants—Definition of an Animal.

WHEN we contemplate the face of the earth, we perceive it to be covered with living beings. Animals and plants are to be found in every corner of the globe, with the exception of the poles, where perpetual frosts and the long darkness of winter render the land incapable of supporting them; and where, to use the words of the poet, "Life itself goes out." We even find the remains of living bodies at enormous depths below the surface, in spots which once formed the beds of running streams, or the bottom of a mighty ocean, from which situations they have been elevated by the ordinary laws of volcanic agency. The mould forming the surface of the earth is composed of the remains of generations which are now no more: it serves to maintain the growth of living plants, and, through them, of all living animals. In the atmosphere surrounding the globe, every thing is fitted for life: light and heat bring organized bodies into existence; the air, covering the earth in every direction to the depth of many leagues, continually exchanges its particles with those of living bodies. Finally, water, which passes incessantly from the sea to the clouds, and from the clouds to the sea, is another element essential to Life.

Life is one of those mysterious and unknown secondary causes, to which we assign a certain series of observed phenomena, possessing mutual relations, and succeeding each other in a constant order. It is true that we are completely ignorant of the link which unites these phenomena, but we are sensible that a connexion must exist; and this conviction is sufficient to induce us to assign to them one general name, which is used in two senses: first, as the sign of a particular principle; and, secondly, as indicating the totality of the phenomena which have given rise to its adoption.

As the human body, the bodies of the other animals, and of plants, appear to resist, during a certain time, the laws which govern inanimate bodies, and even to act on all around them in a manner opposed altogether to those laws, we employ the terms *Life* and *Vital Principle* to designate these apparent exceptions to general laws. It is, therefore, by determining exactly in what these exceptions consist, that we shall be able to understand clearly the meaning of those terms. For this purpose, let us consider living bodies in their active and passive relations to the rest of nature.

For example, let us contemplate a female in the prime of youth and health. The elegant form, the graceful flexibility of motion, the gentle warmth, the cheeks crimsoned with the blushes of beauty, the brilliant eyes sparkling with the fire of genius, or animated with the sallies of wit, seem united to form a most fascinating being. A moment is sufficient to destroy the illusion. Motion and sense often cease without any apparent cause. The body loses its heat, the muscles become flat, and the angular prominences of the bones appear; the cornea of the eye loses its brightness, and the eyes sink. These are, however, but the preludes of changes still more horrible. The neck and abdomen become discoloured, the cuticle separates from the skin, which becomes successively blue, green, and black. The corpse slowly dissolves, a part combining with the atmosphere, a part reduced to the liquid state, and a part mouldering in the earth. In a word, after a few short days there remain only a small number of earthy and saline principles. The other elements are dispersed in air and water, prepared again to enter into new combinations, and to become the constituent particles, perhaps, of another human body.

It is evident that this separation is the natural effect of the action of the air, heat, and moisture; in a word, of external matter upon the dead animal body; and that its cause is to be found in the elective attraction of these different agents for the elements of which the body is composed. That body, however, was equally surrounded by those agents while living, their affinities for its molecules were the same, and the latter would have yielded in the same manner during life, had not their cohesion been preserved by a power superior to those affinities, and which never ceased to act until the moment of death.

All living beings are found to possess one common character, whatever differences may prevail among them. They are all born from bodies similar to themselves, and grow by attracting the surrounding particles which they assimilate with their substance. All are formed with different parts, which we call *organs*, and from which they derive the appellation of *organized beings*. These organs united together form a whole, which is a perfect unity in respect to form, duration, and the phenomena it exhibits; and, as one of these properties cannot be abstracted from the rest without annihilating the whole, a living being receives the name of *individual*. Each being possesses a degree of heat, differing in different beings, and, to a certain point, independent of surrounding bodies. They all resist the laws of affinity which sway the mineral kingdom, and the compositions which they form are submitted to laws different from those influencing the mixtures of the chemist. They all absorb something from without, and transform it within; and all exhale certain principles, the product of the vital action. All reproduce other and similar beings, by the same actions by which they were themselves produced. All exist for a time, variable for each individual, but nearly the same for the same species, when in the wild state of nature. After this active individual existence, they all cease to live; and, finally, their bodies are dissipated into their more simple elements, according to the universal laws of Inorganic Chemistry.

Thus every living being forms, by its unity, a little world within itself; yet this little world cannot remain isolated from the universe without. In Life, there is always a bond of mutual dependence among the organs—a universal concurrence and agreement

of actions. Every part corresponds with the whole, and the whole with the universe.

If, then, we wish to distinguish a living body from another organized body, but without life, we have only to ascertain whether it continue to interchange particles with the soil, or gaseous fluids, which surround it; or, on the contrary, whether it maintain no active or efficacious relations with the universe. Again, if we wish to distinguish an organized body, which has ceased to live, from a mineral, we have only to ascertain whether the particles are otherwise united than by the ordinary molecular attractions, and whether the free action of the elements is about to annihilate it either by destruction or putrefaction.

The division of Living Beings into Animals and Plants has been already explained. The former, being of a complex nature, are provided with an internal cavity which receives their aliment, and are endowed with sense and spontaneous motion. Directed by instinct, they are alike capable of avoiding injury, and of pursuing their natural good. The latter, fixed to the earth by their roots, and deprived of the faculties of sensation and motion, are placed by Nature in situations fitted to supply their wants. The materials necessary for their sustenance are absorbed directly, without instinct or motion, and are abundantly supplied without either preparation or complicated labour. Animals, endowed with the distinctions of sex, both of which sometimes co-exist in the same individual, but more frequently in separate individuals of the same species, preserve these distinctions during the whole period of their lives. Almost all plants, on the contrary, have the two sexes united in the same being; and the distinctive characters of sex are lost and renewed every year. Again, the internal structure of animals is more complicated than that of plants: it is *internally* that the great functions of life are performed. With plants, on the contrary, the principal organs are placed on the surface; and their functions are mostly performed *externally*. As soon as an animal is born, its organs are exhibited: they require nothing but development and growth to form a perfect animal; and, if we except certain metamorphoses, the external form of the adult is already sketched. The vegetable, born from a seed, develops its organs successively; first the root, then the stalk, leaves, and flowers;—and when the flowers have bloomed, they die; the rest of the organs perish, the whole ceases to live, or sometimes only the stalk, or perhaps only the leaves. Not a year elapses but each flower is destroyed or renewed, partially or entirely. Thus, the two classes of beings possess in common the powers of nutrition and of reproduction. The animal has, however, something more than the vegetable, and enjoys the higher powers of sensation and voluntary motion. The animal alone possesses nerves, muscles, blood, and some kind of stomach. One at least of these organs is always visible; and, as the nerves and muscles are intermittent in their action, and incapable of maintaining a long-continued exercise without repose, animals possess a new distinctive mark in that periodical sleep to which they are at intervals subjected.

To a person who has considered Life only in Man, or in those higher animals which most resemble him, it appears almost superfluous to explain the essential difference between an animal and a plant. If there existed upon the face of the earth only such animals as Birds, Fishes, or Quadrupeds, there would then be no occasion to enlarge so fully upon the distinctions in their functions: the line drawn by the hand of Nature would suffice. We should readily be preserved from error on this point by their senses, their voluntary motion, the symmetry and complexity of their structure, but, above all, by the instinct which directs their actions. Then we might say with Linnaeus, "*Vegetabilia crescunt et vivunt; Animalia crescunt, vivunt et sentiunt,*" (Vegetables grow and live; Animals grow, live, and feel); and this definition would be as accurate as it is brief. We should not be obliged to separate Corals, Polypi, Insects, Crustacea, and Symmetrical Shells, from the Vegetable Kingdom.

But such is not the case. All animals do not exhibit the distinctive marks of complicated structure and voluntary motion. This may be easily inferred from the fact, that Tournefort, a man of great talents, and an able naturalist, actually formed nine genera in the seventeenth family of his Botanical system with those Polypi which were known to him and to his learned contemporaries. At a later period, Trembley hesitated for a long time before he could determine whether the Hydra was an animal or a plant; and the experiments which he performed to determine the question have been admired by all the philosophers of his time. The dexterous manipulations of Trembley are the more remarkable, as Peyssonel had previously observed that minute animals inhabit the different compartments of the corals. This discovery was extended by Ellis and Solander to all kinds of Polypi; while Donati, Réaumur, and B. de Jussieu, brought the subject prominently forward in their public lectures and writings. The question, however, still remained in an unsatisfactory state, and attracted the attention of the distinguished naturalists of the eighteenth century. Buffon proposed to establish an intermediate class between animals and plants. Linnaeus adopted this suggestion, although it proceeded from Buffon; and rendered the distinction permanent by the title of Zoophytes, or Animated Plants. The celebrated Pallas followed Linnaeus; Cuvier adopted the word and the distinction; while Lamarck rejected them both.

These doubts and differences of opinion among enlightened men could only have proceeded from the obscurity of the subject. One cause of the obscurity arose from the false direction which their studies had unfortunately taken. Confining themselves to their cabinets, Naturalists remained too far from Nature. They had found solid bodies—Corals, Sponges, Alcyonia, Polypi, of innumerable shapes, sometimes covered with soft and moveable bodies, and sometimes without them. Instead of considering the soft body as the artificer of the solid mass, they believed that the latter produced the former; and as the solid masses were observed to grow and vegetate, they were hastily considered to be plants, while the soft bodies were regarded as the flowers of these extraordinary vegetables. The error was further confirmed by the circumstance, that at the particular period when these Polypi reproduce other beings of the same species, their bodies are covered with little buds and shoots, which bear a great resemblance to certain flowers, the structure of which cannot be very distinctly perceived. But when these supposed flowers were observed to be endowed with spontaneous motion, and that they were possessed of sensation, a great difficulty arose; and the name of Zoanthes, or *animated flowers*, was assigned to them.

It has now, however, been completely ascertained that the Polypi themselves fa-

bricate these solid apparent vegetables, which serve for their abodes. They secrete them in very nearly the same manner as the Mollusca form their shells; the Terebra its testaceous tube; the Lobster its crustaceous envelope; the Tortoise its shield; the Fishes their scales; Insects their elytra or wing-cases; Birds their plumage; the Armadillo his scaly covering; the Whales their horny laminae; Quadrupeds their skins and organs of defence; and Man, his hair, nails, and cuticle. In all these beings there are to be found some parts which vegetate; and if it were necessary to class with plants all beings which are found to vegetate in any of their parts, we ought, consistently, to include all the animals just named with the Zoophytes or animated plants of Linnaeus and Pallas.

The following are the characters by which we may always ascertain whether a living being, organized, growing, drawing in nutriment, possessing an internal temperature peculiar to itself, and reproducing its kind, be an Animal or a Plant.

If it be irritable to the touch, and move spontaneously to satisfy its wants,—if it be not deeply rooted in the soil, but only adhere to the surface,—if its body be provided with a central cavity,—if it putrify after death,—if it give out the ammoniacal odour of burnt horn,—and finally, if in its chemical composition there be found an excess of azote over carbon,—then we may be certain that it is an Animal. But if, on the contrary, the doubtful being under examination enjoy no lasting or spontaneous power of motion,—if it be destitute of an internal cavity,—if it be deeply inserted in the soil,—if, when detached, it speedily fade and die,—if, when dead, it merely ferment, but do not putrify,—if it burn without the odour of a burnt quill or horn,—and if its residue be very considerable and chiefly carbon,—then we may venture to declare it to be a Plant.

These characters are sufficient, and can, in general, be easily ascertained. In this enumeration, no allusion has been made to sensation as a distinctive mark of the two classes of living beings; because, in the lowest classes of animals, where alone any difficulty can arise, it is only from the property of irritability that we can infer sensation. The phenomena of reproduction have likewise not been alluded to, because it is in the lowest animals, which we are the most likely to confound with plants, that this power is still involved in great obscurity, or altogether unknown. It is not, as we might at first sight suppose, the most perfect, or, to speak more correctly, the most complicated plants that are likely to be mistaken for animals. A moment's reflection will readily show how utterly impossible it is to confound a plant, bearing leaves and flowers, with any animal whatever. But it is otherwise with the less characterized beings; and the Animal and Vegetable Kingdoms may be compared to two mighty pyramids, which touch each other by their bases, while their opposite vertices diverge to two infinitely remote points in either direction.

We have thus shown how extremely difficult it is to characterize the essential differences of animals and plants in one short definition. Even Cuvier himself, who spent twenty years of his life in examining the organization of animals, from the simple Polypus up to Man, has carefully abstained from proposing any such definition.

This difficulty increases in proportion to the number of animals under examination. It does not consist in ascertaining the characters appropriated to particular animals, but in selecting such a trait as shall be common to them all. We know that none but animals are possessed of a brain, nerves, muscles, heart, lungs, stomach, or skeleton. We know that they alone move, digest, respire; that they alone have blood, and seem to feel;—but the point is to ascertain which of these characters remains throughout the vast chain of beings, and which of them can be traced in the last link as well as in the first. We see the lungs disappear, then successively the glands, the brain, the skeleton, the heart, the gills, the blood, the nerves, the muscles, and finally, even the vessels; while in the lowest animals of all, we can scarcely ascertain whether they possess a digestive cavity or a stomach. However, as we find this last-mentioned organ in almost all animals, and as it can be clearly observed even in those which have no other externally visible organ, we may reasonably conclude that it is to be found in all; and, if we fail to discover a stomach in many, we should rather suppose our failure to proceed from want of skill, or from want of sufficient delicacy in our senses, arising probably from the excessive minuteness of the beings under examination. We shall, therefore, assume that all animals possess a stomach, and that they digest; we may infer that they are all possessed of sensation; but it is absolutely certain that they all, and they alone, permanently possess the power of voluntary motion.

If, therefore, we may venture to propose a definition which shall be generally applicable to all animals, we should define them to be *Living Beings having stomachs*. The stomach is, in fact, the great essential spring of every animated being. Nerves and muscles, organs of sensation and motion, appear indeed to be of a higher and more elevated character than the organ of digestion. Yet would these golden wheels of animated nature be inert and motionless, if they were not influenced by this prime-mover, formed of a coarser, but more energetic material, which supplies the fuel to their fires, and enables them to maintain undiminished the original vigour of their motions.

SECT. X.—GENERAL REVIEW OF LIVING BEINGS CONTINUED.

Their Unity and Perfection—Symmetry—Mutual Dependence—Classification of Living Beings.

ALL living beings are organized; that is, they are composed of different organs, each performing its separate function, and in its own peculiar manner. These organs collectively form a whole, perfect in each being; and the aggregation of those actions compose all that we are permitted to know of Life. Without the healthy state of the body, life cannot exist; yet the organs remain after life has ceased. We behold a body, which has just been deserted by the breath of life; we perceive an exquisite machine, where nothing seems defective; the wheel-work remains entire, but it wants the propelling hand of the workman. We may admire the sublime mechanism of that mighty Being who formed it, but the moving power ever escapes our research.

The greater number of living beings possess numerous organs, and a complicated structure. When the functions are various, the structure becomes intricate; but there exists a regular gradation—a well-marked hierarchy of functions, as well as of organs. All living bodies absorb nutriment, and reproduce their species; all animals move spontaneously at least some of their parts; many visibly respire; Man thinks. But it is evident that the first order of these functions is Nutrition—the other phenomena always presuppose this one. Let us, then, examine the subject of Nutrition, and we shall assuredly commence at the first link in the vital chain.

The greater number of Plants have a root fixed in the earth, a stem which shoots into the air, and directs itself towards the light. This stem bears leaves, branches, and flowers: these flowers, of various degrees of complication, produce fruits or seeds, destined to form a succession of beings, similar to those which have produced them. If we desire to ascertain which of these organs is essential to the existence of the plant, and, with this view, we successively abstract these several parts; if we cut off the fruits and seeds, the remainder of the plant rests uninjured. The stalk may lose its leaves without perishing; it may be cut, and the roots will continue to live and absorb in their ordinary manner—nay, the root will often even reproduce parts similar to those of which it has been deprived. The root is, therefore, the most important part of the Plant, and by it principally the whole vegetable is nourished.

Something similar to this may be observed in Animals. We see an animal of a very complicated structure. A bony skeleton, nerves, organs of sensation, a brain, muscles for motion, a heart for circulating the blood, lungs for absorbing air, a stomach in which the nutriment is deposited and prepared, glands for secreting the humours, arrangements for continuing the species, a general covering for protecting the whole, and limbs for changing its situation;—all these organs, and many more, compose its substance. In beings of this degree of complication, it is impossible to assign to each organ its proper degree of importance, because we cannot abstract any without injuring them all; and many cannot even be touched without subverting the entire fabric. But this separation, which we should in vain attempt to perform, Nature has herself realized in the long chain of animated existence. In descending from the viviparous Quadrupeds to the Birds, from the Birds to the Reptiles and Fishes, and passing from the Birds and Fishes, by the Mollusca and Insects, to the Worms and Polypi, we see these living machines become more simple, until at length we find, in the lowest orders, nothing but that first principle indispensable to all animals. The whole body of the Polypus forms, in fact, nothing but one entire stomach, without any other perceptible organ; and this alone is essential to the existence of a being so extremely simple.

We may thus conclude, that as the root is the first and essential element of the plant, so the stomach is the foundation of animal organization. Nature confirms this principle throughout all her works. She has created vegetables which are composed entirely of one vast root, and has formed animals of a simple gelatinous mass, containing only one enormous stomach. All the functions, are, however, of an extreme simplicity in bodies so homogeneous. In order that a vegetable may exist, composed entirely of a root, it is necessary that the substances proper to be absorbed should surround this root; it must be attached to a soil, composed of mould, and saturated with moisture, or to another plant; and these conditions are sufficient for its individual existence. As it produces no flowers, the species can only be continued by off-sets, buds, artificial or natural divisions of the root; and it is chiefly in this way that such bodies are propagated. But that an animal—Polypus or Worm—composed of one entire stomach, may exist, different arrangements are requisite. The stomach is placed internally; therefore, it is evident that the food must be carried into it. The animal must be able to move towards the food, and to draw it, by certain partial movements, within the cavity. In order to seek its food, it must feel and perceive; while a certain degree of instinct must exist, that it may adopt these movements in proportion to its wants. Thus, from one fundamental arrangement, there arises a being, perfect though simple, but which, though simplest of its kind, already appears complicated.

We have styled the Polypus a simple being, because it is composed of one entire stomach. Although it moves, and must feel, we can perceive no muscles, brain, or nerves; it possesses powers, while the instruments remain concealed. Yet the Polypus must be considered as a perfect being, because to it is assigned all the conditions necessary for its continued existence: it is in this respect as perfect as a Bird, or as one of the Mammalia. It is true that the animal possesses neither a heart nor lungs, no vessels or glands; but it has no occasion for them. When the body is one entire stomach, and when the animal is perfectly simple and homogeneous throughout, it is evident that these structures would be superfluous. Organs are only necessary when circulation and respiration are confined to particular parts. Every portion of the animal can draw from the alimentary canal that part of the nutriment necessary for its sustenance: it can breathe and assimilate these particles into its proper substance. But when the animal is not possessed of this perfect homogeneity throughout, it then becomes necessary that it should have a proper stomach to receive the nutriment, a heart to distribute it along with the blood into all the organs, and gills or lungs to purify this nutriment by exposure to the air. Unity of action is a first principle in life; and, in the higher orders of animals, it is the heart and the lungs which produce this unity in respect to nutrition, in the same manner as the brain realizes the unity of sensation.

Organization may exist without life, as living bodies are subject to death; but whoever says *Life*, also says *Organization*. Buffon was therefore guilty of a pleonasm, when he defined animals to be—*Bodies, living and organized*.

This organization of living bodies is regulated by certain fixed rules, which have received the name of laws from their constancy and universality. We have just spoken of the perfection and unity observable in all living bodies. The latter, however, is not absolute. Animals possessing a complicated structure are in truth *individuals*; but with plants and with the lower animals, individuals cannot be strictly said to exist, at least in the sense in which the term is understood in regard to Man and the higher animals. It is true that, as long as the several organs remain untouched, they enjoy one common life, and form one perfect and consistent being; but it is not impossible to abstract and prune away some parts, without interrupting the life of the being thus mutilated. We know well that a plant can be deprived of its flowers, leaves, and branches: there may remain nothing but a divided root, with a mutilated stem; and even this vestige of a living being will not cease to enjoy life. Nay, frequently many

of the detached parts will themselves become new beings, when placed under circumstances favorable to their development. A branch and a leaf are sometimes adequate to form a vegetable similar, in all its parts, to the being whence they were derived. Upon this fact rest the whole theory and practice of slips and layers. The same thing is found with certain animals. A naked Polypus, when cut into several pieces, forms so many new and perfect Polypi, which continue to live in exactly the same manner as their original stock. Many of the rays of an Asterias, or Sea-star, may be detached without destroying the animal. The heads of slugs may be cut off, and the animals survive, even without any apparent diminution of their vigour. But what seems still more astonishing, some of the vertebrated animals themselves may be similarly mutilated without being instantly deprived of life. Tortoises and Salamanders, which have been decapitated, will still maintain their existence for a considerable time. The Emperor Commodus used to amuse himself with knocking off the heads of Ostriches while running round the Circus at Rome; and we are told by the historians of the times that they still continued their course. This singular power is even perceptible in the newly-born animals of the class Mammalia, which preserve their existence for a very short period, even when similarly injured. Still, however, these are but exceptions to a general law prevailing throughout the Mammalia, the Birds, and even among animals less complex and less elevated in the scale of creation. With these we in general find, that the extirpation of any important organ is incompatible with life. Sudden death speedily follows such an operation. They are only capable of supporting the amputation of a limb or appendage; they can only endure a superficial wound, or injury. There exists, among all the Vertebrated Animals, a perfect dependence among their primary organs. If one of these be taken away, the remainder of the body ceases to live. If one of them be sick or wounded, the injury affects the other parts. There are five important organs, the integrity of which is absolutely essential to the continued existence of an animal possessing them; these are the heart, the brain, the organs of respiration, the spinal marrow, and the stomach. When these are once associated in a living animal, their co-existence is indispensable; and any serious division or decapitation of a body, provided with these five organs, is speedily mortal.

The parts of a plant are less united and more independent of each other; while the destruction of a part does not lead to the annihilation of the whole, because plants are nearly homogeneous. The portions remaining are provided with the same organs as the entire being. Precisely the same cause enables those lower animals to exist, which are formed but of one simple stomach. They possess no special and circumscribed organs; each of their divided segments partakes of an equal degree of complexity with the whole. But it is evident that a different result ought to be observed among the higher animals, where the functions necessary to their existence are isolated in special and circumscribed organs. With them the existence of the *individual* rests upon the exact mutual relation of the varied pieces composing the entire body.

In fact, it is a general rule, which prevails throughout the entire Animal Kingdom, that the organs essential to life are concentrated and intimately united in an animal, according to its elevation in the scale of creation, or, in other words, according as its structure is more or less complex. The variety and intricacy of the wheel-work requires a greater concentration of the moving power.

The symmetrical forms observable in all Living Beings are surprising. In regard to the roots of plants, and the branches of large trees, we observe that a great irregularity generally prevails. But this is owing rather to inequalities of the soil, and to varieties in the intensity of light, than to any natural disposition to irregularity in the plants themselves. The soil is not composed of uniform materials, and the roots always direct their fibres toward those parts which are most easily moved and yield the most abundant nutriment. The leaves and buds, again, are delicately sensible to nice degrees of light. We accordingly observe that the Coniferae, such as the Pine and Fir, being resinous, and ever-green trees, upon which these powers have least influence, present the most regular and symmetrical forms.

The regular arrangement among plants is no where found in greater perfection than among the Labiatae. We do not here allude to their flowers, which are not so very remarkable in this respect, but to their square stems, their opposite leaves, their branches, and their peduncles. In most of these plants, each leaf, taken separately, is arranged with regularity. But none even of those can compare with the beautiful symmetry observable in the leaves of the Sensitive Plant, the Acaecias, and the Firs. In by far the greater number of plants, we find the utmost exactness in the distances between the several divisions of the calyx and corolla,—the flower-cup, and the flower itself; in the dimensions of each stamen, of each pistil; in every compartment of the ovarium, and of the fruit. With the exception of certain flowers analogous to those of the Acaecias, of the Labiatae, of the Orchideae, and some others, the irregularities which many occasionally present are due to the abortion of certain parts, to their adherence, or to their transmutation into other forms.

Ascending to the Animal Kingdom, and arriving at the Polypi, those lowest of animated beings, we already find the same symmetrical arrangements. Their cilia, their tentacula, or little arms, these appendages of mere animated sacs, are disposed with regularity, around that single orifice, which we dignify by the name of *mouth*. It is only in those calcareous and arborescent masses which they form and inhabit, and which compose by their aggregation, rocks, islands, and rudimentary continents, that we fail to observe this regular arrangement. We may recognise the same order in the starry rays of the Euryalia, and in the spinous compartments of the Echini, or Sea-urchins. In respect to Insects, the symmetry is exquisite. We find the same quality in many Mollusca, but most particularly in their shells, and in the crustaceous envelopes of Crabs and Lobsters.

It is, however, in the higher or Vertebrated Animals that symmetry is brought to its greatest degree. Their bones, their nerves, their organs of sense, their brain, their muscles, their glands, their gills or lungs, are all arranged in lateral pairs; when their number is even; or they are placed in the exact central axis of the body, when their number is odd. We must admit, however, that it is externally we can best trace this correspondence, for the internal organs are not thus arranged. In this respect the contrast is altogether surprising: in vain we seek for symmetry in the disposition of the intestines, the liver, or the heart.

This physiological arrangement is ably illustrated by the excellent Dr Paley. "The regularity of the animal structure," he observes, "is rendered remarkable by the three following considerations:—First, the limbs, *separately* taken, have not this co-relation of parts, but the contrary of it. A knife taken down the chine, cuts the human body into two parts, externally equal and alike; you cannot draw a straight line which will not divide a hand, a foot, the leg, the thigh, the cheek, the eye, the ear, into two parts equal and alike. Those parts which are placed upon the middle or partition line of the body, or which traverse that line, as the nose, the tongue, the lips, may be so divided, or, more properly speaking, are double organs; but other parts cannot. This shows that the correspondency which we have been describing does not arise by any necessity in the nature of the subject; for, if necessary, it would be universal; whereas, it is observed only in the system or assemblage: it is not true of the separate parts; that is to say, it is found where it conduces to beauty or utility; it is not found where it would subsist at the expense of both. The two wings of a bird always correspond; the two sides of a feather frequently do not. In centipedes, millepedes, and the whole tribe of Insects, no two legs on the same side are alike; yet there is the most exact parity between the legs opposite to one another. The next circumstance to be remarked is, that, whilst the cavities of the body are so configurated as *externally* to exhibit the most exact correspondency of the opposite sides, the contents of these cavities have no such correspondency. A line drawn down the middle of the breast, divides the thorax into two sides exactly similar; yet these two sides enclose very different contents. The heart lies on the left side, a lobe of the lungs on the right, balancing each other neither in size nor shape. The same thing holds of the abdomen. The liver lies on the right side, without any similar viscus opposed to it on the left. The spleen indeed is situate over against the liver, but agreeing with the liver neither in bulk nor form. There is no equi-pollency between these. The stomach is a vessel both irregular in its shape and oblique in its position. The foldings and doublings of the intestines do not present a parity of sides. Yet that symmetry which depends upon the co-relation of the sides, is externally preserved throughout the whole trunk; and is the more remarkable in the lower part of it, as the integuments are soft; and the shape, consequently, is not, as the thorax is by its ribs, reduced by natural stays. It is evident, therefore, that the external proportion does not arise from any equality in the shape or pressure of the internal contents. What is it indeed but a correction of inequalities?—an adjustment, by mutual compensation, of anomalous forms into a regular congeries?—the effect, in a word, of artful, and, if we might be permitted so to speak, of studied collocation? Similar also to this, is a third observation; that an internal inequality in the feeding vessels is so managed, as to produce no inequality of parts which were intended to correspond. The right arm answers accurately to the left, both in size and shape; but the arterial branches, which supply the two arms, do not go off from their trunk, in a pair, in the same manner, at the same place, or at the same angle, under which want of similitude it is very difficult to conceive how the same quantity of blood should be pushed through each artery: yet the result is right;—in the two limbs which are nourished by them, we perceive no difference of supply, no effects of excess or deficiency. Concerning the difference of manner, in which the subclavian and carotid arteries, upon the different sides of the body, separate themselves from the aorta, Cheselden seems to have thought, that the advantage which the left gains by going off at an angle much more acute than the right, is made up to the right, by their going off together in one branch. It is very possible that this may be the compensating contrivance: and if it be so, how curious—how hydrostatical!"

Many animals form singular and remarkable exceptions to this general law of symmetry. The Mollusca have generally their digestive orifices, as well as the distinctive characters of sex, placed on one side of the body, and that is usually the right side. Flat fishes swim on one side; both their eyes are placed on that which is turned uppermost, and this again is almost always the right side. Even in those animals which are most beautifully arranged, one side of the entire body surpasses the other in strength, energy, and activity, and this stronger half of the body is almost always the right side. We can observe this circumstance among the Crustacea; we see it in the side-walk of the Crab; and remarkably so in the Pagurus Berniardus, or Hermit Crab, where the right forceps is larger than the left. We even see it in the larger birds, and the feathers of the right wing are always stronger and of a better quality than those of the left. The same inequality can be traced among the Mammalia, and in none of them more so than in Man, who is, perhaps, less ambi-dextrous than any other animal. With him the superiority of the right hand over the left is not altogether the effect of habit, but is founded in nature. In walking, it is the right leg and foot that give the greater impulse to the body; in hopping or leaping, every schoolboy, who is not naturally left-handed, uses his right leg in preference to the left. Diseases of the right are more acute than those of the left side. When a person wishes to examine an object most minutely, he looks at it with one eye, and that is almost always the right eye. Whether it be not a consequence of that more general law, that a concentration of vital force in one organ is followed by a diminution of vigour in others adjacent to it, and that the presence of the heart at the left side deprives that entire division of the body of the vigour enjoyed by the right side, we shall not at present venture to determine.

We have now shown that one general plan can be traced throughout the whole of Living Beings; that analogies, sufficiently precise, may be observed throughout the Animal and Vegetable Kingdoms; and that in every portion of created existence, we find a degree of unity and perfection, a mutual dependence among their parts, and the most exquisite symmetry in their forms. We shall now proceed to trace the analogy perceptible in the essential functions of all these beings. Whether we examine the arrangements for the continuation of the several species, the manner in which that constant ingress and egress of particles, constituting nutrition, is fulfilled, the temperature belonging to each class of beings, or that necessity which compels every one of them to come in immediate contact with pure air, the results are the same for all. It is only the details in the workmanship of the great artificer that vary, but the same divine hand is perceptible throughout the whole. Thus, all Living Beings require nutriment, but animals alone receive the food into central cavities, and digest it. To all Living Beings air is equally essential—all absorb it and respire; but the in-

struments of respiration are infinitely diversified in the several classes of living beings. Man and other Mammalia, Birds, and Reptiles, breathe through lungs; the Fishes, on the contrary, the Crustacea, and the Mollusca, respire through gills or branchiae. Insects, again, perform this function through tracheae, or minute holes, with which their surfaces are perforated; while many Worms and Polypi appear only to absorb air through the pores of their skin, with which they are every where covered. Plants breathe through their leaves; and many of them, deprived even of leaves, only perform this function through the pores of the epidermis which covers their substance.

Again, in respect to the arrangements for continuing the several species, we observe the same general design, while the means are ever various. How different do we see this function in the Mammalia—those viviparous animals, where the young, already active and nearly perfect, immediately commence, from the moment of their separation from the parent, those instincts and actions, which can be terminated only by death; in the numerous class of oviparous, and in the ovo-viviparous animals! Again, how immense the chasm between all these animals just alluded to, and the lower beings which are destitute of any distinctions of sex!—how different is the function performed by the Polypi, without sexes, without germs, producing their kind only by buds or off-sets!—and then, again, another mighty chasm between these and plants, continuing their species by hermaphrodite flowers, or else by flowers of distinct sexes! Nor even here does variety cease to exist, for many are cryptogamous, or apparently destitute of any means for continuing their species, except by certain minute and almost evanescent spores or reproductive corpuscles.

In all functions we trace this analogy in the end, and diversity in the means; and nowhere in a greater degree than in the functions peculiar to animals. They all appear to feel, yet many possess no other organ of sensation than the skin. In very many we find no brain, and in others not even can a vestige of nerves be traced. It is evident that they all move spontaneously, yet in many we can find no visible marks of muscles or organs of motion. We shall, however, not enlarge at present much further on this point, which will be illustrated hereafter in every page of *The Animal Kingdom*, but merely allude to the analogy observable among the Vertebrated Animals.

The analogy among the functions and organs of these animals is so remarkable, and the attention which has in consequence been paid to them so great, that we are exceedingly apt to form limited and erroneous views of the other parts of the animal world;—we expect to find in the lower animals the same parts, the same functions, which are plainly observable in them. Deeply impressed with their structure and functions, we can scarcely bring ourselves to imagine any living being without circulating fluids, a heart, blood, or vessels. So prejudiced are we in favour of the arrangements observable in the higher animals, that we can scarcely imagine any sensitive being without nerves, or any creature capable of moving without muscles. Tournefort even admitted plants to have muscles; nay, further, he actually described them. At the present day, there is little probability of our falling into a similar error; yet we are all naturally disposed, on observing a great analogy in the functions of all animals, to suppose them to be identical in their structure.

We have said that the analogy among the Vertebrated Animals is very remarkable. They are all possessed of a spinal column, composed of numerous vertebrae. Within this solid column is lodged the spinal marrow, and it carries at one extremity a well-defended bony case or head, which contains the brain. In all these beings we find a heart, red blood, lungs, or gills; in all, the organs of the five senses are seen in greater or less degrees of perfection: we find nerves, muscles, a digestive canal, more or less complicated, a liver and pancreas, with evident arrangements for continuing the species. With the exception perhaps of one species, they all have their mouths disposed horizontally; and when they have limbs, these are always four in number. This similarity prevails throughout their structure and functions. It is true that their surfaces vary remarkably according to their several destinations, while the organs of motion differ greatly as they may be designed for swimming, flying, or walking. The organs of respiration vary according as they are intended to breathe in water or in the air. But these differences in external arrangement do not prevent us from tracing the most exact analogy among them all. If we take all the organs, one by one, and compare them separately in any two vertebrated animals, we shall find the most exact equivalents in the two beings; the analogy will be found perfect in all the essential circumstances; it is only the details which are observed to differ. The fish at first sight appears to have neither neck nor thorax: but on inspecting it more attentively, we find it to be possessed of all the series of vertebrae; and that the different pieces of its thorax are concentrated near the cranium, with which they are almost confounded. M. Geoffroy has illustrated this curious organization of the Fishes in a philosophical and truly interesting manner. There is, however, one very remarkable distinction between these aquatic vertebrata and the aerial vertebrata, in the organs of voice, of which the former are completely deprived.

The principles, which must form the bases of a natural system of classification, have been already explained. A knowledge of internal organization, with the laws of the subordination and co-existence of functions, will alone lead us to this result.

Every function presupposes another function. Thus, when we see a being apparently moving voluntarily when irritated by any stimulant, we infer that it feels. We, therefore, conclude that voluntary motion presupposes sensation. Again, Life is temporary in its action; it therefore presupposes the reproduction of individuals with the extinction, and perhaps also the creation, of new species. We also conclude that circulation presupposes respiration; because, wherever we find a heart, we also meet with lungs, just in the same manner as we invariably find nerves wherever we can discover muscles. In fact, Life is but an aggregation of phenomena produced by organs connected and governed by these laws of co-existence.

But in forming a system of classification, the difficulty consists in detecting the law of subordination existing among the various combinations of these instruments of Life. Reflection upon the final cause or design of the functions will often lead us to detect these laws; but there are innumerable relations which no discernment could detect, without the nicest dissection of the bodies, or the most arduous observation of the habits of the animals when in their native elements. The anatomist in his laboratory, and the "out-of-door" Naturalist, who haunts the wilds of Nature,

must unite their labours before we can form a satisfactory system of Classification.

After examining the internal structure of every known animal, it has been found that some of them have vertebræ, and others have none: this is a fundamental fact. Again, on examining further, it is found that all those having vertebræ are also possessed of a spinal marrow and a complicated brain; that they have always four organs of sense, of various degrees of perfection, with horizontal jaws placed in the head; and that they have never more than four limbs, and always red blood. On the contrary, when the Invertebrated animals are examined, they are never found to possess either a brain or spinal marrow; their senses are not so distinctly marked, their blood is white, or not so red, and they all have more than four limbs, or none whatever. Proceeding further, when the Vertebrated animals are more closely examined, some of them are found to continue their species by eggs—they are oviparous; others, on the contrary, produce their young alive—they are viviparous. The latter are found to be alone possessed of mammae, for suckling their young, and hence they are called Mammalia.

Whenever, therefore, we find an animal with a bony skeleton, we know that it must either belong to the Mammalia, or to one of the three classes of oviparous Vertebrata. If it have feathers and lungs, it is a Bird; if it have lungs and no feathers, it is a Reptile; if it have gills and not lungs, it is a Fish. On looking farther into the details of the structure, there are found other varieties, yet ever co-existing with certain essential differences. We are thus enabled to assign precisely the rank of an animal from knowing the smallest part of one of these essential organs; and we can even discover the most curious relations between these differences in the structure of animals, and their habits or instincts. All the Carnassiers, or beasts of prey, for example, have the digestive canal more simple, shorter, less powerful, and consequently their body more slender; on the contrary, they have the canine teeth, or parts analogous to them, much longer, stronger, better armed, and moved by muscles of great energy. Birds of prey have the nails of their claws more fitted for tearing, the beak strong and hooked. The Lion, and all others of the Cat genus, are similarly armed with formidable retractile claws, with alternate and sharp teeth, and with a solid jaw-bone, moved by powerful muscles. These fundamental characters are in a manner reflected throughout the whole structure, in such a manner that, upon examining a process or projection in one of the teeth of a Carnivorous Quadruped, or the condyle of its jaw-bone, we can describe the remainder of its frame-work, and write the history of its habits. In the same manner, we can form an estimate of the force with which a bird flies, by examining the formation of its sternum or breast-bone, to which the muscles of the wings are attached. Whenever we find those two small bones, called Marsupial, in the

pelvis of an animal, we may be certain that its young are produced before their time; that they are received and protected in a ventral pouch or bag. Finally, we know that the Ruminantia, or ruminating animals, all have a cloven hoof; that they all have four stomachs, and no incisive teeth in the upper jaw; and that all which carry antlers or horns on their front, have no canine teeth in the upper jaw. The history of the Animal Kingdom offers many facts analogous to these, which will be pointed out in the course of this work.

But we must remark, that all the organs of each being have the most perfect agreement among themselves. Never does Nature unite among them characters of an opposite kind: we never find the teeth and jaw-bone of the Carnassier, with the cloven foot of an herbivorous quadruped. The poets, painters, and statuaries of former times, loved to blend these distinctive characters into imaginary and fantastic forms. Deceived by their fertile imaginations, they knew not the laws regulating their co-existence. Sometimes we see enormous wings that no muscle can move; sometimes the heads of many animals of different species, united to a trunk which belongs to one of them, or perhaps to a different animal. Nature disdains to present the discordant characters of the Cerberus, Demon, or Angels, of our painters and our poets. One universal harmony characterises all her works, and every part of her perfect mechanism corresponds to the whole.

These, then, are the principles of our Classification, founded on the comparative importance of the organs, their constancy, and the laws of their subordination.

A STOMACH represents the Animal Kingdom, and a ROOT the Vegetable Kingdom. As these can exist isolated from every other part, we must seek for other organs, to form the secondary divisions in the two Kingdoms.

With Animals, we must first examine whether they are Vertebrated; and in that case, whether they are Viviparous or Oviparous; that is, whether they have mammae or not. If they have none, we must next inquire whether they breathe through lungs or gills; and we may further examine whether they are or are not carnivorous, whether they fly, walk, swim, or crawl.

If, on the contrary, the animals under examination be without vertebræ, we examine the general arrangement of their body, their movements, whether they breathe through branchiæ, tracheæ, or simply through the skin; whether they have one or more hearts, or none whatever; whether they have wings, feet, antenna, or tentacula; whether they have testaceous coverings, shells, or elytra; or whether they have nerves, nervous cords, swelling into knots, or an imperfect brain: we may investigate their intestines, or their metamorphoses. In this way, we are conducted by degrees from those first great divisions, which overwhelm us by their magnitude, into the more circumscribed groups of genera and species.

THE ANIMAL KINGDOM,

CONTAINING LIVING BEINGS WITH STOMACHS, ENDOWED WITH SENSATION AND VOLUNTARY MOTION.

<i>Divisions.</i>		<i>Classes.</i>
I. VERTEBRATA	Animals with a bony skeleton, consisting of a cranium, spinal column, and generally also of limbs; the muscles attached to the skeleton; distinct organs of sight, hearing, smell, and taste, in the cavities of the face; never more than four limbs; sexes separate; blood always red.	<ol style="list-style-type: none"> 1. MAMMALIA. 2. AVES. 3. REPTILIA. 4. PISCES.
II. MOLLUSCA....	Animals without a skeleton, the muscles being attached to the skin; body almost always covered with a mantle, which is either membranous, fleshy, or secreting a shell; nervous system composed of scattered masses, or ganglions, connected by filaments; with distinct organs of digestion, circulation, and respiration; never with five senses, and generally without sight and hearing; blood white or blueish; sexes separate; hermaphrodites, perfect or reciprocal; oviparous or viviparous; eggs sometimes without shells.	<ol style="list-style-type: none"> 1. CEPHALOPODA. 2. PTEROPODA. 3. GASTEROPODA. 4. ACEPHALA. 5. BRACHIOPODA. 6. CIRRHOPODA.
III. ARTICULATA	Animals without a skeleton, divided into a number of ring-like segments, having their integuments sometimes hard, sometimes soft, and the muscles always attached to the envelope; with or without limbs; respiring through tracheæ or air-vessels, sometimes through branchiæ; nervous system composed of two long cords, swelling at intervals into knots or ganglions.	<ol style="list-style-type: none"> 1. ANNELIDES. 2. CRUSTACEA. 3. ARACHNIDES. 4. INSECTA.
IV. RADIATA.....	Animals having the organs of sensation and motion, arranged around a common axis in two or more rays, or in two or more lines extending from one extremity to the other; approaching nearly to the uniform structure of Plants. No circulation in vessels; nervous system obscure.	<ol style="list-style-type: none"> 1. ECHINODERMATA. 2. ENTOZOA. 3. ACALEPHEE. 4. POLYPI. 5. INFUSORIA.

THE VEGETABLE KINGDOM,

CONTAINING LIVING BEINGS WITH ROOTS, WITHOUT SENSATION OR VOLUNTARY MOTION.

<i>Divisions.</i>		<i>Classes.</i>
I. A-COTYLEDONES.....	Agamous, or rather cryptogamous Plants, without stamens or pistils.....	<ol style="list-style-type: none"> 1. APHYLLÆ. 2. FOLIACEÆ.
II. MONO-COTYLEDONES	Plants, having the embryo with only one cotyledon perianth simple, consisting of a calyx only; floral organs generally three, or multiples of three; nerves of the leaves generally longitudinal; stem composed of cellular tissue, with scattered vascular fasciculi.	<ol style="list-style-type: none"> 1. HYPOGYNIA. 2. PERIGYNIA. 3. EPIGYNIA.
III. DI-COTYLEDONES.....	Plants, having their embryo with two cotyledons, excepting the Conifere, where there are often from three to ten verticillate cotyledons; all the parts of the stem disposed in concentric layers; flowers generally with a calyx and corolla, the parts of which are usually five, or some multiple of five; nerves of the leaves generally ramified.	<ol style="list-style-type: none"> 1. MONO-CHLAMYDEÆ. 2. DI-CHLAMYDEÆ. <ol style="list-style-type: none"> a. COROLLIFLORÆ. b. CALYCIFLORÆ. c. THALAMIFLORÆ.

THE ANIMAL KINGDOM.

DIVISION I.—VERTEBRATA, SUBDIVIDED INTO FOUR CLASSES.

- 1. MAMMALIA { Man and Beasts, with warm blood; heart with two ventricles; females suckling their young with milk, secreted in breasts or mammae; viviparous, excepting the Monotremata, which are either oviparous or ovo-viviparous.
- 2. AVES..... { Birds, with warm blood; heart with two ventricles; no mammae; oviparous; body covered with feathers, and organized for flight.
- 3. REPTILIA..... { Reptiles, with cold blood; heart with one ventricle; having lungs, or sometimes only gills or branchiæ; oviparous, or ovo-viviparous; generally amphibious.
- 4. PISCES..... { Fishes, with cold blood; heart with one ventricle; no lungs, but breathing by branchiæ; generally oviparous; body organized for swimming.

DIVISION II.—MOLLUSCA, SUBDIVIDED INTO SIX CLASSES.

- 1. CEPHALOPODA... { Cuttle-fishes, having the mantle furnished with a shell, and united under the body, forming a muscular sac; head connected with the mouth of the sac, and crowned with long and strong fleshy limbs, for walking on, and seizing their prey; with two large eyes; and two gills placed in the sac. Sexes separate.
- 2. PTEROPODA..... { Marine animals without feet; with two fins, placed one on each side of the mouth; head distinct; hermaphrodites.
- 3. GASTEROPODA... { Snails or Slugs, and Limpets, with a distinct head; crawling on a fleshy disc; very seldom with fins; generally with a shell; tentacula from two to six.
- 4. ACEPHALA { Aquatic animals, generally with a bivalve or multivalve shell; without an apparent head or limbs; mouth concealed between the folds or in the bottom of the mantle; hermaphrodites; branchiæ external; incapable of locomotion.
- 5. BRACHIOPODA... { Marine Animals, without a head; having two fleshy arms, furnished with numerous filaments; bivalve shells; incapable of locomotion.
- 6. CIRRHOPODA.... { Barnacles, inclosed in a multivalve shell; with numerous articulated limbs or cirrhi, disposed in pairs; incapable of locomotion. General structure approaching to the articulated animals.

DIVISION III.—ARTICULATA, SUBDIVIDED INTO FOUR CLASSES.

- 1. ANNELIDES { Worms, generally with red blood; without limbs; usually hermaphrodites, perfect or reciprocal; body soft; more or less elongated, and divided into numerous segments; circulation double, with one or more hearts or fleshy ventricles; respiring generally through branchiæ; sometimes dwelling within membranous, horny, or calcareous tubes.
- 2. CRUSTACEA { Marine Animals, with a crustaceous envelope, having articulated limbs attached to the sides of the body; blood white; always with articulated antennæ or feelers in front of the head, and generally four in number; distinct organs of circulation; respiring through branchiæ.
- 3. ARACHNIDES..... { Spiders, with the head and breast united in a single piece, and with the principal viscera situate in a distinct abdomen, behind the thorax; without antennæ; oviparous.
- 4. INSECTA..... { Insects, divided into three distinct parts, the head, thorax, and abdomen; always with two antennæ, and six feet.

DIVISION IV.—RADIATA, SUBDIVIDED INTO FIVE CLASSES.

- 1. ECHINODERMATA { Sea-hedgehogs, and Sea-stars, with distinct viscera and organs of respiration; with a partial circulation; often with a kind of skeleton, armed with points or moveable spines; destitute of head, eyes, and articulated feet; nervous system indistinct; organs of motion extremely imperfect.
- 2. ENTOMAZOA..... { Intestinal Worms, with no distinct organs of circulation or respiration; body generally elongated, and organs arranged longitudinally; without head, eyes, or feet.
- 3. ACALAPHE..... { Medusæ, or Sea-nettles, without organs for circulation or respiration; with only one entrance to the stomach.
- 4. POLYPI..... { Small Gelatinous Animals, with only one entrance to the stomach, surrounded with tentacula; generally adhering together and forming compound animals.
- 5. INFUSORIA.... { Animalcules, or Minute Microscopic Animals, found in fluids, or vegetable infusions. As their internal structure is but little known from their extreme smallness, this class will probably be found hereafter to contain animals which ought to be placed in some of the higher divisions.

SECT. XI.—GENERAL REVIEW OF LIVING BEINGS CONTINUED.

Subordination of Characters—Imaginary Chain of Beings—Circular Hypotheses.

THE preceding Tables exhibit the primary and secondary divisions of Living Beings. In the course of this work, we shall describe the organs and functions from which their characters are derived. At present let us consider somewhat further the laws of their subordination and co-existence.

Upon investigating the internal structure of the entire Animal Kingdom, certain beings are discovered, consisting of a stomach isolated from every other organ, without visible nerves or muscles, without a heart or vessels, and destitute of a brain and organs of sense. We are, therefore, led to consider the stomach as the most essential character. The most variable organs must be regarded as of the least importance; and we thence conclude that the nerves, muscles, heart, lungs, and brain, are subordinate characters.

But on investigating the more complex animals provided with all the organs just enumerated, and upon studying the gradual progress of their development, it is found that the heart is the first formed of the organs, or at least it is the first visible organ, and that one in which the vital action is most evident. Upon examining the structure of monstrous beings, we observe that the heart can exist without the other organs much oftener and more perfectly than they can exist without the heart. Again, when we observe an animal already brought to light, and increased in magnitude, we see the organs of sense, the brain, and the greater number of muscles, suspend their functions in a periodical sleep; we see the lungs themselves sometimes cease to act for a short space of time; while the heart continues to beat as long as life exists. For all these

reasons, the heart appears to be the most important organ among the higher animals.

It must be admitted, however, that many difficulties prevent us from determining precisely which of the five organs, essential to the life of a vertebrated animal, is the most important, when we see the animal healthy, full grown, perfectly formed, each organ exactly performing all its functions, and the entire being in the full exercise of all its powers. It has been already explained that the whole of the organs presuppose a stomach which nourishes them. The lungs and gills cannot exist without the brain; the brain in its turn requires the action of the heart; and the heart itself cannot perform its functions without the aid of the spinal marrow and of the lungs, which are ruled by the brain. All the organs form a mutually-connecting bond of union. It is true that if we examine in detail any one of the subordinate organs, it appears to have more need of the blood than of the nerves, and that it can exist longer without the action of the brain than of the heart. But if we contemplate any part of the complicated wheelwork essential to Life, it is found to be reciprocally connected, and this even in the most varied and intricate manner. Yet, when we see the heart commencing to beat before the stomach and lungs are in action,—when it is observed to throb during the absence of respiration, or after it has altogether ceased,—when we see that mutilations of the brain do not always produce instantaneous death, while the destruction of the spinal marrow speedily causes the heart to cease its movements,—we have sufficient grounds for supposing that the circulation of the blood is the primary essential condition of existence among any of the higher animals. For these reasons, in arranging the numerous subjects of the Animal Kingdom, the spinal marrow, which appears to govern the action of the heart, must be considered as the

primary organ of the body; and as this delicate system of nervous matter requires for its protection a bony column of vertebrae, it is necessary to assume the existence or absence of a vertebrated column as the foundation of our primary divisions of the Animal Kingdom.

We shall defer the greater part of our observations upon systems in general, until we come to treat of the history of Zoology. At present our remarks will be confined to the theory of one universal chain of existence, which may not improperly be termed the theory of the straight line; and we believe it to have as little foundation in Nature as the corresponding theories of the circle.

On contemplating the long chain of organized beings, we observe them to become complicated by degrees, without sudden breaks and transitions. The lowest have nothing but a simple root;—the highest possess an exceedingly complicated brain. In passing from one extreme to the other, we first find imperfect plants, or we should rather say, plants of very simple structure; some of which are composed of an umbrella-shaped covering attached to a root,—that essential organ of every plant, excepting perhaps the Krubot; others apparently consist but of simple leaves; and some have only pediculated flowers without leaves. On the other hand, we find plants composed at once of a root, leaves, stem, and flowers; while the flowers either simply present only an ovary, stamens, and pistils—organs essential to the production of seed—or, besides these indispensable organs, they also exhibit petals and a calyx, more or less complicated.

In the Animal Kingdom, the successive gradations in the complication of structure are much more numerous. To the stomach, which we have already mentioned as composing the most simple of animals, we see added, in succession, various appendages, moveable tentacula, and afterwards some rudimentary appearances of vessels filled with white blood. Continuing our observations further, we begin to perceive some scattered nervous filaments, and then some colourless muscular fibres. Soon after, we find that the digestive canal becomes more complicated; instead of one orifice, we now find two; at length we arrive at an elongated and convoluted intestine. In yet higher gradations than these, we perceive lungs, trachea, and gills, with complicated muscles, destined to move particular members, connected by joints of an elaborate mechanism. Further upwards, we perceive hearts of a simple construction, evident organs of sensation, distinct arrangements already of a complicated character, for continuing the species, ganglions or knots of nerves, with a marrow dilated at one extremity. Finally, we arrive at a vertebrated column, perfect senses, a spinal marrow enclosed in a bony tube, a skull, and, to crown the whole, a beautifully-organized brain.

However perfect this chain of animated existence may at first sight appear, we must admit that many objections may be made to its details. The transitions are often harsh, and by no means always very obvious, from one link to another; and if it be true that, whatever fractures a link,

“Tenth or ten-thousandth breaks the chain alike,”

we fear that the advocates for one uninterrupted chain of existence, from the minutest conferva or liehen, to the throne of the Eternal, will find many chasms which cannot be united even in the most fertile imagination.

In attempting to trace this supposed chain between the lowest animals and the Vertebrata, we find that the progressive development of the organs of nutrition and of sensation greatly disturb its uniformity. The organs of sensation and motion have already arrived at a great degree of perfection in animals, in which we can find no heart, no evident circulation, or observable respiration. On the contrary, in other beings, an opposite result may be observed; and while some have a heart already manifest, with vessels and complicated respiratory organs, we find that the organs of sensation have but a very slight degree of development.

If we be desirous of forming in the imagination one of these universal chains of existence, we have but to assign to the mountain rocks, or to the filaments of the asbestos, the faculty of absorbing nourishment and of growing, and we have formed the idea of a being resembling a plant, which possesses two orders of functions,—the one essential to the preservation of the individual, and the other necessary for the continuation of the species. To these two subordinate, yet well-defined functions, let us add the powers of voluntary motion and sensation,—let us add a central cavity for digesting the aliment; and we thus produce an animal of the lowest possible degree. To this moving, sensitive, and instinctive mass, let us join numerous nerves traversing every part, senses of a complex form circumscribed in special organs, a central brain, the instrument of perception and volition; let us add to these, muscles for obeying the determinations of the Will, with a skeleton for affording a support to the muscles, and firmness to the whole fabric, and an animal is constructed of the highest order and of the most complicated form. On the summit of this series of superior beings, let us place Man—a being remarkable for the vertical situation of his body, the volume of his brain, the perfect adjustment of his senses; for his Prudence, Curiosity, and Wisdom; for the energy of his Will, the lights of his Reason, and the sublimity of his Genius.

Many philosophers, but especially Donati and Charles Bonnet, have ingeniously attempted to arrange all the bodies in nature, in a manner similar to what we have here attempted to explain, according to the progressive analogies which they offer to the observer. They have endeavoured to pass by insensible gradations from one natural production to another, just as in the rainbow or solar spectrum we arrive, by unperceived transitions, from colour to colour, from the violet ray to the blue, from the blue to the indigo, from this to the green, yellow, orange, and red, and finally, from the red, by a new circle, round again to the violet. The philosophers whom we have just named thought that every thing in nature formed one long chain, without break or interruption, and Bonnet illustrated his views in the following manner:—

He thought that the talcs, the slates, the schists, but especially the anyanthus, formed a natural and easy transition from the Mineral to the Vegetable Kingdom. Again, the Sensitive Plant, as well as many species of Algae and Fuci, formed a natural link between plants and the most simple kinds of animals. After that, a thousand different shades and nice transitions presented themselves in the Animal Kingdom. If certain species of simple Polypi form the connecting link be-

tween the two great Kingdoms of organized Nature, they serve, at the same time, to unite the Infusoria, those microscopic inhabitants of fluids, with the Acalephæ, Sea-nettles, or Medusæ. Again, these last-mentioned animals conduct us gradually to the Worms and Mollusca, on the one hand, and, for different reasons, to the Insects, the Arachnides or Spiders, and the Crustacea, on the other. Proceeding further, we are led from the aquatic Worms to the Mollusca, by means of the Hirudinea or Leeches, and from the Mollusca to the Reptiles, by the Limax or Snail. The Reptiles, in their turn, form the bond of connexion with the Fishes, by means of the tadpoles, the young of the Frog, in the same manner as the Insects, by another circle, merge successively into the Worms, Mollusca, and Reptiles, by their Larvæ and Caterpillars. Water-serpents are not very different from Eels. The Fishes are related to the Birds by means of the Flying Fish, the Trigla or Gurnard, and the Exocoetus; and, finally, the Birds are linked to the Mammalia by the Ornithorynchus in one sense, and by the Bats and Flying Squirrels in another.

Many analogies of a similar kind are traced by the ingenious Bonnet. Thus, the Palmipedes, or Web-footed Birds, are said to lead us, by a gentle transition, to the Fishes, just as the Penguins and Ostriches merge gradually into the Mammalia. We are conducted from the Mammalia to the Fishes by the Otters and Whales, to the Reptiles by the Seals, and to the Birds by the Bats and the spiny Echidna. The transition is not abrupt, according to Bonnet, from the Moukey to Man, and Man himself is formed after the image of his Creator. He adds, with his usual elegance, “Un seul être est placé hors de la chaîne, et c’est celui qui l’a créée.” (One being alone is placed without the chain, and that is—THE CREATOR.)

We should not have dwelt thus at length upon these analogies, many of which are altogether imaginary, were we not fully persuaded that even these imperfect comparisons are useful in giving a general idea of living beings to persons ignorant altogether of Zoology, and consequently are appropriate for these Introductory pages.

But if Naturalists have failed in attempting to resolve the intricate dispositions of Nature by the straight line, they are equally at fault in proposing Circular theories. In vain do they attempt the solution of problems, which even the highest geometry cannot resolve, by the simple theories of the straight line, and circle. Seduced by an excessive love of simplicity, they depart from those physiological views which should form the basis of a sound system of classification.

Mr W. S. Macleay was the first proposer of the circular system. He thought that the several kingdoms of Nature, as well as their various subdivisions, returned into themselves, and may therefore be represented by circles. He considered the number Five as the basis of this system. Each circle formed precisely five groups; each of these composed other five, and so on, until we arrived at the extreme limit of the system. The proximate circles were thought to be connected by the intervention of lesser groups, to which the term *osculant* was assigned; and relations of analogy were pointed out between certain corresponding points in the circumferences of contiguous circles. We must admit that this theory has been applied with some degree of success to two of the branches of Natural History—Ornithology and Entomology; and the reason of this evidently arises from the great number of objects included in these branches, which gives an unusual facility to the circular theorist.

The objects of Natural History are infinite in number; that is to say, their number is so vast that no individual, however industrious, can possibly, within the usual period of a lifetime, comprehend their various phenomena and relations. Again, these phenomena themselves are innumerable; the connexion of their properties is absolutely overwhelming, by their intricacy and the closeness of their approximation. If, then, we are willing to form a Circular theory, the basis of which is intended to be three, five, seven, or any other number, arbitrarily assumed, we have but to take some one leading group; and, casting about for some other leading group which can join on to this first one, and a third on to the second, we must necessarily fall in with some other leading group which will join on to the first, and thus a circle will be formed. We have said necessarily, because, according to the common theory of probabilities, the number of objects being infinite, and the number of groups, and the relations of groups, also infinite, we must necessarily, without the aid of any very fertile imagination, fall in with some leading property which will conduct us to the spot whence we started.

This capability of arrangement in circles is not exclusively a law of Nature, as the advocates of the circular theories would lead us to suppose. Works of Art may be arranged in a similar manner. The merchant may arrange his goods, or the librarian his books, in circles, according to the most approved principles. Commencing with folios bound in morocco, and passing through all the gradations of binding, size, and colour, he might be easily conducted, by these and other relations, to the unbound folio, stitched in red cloth, which would lead him, by a nice transition, back again to his original starting place; and if any difficulty attached to this arrangement, it might easily be remedied by the invention of groups normal or aberrant.

We are apt to imagine, on falling in by accident with any of the recent works proposing Circular theories, that we have mistaken treatises on Geometry or Mechanics for volumes of Natural History. Considering internal organization and laws of co-existence, as subjects irrelevant to Natural History, they substitute (what a distinguished circular theorist of the present day rightly terms) the “wheels within wheels” of a fertile imagination. They may not be unaptly compared to the Ptolemaic system of Astronomy; and like it, could only be tolerated in the infancy of science.

“With eyele on epicycle,—orb on orb;”

they almost call from us the just, though somewhat startling, observation of Alphonso X. king of Castile.

The combinations of properties among natural objects are so numerous, that many beings must necessarily have the same parts, and there must always be a great number presenting very slight differences. On comparing those resembling each other, it is easy to form series, which will appear to descend gradually from a primitive type. These considerations have accordingly given rise to the formation of a Scale of Beings; and to Circular Theories; the object of the former being to exhibit the whole in one series, commencing with the most complicated, and ending with the most simple organization,—and that of the latter to form two series, which, like two semi-circles,

described with the same radius, shall exactly fit and correspond at their extremities. In each, the mind is led from one link to another by insensible shades, almost without perceiving any interval.

On considering each organ separately, and following it through all the species of one class, we observe that its progression, within certain limits, is preserved with a singular regularity. The organ, or some vestige of it, is to be found even in species where it is no longer of any apparent use, except to prove that Nature strictly adheres to the law of doing nothing by sudden transitions. Yet, the organs do not all follow the same order of gradation. One part is found absolutely perfect in a certain animal, while another part is in its most simple form. Again, on examining a different animal, the relative complication of the two organs is absolutely reversed. If, therefore, we were to class different species according to each organ taken separately, we should be under the necessity of forming as many series as we should have regulating organs. Thus, to make a general scale of complication, it would be essential to calculate the precise effect resulting from each combination, which is far from being practicable.

As long as the great central springs remain the same, and while we confine ourselves to the same combinations of the principal organs, these gentle shades of an insensible gradation are found to prevail. All the animals of each of the primary divisions seem formed on a common plan, which serves as the basis of all their minute external modifications. But the moment that we direct our attention from one prin-

cipal group to another, wherein different leading combinations take place, the scene directly changes. There is no longer any resemblance, and an interval, or marked transition, is obvious to every one. Thus, it is impossible to find in the whole Animal Kingdom any two beings which sufficiently resemble each other to serve as a link between the Vertebrated and Invertebrated animals.

The Creator never outsteps the bounds which he has prescribed to himself in the laws of the conditions of existence. Ever adhering to the small number of combinations that are possible, Nature seems to delight in varying the arrangement and structure of the accessory parts. There appears in them no necessity for a particular form or arrangement, while it frequently happens, that particular forms and dispositions are created without any apparent views of utility. It seems only sufficient for their existence that they should be possible, that is to say, that they do not disturb or destroy the harmony of the whole. These varieties augment in number, in proportion as we turn our attention from the leading and essential organs to those which are less important; and when we finally arrive at the external surface of the body, where the laws of external Nature require that the least essential organs, and those least liable to injury, should be placed, we find the number of varieties absolutely infinite. The labours of naturalists have not yet succeeded in tracing all their differences, and newly-discovered species are continually rising, as it were, into existence. Yet not even is a bone varied in its surfaces, in its curvatures, or in its eminences, without subjecting the other bones to corresponding variations.

THE FIRST GREAT DIVISION OF THE ANIMAL KINGDOM.

ANIMALIA VERTEBRATA—VERTEBRATED ANIMALS.

HAVING A BONY SKELETON, CONSISTING OF A CRANIUM, SPINAL COLUMN, AND GENERALLY ALSO OF LIMBS; THE MUSCLES ATTACHED TO THE SKELETON, DISTINCT ORGANS OF SIGHT, HEARING, SMELL, AND TASTE, IN THE CAVITIES OF THE FACE; NEVER MORE THAN FOUR LIMBS; SEXES SEPARATE; BLOOD ALWAYS RED.

The bodies and limbs of the Vertebrated Animals are sustained by a solid framework or skeleton, composed of separate pieces joined together, and moveable upon each other. This enables them to execute their movements with vigour and precision; while the solid support afforded by the bones permits them to attain a considerable size. It is, consequently, in this division that the largest animals are found.

There are three important purposes answered by the bones of Vertebrated Animals: a solid framework is supplied to the softer parts; bases are furnished upon which the muscles are fixed; and a protection from external injury is afforded to the vital parts, and to the central masses of the nervous system.

A limit to the size of animals is fixed by the force of gravity at the earth's surface. Were animals to exceed this limit, they would fall to pieces by the weight of their limbs; and a certain degree of cohesion, constituting rigidity, is inconsistent with animal motion. This forms a complete refutation of the idle tales of crakens, giants, and other monsters.

The nervous system of the Vertebrata is more concentrated, and its central masses are of greater size than in other animals. Their sensations also are more vivid and prolonged, and they possess superior intelligence and capacity for improvement.

The bodies of the Vertebrata are always composed of a head, a trunk, and [generally] also of limbs.

The head is formed of the cranium or skull, and of the face. The former contains the brain, and in the latter are placed the receptacles for the organs of sense.

The human skull is composed of eight bones, one frontal, two parietal, one occipital, two temporal, one sphenoid, and one ethmoid. The frontal bone (or *os frontis*), forms the entire covering of the forehead, with the upper orbit of the socket for the eye, and extends towards the temples. In the infant, this bone was originally two, which have gradually coalesced into one. Two parietal bones (*ossa parietalia*) form the sides and upper part of the skull. The occiput, or hinder bone of the head (*os occipitis*), forms the base of the skull. There are two temporal bones (*ossa temporalia*), one on each side; and one sphenoid bone (*sphenoides*.) The principal part of the sphenoid bone, and the whole of the ethmoid (*ethmoides*), are placed in the internal part of the skull; they support the brain, and allow the nerves to pass through their irregular grooves and cavities.

In the skull of the fetus, during the earlier months of its existence, cartilage is substituted for bone. By degrees portions of the cartilage are absorbed, and earthy particles are as gradually deposited in their places from certain points, which are thence called centres of ossification.

The form, which was rudely defined at first, advances by gradual steps toward perfection, and by definite and fixed laws. A certain system of ossifying centres belongs to each separate bone. The fibres proceeding from centres of the same bone, have a natural affinity for each other, and generally refuse to unite with the fibres of other bones. This, however, sometimes takes place, as in the *Os frontis*, when the two bones are said to form an *anchoylosis*.

As these bones of the skull are destined to protect the brain, they are formed in a manner peculiarly adapted for that purpose. Each bone is composed of two plates; the internal layer (or *tabula vitrea*) is dense, hard, and well adapted to resist a violent blow; the external layer is fibrous and tough, and fitted to check the vibration

of the internal part. It has been rightly compared to a soldier's helmet, lined with leather and ornamented with hair.

The edges of the bones, where they meet together, are beautifully dove-tailed, forming *sutures*, which give the whole skull unity and strength. These irregular lines of junction are formed by the fibres of opposite centres, which continue to secrete the bony particles, and to insinuate themselves until finally stopped by their mutually increased resistance.

Fourteen bones compose the human face. These are usually grouped together under the names of upper and lower jaws. They consist of two superior maxillary, two malar, two nasal, two palate, two lachrymal, two turbinated, one vomer, and one inferior maxillary bone. Of these, the most remarkable is the lachrymal, which consists of a delicate bony scale, as thin as paper, and containing the passage which conveys the tears from the eye into the nasal cavity.

The relative size and arrangement of the bones of the face and skull vary considerably in different tribes of animals.

The head is always placed at the anterior extremity of the vertebral column, and opposite to the tail. It is divided into three parts, which may vary in their relative proportions, but are never wanting. These divisions are, first, the Cranium, containing the brain, in the partitions of which are situate the cavities of the internal ear, and frequently a part of those of the nose; secondly, the Face, terminated below by the upper jaw, and containing the orbits of the eyes, with the nasal cavities; and thirdly, the lower jaw.

The trunk is sustained by the spine of the back and by the ribs.

The spine is composed of vertebrae. Each vertebra is, in general, moveable on the adjoining ones. The first carries the head; and through each vertebra there is an annular or ring-like part, all of which collectively form a canal. In this canal is placed that portion of the medullary substance called the spinal marrow, from which the nerves proceed.

In the spinal column of adult animals, great strength is combined with a considerable degree of general flexure. The arrangement of the solid matter of which it is composed, is admirably calculated to give lightness to the whole fabric. It is neither collected into one solid mass, nor generally diffused as in sponge. But the column is hollow; and, by the laws of Mechanics, it has been clearly ascertained that while the height and the quantity of matter of two pillars remain the same, that column is the stronger which is, to a certain degree, of a hollow construction.

The cartilages between the several vertebrae yield considerably to the pressure of the body, after remaining for a long time in the vertical position, and expand after repose. Hence arises the very striking phenomenon, that a man is considerably taller in the morning after a night's rest, than in the evening after the fatigues of the day. The long absence of pressure upon the cartilages of the vertebrae causes them to expand. This difference of height has been observed only in the human species; they are the only creatures who walk erect, and throw the pressure of the upper parts of the body upon the back bone. Thus we find no difference in the height of horses, even after the longest day's journey.

Among young people this difference is more observable than in those who are more aged. Persons of very laborious habits sink rather less than those of sedentary habits; and when the height is once lost, it cannot be restored for that day, not even by the use of the cold bath; and it can be alone regained by a night's repose in a horizontal position.*

* Philosophical Transactions, No. 383, p. 87.

The Reverend Mr. Wasse found that several persons, enlisted as soldiers in the morning, had been discharged for want of height, on their being measured again before the officers in the evening. On this occasion, he measured several other persons at different times, and found that the variation, in many cases, was not less than an inch. This gentleman observed, from his own personal experience, that on fixing a bar of iron, which he just reached with his head on getting out of bed in the morning, he would nearly want half an inch of his height in an hour or less, if he employed the time in rolling his garden walks, or any other exercise of the laborious kind. He also observed that the height was very suddenly diminished by riding; and, what appeared remarkable, he found that on sitting almost motionless in his study for several hours he often lost a whole inch of his height.

It appears evident that this change is occasioned merely by the back bone, from the circumstance that it arises in persons when they sit as well as when they stand.

The structure of this part of the body is beautifully adapted to the several purposes for which it was intended in the several tribes of animals, and in none more so than in Man. By the thickness and shortness of the several vertebrae, and by the intervening cartilages, with the bony projections, it is adapted for motions peculiar to itself. Had the several vertebrae been of any considerable length, the articulations must have inclined at a large angle upon their innermost edges, and the spinal marrow within the bones would have been continually liable to injury. Again, if the cartilages had been entirely wanting, it would have been as useless as if it were but one bone, and then the body would have been rendered incapable of bending, and would have remained for ever in an erect posture. The remarkable differences among the cartilages of the three kinds of vertebrae are other singular instances of exquisite arrangement.

The vertebrae of the back require but little motion; and the cartilages in that part of the column are small and thin when compared with those of the loins. In this latter part, the motion is much greater, and being placed lowest, it also supports a greater weight. It therefore follows, that during the period of the day in which we are actively engaged in the several duties of life, until we dispose ourselves for rest, the cartilages of the spine will become more close and compact from the pressure they sustain; and consequently, the whole spine, which alone supports the body, will become shorter. On the contrary, when this superior weight is entirely removed, by placing the body in the horizontal position, as it always is when we are in bed, the compressed cartilages will begin to enlarge themselves, until they gradually recover their expanded state.

As the cartilages between the several vertebrae are twenty-four in number, and as every one of these is pressed in our daily employments, the aggregate of their several expansions cannot be supposed less than an inch. This pressure is occasioned by the weight of the body alone upon the spinal column; it must therefore be much greater in persons constantly employed in carrying burdens. That the compression and expansion of the cartilages in older people is less than in younger, is a necessary consequence of the cartilages growing harder in the course of time, and becoming less capable of compression. It also follows, that old persons must lose some part of their former height, from the cartilages shrinking into a smaller compass as they grow bony; and this shortening, or "growing downwards," is not imaginary, as persons commonly suppose, but a real phenomenon.

In general, the spine is prolonged into a tail, extending beyond the lower extremities.

Man possesses a kind of rudimental tail, in the *os coccygis*, terminating the spinal column. Among Mammalia, the Terate Bats alone are destitute of this rudimental tail; it is wanting altogether in the Batrachia or Frog tribe.

The ribs may be compared to semi-circular hoops, which protect the sides of the cavity of the trunk. They are articulated at one extremity to the vertebrae, and generally the other end is fixed to the sternum or breast bone; but frequently they do not enclose the entire trunk, and there are some species in which they are scarcely visible.

The vertebrae are never entirely wanting, although their number is exceedingly variable. Those which sustain the ribs are called *dorsal*; those between the dorsal and the head are termed *cervical*; those below the dorsal, *lumbar*; those connected with the pelvis, or hinder extremity, *sacral* or *pelvic*; and those forming the tail, *coccygeal* or *caudal*. The ribs are wanting in Frogs, also in Rays, Sharks, and a great number of cartilaginous Fishes. It is obvious that in the animals without ribs, the distinction of the three first kinds of vertebrae cannot take place, and that the distinction of the three last disappears in those having no hinder limbs, or where their limbs are not attached to the spine.

The ribs which proceed from the vertebrae, and join the sternum or breast bone, are called true ribs; those which do not extend so far are termed false ribs. In Quadrupeds these false ribs are always behind; in Birds they are both before and behind. This distinction ceases to prevail in animals that have no sternum. The sternum is absent in Serpents and Fishes, unless we give that name to denote the anterior part of the bony girdle, which supports the pectoral fins, or anterior extremities of the Fishes. Several Fishes have no very apparent neck.

The Vertebrata never have more than two pair of limbs; but these are sometimes altogether wanting, or only one pair of them is deficient. The forms of their limbs vary according to the movements which they are destined to execute. The fore or anterior limbs may be so organized as to perform the office of hands, of feet, of wings, or of fins; the hinder may be either feet or fins.

The limbs are totally wanting in Serpents and in some Fishes. The fore limbs are absent in one species of Lizard; while the hinder limbs are not found in the Apodes order of Fishes, that is to say, in those having no ventral fins; and also in the Cetaceous tribes of Mammalia. No Vertebrated animal ever has more than four limbs, unless we include in the number the kind of wing which belongs to the Flying Dragon (*Draco volans*, Linn.), a little animal next to our Lizard.

The Limbs, when perfect, are divided into four parts. The fore limbs comprise the Shoulder, the Arm, the Fore Arm, and the Hand; the hinder limbs contain the Hip, Thigh, Leg, and Foot. These distinctions do not hold among those Fishes having their limbs consisting only of bony rays; that is to say, of bones constituted like a fan, and articulated to parts corresponding with the shoulder or hip: yet even some analogy may be found between these parts and the divisions in the limbs of the higher animals.

The shoulder consists of the Scapula, placed against the back, and the Clavicle attached to the Sternum. The last is wanting in some Quadrupeds, as well as in the Cetacea, as will be explained hereafter; but it is double in Birds, Tortoises, Frogs, and many Lizards. The Scapula is never wanting when the fore limb exists. The Arm is formed of one bone only; and the fore arm is almost always formed of two. Even when the fore arm has but one bone, there generally appears a furrow, or other vestige, of its ordinary construction. The Hand varies with respect to the number of its bones; but those which exist in it always form the Wrist or Carpus, the body of the hand or Metacarpus, and the Fingers. This organization prevails even in Birds, which have their fingers enveloped in a skin covered with feathers. It likewise prevails in the Cetacea, in which the whole of the fore limb is reduced to the figure of an oar or fin.

The parts of the skeleton are usually disposed with a strict regard to symmetry; so that the halves of the body formed by a longitudinal section are exact counterparts of each other. In one family of Fishes only, called Pleuronectes, including Soles, Plaice, Turbots, and other Flat Fishes, the head is so formed that the two eyes and two nostrils are on the same side, but the symmetry is preserved in the remainder of the skeleton.

Each class and each order of animals have particular characters relative to their skeleton; consisting in the general form of their trunks and limbs, and in the number of their different parts. These particulars will be explained in the future pages of the Animal Kingdom. We may, however, remark here, that though an animal of one class may have some resemblance to those of another, in the form of its parts, and the use it makes of them, that resemblance is external, and affects the skeleton only in its proportions, but neither in the number nor in the arrangement of the bones. The Bats, for example, appear to have wings; but an attentive examination demonstrates that they are real hands, the fingers of which are merely somewhat lengthened. In the same manner, though the Dolphins appear to have fins all of one piece, we find under the skin all the bones that compose the fore limbs of the other Mammalia, only shortened and rendered almost immovable. The wings of the Penguin, which likewise resemble fins in one piece, contain internally the same bones as those of other Birds.

The skeletons of the Vertebrated animals determine their most important forms and proportions. Retaining a general resemblance throughout all the classes of this division, they do not differ so much as their external figures, while they preserve a remarkable uniformity, which would not be always anticipated from the aspect of the parts they sustain. This property cannot be observed among the Invertebrated animals, because their hard parts are placed externally, and must therefore have the same forms as the animals themselves.

In general the bones are joined or articulated together, thus forming one connected frame; but some exceptions to this law are to be found. The bones supporting the tongue in Mammalia and Birds are not connected with the other bones except by soft parts, though in Fishes they are articulated to the rest of the skeleton. Again, the entire of the fore extremities in quadrupeds destitute of clavicles are attached to the remainder of the skeleton by muscles only; but in the others they are united to the sternum by single clavicles, or collar bones. Among Birds this union is effected by double clavicles. In the Fishes, a bony girdle connects the bones of the fore fins strongly with the spine. The skeletons of the hinder fins of the Fishes, on the contrary, are usually isolated, and fixed only in the muscles; while, in the other three classes, the hinder extremities are always attached strongly to the rest of the skeleton by means of the pelvis, or are wanting altogether.

It has already been explained that the bones of the Vertebrata are composed principally of phosphate of lime and of animal matters, such as gelatine, cartilage, and marrow. The quantity of the calcareous phosphate increases in the bones with age; the gelatinous substance, on the contrary, appears most abundant in proportion as it is examined near to the period of birth. The bones of the fetus, in the earlier period of existence, consist merely of cartilage or indurated jelly; for cartilages resolve almost entirely into jelly when subjected to the action of boiling water. In the very young embryo there is no real cartilage; in its place we observe a substance which has all the appearance, and even the semi-fluidity, of ordinary jelly. It has already assumed a determinate shape, and is covered by a membrane, which afterwards forms the external covering of the bones, or periosteum. The flat bones, again, have the appearance of simple membranes during the first stages of ossification. Those which are intended to move on each other exhibit visible articulations, although the periosteum passes from one to the other, and envelopes the whole in one common sheath; while those connected only by sutures, such as the bones of the skull, form a continued whole, in which nothing indicates that these sutures will one day exist.

The phosphate of lime, which gives consistency and strength to the bones, is deposited in this gelatinous basis; this deposition does not proceed irregularly, but by laws, fixed and determinate for each bone. During ossification, we first observe fibres developing themselves separately; and these are shortly succeeded by new and smaller fibres, extending in every direction, and uniting the former into one uniform mass.

The surfaces of bones are generally formed of close and compact fibres, which are placed parallel to each other in the long bones, but diverge like radii, from centres in the flat bones. These fibres proceed from certain systems of points called centres of ossification. Each long bone has usually three systems of this kind; one towards its middle, where a series of ossifying points surround it like a ring, having the bony fibres extended in a direction parallel to the axis; and another principal centre at each extremity of the bone, sometimes accompanied with several subordinate points. When the three bony pieces, formed by the successive extension of these three centres of ossification, have even approached so as to be in contact with each other, they remain

for a long time unconsolidated, and there appears between them a quantity of matter purely gelatinous, capable of being dissolved by boiling water. The extremities, while separated, are called *epiphyses*, while that in the body of the bone is termed *diaphysis*. In the flat bones, the centres of ossification may be compared to suns, of which the bony fibres are the rays, rendered visible through the semi-transparent cartilage by their opaque whiteness. These centres vary their appearances in different bones: in the round bones they resemble small grains or nuclei, but in the angular bones they assume a great variety of forms and positions.

When the fibres of one centre have advanced so far as to come every where in contact with those next to them, the bones are then only separated by sutures, which may afterwards be more or less promptly effaced. Some of these fibres turn aside to the right and left, and thus produce the appearance of lattice-work; while new strata, placed above and below the former, cause the texture of the bone to assume a lamellated aspect.

We are in the habit of considering as single bones, all those of which the different parts ossify and unite in youth, as the vertebrae, the occipital and frontal bones; while we consider those that do not form a union with the neighbouring bones until an advanced period of life, as distinct. Thus the frontal bone, which sometimes remains separate from the parietal bones to a very old age, is regarded as a distinct bone; while at the same time it is composed of two parts, which frequently remain separate until the age of thirty or forty.

Ossification is not found to proceed with an equal rapidity, whether we consider it in each kind of animal, or in the different bones of the same animal. In Man, and all other Mammalia, we observe that the bones of the internal ear are not only first ossified, but that they surpass all others in density, and in the quantity of calcareous phosphate they contain. Thus, the bone of the cavity of the tympanum in the Cetacea, but particularly in the Whale and the Cachalot, is superior to marble in hardness and density. Its section appears equally homogeneous, and exhibits no vestige of fibres, lattice-work, or vessels. On the contrary, other bones are very slow in acquiring the consistency they ultimately possess. The epiphyses, for example, do not ossify until long after the bodies of the bones to which they belong. Finally, there are some cartilages, which, in certain classes of animals, never admit a quantity of calcareous phosphate sufficient to render them completely bony; such as the cartilages of the ribs, and the larynx. It is certain, therefore, that there are several cartilages which are never converted into bones, although there is no bone which did not formerly exist in the state of cartilage; yet, there is a general tendency in all gelatinous parts to receive calcareous matter, as the tendons, and several white parts, ossify with greater facility than the others. The same differences which exist in this respect between the several bones of the same species, are also found to exist between species and species, on comparing the entire skeleton.

We not only find that the bones of an animal are slow in arriving at the degree of hardness which belongs to them, in proportion to the period of the growth of the animal; but we further know, that there are some animals in which ossification is never complete, and whose skeletons are always cartilaginous. This is the case with Sharks, Rays, Sturgeons, and all those Fishes which are thence called cartilaginous, or Chondropterygii. Although the bones of the other Fishes, and of many Reptiles, attain a greater degree of hardness, they still, however, preserve much more flexibility, and retain a far greater proportion of the gelatinous substance, than the bones of animals having warm blood. They grow, therefore, during the whole period of their existence; because it is cartilage only that can grow. On the contrary, when once the bones have attained their proper degree of hardness, their dimensions cannot alter; and the animal can only increase in thickness. At this period, the animal economy commences a retrograde movement, and the first steps are made towards old age and decrepitude.

Animals differ greatly in respect to the texture of the bones, and the cavities of various kinds formed within them, as well as in the rapidity of ossification, and in the proportions which the constituent parts of bone bear to each other. In Man, the internal texture of the bones is very fine. The laminae of their spongy substance are small and close; and where this texture is most unlike lattice-work, it exhibits long and delicate fibres. In Quadrupeds, the texture of the bones is in general coarser; in the Cetacea, it is more loose, the cells are larger, and the laminae which form them much broader. It is easy to distinguish their external fibres, which in the jaws and ribs of Whales and Cachalots may be rendered as evident, by long maceration in water, as the fibres of half-decayed wood. With respect to size, however, they seem to bear no relation to the magnitude of the animal to which they belong. The bones of Birds are of a slender, firm, and elastic nature, and seem formed of laminae soldered, the one over the other. The bones of Reptiles and Fishes are in general more homogeneous, and the calcareous particles seem more uniformly distributed throughout the gelatinous substance. This observation appears the more striking as we approach the cartilaginous Fishes, in which the gelatinous substance completely overcomes, and appears to conceal, the phosphate of lime.

Several animals have no large medullary cavities even in their long bones. There are none in the Cetacea and Seals. Caldesi and Cuvier have long remarked the same thing in respect to the Tortoise. The Crocodile, however, has these cavities very distinct.

In some bones we find other cavities, called *sinuses*, which contain no marrow. They all communicate, more or less directly, with the exterior of the body. Man has sinuses in the frontal, sphenoid, and maxillary bones of the skull. In several Mammalia, these sinuses extend much farther backwards, and penetrate through a great part of the body of the cranium. In the Hog they proceed as far as the occiput; and it is these which swell so singularly the cranium of the Elephant, and which superficial observers are apt to mistake for an extraordinary development of the brain. In Oxen, Goats, and Sheep, these sinuses extend even into the centres of the horns. The Gazelles are the only animals with hollow horns, having the nucleus of their horns solid or spongy without any large cavity.

Other sinuses exist in the temporal bones; these communicate with the cavity of the tympanum. These are particularly extensive in Birds, and occupy as much space as the nasal sinuses do in Quadrupeds. They produce the same effect on the cranium of the Owl, as the other kinds of sinus produce on that of the Elephant.

The growth of the horns of the Deer present singular phenomena, which will be described in their proper place.

The blood of the Vertebrata is always red; and it appears to possess a peculiar composition, fitted to preserve that energy of sensation and muscular vigour observable in this division of animals. These properties, however, greatly depend upon the degree of perfection in which respiration is performed; and this circumstance gives rise to the subdivision of the Vertebrata into four classes [Mammalia, Birds, Reptiles, and Fishes.]

The external senses are always five in number; and they reside in two eyes, two ears, two nostrils, the integuments of the tongue, and those of the whole body. Certain species seem [at first sight] destitute of eyes.

But this is only apparent, as all the Vertebrata have two eyes composed of the same essential parts as those of Man. The only apparent exceptions are the *Mus typhlus*, or Blind Rat, where the eyes are concealed under the skin; and the Fish called *Cobitis anableps*, where the same eye, having two pupils, appears double.

The nerves reach the marrow through the holes of the vertebrae and of the skull; and they all appear to become incorporated with it. After interlacing its filaments, the marrow expands itself in forming the various lobes of which the brain is composed, and terminates in two arched masses called hemispheres; the volume of which is [sometimes] proportioned to the degree of intelligence possessed by the animal.

Most of the nerves of the trunk and of the limbs arise from the spinal marrow, whence they are distributed, and through their means sensation and motion are transmitted to the several parts of the body. When any portion of the spinal marrow is compressed or divided, all those parts to which nerves are transmitted, arising from the portion of the spinal column situate below the part compressed, are immediately paralyzed and deprived of sensation and motion. In some species remarkably tenacious of life, a remnant of consciousness will remain, even after the entire separation of the brain and spinal cord. If the head of a serpent be removed, and shortly afterwards the skin of its tail be punctured by a sharp instrument, the headless trunk will turn instinctively to defend the part attacked.

The internal structure of the spinal cord is well exhibited on making a section of the spine of a Carp. Its spinal cord is composed of six columns running parallel, and arranged symmetrically round a central canal filled generally with fluid. The pair of columns situate behind are appropriated for sensation, and the two in front for voluntary motion. Fibres are transmitted from each side; these unite and form nerves, yet the fibres still retain their characteristic functions. The nerves of sensation have small ganglions or knots near the central column; and the whole are formed into one system by the sympathetic nerve, which is parallel to the spine, and passes near it on each side.

There are four principal portions of the Human Brain—1, the Medulla oblongata; 2, the Cerebellum; 3, the Cerebrum; and 4, the Optic tubercles. Besides these, there are many intricate parts, which we shall not attempt to describe in this outline.

1. The MEDULLA OBLONGATA is that part of the brain which forms the immediate continuation of the spinal cord. It appears to contain the portion most essential to life and consciousness. Every other part of the brain may be successively taken away, at every mutilation the sphere of vital action may be diminished; yet, if the *Medulla oblongata* be preserved entire, nay, even if that minute portion near the origin of the fifth and eighth nerves be uninjured, the animal will still exhibit marks of instinct and sensation. Upon removing the cerebrum, cerebellum, and tubercles of a living hedge-hog, M. Magendie found that the animal was rendered blind; yet it remained acutely sensible to smell, taste, or bodily punctures; and its powers of locomotion were unimpaired. Infants are sometimes born *acephalous*, that is, without a brain, and possessed only of the *Medulla oblongata*, nerves, and spinal cord. When they survive for a short time after birth, which does not often happen, they always possess sensation and motion. Yet their brain only resembles that of the Mollusca, such as the snail or the oyster. One infant, described by Mr Lawrence, survived four days. "The brain and cranium of this infant were deficient, and the basis of the latter was covered by the common integuments, except over the *foramen magnum* (or that hole in the skull which communicates with the vertebral column), where there existed a soft tumour, about equal in size to the end of the thumb. The smooth membrane covering this was connected at its circumference to the skin. The child, as is generally the case in such instances, was perfectly formed in all its other parts, and had attained its full size. It moved briskly at first, but remained quiet afterwards, except when the tumour was pressed, which occasioned general convulsions. It breathed naturally, and was not observed to be deficient in warmth, until its powers declined. From a fear of alarming the mother, no attempt was made to see whether it would take the breast; but a little food was given it by the hand." From these instances, it appears that the brain is not essentially necessary to the performance of the ordinary instinctive functions of an animal; but that it is the *Medulla oblongata* which forms the essential organ. If the head of a tortoise or frog be cut off, sensation will remain either in the separated head, or in the headless trunk, according as the section has been made above or below this vital part. It is a curious fact, that the usual effects of an emetic are prevented by pressure on the *Medulla oblongata*, or vomiting is instantly arrested, if it has already commenced.

2. The CEREBELLUM, or little brain, is the tubercle or tubercles arising from the expansion of the hinder portions of the spinal marrow. It would therefore appear to be more especially designed for sensation. In Man, the *Cerebellum* is composed of two large hemispheres, connected together by the vermiform processes, so as to form one structure, being composed of a white nervous substance, enveloped in a uniform covering of gray matter. When this part of the brain is injured, the animal is affected with a kind of giddiness, by which it appears to be hurried forwards. In attempting

to check itself in this imaginary career, it actually effects a movement in the opposite direction. Dr Mayo describes with accuracy the phenomena attending injuries to the Cerebellum in various animals. "The removal of the Cerebellum in fish produces no further immediate effect than that of weakening the animal; and frogs, from which this organ is removed, show an indisposition to move, unless irritated or placed in water, when the movements, though less lively than before, are not observed to be otherwise affected. In Birds and in Mammalia, more important results ensue upon the injury or removal of the Cerebellum, which, it may be remarked, does not appear to be sensible to pain from mechanical lesion. If the Cerebellum be wounded upon one side, the animal appears to be generally weakened upon the same side: if the wound be deep, the body upon the injured side is rendered paralytic. If, in a rabbit, the upper and middle portion of the Cerebellum be removed, the hind legs are observed to be spread, the fore legs are extended forwards in a state of rigidity: the whole attitude is that of preparation for moving backward, or throwing itself over. After a short time, the animal beats the ground with its fore paws, the hind legs not moving, and urges itself backwards. The flight and walk of pigeons are not affected by the removal of the upper part of the Cerebellum. After a deep section has been made, the bird totters, falls on its breast, rises again, and is in continual agitation. A deeper section still causes it to walk and fly backwards. After the entire removal of the Cerebellum, the bird, when irritated, walks as usual: when thrown into the air, it moves its wings regularly, and lights upon its feet. M. Magendie mentions the case of a young woman, who was affected with a nervous malady, that forced her to run rapidly backwards, disregarding every peril. If, in a rabbit, a section through the middle portion of the Cerebellum be made, in the median plane, the eyes of the animal are observed to be in extraordinary agitation, and as if starting from their sockets: the animal inclines towards one side, then is suddenly thrown towards the opposite, as if unable to balance itself with precision: its fore legs are rigidly extended forwards, as if it were in the act of reeiding. If a vertical section of the Cerebellum be made, leaving one-fourth of the whole adhering to the *crus* (or shank) of the right side, and three-fourths to the left, the animal rolls over and over incessantly, turning itself towards the injured side. The right eye is directed downwards and forwards, the left eye upwards and backwards. On making a similar section upon the left side the animal stops, and the eyes resume their natural direction."

3. The CEREBRUM, or larger lobes of the brain, arise from the expanded portions of the anterior or fore columns of the spinal marrow. When certain portions of the Cerebrum are divided in various animals, they spring suddenly forwards, and continue to advance steadily in a straight line. Even when opposed by some obstacle, they continue to preserve the attitudes of one advancing.

4. The OPTIC TUBERCLES give rise to the optic nerves, and are formed by a production of the central columns of the spinal marrow. Upon injuring this part of the brain, blindness immediately follows.

The relative arrangement of these several parts of the brain differs considerably among the several classes of animals. In Fish, they are arranged nearly in a straight line, while in the Mammalia and other higher tribes, they are disposed in a more complicated manner. The relative proportions also vary. In the higher animals, the cerebral hemispheres are much larger, in proportion to the tubercles, than in fishes.

The Vertebrated animals have always two jaws. The lower jaw possesses the greatest power of motion, and may be either raised or depressed. The upper one is, in general, entirely fixed.

The Upper jaw is immoveable in Man, in Quadrupeds, and in some Reptiles, as the Tortoise and Crocodile; but it is more or less moveable in Birds, Serpents, and Fishes. The lower jaw is always moveable in the Crocodile, although the contrary has been asserted.

Both jaws are almost always armed with teeth. These are excrescences of a peculiar nature, nearly resembling bone in their chemical composition, but which grow by the deposition of matter in certain sacs. Yet one entire class of Vertebrated animals (Birds), have their jaws covered with a horny substance; and among the Reptiles, one entire genus (Tortoises) are similarly supplied.

The teeth are used by the various classes of Vertebrated animals for different purposes. In general they are for masticating the food; often for weapons of defence; in some they are employed for digging and for seeking out the food; and in others, they seem designed for no other purpose than for defending the eyes, as in the Phacochorus *Aethiopicus*, or African bear.

The formation of teeth proceeds upon a plan entirely different from that employed by Nature in the deposition of bone. It will be recollected that the bones are pervaded in every direction by vessels which nourish, renovate, and absorb their particles; but the teeth, on the contrary, are almost entirely destitute of vessels. When once deposited, they remain in a certain degree unchanged; and hence, when once destroyed, they cannot be renewed. The foundations of the teeth are laid before birth, and each tooth is formed in a small sac, by the deposition of earthy matter. They are covered by the *enamel*, which is the hardest animal substance in nature, and will even strike fire from steel.

The structure of the teeth in graminivorous animals is peculiar. A grinder is composed of several distinct teeth, each tooth being covered with its own enamel, and the whole united together by a kind of cement.

The intestinal canal of the Vertebrated animals proceeds from one extremity of the body to the other, undergoing various bendings, with several expansions and contractions. It possesses subsidiary organs, and receives various secretions, having a dissolving power. Some of these are seated in the mouth, and called the saliva; others, formed only in the intestines, bear several names. The two most important secretions are the Juice formed by the gland called the Pancreas, and the Bile, which is produced from another very large gland called the Liver.

After the food has been digested, it passes into the alimentary canal. That portion fitted for nutrition, called the chyle, is absorbed by particular vessels called *Lacteals*, and transported into the veins. After the several parts of the body have been nourished by the blood, the nutritious particles remaining unabsorbed are also introduced into the veins by vessels analogous to the *Lacteals*, and forming with them an arrangement called the *Lymphatic system*.

The veins bring back to the heart the blood that has served to nourish all parts of the body, and which has just been supplied with chyle and lymph. But before it is in a proper state again to be transported by the arteries throughout the body, it is obliged to pass wholly, or in part, through the organ of respiration. In the three highest classes [Mammalia, Birds, and Reptiles] the respiration is pulmonary, or performed through Lungs, consisting of an assemblage of small cells through which the air penetrates. In the Fishes alone, and in certain Reptiles during the first periods of their existence, the respiratory organ consists of Gills, composed of a series of thin plates between which the water flows.

In all the Vertebrated Animals, the blood supplying the liver with materials for the bile, is derived from that venous blood which has partly circulated in the coats of the intestines, and partly in a particular organ named the *Spleen*. After being collected in a canal termed the *Vena-portæ*, this blood is again subdivided at the liver.

Tous ces animaux ont aussi une sécrétion particulière, qui est celle de l'urine, et qui se fait dans deux grosses glandes attachées aux côtés de l'épine du dos, et appelées *reins*: la liqueur que ces glandes produisent, séjourne le plus souvent dans un réservoir appelé la *vessie*. Les sexes sont séparés; la femelle a toujours un ou deux ovaires, d'où les œufs se détachent au moment de la conception. Le mâle les féconde par la liqueur séminale; mais le mode de cette fécondation varie beaucoup. Dans la plupart des genres des trois premières classes, elle exige une intrusion de la liqueur; dans quelques reptiles, et dans la plupart des poissons, elle se fait quand les œufs sont déjà pondus.

DIVISION OF THE VERTEBRATED ANIMALS INTO FOUR CLASSES.

1. *Mammalia* (*Man and Beasts*).—2. *Aves* (*Birds*).—3. *Reptilia* (*Reptiles*).—4. *Pisces* (*Fishes*).

We have just explained the several points in which all the Vertebrated Animals resemble each other. There are, however, certain differences, which give rise to their separation into four large subdivisions or classes. These are characterized by the particular manner in which their motions are performed, or by the degree of their energy or vigour; and these again depend upon the quantity of their respiration. The muscular fibres possess a greater or less degree of irritability and general energy, according as the respiratory organs are more or less perfect.

There are two conditions which determine the quantity of Respiration. The first is, the relative quantity of blood supplied to the respiratory organ in a given time; and the second is, the relative quantity of oxygen, entering into the composition of the surrounding fluid. The quantity of blood, purified by respiration, depends upon the arrangement of the organs adapted for respiration and for circulation.

The organ of circulation [or heart] may be either double or single. The *entire* blood, arriving from all parts of the body through the veins, may be obliged to circulate through the respiratory organ, before being again distributed by means of the arteries; this occurs when the heart is double: or a *part* only of the blood returning from the body may be obliged to traverse the respiratory organ, while the remainder returns through the body, without having been submitted to the action of respiration—which is the case when the heart is single. The latter arrangement occurs in Reptiles; and the quantity of their respiration, with all the qualities depending thereon, is determined by the quantity of the blood transmitted to the lungs at each pulsation.

The circulation of the warm-blooded animals, possessed of a double heart [being Mammalia and Birds] is performed in the following manner:—The blood is propelled from the left ventricle into the aorta, and thence diffused throughout the body by means of the arteries. It passes through the minute capillary vessels at the extremities of the arteries into the veins; from which it slowly collects in the vena cava, and is deposited in the right auricle of the heart, and thence removed into the right ventricle. It is then propelled by the right ventricle through the pulmonary artery into the lungs, where it receives the action of the air; and being restored by the pulmonary veins back again to the left auricle of the heart, it passes thence into the left ventricle, prepared again to resume its circuitous course.

The force exercised by the heart upon the blood, and the velocity of the circulation,

may be understood from the following observations of the learned Dr Paley:—"There is provided in the central part of the body a hollow muscle, invested with spiral fibres, running in both directions, the layers intersecting one another: in some animals, however, appearing to be circular rather than spiral. By the contraction of these fibres, the sides of the muscular cavities are necessarily squeezed together, so as to force out from them any fluid which they may at that time contain; by the relaxation of the same fibres, the cavities are in their turn dilated, and, of course, prepared to admit every fluid which may be poured into them. Into these cavities are inserted the great trunks, both of the arteries which carry out the blood, and of the veins which bring it back. This is a general account of the apparatus; and the simplest idea of its action is, that, by each contraction, a portion of blood is forced as by a syringe into the arteries; and at each dilatation, an equal portion is received from the veins. This produces at each pulse a motion and change in the mass of the blood, to the amount of what the cavity contains, which, in a full-grown human heart, I understand is about an ounce, or two table-spoons full. How quickly these changes succeed one another, and by this succession, how sufficient they are to support a stream or circulation throughout the system, may be understood by the following computation:—Each ventricle will at least contain one ounce of blood. The heart contracts four thousand times in one hour; from which it follows, that there pass through the heart, every hour, four thousand ounces, or three hundred and fifty pounds of blood. Now, the whole mass of blood is said to be about twenty five pounds; so that a quantity of blood, equal to the whole mass of blood, passes through the heart fourteen times in one hour; which is about once in every four minutes. Consider what an affair this is when we come to very large animals. The aorta of a whale is larger in the bore than the main pipe of the water-works at London bridge; and the water roaring in its passage through that pipe is inferior, in impetus and velocity, to the blood gushing from the whale's heart. Hear Dr Hunter's account of the dissection of a whale:—"The aorta measured a foot in diameter. Ten or fifteen gallons of blood are thrown out of the heart at a stroke, with an immense velocity, through a tube of a foot in diameter. The whole idea fills the mind with wonder."

The circulation through a single heart may be seen in the frog. The heart is composed of only one ventricle, and of one auricle. From the ventricle the blood is propelled through two divisions of the aorta, finally terminating in one large branch, and is thence transported through the ramified extremities of the arteries throughout the body. Returning by the vena cava, it is again carried to the auricle, and thence restored to the ventricle. But during its passage a part only of the blood was transported to the lungs through the pulmonary arteries, and again brought back, through the pulmonary veins, after having been purified. This partial aeration of the blood imparts to the Batracbia or frogs a cold and sluggish character.

The Fishes have a double circulation, but their respiratory organ is formed for breathing through the medium of water; and their blood receives the action only of that portion of oxygen which is dissolved or mixed in the water. From this circumstance it follows that the degree of their respiration is still less than that of the Reptiles.

The gills of Fishes are situate at each side of the throat, and immediately adjoining the heart. Dr Monro is of opinion, that they present an extent of surface to the action of the water equal to that of the entire human body. The fibres resemble the teeth of an exceedingly fine comb, and they are covered with minute protuberances, resembling the pile of velvet, while innumerable blood-vessels distribute their delicate fibres over the entire surface. The distribution of these vessels on the folds and divisions of the gills forms one of the most minute and delicate arrangements in the animal economy. By means of these organs, the Fish is enabled to absorb the oxygen dissolved in the water; and after yielding this substance, the water is discharged through the branchial openings. The Fishes form a contrast with animals of the other divisions, in this respect, that they do not inspire by the same opening through which they expire.

In the Mammalia, the circulation is double, and the aerial respiration is simple, that is to say, it is performed only in the lungs. The quantity of their respiration is therefore greatly superior to that of Reptiles, in consequence of the form of the heart, or circulating organ, and also to that of the Fishes, from the nature of the surrounding element.

The quantity of respiration possessed by Birds is yet greater than that of the Mammalia, because they not only have a double circulation, with a direct aerial respiration, but they also breathe through many other cavities besides the lungs. The air penetrating into the cells distributed all over the body, acts upon the branches of the aorta, or arteries of the body, as well as upon the ramifications of the pulmonary artery.

From these circumstances are derived the four kinds of motion for which each of the four classes of Vertebrated animals seems particularly designed.

1. THE QUADRUPEDS, in which the quantity of respiration is moderate, are generally formed for WALKING, for RUNNING, and for developing these motions with vigour and precision.

2. THE BIRDS, wherein respiration is much more perfect, possess that muscular vigour and that lightness of construction necessary for FLIGHT.

3. THE REPTILES, endowed with a more feeble respiration, are condemned to CRAWL upon the earth, and many of them pass a part of their life in a continued state of torpor.

4. THE FISHES, in order to execute their less vigorous motions, require

to be supported in a fluid of nearly the same specific gravity with their own bodies.

All the other organic arrangements proper to each of these four classes, and especially those which are connected with motion and with external sensation, bear a necessary relation to these essential characters.

MOTIONS OF THE VERTEBRATED ANIMALS.

Walking—Leaping—Running—Trotting—Galloping—Climbing—Flying—Darting—Paddling—Diving—Swimming.

To perform all the different kinds of progressive motion which are enjoyed by Man and the lower animals, it is necessary that a certain velocity should be communicated, in one particular direction, to the *centre of gravity* of the animal body, or that point in the body around which all the parts balance and remain at rest. A certain number of joints must exist, capable of a greater or less degree of flexure. Their relative position must be so adapted that it may be comparatively easy to extend them on the side to which the centre of gravity is made to incline, and difficult on the opposite side, so that the general movement may tend in the former direction.

The mechanical part of Animal motion may be understood from the following illustration:—If we imagine a spring divided into two branches, one of which rests upon a firm resisting base, and then suppose that the branches are compressed by some external force, their elasticity will cause them to recede as soon as the compressing force has been removed, and the two branches will be inclined at the same angle to each other as they were before the compression. But as that branch which rests upon the basis is unable to overcome its resistance, the movement takes place wholly in the opposite direction, and the centre of gravity of the spring is forced from the resisting body with more or less velocity. Accordingly, in any animal, while the muscles (*flexors*), which bend the part employed in effecting the movement, represent the external compressing force of the spring, and those muscles (*extensors*), which stretch it out, correspond to the elasticity that makes the branches of the spring fly asunder, the ground supporting the animal, or fluid in which it moves, forms the resisting basis.

In *Walking*, the centre of gravity is alternately moved by one part of the extremities and supported by the other, the body never being completely separated from the ground. It differs essentially from *Leaping*, where the entire body is projected into the air; and from *Running*, which consists of a number of short leaps.

In general, it is less painful to walk than to stand, because the same muscles are not continued in action for so long a period; and it is much easier to counteract those unsteady motions which occur in walking by contrary and alternate actions than it is to prevent them entirely. Thus it follows, that though all animals which stand erect on two legs, such as Man and Birds, can also walk on two legs, yet many moving in an upright position with sufficient ease, cannot stand on two feet for any time without very great fatigue and exertion.

When Man intends to walk on level ground, he first extends one foot. His body then rests equally upon both legs, the advanced leg making an obtuse angle with the tarsus or instep, and the other an acute angle. As the ground does not yield to the point of the foot, the heel and the remainder of the leg must necessarily be raised, otherwise the heel could not be extended. The pelvis and trunk are consequently thrown upwards, forwards, and somewhat in a lateral direction. In this manner they move round the fixed foot as a centre, with a radius consisting of the leg belonging to that foot, which, during the movement, continually diminishes the angle formed with the tarsus. The leg communicating this impulse is then thrown forward and rests its foot upon the ground; while the other, which now forms an acute angle with its foot, has the heel extended in its turn, and in like manner makes the pelvis and trunk turn round upon the former leg. The centre of gravity is thus carried forward by these movements at each progressive step, inclining, however, at the same time to the right and left alternately, so as to be supported by each leg in its turn. It will also be seen that each leg, immediately on extending its heel, bends and rises, in order to its being moved forward,—extends in order to rest its foot upon the ground,—turns upon this foot as on a fixed centre, so as to support the weight of the body,—and then extends its heel again in order to transfer this weight to the other leg.

In this manner, each leg supports the body in its turn; but it is also necessary that the extensors of the thigh and knee should be brought into action, to prevent their articulations from giving way; and this motion is followed by a corresponding action of the flexors of the same articulations. It will be observed, that the three principal articulations of each leg are situate in opposite directions to each other, that the foot should be raised by their flexion immediately over the place which it occupied during their extension. It would otherwise be impossible to bend them without throwing the foot backwards or forwards.

In consequence of the impossibility of regulating the undulatory motion, in a manner perfectly equal on both sides, a man cannot walk in a straight line with his eyes shut; nor could he even preserve a uniform direction, did he not correct these deviations by the sense of sight.

In descending a stair-case, or in walking down an inclined plane, the advanced leg is placed lower than that remaining behind; and the body would fall upon it with a fatiguing and dangerous jerk, were it not carefully checked by the extensors of the hip. By this means, the body is compelled to descend gradually; but the muscles of the loins soon become fatigued by the exertion.

On the contrary, in ascending a stair-case, or an inclined plane, it is requisite at each step, not only to transport the body horizontally, as on a level surface, but also to bear it up against its own weight, by means of the extensors belonging to the knee of the advanced leg, and to the heel of the leg remaining behind. The knee and calf of the leg are therefore fatigued in ascending. A mechanical advantage is gained by leaning the body forward in ascending, because the lever, by which its weight retards the

motion of the knee, is thereby shortened in equal proportion. A fatigue, similar to that produced by the action of ascending, is occasioned by walking with a very wide step. As the legs are thereby placed considerably apart, the body sinks lower at the moment of their separation; and as it is necessary to raise the body proportionally, when turning alternately on each leg, the fatigue is consequently greater.

Man is not compelled to swing his arms greatly to assist his walking, except when confined to a very narrow path from which he cannot depart, and then he employs every means to correct the unsteady motion of the body. Apes always require the assistance of their arms in walking; and such as have these extremities longest, like the Orang Outang (*Pithecus Satyrus*), and the Long-armed Monkey or Gibbon (*Pithecus lar*), use them with the greatest advantage.

Among Quadrupeds, the action of walking is performed in the following manner:—The articulations of the hind-legs are first bent slightly, and extended in order to carry the body forward; in which movement the extensors of the knee and heel particularly contribute. The breast is thrown forward by this movement, the fore-legs incline backwards, and the animal would certainly fall, did it not instantly throw its fore-legs forward in order to support itself. The trunk is drawn upon the fore-legs, which are now fixed in this position, and the action of the hind-legs is again repeated. But it must be observed that, in the action of walking, these movements are not performed at the same instant, by the legs of each pair; for, in that case, the animal would necessarily be completely suspended for a moment over the ground. Its motion would then no longer be a *walk*, but a succession of leaps, particularly denominated a *full-gallop*. On the contrary, each step is executed by two legs only, one belonging to the fore pair, and the other to the hind pair. When the motion is performed by the legs on the same side, it is called an *amble*—when by legs on opposite sides, a *pace*.

During the amble, the body being alternately supported by two legs of the same side, is obliged to balance itself to the right and left, in order to avoid falling, and the right fore-foot moves to sustain the body, urged onwards by the right hind-foot. It is this balancing movement which renders the amble of the Horse and Ass so agreeable to invalids.

In the *pace*, the body is supported alternately by two legs placed in a diagonal manner. The right fore-leg is advanced to sustain the body, thrown forward by the extension of the left hind-foot; and at the same instant the latter bends in order to its being moved forward. While these are raised, the right hind-foot begins to extend itself, and the moment they touch the ground, the left fore-foot moves forward to support the impulse of the right foot, which again moves forward.

Quadrupeds having the fore-feet longer than the hinder, as may be observed in the Giraffe, or Camelopard, possess the chief strength of their body in the fore-legs, and accordingly the principal impulse is given by extending the fore-foot. The Sloths, and all animals which like them have the fore-legs greatly disproportioned to the others, drag themselves onwards with a laborious and tedious movement, by first extending the anterior legs, and then bending them so as to draw the body onwards; and with the Sloths, this difficult motion is further increased by the imperfect articulations and general feebleness of the hinder-legs.

The legs of the Mammiferous Quadrupeds move forwards and backwards in planes nearly parallel to the spine, and not far from the middle plane of the body upon which the weight operates. On the contrary, in the Oviparous Quadrupeds, the thighs are directed outwards, while the bendings of the limbs take place in planes perpendicular to the spine. In the latter case, the weight of the body acts with a much longer lever in opposing the extension of the knee. These animals, therefore, have the knees always bent, and the belly drags upon the ground between the legs. For this reason they have received the name of Reptiles.

The short leaps of the Hares, Rats, and particularly of the Jerboas, are occasioned by the great length of their hinder as compared to the fore-legs. Indeed, their fore-legs are so short, that had they not the precaution to make this prancing movement, these animals would be thrown down by each impulse of the hind-feet. It is only in ascending a hill, that they can be said to walk at all. Their movement on level ground is performed by a succession of short leaps; and when they attempt to walk slowly upon level ground, they are compelled to move themselves by the fore-feet, and merely to drag the hinder pair after them. We may observe the latter movement in the Rabbit, and still more distinctly in the Frog.

The Otters, Beavers, Water Tortoises or Turtles, and other quadrupeds designed for swimming, have the hinder-legs placed very far apart to facilitate the motion. They are, therefore, impelled laterally, the line of motion becomes crooked, and the trunk is urged onwards from side to side.

In Leaping, the body rises entirely from the earth, darts into the air, and remains suspended for a momentary period, depending for its duration on the force of projection. This movement is performed by the sudden extension of all the inferior articulations, after they have undergone an unusual degree of flexion. Their rapid extension gives a violent shock to the bones composing the articulations. The impulse is then communicated to the centre of gravity of the animal's body, and it is projected with a determined velocity depending on its weight. A leaping body is, therefore, a projectile which gradually loses the acquired velocity by which it ascended, its motion being continually retarded, and finally destroyed by the force of gravity exercised by the earth. We are therefore enabled to ascertain the curve described by a leaping body in the air, with the time and place of its descent, when the projectile force and the force of gravity are given, and allowance made for the resistance of the air.

All the animals which leap best have the hinder-legs and thighs much longer and thicker than the anterior—the projectile force, and consequently the extent of the leap, being regulated by the proportional length of the muscles. The surprising leaps of the Kangaroo, Jerboa, and Frog, are plainly owing to this cause.

The smaller animals leap much farther than the larger, in proportion to their size. This must follow obviously, if it be considered that when the projectile force impressed on two bodies is in proportion to their different magnitudes, their velocity will be equal, and that the extent of the space through which they pass depends entirely upon their respective velocities. The leaps of small and large animals are therefore nearly equal.

Man and Birds are the only animals capable of leaping vertically or hopping, because they alone have the trunk placed directly over the legs, and the direction of a leap depends upon the situation of the centre of gravity, in respect to the member by which the impulse is given. They are also capable of leaping forward, by impressing a greater degree of force on the rotatory motion of the thigh than on that of the leg; or they may even leap backwards, by making an opposite exertion. On the contrary, Quadrupeds can only leap forwards.

Running differs from walking, only in the body being projected forward at each step, and in the hinder-foot being raised before the anterior foot touches the ground. It consists, in fact, of a series of low leaps performed by each leg. As the acquired velocity is preserved, and augmented at each bound by the new velocity thereby added to it, running is more rapid than the quickest walking step. An animal cannot, therefore, stop itself instantaneously when running, though a stop may be made at each step in walking. In leaping forward, a previous run is advantageous, because it adds the momentum acquired during the run to that obtained from the leap itself; but a vertical leap or hop would be entirely prevented by a run, or at least considerably diminished. For this reason, a horse in full gallop, preparing to leap, retards his velocity before making the spring. In running, an animal inclines its body forwards, that the centre of gravity may be in a proper situation for receiving an impulse in that direction from the hinder-leg. It is also requisite to move the fore-leg rapidly forward to guard against falling. Were any obstacle to intervene, so as to prevent this leg from reaching the ground in time to support the body, a fall would be the consequence. It also follows, that interruptions of this kind are more dangerous in running than in walking, on account of the greater momentum of the body, and for the same reason they occur more frequently. Man never varies his manner of running, except in taking longer or shorter steps, or in giving to his body a greater or less degree of velocity; but Quadrupeds vary their mode of running, by the different order in which they raise each foot, or bring it to the ground.

The feet diagonally opposite rise simultaneously in the *trot*, and fall at once, each pair alternately, but in such a manner, that for a moment all the four feet are off the ground. The sound of the animal's steps are therefore heard two and two in succession, and a regular motion is produced.

The Dog, Hare, and many other quadrupeds, can only run in the manner particularly denominated the *full gallop*, which is the most rapid motion of the Horse. These animals raise the anterior feet at each step; the body is projected forwards by the extension of the hind-feet; the two fore-feet descend at the same time, and are followed by the two hind-feet also descending together. By this means, the steps of the horse are heard by two beats at a time, differing in this respect from the *common gallop*, where the two fore-feet are lifted unequally, and fall one after another, and from those other varieties of the gallop, where the horse's footsteps are heard by a series of three or four beats, from the hinder-feet falling to the ground either both together or one after the other.

Many animals leap by organs different from feet, but they all agree in this respect, that the movement is occasioned by the sudden extension of several articulations. Serpents leap by folding their bodies into several undulations, which are unbent at the same instant, according to the degree of velocity which they wish to impart to their bodies. Only a few genera are assisted in this motion by the scales of the belly, which they are able to elevate and depress at pleasure. Some Fishes leap to the tops of eataracts by bending their bodies strongly, and then unbending them suddenly, so that they rise with an elastic and powerful spring.

Several animals, which in reality leap, have been improperly said to fly. The Flying Lemurs, Flying Squirrels, and Flying Phalangers, have membranes between the feet, but their toes are not elongated. These membranes serve to support them for some time in the air, and enable them to take great leaps in descending; but the membrane acts merely as a parachute, as these animals cannot raise themselves in the air. In the same manner, the Flying Dragon, a small lizard found in the East Indies, supports itself for some moments during a leap, by a membrane sustained by a few bony rays, articulated to the spine of the back.

Man and various other animals possess the power of seizing objects, by surrounding and grasping them with their fingers. For this reason, it is necessary that the fingers should be separate, free, flexible, and of a certain length. Man has such fingers on his hand only; but Apes and some other kinds of animals have them both on the hands and feet; hence they are termed *quadrumana*, or four-handed.

Man surpasses all other animals in the delicate operations which his hand is capable of performing. The Apes and Lemurs alone possess with him a thumb opposable to the other fingers, and forming with them a kind of forceps. They are consequently the only animals capable of holding moveable objects in a single hand. But it is indispensable to perfect prehension that they should have the power of rotating the hand upon the fore-arm, and the bones of the shoulder must be placed so as to prevent the scapula or shoulder-blade from being thrown forwards.

The Squirrel, Opossum, Rat, and other animals, possess fingers sufficiently small and flexible to enable them to take up objects, but they can only hold them by the assistance of both paws. Dogs and Cats, which have the toes shorter, and besides are under the necessity of resting on their fore-feet, can retain their hold of substances solely by fixing them upon the ground with their paws. Those animals having the toes united and drawn together under the skin, or enveloped in horny hoofs, are incapable of exercising any prehensile power.

Climbing is greatly facilitated by a power of seizing and grasping firmly. Man is but an indifferent climber, because he can only grasp with his hands. His feet are chiefly adapted for supporting the body, and afford but an imperfect means of elevating it by the extension of the knees and heels. The arms form, therefore, the chief means of drawing the body upwards in climbing.

Monkeys, and other Quadrumana, are the best climbers. They can seize equally well with their four extremities; and the position of their hind-feet is still more favorable to this action, as the soles are turned inwards, instead of being directed outwards. Ant-eaters and Sloths have a considerable protuberance on the heel, which nearly accomplishes the same end; and with the Opossums and Phalangers

climbing is assisted by a thumb almost always directed backwards, and forming a kind of heel very powerful in its operation. The animals just mentioned, as well as most of the Quadrumana, are assisted in climbing by their tail, which is capable of seizing bodies almost as powerfully as a hand. For this purpose, additional force is imparted to the common muscles of the tail.

The sharp and hooked claws found in animals of the Cat kind, enable them to climb with facility. Their nails are retained between the toes, with the points elevated by two elastic ligaments, altogether independent of the will of the animal. When they wish to use the nails, either for tearing their prey or seizing moveable objects, the nails are protruded by the muscle, which moves the last phalanx of the toe on the preceding one.

In the Sloth, the ligaments are differently disposed, and the nails being naturally inflected, must be raised when the animal wishes to use them. As the toes are of an inconvenient form, being composed of two phalanges, one of which is very short, and the other entirely covered with the nail, while the metacarpal bones are ossified together, and immoveable, the Sloths perform their movements with constraint and difficulty.

The climbing birds are enabled by their claws to fix themselves to the inequalities in the bark of trees; and they perform this action by the assistance chiefly of the hinder-toes, which are used in supporting and preventing them from falling. The greater number of these genera have two hinder-toes, but the Creepers and Nut-hatches have only one. The Woodpeckers, as well as the Creepers, are assisted in climbing by the quills of the tail, which are stiff and capable of being fixed firmly into the inequalities of surfaces.

Some birds can raise the food to their mouth by means of the one foot, while they stand upon the other. Parrots have their toes conveniently disposed for this purpose, and also the Owls. Without this provision, the latter would frequently fall whenever they attempted to peck, in consequence of the great weight of the head, and the corresponding elevation of their centre of gravity. But as most birds require both feet in order to stand firmly, they seldom use them for holding substances except during flight, when the feet are disengaged. The Cormorant and Pelican will sometimes swim with the one foot and carry some substance in the other; and the Wading Birds frequently stand for a long time on the one leg, which they are enabled to do without much difficulty, while they hold a stone, or some heavy substance, in the other as a counterpoise.

Among the Reptiles, the Chameleon seems to possess adaptations for climbing, enjoyed by no other animals except the Quadrumana. With a prehensile tail, and hands resembling forceps, he exhibits a degree of agility unusual with the Reptiles.

Flying and swimming are leaps taking place in fluids, and the motion is produced by the resistance which the fluid makes to the surface of the wings or fins, when moved by the animal with great rapidity. Leaping, however, takes place on a fixed surface, possessing the power of resistance, from its magnitude and firmness. If we suppose the ground to be either soft or elastic, leaping may still be performed; but there arises a diminution in the velocity of the leap, proportional to the resiliency of the support. It is necessary, therefore, that the moving power should be increased in proportion, to produce an equal momentum by the extent of the vibrating surfaces, and by the rapidity of their vibrations. The velocity with which the wings or fins must be used, depends on the rarity of the medium in which they move. It is less in water, greater in air near the earth's surface, and increases as the animal ascends into the higher regions of the atmosphere. Birds cannot therefore fly above a certain height, dependent on the strength of their muscles; and they are capable of rising to a greater height when the barometer is high than when it is low. The muscles moving the wings and fins, but especially the former, require a force vastly superior to that necessary to produce a simple leap upon a firm surface.

As a flying or swimming body is entirely surrounded by the medium in which it is placed, it experiences an equal resistance in front as well as from behind on striking the fluid. An animal would be incapable of advancing, if it did not possess the power of greatly diminishing the surface of its wing or fin, immediately after having struck the fluid.

Flying and swimming are sometimes performed by the same animal; but the former is executed most perfectly by Birds, and the latter by Fishes. Some birds never fly. The Ostriches, Auks, and Penguins, are possessed of small rudimental wings, but they seem to have them but for the purpose of conforming more nearly in external resemblance to other birds. Some Mammalia can fly, although they have no wings. The Bats possess a membranous expansion, extending to the feet and to both sides of the tail, but supported chiefly by the humerus, the fore-arm, and the four fingers. These bones being greatly elongated, serve to support the membranous surface, which is of firmness and extent sufficient to raise and maintain these animals in the air, when acted upon by the powerful muscles of the breast.

The first motion of a bird in attempting to fly is an ordinary leap with the feet. Accordingly, those birds having the wings very large and the feet very short, as we observe in the Booby and the Martins, commence their flight with great difficulty, as they cannot leap sufficiently high to obtain the space necessary for the extension of their wings.

In flying, the resistance of the air is in proportion to the mass struck at one time. On this account the short-winged birds must repeat their vibrations very frequently; they are therefore soon fatigued, and unable to continue their flight for a long time. When a bird attempts to fly, the humerus is first elevated, and then the entire wing, which had hitherto remained folded; while, at the same time, it is extended in a horizontal direction by means of the fore-arm and the last division of the wing, corresponding to the foot of Quadrupeds. After the wing has thus acquired all the superficial extent which it is capable of attaining, the bird suddenly depresses it, until it forms an acute angle with the vertical plane of the body, subtending the ground. The air resists this motion, which is performed with great rapidity, and produces a reaction of part of the force upon the body of the bird. Its centre of gravity then rises in the same manner as in other leaps. The wings may be compared to a lever, of which the pectoral muscles are the moving power, and the body of the bird the weight; while the air resisting, by its inertia, the action of the expanded wing, is the

fulcrum. The impulse being once given, the bird refolds the wings by bending their joints, elevates them again, and gives a new stroke to the air. The force of gravitation diminishes the velocity which the body thus acquires in ascending, in the same manner as it affects every other projectile. There consequently occurs a moment in which the bird neither ascends nor descends. If it seize this moment precisely, and give a new stroke to the air, its body will acquire a new velocity, which will carry it as far as that obtained by the first impulse; it will then rise in a continuous manner, and with a uniform velocity. If the second impulse of the wing commence before the impulse arising from the first has been lost, the bird will ascend with an accelerated motion; or, if the bird do not vibrate its wings at the exact moment when the ascending velocity is lost, it will begin to descend with great rapidity. Yet the bird may keep itself always at the same height by a series of equal vibrations, if a point be seized in the fall so situated that the velocity which would have been acquired in descending, and the small space there would have been to reascend, reciprocally compensate and destroy each other; but if it once allow itself to descend to the point from which it departed, it can only rise by a much stronger exertion of the wings.

In descending, the bird has only to repeat less frequently the vibrations of its wings. The *darting* of Birds of Prey is occasioned by their suppressing the vibrations of the wings altogether, when the bird, being continually acted upon by the force of gravity, falls with an accelerated velocity. When a bird in descending suddenly, breaks its fall, it is called a *recover*. The resistance of the air then increases in proportion to the square of the velocity, and the bird rises again.

The preceding remarks apply only to flight when made in a vertical direction, either in ascending or descending. The Quails, Larks, and other birds which are observed to fly upwards in a straight line, have the wings placed entirely horizontal; but in the greater number of birds the wing is inclined, and turned backwards. This inclination may be further increased at the will of the bird. It is greatly assisted by the length of the quills, which enable the resistance of the air to act on their extremities with a mechanical advantage, while they are the more elevated by it, from their fixed points being placed at the base. By this arrangement, birds are enabled to advance in a horizontal, as well as in a vertical direction, by a series of oblique curves.

The oblique motion upwards in flight may be resolved into two other motions, the one in a horizontal direction, independent of the force of gravity, and the other in a vertical direction, opposite to that power. In flying horizontally, the bird rises in an oblique direction, and does not make a second movement of the wings until it is on the point of descending below the line of the intended direction of its flight. These partial movements, therefore, will not take place in a straight line, but in a series of curves, nearly approaching to the straight line, and in which the horizontal motion greatly prevails over the vertical. In ascending obliquely, the wings move with greater rapidity; in descending obliquely, their vibrations are less frequent; and both of these motions are performed by a series of curves.

Some birds cannot sufficiently diminish the obliquity of their wings, and with them the horizontal motion is always very considerable. When the wind blows strongly in the same direction with the flight of these birds, they are carried to a very considerable distance out of their intended path. For this reason, those birds of prey which the falconers term *noble*, are under the necessity of flying against the wind when they wish to rise perpendicularly upwards. The anterior quills of their wings being extremely long, and their extremities pressing closely upon each other, the horizontal motion with them is proportionally greater than that of other birds. On the contrary, with the *ignoble* birds the quills of the wings are separated at their extremities, and permit the air to pass between them, which renders the wing less capable of assuming the oblique position.

Deviations from the rectilinear path to the right and left, are chiefly occasioned by the unequal vibrations of the wings. When the left wing vibrates the more frequently, or with the greater force, the left side moves more rapidly, and the body necessarily turns to the right. The rapid movement or greater force of the right wing produces a corresponding turn to the left. The difficulty of suddenly turning increases with the velocity of flight; and this arises partly from the inertia of the body, which perseveres in its rectilinear course, and partly from the increased difficulty of making the one wing to surpass the other in its velocity. For this reason, birds of rapid flight make great circuits in turning. Some will turn on the side, and make use of the tail as a rudder, when they wish to change the horizontal direction.

The tail of birds, when expanded, serves to sustain the hinder part of their body. When depressed during flight, the resistance of the air forms an obstacle which raises the hinder part of the body and depresses the anterior; upon turning the tail upwards, a contrary effect is produced.

As all Birds do not fly, so all Fishes do not swim, yet there are many Birds which perform two motions, resembling those more particularly belonging to each class. Aquatic Birds are improperly said to *swim*; and the poet, describing the swan "sailing with the breeze," is perhaps not aware that his term is philosophically correct.

The bodies of Aquatic Birds are naturally lighter than water, from the great quantity of air which they contain within the abdomen, and from the feathers, which are oily and impervious to moisture. They precisely resemble a boat, and have no further occasion for the feet than as oars for moving forwards. As the fore part of the body is completely sustained by the water, the legs are situate farther backwards than those of other birds, that their effect may be more direct, as their presence farther in advance would be superfluous. The legs and thighs are short, that the resistance of the water to the muscles may be as slight as possible. The tarsus, or instep, is compressed for cutting the water, while the toes are very much expanded, or even united by a membrane, in order to form an oar of greater breadth, and capable of acting upon a greater surface of water; and when the bird inflects its foot in order to give a new stroke to the water, it closes the toes upon each other to diminish the resistance of the fluid.

In diving, these birds are obliged to compress the breast with much force, in order to expel the air which it contains. The neck is then elongated, that the body may acquire an inclination forwards, while, by striking the feet upwards, it is forced

downwards. The Swan, and some other aquatic birds, spread their wings to the wind, and use them as sails to diminish the labour of paddling.

The body of the Fish is rendered of the same specific gravity as the water, by means of the air-bag or swimming-bladder. By the assistance of this organ, it can raise or depress its body in the water. When this air-bag is burst, the fish remains always on its back, and is unable to ascend. In an ordinary state, the fish is able to compress the air-bag precisely in the degree sufficient to enable its body to remain in equilibrium with the water, and to retain it in the same horizontal plane. It compresses the air-bag in a greater degree when it wishes to descend, and dilates this organ when about to ascend. This compressive force is accomplished by the lateral muscles of the body, which tend to contract the bladder by elongating it. In this manner, though the extent of its surface remains the same, the capacity can be diminished, since it is further removed from a spherical form; and it is well known that the sphere possesses the greatest solid content of all bodies of equal surface. Some Fishes are capable of having their air-bags so much dilated by heat, that when they remain for a long time on the surface of the water, exposed to the burning heat of a tropical sun, they cannot compress the bag in a degree sufficient to enable them to descend again.

When the fish is in equilibrium with the water, and wishes to advance, its tail is bent in two different directions, resembling the letter S, by means of its strong and complicated lateral muscles. It then augments the surface of its tail to the utmost extent, by means of the dorsal, anal, and caudal fins. The tail is then extended with great velocity, the resistance of the fluid serves as a solid substance, a part of this velocity is imparted to the fluid, and the body of the fish is propelled onwards by the remainder of that velocity, diminished of course by the resistance of the fluid before the fish. But this is not great, because the force with which it advances is much less than that employed to extend the tail; and also, when the tail returns to a right line, the fish presents to the fluid only the thickness of its body, which is by no means very considerable.

It is necessary that the fish should bend its tail again to give a second stroke to the water. This motion, however, is directly contrary to the direction of the power by which the tail was extended, and produces in the fluid an equal resistance in the opposite direction. This resistance would be equally powerful, and would completely counteract the progressive motion of the Fish, if the surface of the body continued the same as before. But the anal and dorsal fins are then laid down upon the body, while the caudal fin becomes folded and narrow. Again, the curvature of the tail takes place very slowly, while its extension is violent and sudden. On returning to the right line, the tail is bent a second time; but this takes place precisely in the opposite direction, and the impulse resulting therefrom has an equal obliquity only on the opposite side of that imparted by the first stroke. By this means, the course of the body is rendered straight; and, by striking the water more on the one side than on the other, the fish is enabled to move to the right or left, and to turn round horizontally.

It does not appear that the pectoral and ventral fins are of very much use in the progression of Fishes. They seem intended to aid in preserving them in a state of rest, or in equilibrium with the fluid, and they are extended whenever it becomes necessary to correct the vacillations of the body. They are used also in the slight turnings of their progressive motion, and in preventing themselves from falling on one side in swimming. Perhaps in those tribes of fishes where these fins are unusually large, they have some other uses, which a more accurate acquaintance with the habits of these fishes would enable us to describe.

Fishes without air-bags experience a much greater difficulty in changing their elevation in the water. The greater part remain always at the bottom, unless the disposition of their body enables them to strike the water from above downwards with great force. The Rays (*Rain*) elevate themselves with their large pectoral fins, which are very properly termed wings, as these fishes use them in raising themselves, precisely in the same manner as the bird elevates itself in the air by means of its wings. Unlike the other fishes, the Flat Fishes (*Pleuronectes*) are compelled to swim in an oblique position with the back on the one side and the belly on the other, in consequence of their eyes being placed on the same side of the head. In swimming, they accordingly strike the water from above downwards. As both the Rays and *Pleuronectes* are unable to strike the water conveniently to the right and left, they are compelled to make a succession of leaps in order to impart a horizontal direction to the whole of their motions. The tail is struck downwards with great force, which elevates them slightly, and this force, combined with that of gravity, brings them back to the horizontal line after describing a curve. They depart from this line by a new leap, in a manner similar to the flight of Birds.

The same means are employed by the Whale and other Cetacea. It must be observed, that the bodies of these Mammalia are organized for swimming as perfectly as those of Fishes; but they differ from them in this respect, that the efforts of the tail are made principally in a vertical direction. The use of the air-bag is supplied by the lungs, which are compressed or dilated at will by the action of the diaphragm and the muscles between the ribs. Serpents, and many of the Invertebrated Animals having long bodies and no fins, swim in the same manner as Fishes, by suddenly inflecting their bodies.

The Quadrupeds, Aquatic Birds, and Reptiles, swim by means of their feet, which propel them onwards in precisely the same manner as a boat is moved by oars.

When the oar is in a state of rest, it forms two angles with the side of the boat, and these may either correspond or be unequal. The boatman moves the oar so as to render the anterior angle more obtuse, and the hinder one more acute. If the water did not resist by its inertia, the boat could not change its place; but as its resistance obstructs the motion of the oar, the angle in question widens by the progressive motion of the boat. When once the impulse has been given, the boatman draws back his oar or turns its edge, that it may not interrupt the motion, and then repeats the same operation.

The above description of the mechanical process in rowing, is directly applicable to the animals just named, if we only consider their feet as oars, and their bodies as so many boats. The Seals, Morses, and other Amphibia, swim the most perfectly of

all the Mammalia; while they resemble the Cetacea and Fishes in the form of their bodies more nearly than any other animals of the same class. In many Quadrupeds the mechanical power of the feet in paddling is greatly increased by membranes between the toes, as may be observed in the Otter and Beaver, but in general they swim simply by the action of the four limbs. Of these, the hinder serve to urge the body onwards, and the anterior to sustain the fore-part of the body, which is the heaviest.

As the weight of the head in Man is greater in proportion to the size of the body than almost any other of the Mammalia, he experiences greater difficulty in supporting his head when swimming than most of these animals, and he alone, of all Mammalia, seems incapable of swimming naturally, and without repeated trials.

ANALOGIES OF THE VERTEBRATED ANIMALS.

Identity of their Construction—Natural Scale of Animal Organization—Laws of Monstrous Development.

ON stating, for the first time, to a person ignorant of Zoology, that all the Vertebrated Animals are analogous to each other, he is apt to reject the assertion as paradoxical. He may ask, what analogy can exist between a Serpent and a Mammiferous Quadruped, or between a Frog and a Bird? If we answer, that they are composed of the same elements, of the same tissues, however different they may externally appear, and that they are all possessed of the same or nearly corresponding properties, he may reply, that this is natural to all bodies possessed equally of life.

It may be necessary to explain that, when all the Vertebrated Animals are stated to be analogous, it is meant that they are composed of the same constituent materials, and that to a certain point, each similar organ is formed of the same number of pieces. By this it is not meant that these animals are all possessed rigorously of the same number of organs, or of parts of an organ; on the contrary, many are altogether deprived of certain parts which are found well developed in other species. It is evident that the Boas, destitute of limbs, cannot resemble in this respect the Fishes provided with fins, or still less the Mammalia, possessed of four limbs. It is only asserted, that when we investigate the corresponding organs of these animals, we find them to be composed of the same materials, and of the same constituent pieces.

It is unnecessary at present to allude particularly to the internal organs of animals, such as the muscles, arteries, and viscera, as every one is aware that a certain degree of analogy prevails in their internal parts or entrails. It is only necessary to point out some of the leading organs of the animal body, to be assured that there exist undoubted points of analogy in their structure. In attempting to trace these analogous parts, it is convenient to select young animals, or rather the unborn embryos, in preference to the adult animals, because the identity and similarity of the original and essential outline become gradually disguised by those characters, which afterwards form the distinctions of genera and species.

The external coverings of the Vertebrated Animals appear at first sight destitute of every pretension to analogy. We are struck with the remarkable differences between the scales of the Fish, and the feathers of the Bird, or between the shield of the Armadillo, and the glittering and delicate skin of the Eel. Yet, if we examine the first periods of the existence of these animals, they are all equally covered with a soft and thin membrane,—a simple or naked skin; and, on tracing the subsequent changes which this envelope undergoes, we are led to perceive productions analogous to that same epidermis or cuticle, which invariably forms the external covering of each animal. Whatever changes the outward garb of the animal may undergo, whether it become hairy, scaly, feathered, or covered with a shield, these are merely subsequent modifications which the epidermis or outer skin undergoes in the course of its development.

In the skeleton, these analogies appear still more evident. We see in all the Vertebrated Animals a central column of bones, piled one over the other, called vertebrae; in all, certain projections or processes arise from these vertebrae; and among the greater number, these projections are sufficiently lengthened out in front of the body to form ribs, and to constitute the walls of a cavity destined to contain the heart and the lungs. All these peculiarities appear greatly diversified in the different species of full-grown and perfect animals: but, if we look back to their origin, and investigate at the moment that ossification begins, we find that the first constituent elements are identical—that the points of ossification are the same in all. This appears still more evident in the structure of the heads of animals. It seems difficult to conceive that the heads of the Crocodile and of the Sparrow are composed of precisely the same number of pieces as those of Man, or any other of the Mammalia. If we were only to compare the skulls of these several animals, in their permanent adult states, we should be compelled to admit that their differences were more numerous than their analogies, and they would then appear to differ as much in their details as in their general form when taken as a whole. But upon examining these several heads at the period when they first begin to ossify, they exhibit the most perfect similarity in the number of pieces of which they are thus originally composed.

It would doubtless form a deeply interesting object of inquiry, to ascertain the cause of this remarkable contrast in the results, while the materials are identical, and whence it arises that so great an analogy among the elements finally produces such evident differences in the final structure, and in its progress towards completion. The cause, however, is involved in impenetrable obscurity; such is the constitution of Nature, and we are only left to ascertain the facts, without venturing to speculate upon the cause.

The essential pieces of the skull are at first of the same number in all the Vertebrated Animals; but they have neither the same form nor size. A certain part, which in one species is excessively reduced in size, takes an extremely large volume in another; and this part, which in some is so greatly developed, occasions the neighbouring parts to become abortive. There are some heads in which the vomer and the bones of the nose are as large as the frontal bone; yet these bones do not on this

account lose their distinctive characters. Another cause of variety in the ultimate development, while there is a perfect similarity in the primitive elements, arises from this circumstance, that the different portions of these bones remain isolated in certain species, while in others the greater number of scattered pieces become grouped together, and coalesce into one bone. These modifications are particularly realized in the bones of the Skull; as it was especially necessary that this solid covering should be modified so as to suit the peculiarities of the brain and the other essential organs, which it was destined to enclose and to protect.

This instance is not solitary; the other pieces of the skeleton are similarly modified in their arrangement, to correspond with the adjustment of the more important organs. In the Fishes, for example, we find that the bones of the breast follow the respiratory organs into their appropriate situation, and are grouped along with them in the vicinity of the head. Without disturbing the order of Nature, it was impossible that the air, when dissolved in water, could retain that elasticity belonging to its gaseous form; it is unable to rush by its pressure within the body of the fish, and to seek out, as it were, the blood in the respiratory organ, for the purpose of purifying it. The gills are accordingly placed in the vicinity of the jaws; and it is only a consequence of these remarkable laws of analogy, that they should be accompanied in their places by the bones fitted for sustaining them, and by the muscles which enable them to act. These analogies, so obvious in the structure of the bones, may also be traced in the nervous system of the Vertebrated Animals.

It has been already observed, that the elements composing the bodies of the animals belonging to the First Great Division are analogous; but the analogy exists most perfectly only up to a certain period of animal development, and this period is not the same in all, but varies according to the degree of complication in their structures. A young unborn Mammiferous quadruped resembles a Human embryo, which is less grown than itself; but at the same time it resembles the embryo of a Bird in a higher state of advancement, that of a Reptile in a still more perfect condition, and that of a Fish, when completely finished, and perhaps already born. Thus, the classes of Vertebrated Animals are perfectly analogous only at ages differing for each class. Fishes and Reptiles may only resemble Birds and Mammalia which are much younger than themselves. These last-mentioned animals, on the contrary, continue to grow, and to increase in complication at a period of time long after the Reptiles and Fishes have ceased to develop themselves. We thus see the cause of the greater complication of structure among the higher animals. They are all identical in their first formation, but the Reptiles continue their growth for a longer time than the Fishes, the Birds longer than both Reptiles and Fishes, and Man and other Mammalia longer than these three classes of Birds, Reptiles, and Fishes.

Since all the Vertebrata can thus be brought to one common type, and to a base nearly identical for all classes, it follows that each higher animal undergoes revolutions analogous to those, observable in the whole series of animals inferior to it. One single Vertebrated animal of the highest order, will hence exhibit in those transitory states of existence, which pass from its first origin to its final completion, all those characters which are permanent arrangements in the lower classes of Vertebrated Animals. It also arises, that the first ages of the human embryo form analogous types to the other animals; it first resembles a Fish, then successively a Reptile, Bird, and finally a Mammiferous animal. Hence it appears, that in studying the development of the human embryo, we are reading a minute, and, in its leading characters, an accurate description of the physiology belonging to the higher classes of animated nature. It has been often admired that so small and delicate an organ as the retina of the human eye can exactly represent a distant and intricate scene with a precision which the most perfect human artist would in vain attempt to imitate; and shall we not equally admire that minute and exquisite disposition of things, by which the most complicated characters belonging to the distant inhabitants of the sea, of the land, and of the air, are thus brought together and transcribed in miniature, so that a complete history of a large portion of the Animal Kingdom is traced within the shell of an egg, or the membranes of a human embryo!

This remarkable disposition of Nature requires further elucidation.

The skin of the Human embryo precisely resembles that of certain Reptiles, or even of the Medusæ and Polypti, by its softness, its perfect nakedness, as well as its simplicity. In the earliest age, the anterior and central opening of the abdomen corresponds to a disposition observable in the Oyster and some other Mollusca, which have the mantle divided during the whole period of their life. At this time, likewise, the muscles are colourless, soft, gelatinous, and destitute of tendons, as we may see among the lower animals, such as the Worms. The bones of the human fetus are nearly rounded, as we find in adult animals of the lower grades. The same bone, which is designed to form afterwards a whole, perfect in itself, is at this early period broken up into as many separate points of ossification as we can find divisions, permanently separate among the Mammalia and Birds, but especially among the adult Reptiles and Fishes. This singular correspondence of the temporary state of the human bones with the permanent state of the same bones in the other Vertebrata, is particularly observable in the occipital and sphenoid bones, in the upper jaw and temporal bones, in many bones of the face, and also in the sternum, or breast-bone. The breast-bone, for example, consists almost always of nine pieces in the first ages of the human embryo, and nine pieces are to be found in the Tortoise during the whole course of its life. The upper jaw-bone is at first composed of five pieces in the human fetus, and the Crocodile continually preserves these five pieces isolated. We might bring forward many other parallel instances of analogy among ages and classes, by entering more minutely into the details of the skeleton. It is only in consequence of this law that the bones of inferior animals are more numerous than those of animals more elevated than themselves, and that the animal skeleton exhibits a greater number of bony pieces, as we approach the first periods of ossification. Indeed, there is almost as much difference between the skeletons of the human fetus and that of the full-grown Man, as between those of the adult Reptile, and of a Mammiferous Quadruped in its embryo state.

We shall find that these analogies, between the permanent states of the inferior classes, and the transitory states of embryos of the higher animals, can be traced equally in the heart and circulating organs, in the lungs and respiratory organs, in the nervous

system, and in the organs of sense, as well as in the arrangements finally destined to continue the several species.

The heart of the human fetus is first composed of one single cavity. It afterwards divides into four, which form momentarily a communication with each other, but speedily separate, in such a manner that the two cavities of the left side end in having no direct communication with the cavities on the right. This sketch of the progress of the human heart, which is equally applicable to that of the other Mammalia and of Birds, indicates a new analogy between the very young human embryo, still destitute of a heart, and the Worms, which never have a heart. Again, when the heart of the human embryo has only one ventricle, it resembles that of the Arachnides and Crustacea; afterwards, the heart with two cavities corresponds to those of the Fishes and Batrachian Reptiles. Finally, when there are but three cavities, the two auricles having coalesced into one, it resembles the hearts of the Tortoises and Serpents; and when the partition of the auricles is pierced by the hole termed the *foramen ovale*, the heart of the human fetus bears a striking analogy to a permanent arrangement found in the Seals.

In following out this comparison of the progress of the human embryo, with the permanent arrangement of the adult animals, we see the venous blood of the human fetus communicate primitively with the arterial blood, which is a natural arrangement in all the inferior animals, beginning from the Birds. The digestive canal is at first short and simple, as we find in animals of the lowest degree. The liver is originally composed of little compartments, as may be seen continually in the Crustacea; afterwards, it resembles that of the Mollusca, in being formed of lobes slightly united. The spleen and thymus gland are always absent among the Invertebrated Animals, and the latter is wanting even in the Fishes. These organs are developed very late in the embryo of Man and other Mammalia. The same remark applies to the breast-bone. It is wanting in many Reptiles and in all the Fishes, and it is very late in making its appearance in the embryo of the larger animals. In general, we find that those organs, of which the lower animals are altogether destitute, are the slowest in being developed in the human fetus. On the contrary, the greater number of the organs which exist only temporarily in the human fetus are the first to appear; and thus the gills, which in our species appear in its very earliest state, soon vanish; and that kind of tail, which may be seen in the human embryo when forty days old, does not exist longer than the fiftieth day.

The kidneys of the fetus among the Mammalia are always very large, which arrangement is found to remain continually with the Fishes. They are at first lobed and of an unequal surface in the human embryo, nearly resembling that form which may be seen in the adult Fishes, Birds, and in many Reptiles and Mammalia. The subrenal capsules are at first very large in the human embryo, a disposition which exists in the Apes, and in several adult Rodentia, such as the Squirrel and Mouse. There appears also to exist a *clauca* in the embryo of Man and of the Mammalia, as may be invariably found during the whole lives of the oviparous animals, and in the Monotremata of M. Geoffroy-Saint-Hilaire.

We see corresponding analogies in the instruments of respiration, and in the manner in which this function is performed. The Birds commence by breathing through means of the membranaceous filaments of the allantois, just as the Polypti respire through the skin. The fetus of Man, at first, has gills resembling those of the Fishes; and the Batrachian Reptiles, before they have lungs fit for acting, breathe through gills like the Crustacea; Birds breathe through simple membranes before they respire through lungs; and Man receives, through the placenta, blood already purified, as long as his lungs cannot gain access to the air of the atmosphere. There are even some animals, such as certain Reptiles during their metamorphoses, which successively present all these different modes of respiration, and which thus resemble in turn all the different classes of animals, excepting the Insects, breathing through tracheæ. These Reptiles respire, at first, through a naked skin like the Polypti; afterwards, through external gills, like the Crustacea and Annelides; after that again, through internal gills, like the Fishes; and finally, through lungs, in the same manner as the other animals of their own and superior classes.

But these analogies among the transitory states of the fetus and the permanent form of the lower animals, when in a state of perfection, are in no respect more evident than in the details of the nervous system. Thus the human fetus, which we have selected as forming the standard of comparison, has at first certain parts of the brain (*corpora quadrigemina*) exactly similar to those belonging to the perfect Reptiles and Fishes. These organs were originally hollow, lobed, not quadruple, but double only, and placed merely on the surface of the encephalon; yet they finally assume the permanent form of the Reptiles and Fishes. The Mammalia are the only animals in which these tubercles become quadruple, and they are the only ones where they become solidified by the obliteration of the central cavity. Besides the above-mentioned analogy in regard to the nervous system, the human embryo presents many other peculiarities corresponding to those of the lower animals. For example, the hemispheres of the brain are possessed at first of only a small volume, and they are rounded in a manner resembling the adult Fishes. Certain parts of its brain (*corpora callosa*) are so divided that they appear at first sight to be absent, in the same manner as with the Birds of every age.

The spinal marrow of the human embryo exhibits a central cavity; and a similar arrangement is found in all perfect animals of classes inferior to the Mammalia, while even the lateral nervous cords are originally so much isolated, as to give to the entire structure the appearance which it always preserves in the Articulated animals. Besides this, the marrow of the human embryo originally occupies the entire length of the vertebral canal, as in the other animals, but it is only in the third month that it ascends as high as the loins. Finally, its entire nervous system exhibits several analogies to the permanent dispositions in the other classes of Vertebrata, such as analogies of consistency, volume, greater or less numerous subdivisions, and even of faculties.

In regard to the organs of sense, analogies of a similar order may be traced. The mouth of the human fetus is at first without lips, as in the Vertebrated Animals of the inferior classes. Its palato is then divided, and the mouth, on that account, communicates directly with the nasal fossæ, as in the Reptiles and Birds. The

tongue is originally small as we find in the Fishes. The nose and ear present no external projection, in which respect they again resemble these organs in the Cetacea, and in the great oviparous animals. Again, the eye appears at first without an eyelid, as it is always found in Insects, the Crustacea, the Mollusca, the Fishes, and certain Reptiles.

Finally, the general form of the human embryo does not exhibit a less degree of analogy with the perfect states of other animals. The head is at first so slightly developed, as to give to the body of the embryo the appearance of an Invertebrated Animal. It resembles a Fish or a Reptile by the absence of limbs; and the caudal or tail-like appendage, which we have already mentioned, gives it for a short time the aspect of an ordinary quadruped.

From what has been said, it appears that the embryos of the higher animals exhibit in the course of their growth the greater part of the characteristic peculiarities of all classes of animals, and present the fleeting models of almost all the different kinds of organization. The rudiments of Man thus form a reduced, yet striking, image of the entire Animal Kingdom.

We must admit, however, that these resemblances which have just been enumerated are far from establishing among all beings a perfect and absolute identity, whether we consider different animals in their states of perfection, or upon comparing one animal at the different ages of its progress, and with other animals of different yet inferior species. Every animal preserves continually, and throughout every age, certain well-marked characters peculiar to its species. These differences are so striking, even in those which appear to resemble each other most nearly, that it becomes impossible for us to conclude, that they may all be arranged in one graduated scale, every where complete and continuous; or that they all possess one common framework, one visible and identical basis, with the same number of essential organs, possessing the same natural characters. Still less can they be supposed to be derived by gradual metamorphoses and complications from one common stock, from binary, or even from ternary types. These analogies being always partial, and frequently vague, can by no means warrant the adoption either of the universal chain of existence proposed by Bonnet, or the transmutation of species, and the successive filiation of Demaillet and Lamarck. Still less will they admit the adoption of the organic identity proposed by certain French and German writers.

If animals resemble each other universally, it is only in the great phenomena of existence, of which we have already treated. When, however, we descend to the instruments producing these phenomena, we are surprised to find the most striking difference, instead of resemblance, which can be considered as perfect. One animal seemingly superior to another in some of its organs, is often evidently inferior to the same animal in other details of its structure. We sometimes find that two animals which resemble each other entirely in respect to one set of organs, are sometimes so dissimilar in their conformation, that it is impossible to blend them together even in imagination. Finally, there are some organs of which certain entire classes of animals are altogether deprived, and yet they may exhibit, in two other classes of animals apparently allied to each other, the most discordant characters. Indeed, it is certain that there is not a single organ which does not vary from one genus or from one family to another; but at the same time, there is not an organ, except perhaps the stomach, which can be found in all families and in all genera. We shall see numerous proofs of this in the details of the Animal Kingdom.

The real cause of analogies among different ages and species must be found in this,—that they are all constructed upon models evidently analogous. The same Divine Artificer formed them all. We find the same style in every page of the great book of Nature; and we every where see the most evident affinities both in the essential organs of animals, and in the phenomena which they exhibit.

From what has already been said, we may easily perceive the cause of those wonderful productions, those *Lusus Naturæ*, or monstrous births, which in all ages have astonished and alarmed the ignorant. These evidently arise from a retardation in the

growth of some organs. An animal, though remaining incomplete in regard to one organ, may yet continue to grow in all other respects, and the disproportion of the organs may thus proceed to the most shocking disparity. Another consequence of this law is, that the abortive and imperfect organs of an animal must resemble the usual organs of the same animal in an earlier state of its existence, or those of a lower animal in an adult form. Though all the organs may have been originally perfect, yet if one ceases to develop itself, while all the others continue their progress, the monstrosity of the final result is the necessary consequence.

It follows also, that what is a deformity in one animal, may be a constant and permanent character of another. The monstrosity of a higher animal may bear a decided analogy to the regular form of one of another grade. For example, it is evident that one of the Mammalia, born without hair, is analogous to the lowest classes of animals having the skin naked. If the skin be scaly, it brings the Quadrupeds down to the level of the Fishes and the Ophidian Reptiles. The Mammalia and Man often have a divided palate, like the Birds, the Fishes, and many Reptiles. The occasional absence of the teeth in Mammalia may be explained on the same principle. The monstrous development of the liver is found naturally in Birds, Fishes, and also in some Cetææ and Reptiles. To want the tongue, or to have it forked—to have the limbs abortive, or altogether wanting, though monstrous developments, are natural and constant arrangements in other species.

The following are the most remarkable of the laws of Monstrosity, or, as Lord Bacon calls them, "the laws which govern the sports of Nature:"—

1. Monstrosities are always found more frequently in females than in males. The cause of this is to be found in the fact, that the male sex is a more advanced state of development than the female. All embryos, of whatever sex they may ultimately be, are at one time females. In infancy, too, the female character predominates. Young boys preserve for many years the smooth chin, the narrow larynx, the silver voice, and the rounded limbs of the young female. The young birds of both sexes have at first the same plumage as their mothers, and moult at the same time that they do. The same thing holds with all the other characteristics of the male sex. The mane of the Lion, the crests, spurs, and other ornaments of the male Birds, the antlers of Stags, the horns of Cattle, the vivid colours and powerful energy which belong to the males of different species, are all characters slow in developing themselves.

2. Monstrosities never exceed certain limits, and deformities have their fixed laws. Thus, when there are supernumerary fingers, they are always similarly disposed.

3. They always preserve a degree of symmetry, even among the most shocking irregularities. A double monster seems to result from the same law, which occasions both sides of the body to be symmetrical.

4. The absence or excessive smallness of one organ is always followed by the extreme development of another.

5. Monstrosities are more frequently found in the left side than in the right, because the left side is always the more feeble and imperfect.

6. Deformities generally go together in pairs. Thus, the presence of supernumerary fingers and the division of the palate; the excessive smallness of the lungs, with a great development of the liver; and these dispositions, which usually co-exist in monsters, are found naturally in many animals.

7. The most diversified organs of the animal series are the most liable to monstrosity in the higher animals.

8. Monsters always have some of their organs below their age, and consequently below their class, but never above them. A monstrous Bird or Quadruped often has its organs analogous to those of a Reptile or of a Fish; but a Fish or Reptile never has those of a Bird. This rule is general and constant.

Several more laws might be mentioned, but these seem sufficient for our present purpose. We shall now proceed to consider the Animal Kingdom more in detail, and accordingly commence with the Mammalia.

THE FIRST CLASS OF THE VERTEBRATED ANIMALS.

THE MAMMALIA—MAN AND BEASTS.

WITH WARM BLOOD; HEART WITH TWO VENTRICLES; FEMALES SUCKLING THEIR YOUNG WITH MILK SECRETED IN BREASTS OR MAMMÆ; VIVIPAROUS, EXCEPTING THE MONOTREMATA, WHICH ARE EITHER OVIPAROUS OR OVO-VIVIPAROUS.

The Mammalia should be placed at the head of the Animal Kingdom, not only because it is the class to which Man himself belongs, but because it surpasses all others in the enjoyment of more numerous faculties, of more delicate sensations, of a greater variety of motions, and where all these properties are combined so as to form beings of greater intelligence, fruitful in resources, less the slaves of instinct, and more susceptible of improvement.

This class possesses characteristics peculiar to itself, in its VIVIPAROUS generation [the young being born alive], in the manner by which the *fœtus* [or embryo] is nourished in the womb, by means of the placenta, and in the MAMMÆ, or breasts, by which the young are suckled.

On the contrary, the other classes are OVIPAROUS [or produced from eggs previously laid by the parent]; and if we contrast them generally with the Mammalia, we shall find that they possess numerous points of resemblance

among themselves, which clearly exhibit a special plan of organization in the general system of the Vertebrated animals.

As the degree of their respiration is moderate, the Mammalia are in general adapted for walking upon the ground, but at the same time their movements are performed with vigour, and in a continuous manner. For this reason, the articulations of their skeletons have very precise forms, which determine the direction and extent of their motions with precision.

Some of them can, however, raise themselves in the air by means of elongated limbs, connected by extensible membranes; others have their limbs so much shortened that they cannot move easily except in the water. But this circumstance by no means deprives these last-mentioned animals of the general characters of the class.

This variety in the character of their locomotion requires a corresponding differ-

ence in the organs by which their movements are effected; and, consequently, the skeletons exhibit many important peculiarities when compared with those of Man, and with each other. Yet, whatever differences may be found to prevail, one general character can be discovered throughout the whole. The same bones which compose the arm and hand of Man, or of the Monkey tribe, are found equally in those genera which use their fore extremities for walking, swimming, or flying; the proportions of the bones being only altered, or some of the parts being obliterated, or changed. We find them equally in the fore-leg of the Deer, in the wing of the Bat, and in the fin of the Whale. One order of animals having an abdominal pouch for containing the young, are supplied with two additional bones, called *marsupial*, moved by appropriate muscles.

The interior composition in the bones of the Mammalia is generally the same; but their texture varies, being denser and closer in the smaller tribes, but very fibrous, and loosely arranged in the Cetacea. The texture of the bones in the sea-beasts is particularly adapted for locomotion in water, being aided by the lightness of their structure, and by having all the cells of their bones filled with an oily fluid.

The joints or articulations by which the bones of the Mammalia are connected together greatly influence the habits and general economy of these animals. Some of the joints are only capable of performing an imperfect motion, while a greater latitude is assigned to others. Appropriate names have been assigned to these several kinds of articulations, and they have been further arranged in divisions and sub-divisions. Some kinds of articulation are observed to be altogether peculiar to certain classes of Mammalia; while it frequently occurs that the corresponding bones will vary in their mode of articulation for different Mammalia. Other bones again, which are separated in one genus, will be intimately and closely united together in another.

The first class of articulation (*Diarthrosis*) contains the free and perfect joint. The opposite surfaces of the bones are distinct and well defined, being covered with a polished and smooth cartilage. A continuation of the periosteum or external covering of each bone passes onwards from one to the other, forming a kind of capsule, or little bag, and permitting nothing either to pass within or to escape from the cavity. But the periosteum does not cover the articular cartilages, it merely forms the external covering of the entire joint. Other ligaments frequently strengthen this covering either externally or within the capsule, and thus will limit the motions of the bones more perfectly than the capsule alone could have done. The interval within the capsule is occupied by an oily fluid, or else each bone is covered by a smooth and polished cartilage. Sometimes a piece of cartilage will be found; perhaps also some peculiar gland, or other solid body.

The direction and extent of motion possessed by the bones of the Mammalia is dependent upon the rigidity or number of the ligaments, as well as upon the form and depressions found in the articulated surfaces.

When a bone is articulated to another by one of its extremities, it admits only of two species of motion, torsion or flexion.

The torsion, or twisting, takes place when the bone is capable of moving round its own axis, or else round an imaginary axis passing through the articulation. This kind of motion can only be found when the articulated surfaces are plain or spherical, and the latter are alone capable of motion in every direction. Flexion or bending takes place when the extremity of the bone, farthest from the joint, approaches the bone which is fixed.

The different kinds of torsion have been assigned different names; there is the hinge-joint (*Ginglimus*), the ball and socket-joint (*Enarthrosis* or *Arthrodia*), and the rotating joint (*Trochoides*).

The manner in which the head is attached to the trunk, the lower jaw to the head, and the several parts of the limbs to each other, differs in the several classes of animals. The head of the Mammalia is united by a hinge-joint to the neck; in the Birds it is connected by a ball and socket-joint. Even among the Mammalia themselves the articulations are found to differ. In Man, the radius of the fore-arm is connected by a ball and socket-joint with the humerus, at its one extremity, and it rotates upon the other. But in the Rodentia, and many Pschydermata, the radius is connected by a hinge-joint with the humerus, and is immovable at its other extremity. In some species these bones are even completely united.

The second class of articulation (*Synarthrosis*) admits of no motion whatever; it is said to form a *suture* when two flat bones join each other by the edges; to be *squamous*, when the thin edge of the one bone covers that of the other; *denticular*, when the edges are notched and indented together; and *harmonic*, when they simply touch each other. We find, in the bones of the face and head of Man, instances of these different kinds of articulation. The manner in which the bones of the skulls belonging to the several Mammalia are joined together, bears a great resemblance to that observable in Man; and we find, in all, that they have a tendency to ossify as their ages increase. A variety of this kind of articulation is found in the teeth of Man and Quadrupeds. These are inserted like wedges into the cavities of other bones. In some species these bones are even completely united.

To this style of connexion the name of *Gomphosis* has been assigned. There is no instance found in the human skeleton corresponding to that singular kind of articulation observed in the nails of the Cats. These are inserted into small cavities in the last phalanges of the toes, and at the same time they receive a pivot, or eminence of the phalanx, into a small cavity of their own, prepared to receive it. This curious contrivance is also found in other quadrupeds with powerful claws. We also find it in the tusk of the Morse, where a small pivot is observed to project from the basis of the *alveoli*.

The third kind of articulation (*Amphiarthrosis*) admits only of a slight and restricted motion. This is not occasioned by the form of the bones, which are perhaps perfectly adapted for free motion, but by the cartilages and ligaments which are placed between the bones forming the articulations, and uniting firmly with them. The vertebrae of the back exhibit this restricted motion; but the bones of the pelvis are joined in such a manner as scarcely to permit any motion whatever. The bones of the wrist and instep are considered, by some anatomists, to belong to this class; for, though they appear to be provided with a few smooth articulated surfaces, yet they are confined so greatly by the surrounding ligaments, that they move upon each other with great difficulty and through a very narrow space.

In the second and third kinds of articulation, the edges or surfaces of the bones either come immediately into contact, or else they are bound together by a substance which attaches itself throughout their entire parts of connexion. Also, the periosteum is continued from one bone to the other, and is more intimately connected at the place of their junction than at any other part. In this respect they differ wholly from the kind first described.

The muscles which set these bones into motion are as various as the movements destined to be performed. Those composing the trunk of the Elephant are unrivalled for the union of strength, variety, and delicacy. As the snout of most animals is incapable of performing any considerable motion, we are naturally struck with astonishment at seeing an organ, which appears at first sight to be merely a prolongation of the snout, performing all the offices of the human hand. This delicacy is owing to the immense number of minute muscles which are arranged in various directions, and thus enable the animal to execute the various movements of the organ. Upon making a transverse section of the proboscis, counting the number of short muscles, and then allowing the breadth of a line for the succeeding ones, which is considerably more than their thickness, some estimate may be formed of the number of muscles composing the trunk of the Elephant; and, upon adding these to the number of bundles comprising the horizontal layers, they are found to amount to between thirty and forty thousand. The snout of the Tapir is formed on a similar principle, with an additional muscle, corresponding to that which raises the upper lip of the horse.

In Monkeys, the muscle which frowns (*corrugator supercili*) is large, and is frequently used, but without expressing the feelings indicated by that action in Man. In most quadrupeds the muscles, moving the external ear, are more strongly developed than in Man. They are thus enabled to give a great variety of attitudes to that organ, which enables them to collect sounds in every direction. Most quadrupeds, after an agreeable sensation, will erect their ears, and depress them when displeased, in the same manner as the Horse is in the habit of doing. Those animals which possess the power of rolling themselves up, as the Hedgehog, have a number of curious muscles for that purpose. The muscles of the tail are generally strongly developed; especially in the Kangaroos, which use them for standing and leaping, and in the Monkeys having prehensile tails.

A certain degree of similarity prevails between the muscles of Man and those of all the other Mammalia; but this resemblance is, upon the whole, greatest between Man and the Quadrumana. But we cannot fail to remark the small development in the calf of the leg, and in the buttock, among the Apes, as these muscles are intimately connected with the upright posture peculiar to Man, and the beauty of the human form. Many muscles, however, are found exclusively in Quadrupeds. Thus the fleshy pannicle (*panniculus carnosus*), that sub-cutaneous covering of the body, is of very great size in the Hedgehog, Armadillo, Porcupine, and all animals possessing the power of rolling themselves up. This cutaneous expansion is even found in the Cetaceous tribes; and the inhabitants of the Alantian Islands are said to fabricate a thread of great delicacy from the tendinous fibres of this muscle, procured from the Whale.

Certain muscles are distinguished for their very great strength. Thus the Horse is enabled to kick backwards with very great force, owing to the great development of the *Gluteus medius* and *Gemellus* muscles. The Mole is enabled to burrow under ground, and to throw up the earth, by the great magnitude of the *pectoralis major*, *latissimus dorsi*, and *teres major* muscles.

There is also a curious arrangement in the muscles belonging to the epiglottis of the several Mammalia. In the motion by which we elevate and depress the hyoid bone and the larynx, the muscles acting on the bones, and other hard parts, may be compared to ropes drawing a resisting object in a certain direction. Innumerable muscles of a complicated form may be seen in the tails of these Apes having that organ prehensile. It is said that no less than two hundred and eighty muscles were discovered by Mery in the prehensile tail of a *Cercopithecus*.

Although the manner in which the bones are articulated determines the motions which they are capable of performing, yet it is by the number and direction of the muscles attached to the bones that the motions performed by each bone are fixed.

The muscles are attached to the bones by tendons. The fibres of which the tendon is composed are of a closer and denser texture than those of the muscles, and of a silvery whiteness. Being penetrated by fewer vessels and no nerves, its substance seems altogether gelatinous. It possesses neither irritability nor sensibility, and forms the passive link, by means of which the muscle acts upon the bone. Portions of tendon are found both inside and on the surface of several muscles; and even those tendons, by which the muscles are inserted to the bones, penetrate a certain length into their fleshy substance, where they are interlaced in various manners. The term *aponeurosis* has been applied to those tendons which are broad and thin. The tendons have a great affinity for phosphate of lime, which they often absorb with facility when their action is frequently repeated, and when employed to execute violent motions. This frequently occurs with the Jerboas and other animals, which constantly leap with their hinder limbs. It is considered probable that all the elementary muscles exercise an equal force at the moment of their contraction; but the degree of force with which a muscle can be exercised greatly depends upon the manner in which its fibres are disposed, and the situation of the muscle itself, in respect to the bone or part it has to move. We therefore cannot estimate the force of a muscle by its mass, or by the number of fibres of which it is composed, but must also consider the composition of the muscle and the method of its insertion.

The muscles are either *simple* or *compound*. In the simple muscles all the fibres have the same disposition. The most usual are the *ventriform*, having all the fibres nearly parallel, and forming a long bundle of a round form. The fleshy parts swell in the middle, forming the belly of the muscle, and becoming smaller at each extremity, where they terminate in tendons. Another kind of simple muscle consists of those that are flat, and have parallel fibres, forming a sort of fleshy membrane, which is terminated by aponeuroses or tendinous membranes, instead of ending in small tendons. Both these kinds sometimes have tendons or aponeuroses in their middle, or in other points of their bodies. It is obvious that, in either, the total action of the muscle is equal to the sum of all the particular actions of the fibres; and that, if the

action experiences any mechanical disadvantage, it arises from the mode of insertion, and not from the composition of the muscle. This is not the case with the two other kinds of simple muscles, the *radiated* and *penniform*.

The *radiated* muscles are those which have their fibres disposed like radii of a circle, and which proceed from a base more or less extended, while they incline towards each other, and are inserted in a small tendon.

The *penniform* muscles have their fibres disposed in two rows, uniting in a middle line, and forming angles more or less acute, so that they resemble in some degree the arrangement of the feathers in a quill. The tendon forms the continuation of this middle line.

It may be easily perceived that, in the two last-mentioned kinds of muscles, the total or resulting force is less than the sum of the component forces; and that, if we take successively the lengths of every two fibres, which unite in producing one angle, as the measures of their individual forces, the diagonal of the ultimate parallelogram which may be formed thereon will represent the entire resultant, in quantity and direction, belonging to the fibres of the whole muscle.

When several muscles unite in one common tendon, the result is called a *compound* muscle. These muscles may be similar in their nature, but sometimes they are formed of very different kinds, such as the radiated and the ventriform uniting to form one compound muscle. We may, then, estimate the particular action of each according to the preceding observations, and the total action can then be estimated according to the degree of their inclination. Other muscles, again, are styled *complicated*: these may have only one belly with divided tendons; or they may have several fleshy parts, wherein the tendons are interlaced in several ways.

The absolute force of the muscles is determined from these several dispositions; but it is their insertion which determines their real effect. The muscular insertions may be referred to eight distinct classes:—1st, the fleshy envelope; 2d, the sphincter or ring; 3d, the curtain; 4th, the rotatory; 5th, the rope; 6th, the lever of the first kind; 7th, the lever of the second; and 8th, of the third kind. The first four have a striking similarity, in their being all formed of a girdle, or portion of a girdle, which contracts upon the surrounding parts.

1. The diaphragm and abdominal muscles are instances of the fleshy envelope. Being destined to compress the soft parts contained in a certain cavity, they envelope that cavity in every direction, in the form of membranes or bands. When all the fibres act simultaneously, it is for excretory purposes; but they usually act alternately, and then the effect is to enlarge one cavity and to diminish the other. Thus, at each inspiration the abdomen becomes wider and shorter, while the contrary happens on each expiration. The heart, arteries, and intestines, have muscles of this kind; and the muscles moving the tongue in Man and Beasts must also be referred to this class.

2. The sphincter muscles are calculated to widen or contract some soft aperture. Some of them surround the orifices like rings, and others are inserted in a manner, more or less directly, upon the edges of the opening. If the muscle be uniformly distributed around the orifice, it always preserves its figure, and is dilated or contracted always in the same manner. But when these muscles have different directions, and make different angles with the edges they have to move, the form of the aperture is very variable, as we may see in the lips of Man. No animal possesses so great a mobility of this part, and none can therefore possess so expressive a physiognomy.

3. The curtain muscle is seen in the eyelids of Man and other Mammalia. When these muscles are placed in the body of the membrane, which is destined to cover some other parts, their structure is such as we have just described; but when they are situate externally, they have the form of very complicated pulleys, as will be explained when we come to treat of the Eye in Birds.

4. The rotatory motion of the muscles may be seen in the means by which the globular mass of the eye is rolled and supported on every side.

5. The rope muscle has already been alluded to, in speaking of the larynx, and may be regarded as the most advantageous form in which a muscle can be applied.

6, 7, 8. When a bone intended to be moved is articulated at any particular point, it cannot be elevated or depressed in a direct line, but must be considered as a lever having its fulcrum in the articulation. The bone forms a lever of the first kind when the articulation is between the two extremities, and the muscles are placed at one of them, as we may observe in the muscles attached to the olecranon and heel-bone. But the most usual case is when the articulation is at one of the extremities of the bone; and then the most favorable position for the muscle is when it rises from another bone parallel to that which it has to move, or which forms with it only a very small angle. This is the case with the muscles between the ribs (*intercostales*), and several others. Yet these muscles possess a degree of obliquity which considerably diminishes their power. The muscles closing the mouth of Man may also be compared to those just mentioned with respect to their small obliquity; but they are inserted much nearer to the point of support than the former, a circumstance which also considerably diminishes their force.

The most usual kind of insertion is where a muscle attached to one bone is inserted into another, which last is articulated either mediately or immediately with the first, and may be extended until they both form a line, or inflected so as frequently to make a very small angle. This mode of insertion appears to be the most disadvantageous of all in respect to mere force, on account of the obliquity of the insertion when the moving bone is extended, and also on account of its proximity to the fulcrum. The first inconvenience is partly corrected by the heads of the bones. Their articular extremities are usually enlarged, so that the tendons of the muscle, by turning round a convexity, in order to be inserted below it, form more obtuse angles with the lever, or body of the bone, than would be practicable if the head did not exist. By this means the obliquity of their insertion is diminished, and rendered less variable.

The proximity of the fulcrum was necessary to prevent the members from being monstrously large in the state of flexion, but particularly for producing a prompt and complete flexion. As the muscular fibre loses only a determinate fraction of its length by contraction, if the muscle were inserted at a greater distance from the joint, the moveable bone would only be approximated to the other by a small angular quantity. On the contrary, by inserting it near the apex of the angle, a very small contraction occasions a considerable approximation. Velocity is gained in proportion as the space

through which the muscle acts is diminished. In this manner, muscles of this kind exercise a power which surpasses all imagination.

There are many instances of muscles inserted at a considerable distance from the fulcrum, especially in the short bones, which must be completely inflected. The vertebrae and phalanges of the fingers are in this situation. Muscles extended from the one to the other of these bones would not have produced a sufficient degree of flexion. In the phalanges, the fingers would have been two thick. It was also necessary that the tendons of these muscles should be attached to the bones over which they pass. If this were otherwise, it would happen that, whenever the phalanges were bent so as to form an arc, the muscles with their tendons would remain in a straight line, and form its cord. We may hence perceive the necessity of the annular ligaments, the sheaths and perforations. The last-mentioned arrangement occurs solely in the flexions of the fingers and toes of Man, Quadrupeds, and some other animals, and consists in the muscles which have to extend farthest being placed near to the bones, while their tendons, perforating those of the muscles, are inserted at a shorter distance, and lie over the first. When there are only three phalanges, there is but one perforation. The muscles moving the tail in the Quadrupeds are placed at a great distance from it; but their long and slender tendons are inclosed in sheaths, which they do not leave excepting immediately opposite the points into which they are to be inserted.

The whole of the Mammalia have the upper jaw fixed to the skull; and the lower one is composed of only two pieces, articulated to the temporal bone, by a projecting part [called the condyloid process.]

By the elongation of the condyles, which fit into the zygomatic process of the temporal bone, this joint is nearly restricted to the motions of a hinge, alternately raising and depressing, while the lateral motion is only just sufficient for the grinding of the food.

There is a single or double bone, found in most Mammalia, called the inter-maxillary bone, but of which Man is entirely destitute. In these animals the upper jaw-bones do not touch each other under the nose, nor do they contain all the teeth, but the inter-maxillary bone is wedged in between the former, and contains the incisive teeth of those animals possessing them. The size of this bone varies surprisingly in the several orders and genera of Mammalia, being small in the Walrus and many Carnassiers, but large in the Beaver, Marmot, Hippopotamus, and Cachalot, but especially in the Wombat. In the Ornithorynchus it is constructed of two pieces in the form of hooks. This bone is seen to exist in animals altogether destitute of teeth, and is also found in such Ruminantia as have no incisive teeth in the upper jaw. Some anatomists have doubted whether the upper jaw-bones and inter-maxillary bones are not the same, and that the latter is merely the anterior or incisive portion of the former. The latter opinion appears to be the more probable, as the division is found in the human foetus, while, in some quadrupeds, the two bones are frequently seen to coalesce. The lower jaw surpasses all other bones in the variety of its forms among the different Mammalia. It possesses very strong projections on the under side in the Wombat; and we may remark in the *Cercopithecus Beelzebub*, and other Brazilian Monkeys, a remarkable lateral development of the bone, which assists the larynx in the emission of that extraordinary deafening sound peculiar to these animals. In the Ornithorynchus, the anterior part of the lower jaw is shaped like a shovel.

An intimate relation may be observed between the kind of food with which an animal is nourished, and the motions performed by its lower jaw; and these again are greatly influenced by the form of its condyles. Thus, Mammalia living on vegetables possess a power of moving their lower jaws from side to side, so as to produce that grinding effect necessary for pulverizing and dividing grain, and for bruising grass. These animals are in this way able to move their lower jaw in almost every direction, by the form of the condyle, and of the cavity to which it is articulated. On the contrary, with the Carnassiers, we find that the lower jaw is altogether incapable of any other motion than simply downwards and upwards, being destitute of that lateral grinding motion attendant on mastication in its most perfect form. Thus, while the teeth of the Herbivorous quadrupeds may be compared to the stones of a mill, the movements of the teeth, or rather tusks, in the Carnivorous quadrupeds greatly resemble the dividing motion of seissors.

The neck consists of seven vertebrae, one species excepted [the three-toed sloth] which has nine.

A great variety is found in the number of their vertebrae, excepting those of the neck. In the Cetacea, where the neck is very short, the bodies of the Cervical Vertebrae are extremely thin, and form by *anchylosis* one bone; so that the original number of vertebrae, with their processes, can scarcely be perceived. In Quadrupeds having long and flexible necks, such as the Camel, and Camelopard, the spinous processes of the vertebrae of the neck are small, or they are nearly obliterated. A peculiar substance of great strength, called the *ligamentum nucha*, is attached to the necks of the larger quadrupeds. By means of this elastic body, the great weight of the head is supported. In the Elephant, it is of a very great size. The short-necked Cattle have double transverse processes, and in the bodies of the Cervical Vertebrae, both of Ruminating animals and Horses, there is a longitudinal ridge running along the front. With Carnivorous animals, the *ligamentum nucha* is small; and as the pendulous position of their heads require strong muscles for their support, the Cervical Vertebrae have their transverse processes very large and flat, both in the front and back, and thus afford places of attachment for the muscles of the neck, as well as for those which contribute to open their mouths.

The length of the neck does not depend upon the number of the cervical vertebrae; for, as we have already observed, this is nearly always the same in most quadrupeds. In general, we find the length of the neck to be such, that, when it is added to the head, their united lengths are exactly equal to the height of the animal from the ground. Were this otherwise arranged, quadrupeds could not easily have reached either the herbs on which they feed, or the water they must drink. The bulk of the head, in all those animals where this rule is observed, is very nearly in an inverse proportion to the length of the neck, else the muscles would be unable to elevate the head. This rule, however, is not adhered to in such animals as lift their

food to the mouth by means of hands, or of feet constructed somewhat similar to hands. Neither do we find it in the Elephant, where the proboscis is substituted for hands, nor is it to be found in the Cetacea, which obtain their food in water: the latter possess the shortest necks of all the Mammalia. It appears singular that the number of cervical vertebrae should remain constantly the same, although the necks of different animals differ so very widely in length. In Man, we sometimes observe the vertebrae of the back and loins to vary from their usual number, but never those of the neck.

The Dorsal Vertebrae are very large and long in all quadrupeds with long necks and ponderous heads, especially in the Horse, Camel, Elephant, and Camelopard, which arrangement seems necessary to afford a place of attachment for the *ligamentum nucha*.

The number of Lumbar Vertebrae varies exceedingly in different Mammalia; and when the length of the body is remarkably great, it is usually occasioned by a greater or less number of these vertebrae of the loins. Their motion is more or less restrained in nearly all quadrupeds; and this is effected by the exterior side of each posterior articular process being directed backwards, so that the anterior articular process of the next vertebra falls between two prominences. The shape of the body in animals, whether slender, short, or thick, is chiefly determined by the length of the loins, and this again depends upon the number of the lumbar vertebrae.

The anterior ribs are attached in front by cartilaginous portions to a sternum or breast-bone, composed of a certain number of vertical pieces.

Some of the ribs are attached only by the hinder extremity to the spine, and are called *false* or *shaking ribs*, to distinguish them from the *true*, which are united to the sternum. The ribs of the Mammalia vary greatly in number. In no instance is the total number less than twelve, being the number in the human skeleton. The horse has 18 ribs, being 8 true and 10 false; the Elephant has 20 ribs, being 7 true and 13 false. The strength of the spinal column, and its consequent ability to sustain great weights, depend very much upon the size of the ribs, and upon the figure which they give to the rest of the body; accordingly, we find that in the large herbivorous quadrupeds, which are usually employed as beasts of burthen, the ribs are thick and broad. Those quadrupeds which have no clavicles have less curvature upon their sides than the others. Being never required to use the anterior extremity as a prehensile member, the chest is narrowed and flattened upon the sides, especially towards the sternum, whereas Mammalia with clavicles have their chest shaped nearer to the human form.

The ribs are remarkably strong and compactly set in all quadrupeds destined to roll themselves up when attacked by other animals. In all Mammalia, they have only a very limited motion upwards and downwards, and their articulations are strengthened by a great number of ligaments. There are capsules at each articulated extremity of the ribs, which retain them upon the bodies and transverse processes of the vertebrae. They are further secured by means of two ligaments, the one being inserted into the transverse process of the superior vertebra on the *inside*, and the other into the lower articulating projection of the same vertebra, but on the *outside*. By this means the cavity of the chest is rendered secure, as well as by the capsula which unites the other extremity to the prolonged cartilage of the breast. There is also a ligamentous expansion between the ribs, connecting the lower edge of the one rib to the upper edge of the next.

In all animals, excepting perhaps the Marmot, the thorax or chest is narrower than in Man, and deeper from the spine to the breast. This peculiarity arises from the greater length of their breast-bone, and the less-marked flexure of their ribs. The Camelopard, and other animals having very long legs, possess the keel-like form of the chest in a remarkable degree; this is especially observable in the Deer tribe.

The Sternum, or Breast-bone, differs generally from that of man, in being composed of a greater number of pieces, and in being rounder and narrower. It is also longer in proportion to the rest of the body. In the Mole, the sternum is remarkably thick and strong. To enable this animal to excavate the earth for the admission of its body, the anterior portion of the clavicle is compressed upon the sides, so as to give it the form of a ploughshare. It projects beyond the line of the first rib, and thus enables the animal to burrow with singular rapidity.

The anterior extremity of the Mammalia commences in a shoulder-blade, which is not articulated, but merely suspended in the flesh; often resting on the sternum, by means of an intermediate bone, called a clavicle.

The anterior extremities, or fore-limbs, often appear to differ widely from each other upon superficially comparing the external forms in different species with each other and with Man; thus, the Dolphin and Whale seem to possess fins, and the Bat wings. But this difference is more apparent than real. Upon examining their internal structure, we find that the fore-limb consists always of four component parts, the Scapula or shoulder, the Humerus or arm, the Fore-Arm, and the Hand. In the fins of the Cetacea we perceive all these bones flattened in their form, and scarcely capable of moving upon each other, while the wing of the Bat is really a hand, with its fingers excessively elongated. There are also found a class of limbs intermediate between the fore-foot of the quadruped and the pectoral fins of the Cetacea. The Otter, Seal, and Walrus, have their bones covered with a web-like integument, adapted for the purpose of swimming. Their limbs are much more freely developed than in the Cetacea, and possess a greater freedom of motion, so that they form an intermediate transition from the one structure to the other.

The Scapula, or shoulder-blade, is found in all Mammalia. In general, the edge of this bone, next to the spine, is rounded, and the posterior angle is thus rendered blunt. The shape of the Scapula depends on the presence or absence of a clavicle; the acromion not being so prominent when this clavicle is absent; and then there is another process called the *recurrent process*, pointing backwards almost perpendicularly to the spine. The posterior angle is also most elongated in those species having complicated motions of the anterior limbs. In animals having only the rudiments of clavicles, or none, the acromion process is nearly deficient.

The Clavicle, or Collar-bone, is not found in species which employ their anterior

limbs only for progressive motion. In the Mole, the clavicle is of an extraordinary thickness, being nearly square, and slightly greater in breadth than in length. In the Bat, it is very large and strong. Indeed the Clavicle is found in all Mammalia which use their fore-limbs for burrowing, like the Mole; for raking the ground, like the Hedgehog and Ant-eater; for climbing, like the Sloth; or for holding objects, like the Beaver and Squirrel. In the other Mammalia, we often find in its place a smaller bone called the *Oss. clavicularae*, analogous to the true clavicle, but merely connected to the muscles. This arrangement is observed in most Carnassiers, and in many Rodentia.

Sir Charles Bell observes, that "Animals which fly, or dig, or climb, as bats, moles, porcupines, squirrels, ant-eaters, armadillos, and sloths, have the clavicle; for in them a lateral or outward motion is required. There is also a certain degree of freedom in the anterior extremity of the cat, dog, marten, and bear; they strike with the paw, and rotate the wrist more or less extensively; and they have therefore a clavicle, though an imperfect one. In some of these, even in the Lion, the bone which has the place of the clavicle is very imperfect indeed; and if attached to the shoulder, it does not extend to the sternum, it is concealed in the flesh, and is like the mere rudiments of the bone. But however imperfect, it marks a correspondence in the bones of the shoulder to those of the arm and paw, and the extent of motion enjoyed. When the Bear stands up, we perceive by his ungainly attitude and the motion of his paws, that there must be a wide difference in the bones of his upper extremity from those of the Ruminant or Solipede. He can take the keeper's hat from his head and hold it; he can hug an animal to death. The Ant-bear especially, as he is deficient in teeth, possesses extraordinary powers of hugging with his great paws: and, although harmless in disposition, he can squeeze his enemy, the Jaguar, to death. These actions, and the power of climbing, result from the structure of the shoulder, or from possessing a collar-bone, however imperfect. Although the clavicle is perfect in man, thereby corresponding with the extent and freedom of the motion of his hand, it is strongest and longest, comparatively, in the animals which dig or fly, as in the Mole and the Bat."

It follows from these observations, that animals possessing a clavicle, and thus having the power of hugging, are unable to bear a severe shock on their fore-limbs without running the risk of fracturing the collar-bone. "If we observe the bones of the anterior extremity of the horse," continues the same eminent anatomist, "we shall see that the scapula is oblique to the chest; the humerus oblique to the scapula; and the bones of the fore-arm at an angle with the humerus. Were these bones connected together in a straight line, end to end, the shock of alighting would be conveyed through a solid column, and the bones of the foot, or the joints, would suffer from the concussion. When the rider is thrown forwards on his hands, and more certainly when he is pitched on his shoulder, the collar-bone is broken, because in man this bone forms a link of connection between the shoulder and the trunk, so as to receive the whole shock; and the same would happen in the horse, the stag, and all quadrupeds of great strength and swiftness, were not the scapulae sustained by muscles, and not by bone, and did not the bones recoil and fold up."

The varieties of form observed in the clavicles are very great. In the Two-toed Sloth they have the form of a rib; in the Mole they are nearly cubical. The clavicles are very long in the Bat, but in the Quadrumana they greatly resemble the same bone in Man. The clavicle is not found in the Cetacea, Ruminantia, or Solipeda, and generally it is deficient in all long-legged quadrupeds, having a keel-shaped chest.

The anterior extremity of the Mammalia is continued by an arm, a fore-arm, and a hand.

The Arm-bone, or Humerus, varies considerably in the elevation of its processes, and in its length and breadth. In quadrupeds, the Humerus is much shorter comparatively than in the human subject. It was this circumstance which has led the ancient anatomists, and persons ignorant of Comparative Anatomy, to consider quadrupeds as having the elbow turned forwards. That part which is usually considered the knee of a Horse, corresponds to the human wrist, the arm-bone being concealed within the muscles of the shoulder. The Humerus is very long in the Bat, but very short and thick in the Mole.

The human fore-arm is composed of two distinct bones, the Ulna and the Radius; the former swings with a hinge-like motion upon the elbow, and the latter gives the wrist and hand a rotatory motion. Accordingly, in all animals which use their fore-arms, like Man, for other purposes than walking, both of these bones are distinctly developed; but, in the true quadrupeds the Ulna diminishes in size, is altogether absent, or becomes a mere appendage to the Radius, which is then the principal bone of the fore-arm. In cattle, the Ulna is immovably united to the Radius throughout its entire length, becomes finally ossified, and may then be considered but as a single bone. They thus form a perfect hinge-like joint, which does not admit of any rotatory motion, and having the pulley placed on the end of the Humerus. These quadrupeds have therefore their anterior extremities always in a state of pronation, that is, the back of the wrist is always turned upwards.

The general arrangement of the bones in the anterior limbs, though the same throughout the entire class, yet changes surprisingly in its details with the different orders and genera. In the Bat the radius is nearly deficient, being reduced merely to a slender and sharp-pointed rudiment. Its thumb is short, and furnished with a hooked nail, while the phalanges of the four fingers have no nails, but are extremely long and thin, almost like the spines of a fish, while the membranous, or wing-like expansion, is extended upon them. Again, in the Mole, we see a striking difference in the form of the anterior extremity. The bone of its fore-arm is thin in the middle, but surprisingly expanded at either extremity; and a peculiar bone, called the *falci-form bone*, is found at the extremity of the radius. Its paw is shaped like a shovel, the phalanges of the fingers are supplied with *sesamoid* bones and numerous processes, which increase the angle of insertion for the tendons, and facilitate the great muscular motion required by this little animal. The Flying Squirrel possesses a peculiar arrangement for enabling it to spring from great heights. This consists in a sharp-pointed bone at the outer edge of its Wrist, connected to that part by means of two smaller round bones.

In general, the Radius forms the principal bone in the fore-arm of the Mammalia, while the Ulna is a slender and small bone, which is frequently consolidated with the radius, and terminates in a point before reaching the wrist. There are only a few genera which possess the power of rotating the wrist freely, so as at one time to present the palm of the hand downwards (*pronation*), and at another time the palm of the hand upwards (*supination*). This power diminishes in proportion as the fore extremities are used for progression, and for supporting the body in standing. While in these positions, the fore extremity is always in a state of pronation. The radius and ulna are flattened in the Cetacea and Seal; and in the Elephant the lower extremity of the ulna is larger than that of the radius, a conformation which is peculiar to that animal.

The Hand is formed of two rows of bones called the Carpus or Wrist; of one row called Metacarpus; and of Fingers, each composed of two or three bones, called Phalanges.

The forms of the wrist and remote extremities vary with the delicacy of the organs of touch. It is only in few genera that a Hand, properly so called, is found; but when it exists it is always much less complete, and therefore less useful than that of Man. The mechanism of the human hand is exceedingly curious, and admirably adapted for the various purposes of life. Anaxagoras is said to have maintained that Man owes all his wisdom and superiority over the other animals to the use of the hand; but Galen's view of the matter was rather more philosophical. According to him, Man is not the wisest creature because he has hands; but he had hands given him because he was the wisest creature, for it was not hands that taught him the arts, but Reason. The great superiority of the human hand over that of any other animal, arises from the circumstance that his thumb is of a great size and strength, and can be brought in opposition to the fingers. It thus gives him the power of holding whatever he seizes; and were it not for the thumb, various arts and manufactures of civilized life would either remain unexecuted, or would require the awkward concurrence of both hands. Albinus calls the thumb a second hand. "*Manus parva majori adjutrix.*" The want of the thumb, and the absence of fingers of any great length, compel the Squirrel, Rat, and Opossum, to hold objects in both paws. The Cat and Dog, which are obliged to use their fore-paws for progression, only hold objects by fixing them on the ground. The Solipeda and Ruminantia cannot hold objects at all. On comparing the hand of the Apes with that of Man, which it most resembles, we cannot fail to remark the smallness of their thumbs in proportion to the length of the fingers. These are slender and very long, while the thumb is weak, small, and short. In the Cercopitheci, the thumb is concealed under the integuments, and their mode of seizing food and bringing it to the mouth differs but slightly from that employed by the Squirrel. The fore-foot of the Horse is terminated by a single bone, called the coffin bone, corresponding in some degree to the third phalanx of the human finger, as the pastern, to which it is united, is analogous to the first phalanx. There are also two short and immoveable bones placed behind and on each side of the coffin bone, called splint bones.

If we except the Cetacea, all the Mammalia have the first part of their hinder extremity attached to the spine, and formed into a Pelvis or Basin, which, during youth, is formed of three pairs of Bones, the Ilium, attached to the Spine; the Pubis, which forms the anterior; and the Ischium, forming the hinder part of the Pelvis.

All these bones are generally more narrow and elongated in the quadrupeds than in Man. In no instance do they form a basin like the human Pelvis; while frequently the distinction between the large and small Pelvis does not exist, and the cavity often looks obliquely upwards, towards the Spine. One class of Mammalia, possessing abdominal pouches, have two small Marsupial bones placed on the anterior part of the Pubis. These are of a flat and elongated form, and serve to support the abdominal pouch of the female; yet in some species they are also found in the male.

At the point of union among the three bones of the Pelvis, is placed the cavity, to which the Thigh-bone or Femur is articulated. To this last bone is attached the Leg, composed of two bones, the Tibia or Shin-bone, and the Fibula.

The Femur is remarkably short in quadrupeds having a long Metatarsus, as in the Horse, and in common cattle; and the bone is so enveloped with muscles, that the part usually called the thigh is really the leg. The Fibula, in many quadrupeds, bears a striking analogy to the Ulna of the fore-arm, from its declining in size, and becoming united, by *anchylosis*, with the Tibia, or else appearing merely in a rudimental form.

This extremity of the Mammalia terminates in a Foot composed of parts analogous to those of the hand, namely, a Tarsus, Metatarsus, and Toes.

These bones are altogether wanting in the Whale, Dolphin, and other Sea Beasts. They have no pelvis, properly so called, as the Ischia are absent; yet we find two small isolated bones which may be compared to the ordinary Pubis.

The head of the Mammalia is always articulated by two condyles upon their atlas or first vertebra.

This name of *Atlas* is assigned to the first vertebra, because it sustains the globe of the head. The second vertebra is called the *Dentata*, or *Axis*, because it has a tooth-like process, or axis upon which the first turns. "I challenge any man," says Dr Paley, "to produce in the joints and pivots of the most complicated or the most flexible machine that was ever contrived, a construction more artificial, or more evidently artificial, than that which is seen in the vertebrae of the Human neck. Two things were to be done. The head was to have the power of bending forward and backward, as in the act of nodding, stooping, looking upwards or downwards, and at the same time, of turning itself round upon the body to a certain extent, the quadrant,

we will say, or rather perhaps a hundred and twenty degrees of a circle. For these two purposes, two distinct contrivances are employed: First, the head rests immediately upon the uppermost of the vertebrae, and is united to it by a *hinge-joint*, upon which joint the head plays freely forward and backward, as far either way as is necessary, or as the ligaments allow, which was the first thing required. But then the rotatory motion is unprovided for. Therefore, secondly, to make the head capable of this, a further mechanism is introduced—not between the head and the uppermost bone of the neck, where the hinge is, but between that bone and the bone next underneath it. It is a mechanism resembling a *tenon* and *mortice*. The second, or uppermost bone but one, has what anatomists call a process, viz. a projection somewhat similar, in size and shape, to a tooth; which tooth, entering a corresponding hole or socket in the bone above it, forms a pivot, or axle, upon which that upper bone, together with the head which it supports, turns freely in a circle, and as far in the circle as the attached muscles permit the head to turn. Thus are both motions perfect without interfering with each other. When we nod the head, we use the hinge-joint, which lies between the head and the first bone of the neck. When we turn the head round, we use the tenon and mortice, which runs between the first bone of the neck and the second. We may add, that it was on another account also expedient that the motion of the head, backward and forward, should be performed upon the upper surface of the first vertebra; for, if the first vertebra itself had bent forward, it would have brought the spinal marrow, at the very beginning of its course, upon the point of the tooth."

The Brain of the Mammalia is always composed of two hemispheres, united by a medullary layer called the Callous body (*Corpus Callosum*), inclosing two ventricles, and enveloping the four pairs of Tubercles, or eminences called the Striated Bodies (*Corpora Striata*), the Beds of the Optic Nerves (*Thalami Nervorum Opticorum*), the Nates, and the Testes. Between the Beds of the Optic Nerve is placed the third ventricle, which communicates with the fourth, situate under the Cerebellum. The crura of the Cerebellum always form, under the *Medulla Oblongata*, a transverse eminence called the Bridge of Varolius (*Pons Varolii*).

The Brain in the Monkey tribe is rather flatter in the superior surface of its hemispheres than in Man; but in Quadrupeds it is very considerably fatter. In the Dolphin, and other Sea-Beasts, the Brain has a different shape from that of the other Mammalia, being rounded in every part, while its greatest diameter is across. There are no olfactory nerves in the cetaceous animals, while those of quadrupeds are of an enormous size, especially in the larger herbivorous tribes.

The proportion which the size of the Brain bears to that of the entire Body, varies greatly for different Mammalia. Even in the same individual it will change with the degree of fatness, or with the age of the animal. As these circumstances cannot be supposed to affect the powers of the mind very materially, we may naturally inquire how the relative size of the brain, and of the entire body, can be assumed as the measure of intelligence in an animal. To enable the student to form his own conclusions on this subject, we annex the following TABLE, showing the proportion that the size of the whole body bears to that of the Brain in several animals:—

The Squirrel Monkey (<i>Callithrix sciureus</i>),	as 22 to 1
Capuehin Monkey (<i>Cebus capuehinus</i>),	25 ... 1
Striated Monkey (<i>Jacchus vulgaris</i>),	28 ... 1
Field Mouse (<i>Arvicola vulgaris</i>),	31 ... 1
MAN, according as he is young or old,	as 22, 25, 30, and 36 ... 1
The Mole (<i>Talpa Europæa</i>),	as 35 ... 1
Coaita Monkey (<i>Ateles paniscus</i>),	41 ... 1
Mouse (<i>Mus musculus</i>),	43 ... 1
Varied Monkey (<i>Cercopitheus mona</i>),	44 ... 1
Gibbon (<i>Hilobates lar</i>),	48 ... 1
Collared Mangabey Monkey (<i>Cercopitheus Æthiops</i>),	48 ... 1
Rat (<i>Mus decumanus</i>),	76 ... 1
Ruffed Lemur (<i>Lemur Macaco</i>),	84 ... 1
Porpoise (<i>Delphinus phocæna</i>),	93 ... 1
Great Bat (<i>Vespertilio Noctula</i>),	96 ... 1
Dolphin (<i>Delphinus delphis</i>),	as 25, 36, 66, and 102 ... 1
Great Baboon (<i>Papio Maimon</i>),	as 104 ... 1
Barbary Ape (<i>Inuus magotus</i>),	105 ... 1
Ferret (<i>Mustela furo</i>),	138 ... 1
Rabbit (<i>Lepus cuniculus</i>),	as 140, and 152 ... 1
Cat (<i>Felis catus</i>),	as 82, 94, and 156 ... 1
Hedgehog (<i>Erinaceus Europæus</i>),	as 168 ... 1
Fox (<i>Canis vulpes</i>),	205 ... 1
Calf (<i>Bos taurus junior</i>),	219 ... 1
Hare (<i>Lepus timidus</i>),	228 ... 1
Wolf (<i>Canis lupus</i>),	230 ... 1
Pantler (<i>Felis panlus</i>),	247 ... 1
Ass (<i>Equus asinus</i>),	254 ... 1
Bear (<i>Ursus arctos</i>),	265 ... 1
Beaver (<i>Castor fiber</i>),	290 ... 1
Sheep (<i>Ovis aries</i>),	as 192, and 351 ... 1
Marten (<i>Fivera martes</i>),	as 365 ... 1
Dog (<i>Canis familiaris</i>),	as 47, 50, 57, 154, 161, and 365 ... 1
Horse (<i>Equus caballus</i>),	as 400 ... 1
Domestic Hog (<i>Sus seropha</i>),	412 ... 1
Elephant (<i>Elephas Indicus</i>),	500 ... 1
Wild Bear (<i>Sus seropha</i>),	672 ... 1
Ox (<i>Bos taurus</i>),	860 ... 1

From the above Table it would appear that the Brain is proportionably largest in the smaller animals. Man is surpassed in this respect only by a small number of

Mammalia, and these are lean and meagre. The Rodentia generally possess the largest proportional Brain, and the Pachydermata the smallest. It is very difficult, if not impossible, to arrive at these results with any great degree of accuracy, because the weight of the brain generally remains the same, while that of the body will vary considerably according as an animal is lean or fat.

The proportion which the Cerebrum bears to the Cerebellum is, in

The Squirrel Monkey (<i>Callithrix sciureus</i>),	as	14 to 1
Man,	9	1
The Ox (<i>Bos taurus</i>),	9	1
Dog (<i>Canis familiaris</i>),	8	1
Wild Boar (<i>Sus scropha</i>),	7	1
Horse (<i>Equus caballus</i>),	7	1
Cat (<i>Felis catus</i>),	6	1
Hare (<i>Lepus timidus</i>),	6	1
Sheep (<i>Ovis aries</i>),	5	1
Mouse (<i>Mus musculus</i>),	2	1

"It is a common opinion," observes Dr Herbert Mayo, "that the front of the brain is the seat of the intellectual faculties; yet in Monkeys and in Man the back part of the brain is that which has the largest relative size. The sheep, on the other hand, has an ample front to its brain, a large intellectual region, according to the phrenological theory, while its instinct of attachment to its young has a poor locality in its moderate posterior cerebral lobe. Has nothing then been discovered to mark an essential superiority in the brain of Man? The question must, I believe, be answered in the negative. No physical condition, distinguishing the human brain from that of animals, and therefore fitting it to co-operate with a rational soul, has as yet been ascertained, or even plausibly conjectured to exist."

Physiologists have been led, in all ages, by that marked superiority of mental power which Man possesses above the other animals, to seek in the structure of their brains for some corresponding difference. It was long supposed that Man has the largest brain in comparison to his body; but the above Tables show that he is surpassed by several Quadrumana, and by the Mouse.

There is another point of comparison which seems to approach nearer to their actual comparative intelligence, which was first proposed by Sömmering. By comparing the quantity of the brain with that of the nerves arising from it, we ascertain more accurately the degree in which its purer intelligence exceeds its mere animal nature. "Let us divide the brain into two parts; that which is immediately connected with the sensorial extremities of the nerves, which receives the impressions, and is therefore devoted to the purposes of animal existence. The second division will include the rest of the brain, which may be considered as connecting the functions of the nerves with the faculties of the mind. In proportion, then, as any animal possesses a larger share of the latter and more noble part—that is, in proportion as the organ of reflexion exceeds that of the external senses—may we expect to find the powers of the mind more vigorous and more clearly developed. In this point of view Man is decidedly pre-eminent; here he excels all other animals which have hitherto been investigated." Sömmering found that the brain of Man never weighed less than 2 lb. 5½ oz., while that of the Horse never exceeded 1 lb. 4 oz. in weight. But the nerves arising from the brain of the Horse were at least ten times larger than those in Man.

However ingenious this theory may be, it is not found to hold good in every instance; and even if proved, it would still leave the nature of the union between Mind and Matter as mysterious and as incomprehensible as ever.

The nerves of the Mammalia bear a striking resemblance in their disposition to those of Man, with the exception of the olfactory nerves, which are large and hollow processes of the anterior lobes of the cerebrum, the cavities of which communicate with the lateral ventricles of the brain.

Their eyes, invariably placed in their orbits, and preserved by two eyelids and the vestige of a third, have their crystalline humour preserved by the ciliary process, and sclerotic coat, composed of simple cellular substance.

The eye-ball of Man is nearly globular, and about one inch in diameter. It is defended externally by a white opaque membrane, having the density of tanned leather, called the *Sclerotica*, which surrounds every part, excepting the small circular portion in front called the *Cornea*, and a small perforation behind to admit the optic nerve into the brain. The *Cornea* is perfectly transparent and possesses great sensibility; yet at the same time it is so tough, as to offer a powerful resistance to external injury. Within the *Cornea*, and immediately in contact with it, is placed a small quantity of pellucid fluid called the *Aqueous* humour, which occupies the external visible portion of the Eye. The *Iris* is situated behind the *Cornea* and the *Aqueous* humour. It consists of a circular membrane, perforated by a small hole in the centre called the *Pupil*. The colour of the Eye resides in this membrane, and both its structure and functions are very remarkable. It is formed of two layers of fibres; in the one, they are arranged like rays from the inner to the outer margin; and in the other, they form concentric circles. By the action of the radiated fibres, the pupil is contracted; but it is dilated by the action of the circular fibres. These delicate motions are executed in a manner which human ingenuity in vain attempts to equal. The pupil instantly contracts when exposed to a strong light; but when the light is deficient, it dilates readily, in order to admit as great a number of rays as possible. Behind the pupil, a fluid in the shape of a double convex lens is placed, called the *Crystalline* humour, formed of denser materials than any other liquid in the human Eye. The remaining portion is filled up with the *Vitreous* humour, which is the most plentiful of all its fluids. The inside of the *Sclerotica* being lined with a coloured viscid secretion called *Pigmentum nigrum*, or black Pigment, and the inner surface of the *Iris*, with a dark brown pigment, any scattered rays of light which would otherwise render vision obscure are intercepted. These pigments are therefore of the same utility with the black paint which lines the interior of telescopes and other

optical instruments. The Retina, or expanded extremity of the optic nerve, is the immediate seat of sensation. Upon this delicate membrane, an inverted picture of the external scene is exactly delineated; and though scarcely half an inch in diameter, it contains the forms, positions, and colours of the most distant objects, without confusion or irregularity.

The black pigment of the Eye is wanting in that variety of the Human race called Albinos, and this deficiency is connected with the want of colouring principle in the hair. The Rabbit, Mouse, and Horse, are sometimes found to possess this peculiarity when they are said to be *glass-eyed*. They are capable of transmitting it to their posterity, and thus forming a breed of white animals. The Ferret's eye is naturally destitute of the black pigment.

The immediate object of vision is colour, and to this alone its function was originally confined. By habit and by comparison with the other senses, but especially with that of touch, it acquires new powers; and the coloured canvas of original perception is embodied into a real scene, in which the distance, magnitude, and figures of objects may be, in general, instantaneously discovered. This remarkable fact was fully established by Mr Cheselden, who couched the eyes of a young gentleman born blind, and ascertained the effects produced on the mind by the first exercise of the power of vision.

By certain exquisite contrivances, the Eye is so constructed as to correct the defects which Opticians experience in their own artificial instruments. But the consideration of the Spherical, Parabolic, and Chromatic Aberrations of light, belongs more properly to the science of Optics.

In the Mammalia, the eye is composed of the same coats and humours as in Man, being only slightly modified and adapted to surrounding circumstances. The eyes of the Cetaceous tribes more nearly resemble those of Fishes, as they are flattened on the anterior side, and adapted to the dense medium in which they reside. By the exquisite arrangement of the sclerotic coat and cornea in the Seal tribe, these animals are able to adapt their vision to the two different media of air and water; and they are enabled to shorten or elongate the axis of the eye according to circumstances. The eye of the *Mus typhlus*, or Blind Rat, is not larger than a poppy seed, and is altogether covered with hair, so that the animal can scarcely perceive the difference between light and darkness. The eyes of the Mole are so minute that most persons imagine them to be entirely absent. The pigment at the back of the eye receives the name of the *Tapetum lucidum*; it is of different colours in different animals.

In the Monkey it is	dark-coloured.
Ox,	green.
Sheep,	pale yellow.
Rabbit, Hare, and Hog,	brown.
Lion, Bear, Cat, and Dolphin,	pale golden yellow.
Dog, Wolf, and Badger,	pure white, fringed with blue.
Horse, Goat, Stag, and Buffalo,	silvery blue, changing to violet.

It has been supposed that the *Tapetum* enables these animals to see more distinctly in the dark.

In the Ear a cavity is always found called the Tympanum or Ear-drum, which communicates with the hinder part of the mouth by a canal called the Eustachian tube. This cavity is closed externally by a membrane, termed the *membrana tympani*, and contains within it a chain of four bones, called the *Malleus*, or Hammer Bone; the *Incus*, or Anvil; the *Os Orbiculare*, or Lenticular Bone; and the *Stapes*, or Stirrup. The *Stapes* rests upon a vestibulum or central porch, which leads on the one side to three semi-circular canals, and on the other to a Cochlea, or spiral canal, which communicates by one extremity with the vestibulum, and by the other with the Tympanum.

The Vestibule, Cochlea, and semi-circular canals, collectively form the *Labyrinth*. This is the essential part of the organ; and no obstruction or removal of the external parts can altogether destroy the sense of hearing as long as the *Labyrinth* remains uninjured. The precise uses of these several parts are not yet fully understood.

The Mammalia do not appear to be capable of distinguishing musical sounds with that nicety, or of deriving that extent of enjoyment which has been bestowed on Man. The Dog may be trained to distinguish one particular tune from another; but the extent of his pleasure or acquirements seems greatly limited. But Man, besides being able to perceive differences between acute and grave tones, is capable of distinguishing four or five hundred varieties in their quality and intensity. A flute, hautboy, and violincello may all sound the same note, and yet the peculiar quality of each may be readily perceived. An attentive ear will observe some differences although twenty human voices sound the same note, and with equal strength; nay, even the same voice may be varied in many ways, by sickness or health, youth or age, leanness or fatness, good or bad humour; and the same words spoken by foreigners and natives, or even by the inhabitants of different provinces in the same nation, will be readily distinguished.

To ascertain the effect of the high and low notes of the piano-forte upon the Elephant and Lion, Sir Everard Home procured one of Broadwood's piano-fortes to make the experiment at the Menagerie in Exeter Change, London. The Elephant was first tried. His attention was scarcely attracted by the high notes; but when the low ones were played, he brought his broad ears forward, remained evidently listening, and made use of sounds rather expressive of satisfaction than otherwise. The full sound of the French horn produced the same effect. But the Lion was much more forcibly affected. When the high notes were played he remained silent and motionless, but listening with deep attention. No sooner, however, were the low notes sounded than he sprang up, endeavoured to break loose, lashed his tail, and appeared to be enraged and furious, so much so, as to alarm the female spectators. This was accompanied with the deepest yells, which ceased with the music.

The Cranium, or skull of the Mammalia, may be subdivided into

three compartments; the anterior portion, containing the two frontal bones and the Æthmoid; the central portion, being the Parietal bones and the Sphenoid; and the hinder portion, being the occipital Bone. Among the occipital, the two parietal, and the sphenoid, are interposed the Temporal bones, of which one portion properly belongs to the face.

The bones found in the skulls of the Mammalia frequently differ in number from those of Man. In some, the sutures which are always observable in the human Cranium are obliterated at an early period of life, and two, three, or more bones, are consolidated into one. In other species, some bones which become consolidated into one in Man, remain during their entire lives as separate pieces. In the Elephant, all the sutures of the skull soon become united into one solid piece.

The occipital bone is divided into four portions, during the first or Fœtal period of life. The body of the sphenoid bone is then composed of two middle parts, which are themselves subdivided, so as to form three pairs of lateral wings. The temporal bone is composed of three portions; one of these serves to complete the Cranium; another to close the labyrinth of the Ear; while the third forms the walls or parietes of the Ear-drum. These bony portions are multiplied to a still greater extent in the first age of the Embryo; they coalesce more or less rapidly according to the species; and the bones themselves finally unite into one in the adult animal.

The face in the Mammalia is essentially formed by the two maxillary bones, between which passes the canal of the nostrils. In front of them are placed the two intermaxillary bones, and behind the two palate bones; between them descends the single projecting plate of the æthmoid bone, called the *vozer*, and upon the entrances to the nasal canal are situate the bones distinguished by the proper term *nasal*. To the external parts of its entrance are found the inferior turbinated bones; the superior turbinated bones, on the contrary, belong to the æthmoid bone, and are placed behind and above.

To this complicated arrangement of the bones of the nose in the Mammalia, these animals owe their superiority over man in receiving impressions of odoriferous effluvia. The inferior and superior turbinated bones are greatly subdivided and convoluted. The obvious design of this arrangement, is to extend the surface of the pituitary membrane which is spread over them; and the extent of this surface is always found to bear a constant relation to the acuteness of the sense of smell.

The frontal sinuses, and in general the sinuses of all the bones in the neighbourhood of the nasal cavity, are very large, which has led several eminent physiologists to consider them as subservient to the organ of smelling; others consider these cavities to be merely reservoirs for containing a watery fluid, which lubricates the parts where this sense more especially resides.

The Cetaceous tribes do not possess the sense of smell, nor have they any organ which appears capable of exercising it. The two canals which correspond to the nostrils are used by the Whale tribes for transmitting air to and from the lungs. They do not respire through the mouth, and the nostrils are placed on the top of the head. By this arrangement they can swallow their food and keep the mouth in water, without interrupting their respiration.

The Jugal, or cheek-bone, unites the maxillary to the temporal bone, and often to the frontal. The lachrymal bone occupies the internal angle of the orbit, and sometimes a part of the cheek. In the embryo, all these subdivisions are much more numerous. The tongue in the Mammalia is always fleshy, and attached to the hyoid bone (*os hyoides*); it is composed of several pieces, and suspended to the cranium by ligaments.

It is generally supposed that the sense of taste resides exclusively in the tongue; but this is not strictly correct. Some substances will excite particular tastes on passing over the inside of the lips and fauces. Blumenbach mentions that he had seen a man, in other respects well formed, who was born without a tongue; yet he could distinguish very readily the tastes of solutions of salt, sugar, and aloes, when rubbed on his palate, and would express the taste of each in writing. The tongue of the other Mammalia differs always from that of Man. In the Monkey tribes it is longer and thinner. The entire Cat genus have horny integuments surrounding the conical papillæ, which are on the middle of the tongue. These are small hooks or claws, sharp-pointed, and inflected backwards; so that when any of the larger animals of this genus employ the tongue in licking the human hand, they tear off the skin.

There does not appear to be any conical papillæ on the tongues of the Cetacea. Cuvier was unable to discover them, even with a glass, upon the tongues of the Dolphin and Porpoise; and John Hunter compared the tongue of the large Whales to a feather-bed. The worm (*lytta*) of the dog's tongue is a tendinous bundle of fibres, running length-wise under the tongue. Casserius thought that it assisted dogs in lapping up fluids. We need scarcely observe that the practice of cutting out the worm as a preventive of Hydrophobia, though sanctioned by Pliny, is an old prejudice long since exploded. The Edentata, such as the Ant-eater and Manis, possess a long worm-like tongue, which is apparently used for no other purpose than for taking up the food.

Their Lungs, two in number, are divided into lobes, composed of an infinite number of small cells; they are always inclosed loosely in a cavity formed by the ribs and the diaphragm, and lined by the pleura.

The number of lobes in the lungs often varies in individuals of the same species, but in general they are more numerous than in the human species. A duo proportion

is always observed between the size of the lungs and that of the animal, although the external form of the chest would lead an observer to arrive at an opposite conclusion. The convexity of the diaphragm is not considerable, and the thorax is proportionately wide in species having a short chest; but, when the thorax is long, the diaphragm projects far into the chest, and the thorax is narrowed. Thus, in the rhinoceros, elephant, and horse, the diaphragm passes up into the thorax, and permits the viscera to lie within the margin of the ribs.

The Mammalia respire in a manner exactly resembling Man. Atmospheric air rushes into the cells of the lungs through the windpipe the instant after birth; it is expelled and replaced by fresh air, and the action continues as long as life remains. Although the muscles which enlarge the chest were to act with unlimited force, no air could enter the lungs at each attempt at inspiration, if they were of a firm and inelastic texture. A vacuum would, on the contrary, be formed between the pleura pulmonalis or external covering of the lungs, and the pleura costalis or internal lining of the ribs. But the lungs are highly elastic and free in their motion, so that atmospheric air rushes into and dilates the cells, exactly in proportion to the expansion of the area of the chest. When any cause prevents the air from rushing into the lungs, death by suffocation or *asphyxia* is occasioned. On examination, the lungs are found collapsed, as during expiration; the right cavities of the heart, and the veins leading to them, are filled with dark blood, while the left cavities of the heart and the arteries are nearly empty. In animals of the first class, which are hanged, death is occasioned by strangulation, and not by apoplexy, as is frequently supposed. This was proved by Gregory, who opened the windpipe of a dog, and passed a noose round his neck above the wound. The animal, when hanged, continued to live, and to breathe through the small aperture; but he died when the rope was attached below the wound. M. Richerand asserts that a respectable surgeon in the Austrian army had informed him that he once saved the life of a soldier by performing the operation of opening the windpipe, a few hours before his execution. The soldier, feigning to be dead, was cut down, delivered over to the surgeon for anatomization, and thus finally escaped.

The glottis through which the external air rushes into the lungs, is so small that it may be readily obstructed when the epiglottis rises during the act of swallowing, and the substance swallowed may stop up the mouth of the larynx. Anacreon, the celebrated poet, was in this manner suffocated by a grape seed, and Gilbert, also a poet, met his death in a similar manner.

The organ of voice, in the Mammalia, is always at the superior extremity of the Trachea or windpipe;—a fleshy prolongation, called the *velum palati* or *palate-curtain*, establishes a direct communication between the Larynx and the back part of the nostrils.

“The human voice,” says Sir Charles Bell, “commences in the Larynx, but reverberates downwards into the Trachea, and even into the chest, whilst it may be directed with different effects into the cavities of the head, mouth, and throat. The organ of voice is neither, strictly speaking, a stringed instrument, nor a drum, nor a pipe, nor a horn, but it is all these together; and we will not be surprised at this complication; if we consider that the human voice is capable of every possible sound,—that it can imitate the voice of every beast and bird,—that it is more perfect than any musical instrument hitherto invented;—and, in addition to every variety of musical note, it is capable of all combinations, in articulate language, to be heard in the different nations of the earth. The essential and primary parts of the organ are the *vocal cords*, or thyro-arytenoid ligaments. The membrane lining the larynx is reflected over these ligaments, so as to be drawn by them in their motions; and this is what is meant when it is said the organ is like a drum, for these membranes must vibrate in the air. The muscles of the arytenoid cartilages draw tight the vocal cords and their attached membranes, and thus give them a certain tension; and the air being expelled forcibly from the chest at the same time, they cause a vibration of these ligaments and membranes. This vibration is communicated to the stream of air, and sound is produced. This sound may reverberate along all the passages from the lungs to the nostrils; but unless there be a certain vibration in these cords of the larynx, there is no vocalization of the breath. For example, a man in whispering articulates the sounds of the mere breath, without the breath being vocalized and made audible by the vibrations in the larynx. In singing, the vocalized breath is given out uninterruptedly through the passages, the rising notes in the gamut being produced, first, by the narrowing of the glottis, and secondly, by the rising of the larynx towards the base of the skull. In the graver notes, the larynx is drawn down, and the lips protruded; and in the higher notes the larynx is elevated to the utmost and the lips retracted.” The various sounds emitted by different animals, to which we assign the terms roar, bray, howl, purr, scream, whistle, bark, grunt, snort, and hiss, are all caused by peculiarities in the construction of their vocal organs, which will be explained hereafter.

As the Mammalia [generally] reside on the surface of the earth, where they are exposed to moderate variations of temperature, their covering of hair is but moderately thick; and in many of the animals inhabiting warm countries this integument is generally deficient. The Cetacea, which live entirely in the water, are, however, the only species wherein it is altogether wanting.

The abdominal cavity of the Mammalia is hung round with a membrane called the Peritoneum, and their intestinal canal is suspended to a fold of this peritoneum, called the Mesentery, containing numerous conglobated glands, in which the lacteal vessels are ramified. Another production of the peritoneum, called the Epiploon, hangs before and beneath the Intestines.

The uses of these several parts are precisely the same in the other Mammalia as in Man; but their form and extent depend upon the convolutions and length of the intestinal canal; and therefore its reflexions, which form the omentum and the

envelopes of the intestinal canal differ greatly among the several quadrupeds. There are lateral omenta in some of the quadrupods, which hibernate, such as the Polish and Alpine Marmots, in addition to the usual omenta of other quadrupeds. They arise from the loins, cover the sides of the abdomen, and advance nearly to its centre. These processes of the Peritoneum become loaded with fat, about the period that the animals remain torpid, and the fat is entirely expended during the time of their hibernation. The use of these lateral omenta is sufficiently obvious; yet it is very singular that other species which sleep during the winter, and are nearly allied to those just mentioned, such as the Garden Dormouse (*Myoxus nitela*) and the common Dormouse (*Myoxus avellanarius*) are destitute of them.

L'urine, retenue pendant quelque temps dans une vessie, sort, dans les deux sexes, à un très petit nombre d'exceptions près, par les orifices de la génération.

In all the Mammalia [with the sole exception of the Monotremata] the generation is essentially viviparous. Immediately after conception, the fœtus descends into the Womb, surrounded with its membranes, of which the exterior is called the *chorion*, and the interior *amnios*. It is fixed to the sides of this cavity by one or more folds of vessels called the *placenta*, which establish the communication with the mother, from whom it derives its nourishment, and probably also its oxygenation. In the earlier periods of gestation, the fœtus of the Mammalia possesses a small vessel, analogous to that which contains the yolk of the Oviparous animals, and receiving supplies from the vessels of the mesentery in a similar manner.

Ils ont aussi une autre vessie extérieure, que l'on a nommée allantoïde, et qui communique avec celle de l'urine, par un canal appelé l'ouraue.

La conception exige toujours un accouplement effectif, où le sperme du mâle soit lancé dans la matrice de la femelle.

The young are nourished for some time after their birth by MILK, a fluid peculiar to this class, and produced by MAMMÆ, or Breasts. This secretion commences at the moment of birth, and continues as long afterwards as the young may require. It is from these Mamme that the class has obtained its name of MAMMIFÈRES, or MAMMALIA. This being a characteristic peculiar to the animals composing this class, serves to distinguish them more precisely from the remaining classes than any other external character. It remains, however, still doubtful whether the Monotremata possess mamme or not.

Meckel could find no traces of Mamme in the male Ornithorynchus, but thought he perceived them in the female. "I detected, on the right side of the abdominal muscles," he observes, "a small round mass, which at first bore the appearance of a portion of intestine accidentally pushed into this situation. I was satisfied that this gland was a true Mamme, an opinion which was more forcibly impressed upon my mind from its structure and situation, from its marked development in the female, and the want of it in the male, or at least its existence in so minute a degree as to have hitherto eluded the closest examination." Oken and De Blainville asserted, *à priori*, and without having ever examined a female Ornithorynchus, that its Mamme must exist, and would no doubt be discovered hereafter, on account of the very numerous analogies which this animal presents to the other Mammalia. Sir Everard Home describes the Mamme of the Ornithorynchus in the Philosophical Transactions for 1802.

On the other hand, M. Geoffroy considers that these organs are not real Mamme, but are analogous only to the lateral glands of the Muscardin (*Myoxus avellanarius*.) Again, the Ornithorynchus is either oviparous or ovo-viviparous, which properties are always connected with the absence of Mamme, and its bill evidently appears unfitted for sucking; so that, upon the whole, it must still be considered as doubtful whether these organs really perform the functions of Mamme.

Although the Mamme are always found, with the above exception, in the females, yet the males of many species are destitute of them, as the Hamster (*Cricetus vulgaris*), and the *Lenur mongoz*, while in some others, as the Horse, they are found in an unusual situation. The Mamme are frequently less numerous in the male than in the female. Milk has often been secreted in the breasts of Men, as well as of other male animals, such as the Goat, Ox, Dog, Cat, and Hare. Blumenbach describes a he-goat which it was necessary to milk every other day for the space of a year. It is very common to find milk in the breasts of newly-born children of both sexes; and the same circumstance has likewise been observed in the calf and foal.

In the Cetacea and Marsupialia the Mamme do not project so as to form udders or breasts, but they lie flat under the skin. In general the Mamme are very observable only during the period of suckling, at which time they are largely distended with milk, except in those animals having them placed upon the chest, when they possess that graceful and delicate form observable in the human female of the Caucasian race during the bloom of youth. It is very difficult to discover them in the Marsupial animals, except at the period when the young are actually contained in the abdominal pouch of the female. The number, as well as the position of the Mamme, varies greatly in different animals. It would appear that there are frequently twice as many teats as the number of young usually produced by each animal. Yet this rule is not without several exceptions, among which may be included the Guinea-pig (*Cavia cobaya*), and the Domestic Sow. Indeed it is among the domesticated races that these exceptions are chiefly found. Thus, according to Buffon, the mammae of the Sow vary from ten to twelve; of the Cow from four to six; of the Rat from eight to ten. The Mare and Ewe may have from two to four, while the Ferret sometimes has three on the right side, and four on the left. From these examples we may readily perceive that no fixed law is observed in the number of the mamme.

DIVISION OF THE CLASS MAMMALIA INTO NINE ORDERS.

1. *Bimana*—2. *Quadrumanæ*—3. *Carnassiers*—4. *Rodentia*—5. *Edentata*—6. *Marsupialia*—7. *Pachydermata*—8. *Ruminantia*—9. *Cetacea*.

THOSE variable characters, which establish the essential differences of the Mammalia among themselves, are derived jointly from the organs of touch and from those of mastication. The forms of the hands or feet chiefly determine the degree of their agility and dexterity, while those of their teeth not only correspond to the nature of their aliments, but draw along with them innumerable other distinctions, relative to the digestive organs, and even to the intellectual functions.

The degree of perfection in the organ of touch is estimated by the number of the fingers, their capability of motion, and the extent in which their extremities are enveloped in a nail or hoof.

A HOOF which entirely surrounds that extremity of the finger nearest to the ground, blunts its sense of touch, and renders it incapable of grasping an object.

The opposite character is found in the NAIL, composed of a single layer, which covers the one side only of the extremity, and leaves to the other the utmost sensibility of touch.

The nature of their ordinary food is determined by the form of the MOLAR or CHEEK TEETH, and this always corresponds to the mode in which the jaws are articulated. In order to cut flesh, the Molars must be serrated, or saw-like, and the jaws united in the manner of scissors, which can only open and shut. On the contrary, in order to crush grains, it is necessary that they should have Molars with flat crowns, and jaws capable of moving horizontally. It is also requisite that the crown of these teeth should possess that kind of inequality which the millstone acquires, that its substance should be of different degrees of hardness, and that some of its parts should wear away more rapidly than others.

All animals with Hoofs [thence called UNGULATED] must of necessity be herbivorous, that is, possessed of Molar teeth with flat crowns, because the structure of their feet prevents them from seizing a living prey.

It is different with those animals said to be UNGUICULATED, from their possessing Nails. They are susceptible of several varieties, and may partake of different species of food; but they differ still more from each other in the extent of motion possessed by the fingers, and the delicacy of their touch. There is one characteristic which exercises a mighty influence on the degree of their address and means of industry—that is, the power of opposing the thumb to the other fingers, for the purpose of seizing small objects, which constitutes it a HAND, properly so called. It is in Man, whose fore-extremity is entirely free, and capable of being employed in seizing, grasping, or holding, that this power reaches its limit of perfection.

These different combinations, which determine rigorously the nature of the different Mammalia, have given rise to their subdivision into the following orders:—

THE UNGUICULATED MAMMALIA.

1. *BIMANA*.—Man alone possesses hands solely at his fore-extremities, and at the same time is privileged in many other respects, so as to entitle him to the first place among the unguiculated animals; his lower extremities alone support his body in a vertical position.

2. *QUADRUMANÆ*.—The order next to Man possesses hands at all the four extremities.

3. *CARNASSIERS*.—The third order has not the thumb free and opposable to the other anterior extremities.

All the animals of the above orders possess three kinds of teeth, namely, Molars, Canines, and Incisors.

4. *RODENTIA*.—The fourth order differs but slightly in the structure of the fingers from the Carnassiers, but it wants the Canine Teeth, and the Incisors are disposed in front for the peculiar kind of mastication, termed Gnawing.

5. *EDENTATA*.—Next follow those animals having the fingers very much confined, and deeply sunk into large nails, which are often very crooked. They also have the imperfection of wanting Incisors. Some also want the Canines, and others have no teeth at all.

6. *MARSUPIALIA*.—This distribution of the Unguiculated animals would have been perfect, and might form a chain of some regularity, if New Holland [and America] had not furnished us with a small collateral chain, composed of animals with POUCHES. All these genera resemble each other in the whole character of their organization, yet some of them correspond to the Carnassiers by the structure of their teeth, and the

nature of their food; others agree with the Rodentia in these particulars, and others again with the Edentata.

THE UNGULATED MAMMALIA.

The animals with Hoofs are less numerous, and at the same time less various in their structure.

7. PACHYDERMATA, or Jumenta, comprise all the hoofed animals which do not ruminate. The Elephant, though included in this class, would properly form a class of itself, which is allied to the Rodentia by some remote analogies.

8. RUMINANTIA.—The Ruminating animals form a very well-marked order, from their cloven feet, their four stomachs, and the absence of true Incisors in the upper jaw.

THE SEA-BEASTS.

9. CETACEA.—Finally, we arrive at the Mammalia altogether destitute of hinder extremities. From their partaking of the form of the Fishes, and their aquatic life, we should be led to constitute them a separate class, did not the remainder of their economy resemble the Mammalia in every respect. These are the Fishes with warm blood of the ancients [the Sea-Beasts of the present day], which unite the strength of the other Mammalia to the advantage of being sustained by the watery element. It is accordingly in this class that the most gigantic animals are found.

The characters upon which these orders are founded will be seen more clearly in the following Analytical Table:—

DIVISION OF THE CLASS MAMMALIA INTO NINE ORDERS.

CLASS I.—MAMMALIA.

CONTAINING MAN AND BEASTS, WITH WARM BLOOD; HEART WITH TWO VENTRICLES; FEMALES SUCKLING THEIR YOUNG WITH MILK, SECRETED IN BREASTS OR MAMMÆ; VIVIPAROUS, EXCEPTING THE MONOTREMATA, WHICH ARE EITHER OVIPAROUS OR OVO-VIVIPAROUS.

Orders

Limbs Four,	With nails or claws,	Without Marsupial bones,	With three kinds of teeth,	With two hands,	1. BIMANA.
				With four hands,	2. QUADRUNANA.
Limbs Two,	With hoofs,	With Marsupial bones,	Without canine teeth,	Without hands,	3. CARNASSIERS.
				Without incisors,	4. RODENTIA.
					5. EDENTATA.
					6. MARSUPIALIA.
		With less than four stomachs,			7. PACHYDERMATA.
		With four stomachs,			8. RUMINANTIA.
					9. CETACEA.

GENERAL REVIEW OF THE MAMMALIA.

External relations of the Mammalia to the other Classes, and to each other.—Usage of the terms Mammalia, Beast, Quadruped, Bimanous, Quadrumanous, and Cetaceous.—Further subdivision of the Mammalia into Families and Tribes.

IN the preceding outlines, the internal organization of the Mammalia, and the leading principles of their classification, have been briefly explained. We shall now proceed to consider, in a general manner, their external relations to the remaining classes of animals and to each other.

In those superficial characters, which strike the observer most forcibly at first sight, the Mammalia present many traits which are to be found equally in the other Classes, a fact which is not sufficiently adverted to in ordinary discourse. Thus, by the term Beast or Quadruped, it is usual to understand an animal covered with hair, and having four feet; and whenever a Bird or a Fish is referred to, the feathers of the former and the scales of the latter offer themselves readily to the imagination. Yet these external characters by no means serve to distinguish the several classes of Vertebrated Animals. The property of having four feet, which is possessed by a large and important portion of the Mammalia, is not confined solely to them. Many oviparous animals belonging to the Third Class (*Reptilia*) possess the same characteristic; and in this respect the four-footed Beasts of the earth, which approach Man so nearly in their other characters, and occupy so high a place in the economy of Nature, are not superior to the Lizards and Frogs. Again, the Armadillos (*Dasypus*), instead of being covered with hair, are armed with a solid covering like the Tortoises, or even like the Crustacea. The animals of the genus *Manis* are covered with scales not very different from those of the Fishes, and the same structure is found in the tail of the Beaver (*Castor Fiber*.) The Porcupines (*Hystrix*), and the Hedgehogs (*Erinaceus*), are covered with a species of sharp quills, without feathery fibres on the extremity, but having the tube very like that of Birds. The Cetacea, or Sea-beasts, resemble the Fishes so forcibly in their external forms, that the uninformed portion of mankind persist in calling them Fishes in opposition to the universal decision of Naturalists. The Whale, Dolphin, Grampus, and other animals of this order, have nothing in common with the Fish, except the circumstances of their living in the same element, in being destitute of hair, and in possessing that external form necessary for rapid motion in a fluid of considerable density. Yet the term Whale-fishery will long preserve its usage among that numerous class of persons, who are apt to reject the critical observations of Naturalists, from their apparent over-refinement.

Nature appears to evade, by the variety of her combinations, those obvious divisions which a superficial examination would lead us to form; and the Mammalia approach to the Birds, the Reptiles, the Fishes, and even the Crustacea, in the character of their external covering. This variety in the superficial appearance establishes clearly the necessity of seeking, in their internal organization, for the principles of classification. It has often been stated, that while Error lies on the surface, Truth must be sought deeply in the hidden parts; and this assertion, which is only made *metaphorically* in reference to moral subjects, is *literally* true in Natural History.

The Birds share their quills with the Hedgehogs and Porcupines; and their long bills destitute of teeth, with their tongue, are imitated by the trunk and tongue of the Ant-eaters (*Myrmecophaga*.) The Reptiles are not alone armed with a solid covering. The Fishes share their scales with the Beaver and Manis, and their fins with the Seals (*Phoca*), the Morse (*Trichechus*), the Manatus, and the true Cetacea. The Birds have their powers of flight assigned also to the Bat; the crawling

of the Reptiles and Eels is imitated in some degree by the slow movements of the Sloth (*Bradypus*); and the Fishes share their powers of swimming with most Mammalia, but more especially with the tribe Amphibia, and order Cetacea.

As the meanings of the terms Beast, Bird, Fish, and Quadruped, are established by popular usage alone, they are necessarily destitute of that precision which should characterize the language of science. The term *Mammalia*, which has been generally adopted by Naturalists, is much more wide in its signification than that of *Quadruped*; it agrees more nearly with the word *Beast* than perhaps any other term, although not exactly, as the latter term excludes Man, and the Cetacea are not always understood by the vulgar to be really Sea-beasts. The term *Quadruped* is still more improperly considered as synonymous with *Mammalia*, with which, however, it is often confounded. In the last-mentioned class Man is included as well as the Cetacea, although he is a *Biped*, and they are altogether destitute of hinder limbs. The Ape tribes are possessed of four hands, and properly *Quadrumanous*. Even of those animals which are, strictly speaking, Quadrupeds, from their walking habitually on four feet, many either frequent the water or are capable of supporting themselves in the air. The Seals and other Amphibia, although Mammalia, cannot properly be styled Quadrupeds, and the same observation applies to the Bats.

The true Quadrupeds live exclusively on the land; they may be said to divide it with Man, whose Nature they approach more nearly than that of the Birds, Reptiles, or Fishes. But we must observe that the term quadruped strictly supposes that the animal walks on four feet. If it be destitute of feet like the Manatus and true Cetacea, if it be supplied only with arms and hands like the Ape, or if it possess wings like the Bat, the term Quadruped ceases to be applicable. Man is the only Biped and Bimanous animal, because he alone possesses two feet and two hands; the Manatus is only Bimanous, and the Bat is a Biped, while the Ape is Quadrumanous or four-handed. The Jerboas (*Dipus*), and Kangaroos (*Macropus*), cannot properly be styled Quadrupeds, because they can walk only on their hind-feet, in consequence of the fore-limbs being too short and weak. The signification of the term Quadruped is further restricted by removing all those animals which are able to use their fore-paws as a substitute for hands, such as the Bears (*Ursus*), the Marmots (*Arctomys*), the Coatis (*Nasua*), the Agoutis (*Dasyprocta*), the Squirrels (*Sciurus*), and the Rats (*Mus*); and those last-mentioned animals form a kind of intermediate class between the Quadrupeds and the Quadrumanous tribes. The term Quadruped is thus applicable only to one half of the Mammalia: it is totally inapplicable to at least one quarter, and is not strictly applicable, in its full extent, to the remainder.

The Quadrumanous fill up the link which would separate the form of Man from that of the Quadrupeds. Those animals, with true clavicles, form another subordinate link between the Quadrumanous and Quadrupeds; while the Bipeds with wings lead us to the Birds. None of the vague terms of ordinary discourse correspond exactly with those nice distinctions which the philosophical student loves to trace in the works of Nature.

As it is the leading design of classification to assist the memory by a clear and lucid arrangement of Natural objects, it frequently becomes necessary to multiply subdivisions in a few orders, which would be altogether superfluous in the remainder. By this contrivance we are enabled to arrive at general views in every department of Nature, and to remember a vast mass of phenomena not otherwise attainable. These subordinate divisions are termed *Families* or *Tribes*, and are determined either by some general resemblance prevailing throughout that whole department, or else by some particular character possessed by all the individuals included therein. The

selection of these characters is more or less arbitrary. No general rules can be given for their institution, and they must depend chiefly on the skill of the Naturalist. Yet they are not altogether capricious, as will be readily seen hereafter. The general style of the objects under examination must be seized at a glance; and the groups must be strictly natural, or they will defeat the end for which they were instituted.

In the First Order (*Bimana*) Man alone is included; and it admits, therefore, of no further subdivision. The Second (*Quadrumana*) comprises the Monkeys, Baboons, Sapajous, Sagoins, Ousititis, and Makis—animals which form a decidedly natural group, and all partake more or less of the same physical peculiarities.

It is different with the Third Order (*Carnassiers*), being those Mammalia, without Marsupial bones, which have three kinds of teeth, and are destitute of hands. Among these we find the Bat, the Mole, the Bear, the Cat, and the Seal; all which animals differ greatly in the subordinate characters of their structure, and consequently in their habits and external appearance. All the Carnassiers, as their name denotes, subsist either partially or entirely upon animal food. But some of them possess a remarkable fold of skin, which connects the sides of the neck with all the limbs, and the fingers of the anterior pair. This singular membrane confers upon the group the power of flight, exercises a remarkable influence over their general habits and structure, and hence we distinguish the first family, *Cheiroptera*.

Of the remaining Carnassiers, some have their molar teeth with conical crowns; their habits are subterranean or nocturnal, and they feed on Insects. These Carnassiers form the second family, *Insectivora*.

We are thus left only with those Carnassiers which are destitute of a membrane fitted for flight, and whose molar teeth are destitute of conical crowns. To these negative characters they join the positive one of being more decidedly Carnassiers, or of living more exclusively on flesh; for which reason they compose the third and last family, *Carnivora*. But this numerous and interesting family admits of further subdivision into Tribes.

The *Plantigrada* walk on the entire soles of their feet.

The *Digitigrada* walk on the ends of their toes.

The *Amphibia* have their feet furnished with webs, which adapt them for an aquatic life.

The Fourth Order (*Rodentia*) is a very natural division, and does not require to be subdivided, unless we were to consider the presence or absence of perfect clavicles as a sufficient ground for the institution of two tribes founded on this distinction.

The Fifth Order (*Edentata*) would remain undivided, did not the extraordinary peculiarities of the Sloths (*Bradypus*) authorise their separation from the ordinary Edentata, the former tribe being marked by its very long and crooked claws.

The Sixth Order (*Marsupialia*), among which we propose to include the Monotremata, forms a division of animals possessing marsupial bones, but at the same time partaking of the characters of many of the preceding orders in general structure and habits. Their anomalous dentition renders any classification, founded upon this character, liable to some objections. It is, therefore, not without some hesitation that we venture to propose an arrangement, founded on the presence or absence of incisors and canines in the lower jaw.

The first tribe (*Didelphida*) has both incisors and canines in the lower jaw, and includes the genera *Didelphis*, *Thylacimus*, *Phascogala*, *Dasyurus*, and *Perameles*, all of which are more or less carnivorous.

The second tribe (*Macropoda*) have incisors, but the canines are either wanting altogether in the lower jaw, or else are very small. They live chiefly on fruits or herbs. In this tribe we propose to include the genera *Phalangista*, *Petaurus*, *Potorous*, *Macropus*, *Lipurus*, and *Phascolumys*.

The third tribe coincides exactly with the *Monotremata* of M. Geoffroy St Hilaire, being destitute both of incisors and canines, and containing the two genera *Echidna* and *Ornithorynchus*.

Arriving at the Mammalia with Hoofs, we find that, in the Seventh Order (*Pachydermata*), it is necessary to distinguish the remarkable proboscis of the Elephant—a character which establishes his claim to a separate tribe (*Proboscidea*), if not to a separate order. The solid hoof peculiar to the genus *Equus* also gives rise to the formation of a tribe of *Solipeda*, leaving the remaining genera to form a natural group of *Pachydermata*, or thick-skinned Mammalia.

The *Ruminantia* or Eighth Order exhibit, in their four stomachs, and indeed in their entire conformation, that close resemblance which would render any intermediate divisions at present superfluous.

The Last Order (*Cetacea*) admits of further subdivision into the *Herbivora*, destitute of spiracles on the top of their head, and destined, by their dentition and general construction, to feed on marine vegetables; and the true *Cetacea*, with spiracles on the top of the head.

These subdivisions, and the leading characters on which they are founded, are shown in the following Table, with a few examples of each family and tribe, to enable the student to fix them more easily in the memory:—

SUBDIVISION OF THE ORDERS OF THE CLASS MAMMALIA INTO FAMILIES AND TRIBES.

Orders.	Families.	Tribes.	Examples.									
1. BIMANA,			Man.									
2. QUADRUMANA,			Monkeys, Lemurs.									
3. CARNASSIERS,...	With a fold of skin connecting the sides of the neck, with all the limbs, and the fingers of the anterior pair,	1. CHEIROPTERA,	Bats, Flying Cats.									
		2. INSECTIVORA,	Moles, Hedgehogs, Shrews.									
	Without a fold of skin as above,	Molar teeth, with conical crowns, Molar teeth, without conical crowns	3. CARNIVORA, <table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td rowspan="3" style="vertical-align: middle;"> Feet without Webs, Feet with Webs, </td> <td>Walking on the entire soles of the feet,</td> <td>1. PLANTIGRADA,</td> <td>Bears, Badgers.</td> </tr> <tr> <td>Walking on the toes,</td> <td>2. DIGITIGRADA,</td> <td>Weasels, Dogs, Foxes, Cats.</td> </tr> <tr> <td></td> <td>3. AMPHIBIA,</td> <td>Seals, Walrus.</td> </tr> </table>	Feet without Webs, Feet with Webs,	Walking on the entire soles of the feet,	1. PLANTIGRADA,	Bears, Badgers.	Walking on the toes,	2. DIGITIGRADA,	Weasels, Dogs, Foxes, Cats.		3. AMPHIBIA,
Feet without Webs, Feet with Webs,	Walking on the entire soles of the feet,	1. PLANTIGRADA,	Bears, Badgers.									
	Walking on the toes,	2. DIGITIGRADA,	Weasels, Dogs, Foxes, Cats.									
		3. AMPHIBIA,	Seals, Walrus.									
4. RODENTIA,			Squirrels, Mice, Hares.									
5. EDENTATA,.....	Nails long and bent,	1. TARDIGRADA,	Sloths.									
	Nails short,	2. EDENTATA (proper),	Ant-eaters, Armadilloes.									
6. MARSUPIALIA,	Lower jaw	With incisors and canines,	1. DIDELPHIDA,	Opossums.								
		With incisors, but the canines wanting or very small,	2. MACROPODA,	Kangaroos.								
		Without incisors or canines,	3. MONOTREMATA,	Ornithorynchus or Duck-bill.								
7. PACHYDERMATA	With a proboscis,	1. PROBOSCIDEA,	Elephants.									
	Without a proboscis,	{ With two or four hoofs on each foot, { With only one hoof on each foot,	2. PACHYDERMATA (proper), 3. SOLIPEDA,	Rhinoceroses, Hogs. Horse.								
8. RUMINANTIA,			Camels, Deer, Sheep, Oxen.									
9. CETACEA,.....	Without spiracles on the top of the head,	1. HERBIVORA,	Dugong.									
	With spiracles on the top of the head,	2. CETACEA (proper),	Dolphins, Whales.									

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Some popular and external characters of the preceding Tribes and Families.

We shall defer our observations upon the first order BIMANA, until we come to treat of the physical history of Man. At present it is necessary to add a brief review of the superficial and external characters of those tribes and families which we have enumerated above.

2. QUADRUMANA.—Next to Man, but at a considerable distance below him, we find the numerous tribe of Apes, from the Orang-Outang to the Sagoins, all possessed of hands on their hinder extremities, and if we except a few genera, also a

thumb free and opposable. The latter characteristic gives them the utmost facility of climbing trees, and of grasping the branches. Accordingly, the Apes feed in general upon fruits and nuts. Some of the American species, such as the Sapajous, are capable of hanging to the trees by means of a prehensile tail, which twines around the branch, and enables them to swing with the head downwards. These animals, as well as the Sagoins, are distinguished from the Apes of the old continent by a nose so broad and flat, that both nostrils can be seen on either side. Among the Apes of the old Continent, we find the genera *Macacus*, *Inuus*, *Hilobates*, *Cercopithecus*, the ferocious *Mandrills* (*Papio*), and several others. All these animals live in the forests of tropical countries, where they form numerous bodies. They compose a

tribe remarkable for its great resemblance to Man, and the natural propensity to imitate his actions—qualities which are combined with some degree of skill and intelligence, a singular liveliness of disposition, and innate fondness for mischief. It is said that they form regularly organized bodies in their native forests, and establish among themselves a kind of rude police for pillaging or guarding the fruits of the different districts. The females carry their young in their arms like the Negresses, and are often observed to kiss them tenderly, and frequently to beat or bite them as a punishment. This close resemblance between the Ape and the human species when in the savage state, will hereafter become the subject of our consideration.

The Makis, a branch of the Quadrumana, are diminutive like the Apes, whom they resemble greatly, both in manners and disposition, but are at once distinguished by their pointed muzzle. They live mostly on Insects, and are marked by meagre and elongated fingers and arms.

3. CARNASSIERS.—After this family we find the Bats, which bear a near relation to the preceding, both in general conformation, and in having their mammæ placed on the chest. Their wing-like arms, and their elongated fingers attached to a membranous expansion, impart the power of flying, or rather of supporting themselves by a rapid succession of vaulting movements. They are all of a hideous aspect. The young cling to their mother, who gives them the breast even when flying. Unable, by the delicacy of their eyes, to endure the full blaze of day, they appear only at night, when they vault rather than fly after the insects which form their prey. In the warmer climates there are enormous Bats, which live also on the fruits of trees. All these animals hang by their thumb-nails in the depths of obscure grottoes, caverns, and other retreats, and in our climates they are observed to become torpid during the winter.

The remaining tribes of Carnassiers follow the preceding races, and constitute two numerous, as well as interesting families. Among the Insectivora, we find the Hedgehogs (*Erinaceus*), the Shrews (*Sorex*), and the Moles (*Talpa*). The paws of the last are not very unlike hands in their general appearance, and are used for digging in the earth, as well as for climbing and raising food to the mouth. All the genera of Insectivora are fond of darkness and retirement. Among the Carnivora we find the family Plantigrada, which walk with the entire soles of the feet upon the ground. In this first tribe of the Carnivora, we have the Bears (*Ursus*), the Badger (*Mes*), and a few others—mostly animals of a surly and savage disposition, retiring during the winter into caverns and other obscure retreats. Among the Digitigrada, forming the second family of the Carnivora, we find the Weasels (*Mustela*), the Otters (*Lutra*), the Civets (*Viverra*), possessed of a fine and glossy fur, a long and slender form, and a light step. Concealing themselves among crevices, they steal slyly upon their prey, whose blood they suck with delight. The animals of the Genus *Mephitis* exhale a most insupportable odour. The Otters frequent the borders of streams or the sea shore, and seek their prey in the water. Among the more ferocious Digitigrada, we find the Wild Dog, Wolves, Foxes, and Jackalls (*Canis*), with the Hyæna—animals with a keen sense of smell, hunting together in packs, and overcoming by force of numbers the most powerful beasts of prey. They present a haughty demeanour, an elevated head, and are eminent at once for brilliancy of instinct, and for sanguinary courage. In the last quality they are only surpassed by the Lion, the Tigers, Leopards, Panthers, and the Lynx, all forming part of an extensive genus (*Felis*), of which our domestic Cat is considered the type. These animals are enabled by their strong and retractile claws to climb with facility. Their head is round, their eyes glitter in the darkness of night, their tongue is roughened like a file, and their teeth are exceedingly powerful. They wait for their prey; with a sudden spring they dash it to the ground, and enjoy with ecstacy the flesh yet throbbing from the breast of their victim, and the blood still warm from its heart. Among the Amphibia, which conclude the long list of Carnassiers, we find the Seals (*Phoca*) and the Morso (*Trichechus*), animals which greatly resemble the Cetacea in external form and habits, but differ decidedly from them in the structure of the teeth.

4. RODENTIA.—The family of Gnawers follow the Carnassiers, from whom they are separated by very distinct characters. We find in them two long cutting teeth, in the front of each jaw, no canines, but molars, and intestines of great capacity. These timid animals, destined for the most part to gnaw vegetable substances, do not eat flesh except under extraordinary circumstances. Their hinder legs, and the entire hinder part of their body, is stronger than the fore, and they run and leap rapidly. Their muzzle is more or less arched, their eyes project, yet their sight is not acute, but this deficiency is compensated by the fineness of their hearing. Such is the general character of the Dormice (*Myoxus*), the Marmots (*Arctomys*), the Hamsters (*Cricetus*), the Field Mice (*Arvicola*), animals which become torpid during the winter season; also the Squirrels (*Sciurus*), the numerous tribes of Rats and Mice (*Mus*), the Hares (*Lepus*), the Guinea-Pigs (*Cavia*), the blind Rat (*Spalax*), the Beavers (*Castor*), the Porcupines (*Hystrix*), and some others. We find the most singular habits and instincts among these animals. The industry of the Beavers is known to all, and the sagacity and skill with which they fell trees by means of their powerful teeth, draw them across rivers, form dikes with their hand-like paws, and construct cabins above the water, where they amass stores of bark for their maintenance. Their large and flat tail serves them as a trowel to work up the earth with which they form the walls of their singular masonry. Every one is familiar with the nimbleness of the Squirrels (*Sciurus*); but all are not aware of that instinct which leads them to peel off a piece of bark from a tree, when about to cross a brook. Mounting this frail boat, with their bushy tail stretched like a sail before the breeze, they gain the opposite bank in safety. In the genus *Pteromys*, we find the Flying Squirrels provided with a membrane extending from the fore to the hind feet, so that, by stretching out their limbs, they form a parachute, which assists their great leaps from tree to tree. Many species of Rats (*Mus*), and Field Mice (*Arvicola*), live in the earth, united together in social bands, where they amass magazines of provisions, and construct warm retreats of hay and moss, for their protection during the winter. The Hamsters (*Cricetus*), have large checks, which they fill with provisions, and transport the contents to their subterranean retreats. There are other Rodentia, such as the Lemmings (*Lemmus*), which emigrate every year, according to the seasons, to

gather the provisions which Nature has scattered over different countries. Certain species of economical Mice in Tartary, collect so large a quantity of nutritious roots, that the people of that inhospitable climate avail themselves of the supply afforded by their nests as a provision for themselves during the winter. In the East Indies and in Africa, we find Jerboas (*Dipus*), a kind of Rat with hind-legs of so great a length, that they are supported almost in a vertical position, and are enabled, like grasshoppers, to leap continually, and to an immense distance.

5. EDENTATA.—The first tribe (*Tardiqrada*) of the Edentata, is composed of those singular animals found in America, called Sloths (*Bradypus*), from the excessive slowness of their movements. They present some slight resemblance to the Monkey tribes in their general form, and in the circumstance of their mammæ being pectoral, but they are destitute of the front teeth, and instead of hands, exhibit large crooked nails fitted for climbing on trees. They live entirely upon leaves, and lead a life which we would consider melancholy, uttering the most lamentable cries, and moving themselves with great apparent difficulty. Of the remaining tribe composing the true Edentata, we find that nature has provided some compensating protection for the want of canine and incisive teeth, either by bestowing on them scales, placed one over the other, resembling the sepals or flower-cup-leaves of the artichoke, as may be found in the Manis, or else a bony cuirass of moveable pieces, seen in the Armadillos (*Dasyppus*). The Ant-eaters (*Myrmecophaga*), are supplied only with hard and tufted hair, but being altogether destitute of teeth, they are furnished with an elongated and viscid tongue, which they extend into the nests of Ants, and these insects, adhering to it in numbers, are speedily brought into their mouth.

6. MARSUPIALIA.—Commencing with our first tribe, Didelphida, we find in America, the Opossums (*Didelphis*), and in New Holland, the Dasyurus—animals which are more remarkable than perhaps any of the preceding. In form, they somewhat resemble a very small Fox, with a long tail, naked and flexible at will, while their fore-paws approach the form of hands. But the singular part of their structure is the abdominal pouch found in the females, which serves as a double womb. The young are produced before their time, and attach themselves immovably to the teats of the mother, which are placed within the pouch. After their second birth, they retreat into this natural pocket, which protects them from the severity of the cold. When arrived at a more advanced age, they climb upon the back of their mother, and, by means of a long and flexible tail, they hook themselves to her tail or limbs, so that she is able to carry them when alarmed, in this manner, and can run or climb trees with considerable speed when pursued. This tribe is naturally carnivorous, feeding on birds and other small prey. The second tribe, Macropoda, of which the Kangaroo (*Macropus*) may be considered the type, contains several remarkable animals, some of which are almost as large as our sheep. They have strong and large hind-limbs, with a long and stiff tail, collectively forming a tripod, upon which they stand, or rather sit, securely. In this position they usually remain, for their fore-paws are very short, and are used only as hands. Instead of walking, they move nimbly by a succession of elevated leaps; but as their feeble progeny are unable to follow their mother in this rapid movement, a kind and benevolent Nature has bestowed upon them an abdominal pouch, like the Opossums, to transport their young ones. These species are of a mild disposition, are easily tamed, and possess that timidity which we find in most animals living exclusively upon vegetable food. The last tribe (*Monotremata*) are also found in New Holland. These quadrupeds are covered either with smooth or bristly hair; but instead of jaws, they exhibit the singular anomaly of a beak exactly resembling that of a Duck, with reproductive organs like the Birds. These curious animals frequent the water, and burrow under ground.

Nearly all the genera of which we have spoken in the preceding outline have Clavicles, or collar-bones, which enable them to use their fore-feet for other purposes than walking. They can seize various objects; their fingers are separate and furnished with nails, which distinguishes them from the Ungulated or Fissipeda classes. The former are also, in general, more expert and intelligent than the species of which we shall now treat; for the Ungulated animals being less free in the motions of their limbs, have also less skill and intelligence. The Ungulated Mammalia are mostly polygamous. That fond affection for their offspring which is found in the Unguiculated classes, is almost unnecessary with them, as their young are more precocious, that is, they arrive sooner at the full exercise of their faculties than the progeny of the Unguiculated Mammalia.

7. PACHYDERMATA.—In the first rank of Ungulated Mammalia, we find the Elephant distinguished by the superiority of his intelligence from the proper Pachydermata: These last mentioned animals are, on the contrary, very rude and unintelligent. They are covered with thinly scattered bristles rather than hair. The form of their bodies is clumsy and inelegant. They are fond of wallowing in the mire, and of frequenting the water, or low and moist grounds, where they live on coarse food, such as stalks and roots. Their sight is not acute, but their sense of smelling is very fine. Under the skin, we usually find a thick layer of lard, which renders them but slightly sensitive, except towards the nose and mouth. We next find the interesting family of the Solipeda, so called from their feet being enveloped in a single hoof, such as the Horse, Ass, Zebra, and some other animals, all of the genus Equus, which are equally fitted for running rapidly, or for the transportation of burdens.

8. RUMINANTIA.—Arriving at the ruminating animals, we here find the genera of the Camel and Dromedary (*Camelus*), the Lama and Vicugna (*Auchenia*), the Musk (*Moschus*), the Elk, Reindeer, Stag, Fallow-deer (*Cervus*), the gigantic Camelopard (*Camelopardalis*), the beautiful Gazelles or Antelopes (*Antilopa*), the Goats (*Capra*), the Sheep (*Ovis*), the Buffalo, Musk-Ox, and common Ox (*Bos*), and many others of great interest. All these animals are readily marked by their cloven feet, that is, their feet divided into two hoofs, by the horns which most of them possess, and by the want of front teeth in the upper jaw. Those ruminating animals naturally without horns, like the Camels, Vicugna, and Musk, find an equivalent in the canine teeth of their upper-jaw. Among the Deer, the horns are branched, and fall each year after the rutting season, when their warlike ardour is over. In the other genera, the horns are hollow, and fit firmly into a bony receptacle, which prevents them from falling. All these animals feed on grass or leaves; they have four stomachs, and ruminates, that is, they restore their food a second time

into the mouth for undergoing a final mastication. The females are easily tamed; they yield an abundance of milk, and instead of fat are supplied with suct. The males, which are less numerous in each species, are consequently polygamous, and the females produce only one or two young ones, which are able to walk from their birth. The mammae are always placed near the abdomen; the flesh forms a healthy food. Every one is acquainted with the immense advantages which Man derives from the domestication of these genera, with the fleeces and skins of the Sheep, Goat, Vieugna, and with the leather yielded by the skins of all the animals of this tribe. Without the Rein-deer, the Polar regions would be uninhabitable by the Laplander and many other nations. Without the Horse and Ox, agriculture would be impossible, and nations could no longer exist in their present state of civilization. The Arab in vain might attempt to traverse the Deserts without the aid of the Camel.

9. CETACEA.—Finally, we arrive at the Cetacea, whose limbs are formed into oars or fins. They all live upon the water rather than in it, for they can only breathe atmospheric air, and may be drowned by too long an immersion in the water. The Herbivora, a tribe of aquatic Mammalia, are analogous in many respects to the Amphibia. Among them we find the Manatus or Sea-cow, and the Dugong (*Halicore*), animals which have probably given rise to the accounts of Tritons, Sirens, and Mer-men. The Cetacea proper are more peculiarly aquatic than the Amphibia, for they are never found to rest upon the ground. The female usually produces one or two young ones alive in the water, where she gives them the breast, watches over them, and supports them when fatigued upon her back and sides.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Relations to the other Classes—Gradual degeneracy of form—Fitness for their several stations.

From the brief outline which has been attempted in the preceding sections, it may be easily understood that the other Mammalia approximate very closely to Man in their general nature, and more especially that portion of them which compose the Viviparous Quadrupeds. These form unquestionably the most important portion of the Animal Kingdom, from the similarity of their external shapes to our own, the superiority of their instincts above all other animals, the meek submission of some to the force of domestication, and the determined hostility of others to any modification of their original habits.

Their marked resemblance to ourselves naturally leads us to view the Quadrupeds, and indeed all the terrestrial Mammalia, with feelings of interest, which the other classes of Vertebrated Animals must in vain attempt to claim. It is true that we admire the delicacy and lightness exhibited in the forms of most Birds, the general warmth of their temperament, their liveliness, and perpetual motion, which we are apt to compare to their own airy medium. The Fishes, on the other hand, are naturally a stupid race, without animation or sensibility; and, like the ocean which serves as their dwelling, preserve nearly the same temperature at all times. Their exertions are seen only in efforts to swim, or to satisfy their most pressing necessities; and that scaly covering which surrounds many of their bodies blunts their sense of touch, and renders them more or less insensible to external impressions. On the contrary, the Quadruped preserves a middle station between the heights of the atmosphere and the abysses of the ocean. He seems to share with Man the sovereignty of the earth, and, like him, to exhibit an intermediate character. He neither possesses the ardour and vivacity of the Bird, the stupidity of the Fish, nor the heavy apathy of the Reptile. But, fixed to the firm and dry land, the Quadruped has received a certain degree of solidity and firmness of structure. His walk has not that rapidity which characterizes the flight of Birds, or that nimbleness which we observe in the movements of the Fish; yet his motions do not partake of the laborious dullness observed in the Tortoise, and other Reptiles. His moderate swiftness permits the muscles to act with greater vigour, and allows his faculties time to expand. Indeed, without considering Man, the other Mammalia contain beings the most susceptible of intelligence on the face of the globe.

We have already pointed out the leading characters which belong to Man, as well as all the other Mammalia; yet we must observe, that throughout their entire orders, from the Binana to the Cetacea, we may easily trace a kind of gradual departure from the external form fitted for Man. Whether we consider the Monkey tribe in their external appearance, or in their internal organs, we find the closest resemblance. The skeleton, the muscles, and all the internal organs, even to the ramifications of the smallest vessels, present a degree of similarity to Man at once startling and mortifying. In fact, the Apes, though forming many distinct genera and species of themselves, seem but a rough sketch of human degradation. The same shades of deviation can be seen in descending from the Quadrumana to the Cheiroptera, the Carnassiers, the Tardigrada, and indeed throughout all the series. We must, however, recollect, that the most important organs, such as those which are the essential attendants of their internal functions, never change materially. They are identical in all the Mammalia, and fulfil their uses in nearly the same manner. It is only externally and superficially that this degeneracy of form exhibits itself. Thus, for example, the hand of Man may be recognized in that of the Ape. In the Makis it already begins to appear deformed, and continues to deteriorate through the Hedgehogs, the Moles, and Bears. It becomes a paw, when we arrive at the Dogs. Afterwards the nails exhibit, in the Sloth, the transition to the solid hoofs of the Sheep, Stag, and Ox, and terminate in the uniform hoof of the Solipeda. Finally, we find in the Whales and Dolphins no other vestige than a stump rudely fashioned as an oar. Yet, if we open the skin of this part, we still find the principal bones of the hand and arm, but in that rudimental form which serves but to mark the wideness of their separation from the perfectly-developed hand of Man. This law of degeneracy is, however, by no means invariably adhered to, and we have intentionally passed over several genera which exhibit marked and decisive exceptions to its generality.

From the Quadrumana to the Cetacea we observe a decided contrast to Man in the elongation of their muzzles, their general tendency towards the earth, and the violence of their passions, unrestrained like his by the voice of Reason and Conscience. It is probable that their enjoyments of sense are more vivid than those of Man; they always yield to the present impulse, and are susceptible only in a slight degree of intellectual improvement.

It is for action and not for reflection that the Beasts of the earth are designed. Their limbs are more robust than those of Man; and this natural vigour is further improved in the wild races, especially the Carnivora, by continual exercise. Their constant activity increases this muscular vigour, their bodies are more healthy, and become more capable of resisting external injury or the inclemencies of the seasons. Nearly the same kind of contrast which we remark in our own species, between the vigorous and thickly-set Mechanic and the delicate and lively Female, may be observed between a wild animal of the forest and a robust Man. In proportion as the external qualities of the body are improved, sensibility and delicacy of feeling diminish; and it would almost appear to be the necessary result of civilization and refinement that the muscular vigour of our species should diminish, and that their liability to disease should increase.

However inferior the other Mammalia may be to Man in intellect, they are of all animals the best able to understand his commands. The Birds are not capable of holding these intimate relations to ourselves: for, whatever degree of intelligence may be attributed to the domesticated Parrot or tame Canary-bird, these are greatly surpassed by the superior instincts of the Dog, the Beaver, and the Elephant. Still less are we capable of forming modes of connexion with the Reptiles and Fishes, while the Mollusca and lower divisions of animated Nature form other natural societies in which the influence of Man cannot be felt. In short, his power becomes extensive in proportion as the animal approximates to his Nature. We can teach the Insect, the Fish, or the Reptile, absolutely nothing; our influence increases over the Birds; but the other Mammalia are capable of considerable instruction. They are not mere automata, but possess a certain degree of perfectibility. Indeed, the instincts of the Mammalia seem to establish an intermediate intelligence between the Human Soul and that mere animal existence enjoyed by the other divisions, whose whole lives are absorbed in seeking their food or continuing their species.

Every animal must necessarily be fitted for the station in which it is placed by Nature. For if, by any accidental or natural event, an animal be placed in a situation for which it is unfitted, it will either perish absolutely, or else its original constitution will be modified so as to correspond accurately with its new condition. Thus the animals of the torrid zone are supplied with a very slight coat of hair, as we see in the Barbary Dog, and the Apes; while under the frigid zone they exhibit the warmest and thickest furs, as in the Sable (*Mustela zibellina*), the Bears, and the Arctic Fox (*Canis lagopus*).

This adaptation to surrounding circumstances is found equally in their senses, their means of defence, the greater or less swiftness of their movements, and the ferocity or mildness of their dispositions.

Though all the Mammalia possess five senses, they do not enjoy each sense with the same degree of intensity. Those species which dwell in the mountains, like the Chamois (*Antelope rupicapra*), and the Ibex (*Capra ibex*), whose flight is rapid, and which lead a wandering life, are far-sighted; on the contrary, the heavy animals dwelling in the valleys, like the Hogs and Rhinoceroses, are near-sighted. Those again whose eyes are too delicate for the full blaze of daylight, come from their dens only at night, or in the twilight, like the Bats, or else conceal themselves in the earth like the Armadillos and Hedgehogs. The more timid and feeble races make a greater use of their ears than of their eyes; the Hare, the Rabbit, the Jerboa, the Mouse, and other Rodentia, raise their ears at the slightest noise, preparatory to flight; but the more powerful and courageous races, such as the Lion, the Tiger, the Lynx, and other Cats, endowed with a keen and piercing sight even at night, have their ears small and their hearing indistinct. Thus the feebleness of one sense is made up by the perfection of another, just as in Man, when accident deprives him of sight, the sense of hearing becomes more acute. The power of smell, in the Mammalia, always refers to their proper food or to their own species. A dog, which finds no pleasure from the scent of the Tuberoses or the Carnation, will discover the female of his own species, or the carcass of another animal, at an immense distance. With the Carnivorous animals the sense of taste becomes a fierce and sanguinary appetite; with the Herbivorous tribes it possesses an equal sensibility in distinguishing the nutritious plant from the poisonous weed.

The same adaptation to their wants and enjoyments is found in the general form of their limbs. "In some," observes Goldsmith, "they are made for strength only, and to support a vast unwieldy frame, without much flexibility or beautiful proportion. Thus the legs of the Elephant and Rhinoceros resemble pillars; were they made smaller they would be unfit to support the body; were they endowed with greater flexibility or swiftness, they would be needless, as they do not pursue other animals for food; and, conscious of their own superior strength, there are none that they deign to avoid. Deer, Hares, and other creatures that are to find safety in flight, have their legs made entirely for speed; they are slender and nervous. Were it not for this advantage, every carnivorous animal would soon make them a prey, and their races would be entirely extinguished. But in their present state of nature, the means of safety are rather superior to those of offence, and the pursuing animal must owe success only to patience, perseverance, and industry. The feet of some that live upon fish alone are made for swimming. The toes of these animals are joined together with membranes, being web-footed like a goose or duck, by which they swim with great rapidity. Those animals that lead a life of hostility, and live upon others, have their feet armed with sharp claws, which some can sheath and unsheath at will. Those, on the contrary, who lead peaceful lives, have generally hoofs, which serve as weapons of defence, and which in all are better fitted for traversing extensive tracts of rugged country, than the claw-foot of their pursuers."

In obedience to the same universal law of adaptation, we find that the Armadillos and Manis, which are destitute of teeth, find a counterbalancing defence in their horny cuirass or scales. In the Porcupine and Hedgehog, which are in other respects

both feeble and defenceless, Nature has converted the ordinary hair of the other quadrupeds into a forest of pointed darts; and these animals, rolling themselves into a spiny ball on the approach of danger, are invincible to all other species. The herbivorous tribes do not possess strong teeth or hooked claws, but many of them have the head armed with powerful horns. The timid Rodentia either seek with instinctive industry to hide themselves under ground, like the Marmot, the Rabbit, and the Rat, or they leap with agility, like the Squirrel, from tree to tree, or else, like the Jerboas and Cape Rat, they avoid their pursuers by wide and frequent springs resembling Grasshoppers; again, the Vieugna and Llania have no means of defence, yet when attacked they dart upon their enemies an acrimonious and disgusting saliva. The Pole-cats and the Mepbitis exhale, when pursued, odours so execrable, that they compel their most irritated enemy to desist in his pursuit. Some animals, like the Howling Sapajous (*Ateles* and *Lagothrix*), attempt to terrify their enemies by the most frightful howls; others avoid them by climbing trees, by darting into their subterranean retreats, by vaulting, by leaping, by plunging into the water, by distracting their pursuer with a host of ingenious devices and precautions, or by the construction of fortified dens or impenetrable recesses.

Besides these means of defence, the smaller species are more productive, both in number and frequency, than the larger species; they are also more robust, lively, and active, in proportion. Before an Elephant or a Whale can turn round once, a Muscardin or a Mouse will have made a hundred movements. The smallness of their limbs gives more unity and solidity to their bodies. Their shorter muscles contract more easily, and more forcibly, than in these larger and more unwieldy machines. Were an animal to exist three or four hundred feet in length, and of a proportionate thickness, it would lie gasping on the earth overwhelmed with its weight, and would become the easy prey of all other animals, even of the most feeble.

Thus we find that the Mammalia are fitted in every respect for the stations which they occupy, and that a bountiful Nature provides, by means of their complicated relations, for one continual scene of activity and enjoyment.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Their Food—Carnivorous Tribes—Final causes of their Mutual Destruction—Herbivorous Tribes.

THE surface of the earth, clothed with verdure, is the inexhaustible source whence Man and Animals derive in common their subsistence. Every animated being lives ultimately upon vegetables, and vegetables are maintained by the debris or remains of every thing which has lived and vegetated. A perpetual round of existence is thus maintained. Without Death there could be no Life, and it is only by annihilating other beings that animals are able to support themselves, and to continue their species; they must either feed on vegetables or upon other animals. Yet Nature, like an indulgent mother, has fixed limits to this apparently indiscriminate destruction. The carnivorous and voracious individuals are reduced to a small number, while she has largely multiplied both the species and individuals which are herbivorous. Man too has greatly assisted in exterminating, or confining within narrow limits, the predaceous species, and in establishing the more peaceful tribes. Among the Marine genera, although some are herbivorous, yet the greater number are nearly equally voracious. These devour their own and different species without ever appearing to exterminate each other, because their fecundity is as great as the destruction; and nearly all this mutual consumption acts as a new incentive to reproduction.

Man stands foremost among the carnivorous tribes. Being the predominant species, he exercises over the other Mammalia the privileges of a master. He has chosen those which please his taste, and forms them into humble dependants. By causing them to multiply more rapidly than unassisted Nature would have done, they have given rise to numerous flocks; and from the care bestowed in their production, he acquires a natural right of immolating them to satisfy his wants. This power, however, extends much farther than his necessities would require; for, independent of those species which he has subdued and can dispose according to his pleasure, he carries on a war of extermination against the wild Beasts, the Birds, and the Fishes. He does not even confine himself to the climate which he inhabits, but seeks for new delicacies in the remotest parts of the globe. Nature seems scarcely adequate to supply this continual demand for variety, and Man alone may be said to consume more animal food than all the other Mammalia taken together.

Next to Man, the carnivorous beasts possess the most destructive habits, and are at once the enemies of their fellow-animals, and the rivals of Man. Having the same appetites and the same fondness for animal food, they are under the necessity of disputing with him the possession of their prey; and in the first ages of human society these formed one of the most formidable checks to civilization. Even at the present time, in civilized Europe, it is by the utmost vigilance alone that he can preserve his flocks and poultry from the ravages of the Wolf, the Fox, the Ferret, and the Weasel.

Man thus carries on a continual war against the carnivorous animals, which he either pursues for pleasure or for safety. However superior to him in bodily strength or swiftness, the most powerful fall ready victims to the union of numbers, the superior powers of his mind, and especially to that peculiar art with which he avails himself of the inert materials of Nature as instruments of destruction. No race of animals can resist the agency of gunpowder; the Whale falls before the harpoon; the Elephant and Lion cannot evade the pit-fall and the snare. The largest animals receive death or captivity at his hands, as certainly as the smallest; and Man can confine the limits, or even exterminate every animal which comes within the sphere of his influence.

All animals, whether of the same or of different species, are naturally in a state of warfare. It is chiefly in the tribes more particularly styled carnivorous, that this war proceeds to open hostilities; yet there is a silent and a secret opposition of interest,

even among the most peaceful tribes. As their numbers continually increase, food becomes scarce, disease thins their numbers, and the remainder fall a ready prey to the stronger and fiercer animals. Like plants, they destroy each other as effectually by the mere occupancy of space as they could have done by the fiercest conflicts. The rising generation soon repairs the loss occasioned by the latter, but nothing can extend the numbers of a species beyond the limits marked by Nature in the quantity of its food.

This universal war of species is an established law of Nature, and, however startling it may appear at first sight, is advantageous on the whole. Violent deaths are as necessary to the proper regulation of Nature as natural deaths. The latter preserve the perpetual bloom of youth over the face of the earth; the former assist in maintaining the correct balance among the numbers of different species, and in restraining their exuberance within the proper limits.

To illustrate this important law of Nature, let us consider for a moment some one of the inferior species, which serve for food to the higher classes. The Herrings offer themselves, at certain seasons, in myriads to our fishermen; and, after nourishing the Birds which sport on the surface of the ocean, as well as the predaceous tribes frequenting its abysses, form the principal support of many nations of Europe during a considerable part of the year. The destruction which takes place among these Fishes is overwhelming; yet the consequences would be tremendous if their fecundity were not thus restrained. They would soon cover the surface of the sea, their numbers would then destroy each other, for want of sufficient nourishment their fecundity would diminish, and famine and disease would produce the same results which other animals now effect. But their undevoured bodies would taint the atmosphere, perhaps the ocean itself, and the putrid miasmata arising therefrom would carry disease and death into all species of animated beings, as well as their own. Thus the false sensibility which seeks to restrain the mutual destruction of animals would effectually ensure the entire annihilation of them all. As Nature is at present contented, Life is the consequence of Death; were it otherwise disposed, one universal death-like stillness would pervade the face of Nature. As in the animal frame, the continued action of the vital power necessarily occasions death, so in the frame of Animated Nature the continuance of reproduction must be followed by a corresponding destruction. The same observations which have been made upon the Herrings are applicable to every other species, and hence we may fairly infer that there exists an absolute necessity for the mutual destruction of animals. The futility of that philosophy of the Brahmins which condemns the use of animal food, is sufficiently obvious. From being founded in Nature it is a legitimate usage, and absolutely essential to the well-being of the whole.

By taking a general view of the constitution of Nature, we are enabled to explain those apparent incongruities which strike the observer at first sight. We then discover that "these scattered evils are lost in the blaze of superabundant goodness, as the spots on the disk of the sun fade before the splendour of his rays." In every department of Nature we find

"All partial evil—universal good."

In these wars of the animals, Nature has provided that each creature should meet its death in the easiest possible manner. There is a certain spot in the spinal marrow where the two ascending main nerves that form the great brain cross one another, and if this spot be injured, death is the immediate consequence. This fact is well known to Huntsmen and Butchers. The latter plunges his knife into the neck of the Ox at that exact spot, the animal immediately drops, and ceases to live after a few convulsions. On the same principle the Huntsman cuts through the neck of his game.

The Carnivorous Animals always seize their prey by the neck, and bite through this part. In the same manner the Hound kills the Hare, and the Bird of prey its quarry. The Pole-cat also destroys its prey at a single spring. Dr Gall locked up a Pole-cat for some time, during which he fed it on bones till its teeth were blunted. While in this state, it was unable to kill the Rabbits placed in its kennel with the same despatch as formerly; but when they had again grown sharp, Gall observed that, on the very first leap it made on the Rabbit, it cut the little animal's neck on that very spot with a sharp fang, and instantaneous death ensued. He observed the same thing at a hawking party of the Emperor Joseph the Second. As soon as the Hawk had reached the Hare, it would immediately cut through that part of her neck with its bill.

Yet Nature seems to have stamped a character of marked ferocity upon most Carnivorous tribes. The Cat torments the captive Mouse, and seems to take delight in its convulsive struggles to escape. The Tigress or female Leopard brings her prey still palpitating to her den, and gives the first lessons of ferocity to her progeny.

That sentiment of humanity towards our own species, imparted by Nature for the proper regulation of social intercourse, is transferred by us to the more intelligent and sensitive animals—in other words, to those which most nearly resemble ourselves. We cut and eat a live Oyster without the slightest commiseration, because it does not exhibit external signs of sensation, nor does it raise a cry of suffering when the fatal moment arrives; yet few, whose feelings have not been blunted by early habit, can bear to immolate a Lamb. A wise Providence has thus protected the higher animals from the gratuitous infliction of pain on the part of Man. However necessary the trade of Butcher or of Executioner may be to society, it always appears in some degree odious. The Brahmins have carried this sentiment to a ridiculous extent. They permit the most disgusting Insects to frequent their houses, their food, and their persons, without destroying them; and the Mussulmans have erected hospitals for the accommodation of infirm Dogs.

However odious the Carnivorous Animals may appear to us in the exercise of their legitimate calling, our sense of retributive justice is satisfied in knowing that most of them undergo the same fate which they have inflicted on others. "Every dog has his day," according to the proverb. The proper counterpoise and equilibrium of animals could not be established without them, and their own final fate shows the general system of reciprocity and that balance of good and evil prevailing throughout the Animal Kingdom.

The chief benevolent emotions which the Carnivorous tribes present are seen in their

casual attachment to the females of their own species, the regard of the mother for her young, and that occasional language of signs by which they communicate their wants or their passions. If a Lion or a Tiger meet his mate at an unfavourable time, they both become furious, and a conflict often fatal to one or to both is the result. The circumstance of their both living by the chase renders them natural enemies to each other. This singular combination of love and hatred is wisely given by Nature to assist in preventing the too rapid increase of the more destructive animals.

It is the organization of the Carnivora—the possession of teeth, of claws, of short and narrow intestines—that imposes the office of Nature's executioners upon these animals by an imperative necessity. The sharp teeth of the Leopard or Panther might attempt in vain to grind plants: and even when we compel these animals to swallow bread and other purely vegetable substances, the gastric juice of their stomach is unable to dissolve them. On the contrary, the Lamb and the light Gazelle would refuse animal food with disgust. Their teeth are not formed for tearing, and their entire economy is adapted to a vegetable diet. It is thus that we find, in the organization of the animal, the reasons for all its actions.

This exquisite relation of all the parts of an animal to each other, enables the Naturalist to describe the whole creature on seeing only a part. Thus, from knowing the size of a tooth, we can judge of the height of the animal which bore it; by the shape of the tooth we can tell whether it be carnivorous or herbivorous. Thence follow the general structure of the body, not only of the stomach and viscera, but also the form of their paws, of claws with the one, or of hoofs with the other, the liveliness of their passions, as well as the habits which attend this kind of life and constitution.

Besides the claws and teeth, which form the offensive arms of the Carnivora, they are endowed with superior strength, agility, cruelty, and treachery. The source of these qualities must be sought in the nature of their food—in the superior organization of flesh and blood. The herbivorous tribes want offensive arms in general, yet they are seldom of a timid or peaceful disposition. They love to unite together in social bands, to pasture on the plains or by the mountain side, or else to hoard the common fruits of their industry. The carnivorous tribes, like tyrants, are unfitted for society by their ferocious and domineering tempers; they dread the rivalry of their own species, and the natural attachment of the sexes is with them but a momentary passion. They can endure hunger much longer than the herbivorous tribes, whose food is always spread out before them; and this power of fasting is necessary to animals obliged by their structure to overpower their prey by violence, to run them down by perseverance, or to surprise them by stratagem. They can fast for several weeks, but as their necessities increase they become bolder and more ferocious. The Wolf, with an appetite sharpened by famine, becomes an intrepid and formidable enemy. He then invades the villages, breaks into the stables during the daytime, and even ventures to contend with Man. But when he has found an abundance of nourishment, he gorges himself for several days; and, with an admirable sagacity, conceals the remainder under ground as a provision for future want.

This continual use of animal food, and the high state of organization at which all the solid and fluid parts of their bodies have arrived, renders their flesh at once unpalatable and unwholesome. Their excretions are all fetid, and the slightest check to the vital activity brings on a rapid decay. On the contrary, the vegetable nutriment of the herbivorous tribes imparts to their flesh a high degree of delicacy. Their milk is sweet, agreeable, and nutritious. Thus the herbivorous tribes yield an abundance of nourishment to Man, while he rejects with disgust the flesh of those which are carnivorous.

The natural antipathy of some of the carnivorous animals for each other, proceeds from their rivalry in the chase. It is thus that the Lion, Tiger, Panther, or Bear, permits no poachers upon his hunting grounds. These despots of the Animal Kingdom allow few intruders to share their authority, and clear the forest of all those petty tyrants, which prey only upon small game; and which, like the inferior noblesse of the middle ages, oppressed the lower ranks, and diminished the population.

"It is not among the larger animals of the forest alone," says Goldsmith with his usual elegance, "that these hostilities are carried on; there is a minuter and a still more treacherous contest between the lower ranks of Quadrupeds. The Panther hunts for the Sheep and the Goat; the Catamountain for the Hare or the Rabbit; and the Wild Cat for the Squirrel or the Mouse. In proportion as each carnivorous animal wants strength, it uses all the assistance of patience, assiduity, and cunning. However, the arts of these to pursue are not so great as the tricks of their prey to escape, so that the power of destruction in one class is inferior to the power of safety in the other. Were this otherwise, the forest would soon be despoiled of the feeblest races of animals, and beasts of prey themselves would want, at one time, that subsistence which they lavishly destroyed at another.

"Few wild animals seek their prey in the daytime; they are then generally deterred by their fears of Man, in the inhabited countries, and by the excessive heat of the sun in those extensive forests that lie towards the south, and in which they reign the undisputed tyrants. As soon, therefore, as the morning appears, the carnivorous animals retire to their dens; and the Elephant, the Horse, the Deer, and all the Hare kinds, those inoffensive tenants of the plain, make their appearance. But again, at night-fall the state of hostility begins, the whole forest then echoes with a variety of different howlings. Nothing can be more terrible than an African landscape at the close of evening; the deep-toned roarings of the Lion, the shrill yellings of the Tiger, the Jackal pursuing by the scent, and barking like a dog, the Hyena with a note peculiarly solitary and dreadful, but, above all, the hissing of the various kinds of Serpents that then begin their call, and, as I am assured, make a much louder symphony than the Birds in our groves in a morning.

"Beasts of prey seldom devour each other; nor can any thing but the greatest degree of hunger compel them to it. What they chiefly seek after is the Deer, or the Goat; those harmless creatures that seem made to embellish Nature. These are either pursued or surprised, and afford the most agreeable repast to their destroyers. The most usual method, with even the fiercest animals, is to hide and crouch near some path frequented by their prey, or some water where they come to drink, and seize them at once with a bound. The Lion and the Tiger leap twenty feet at a

spring; and this, rather than their swiftness or strength, is what they have most to depend on for a supply. There is scarcely one of the Deer or Hare kind that is not very easily capable of escaping them by its swiftness; so that, whenever any of these fall a prey, it must be owing to their own inattention.

"But there is another class of the carnivorous kind that hunt by the scent, and which it is more difficult to escape. It is remarkable that all animals of this kind pursue in a pack, and encourage each other by their mutual cries. The Jackal, Syagush, the Wolf, and the Dog, are of this kind; they pursue with patience rather than swiftness; their prey flies at first, and leaves them for miles behind, but they keep on with a constant steady pace, and excite each other by a general spirit of industry and emulation, till at last they share the common plunder. But it too often happens that the larger beasts of prey, when they hear a cry of this kind begin, pursue the pack, and, when they have hunted down the animal, come in and monopolize the spoil. This has given rise to the report of the Jackal's being the Lion's provider; when the reality is, that the Jackal hunts for itself, and the Lion is an unwelcome intruder upon the fruit of his toil."

It is in barren and unfrequented districts that the carnivorous animals are most fierce and sanguinary, because their prey is scarce, and the possession of it is continually disputed by a host of famished rivals. From these continued scenes of violence their character acquires an unusual ferocity. The Bear of the Alps is a formidable and dangerous animal to the traveller. But the beasts that frequent the plains or fertile valleys find their food more easily, and when found it is less disputed. Their character being thus softened down by the comforts of life, loses that high degree of courage and asperity which distinguishes the mountain races.

The carnivorous animals associate in troops only for the convenience of a combined attack; on the other hand, the herds of herbivorous animals seem intended only for their mutual defence. Placing the young ones in the centre, and the females in the rear, the males advance to the front, united in a phalanx, and presenting their horns to the enemy, repel his attack with vigour, and generally with success.

Most of the Frugivorous tribes, such as the Apes, the Makis, and the Loris, ramble about in numerous troops, for the purpose of pillaging the fruits of a district. Like expert marauders, they establish a regular order of pillage. They place sentinels in advance, and, forming a chain, pass the fruit from hand to hand. Upon the slightest alarm being given by the sentinels, the whole troop retreats to the woods or mountains, carrying off as much as they can hold in their hands and cheek-pouches.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Domesticated Animals are not Slaves—Methods of Taming Wild Animals—Influence of Mild Treatment—Hunger—Sweetmeats—Caresses—Chastisement—Their Occasional Revenge.

ANIMALS, whether domesticated or in a wild state, always preserve their real characters, and act in a manner suited to their situation.

The absolute submission which we are in the habit of requiring from our domestic animals, and that kind of tyranny which we exercise over them, have given rise to the belief that they are really Slaves. It is commonly supposed that our superior power compels them to resign their natural fondness for independence, to yield implicit obedience to our will, and to perform those offices for which they are adapted by their organization, intelligence, and instincts. We are in the habit of attributing to our own influence the submission obtained from these animals; we are imagined to be the source of those instincts developed under domestication, and to have commanded obedience, just as our superior power maintains them in captivity.

This conclusion is, however, altogether fallacious. Judging from appearances only, we have confounded two things totally distinct in their nature, namely, Domestication and Slavery. Domestication is a state of freedom, and hence the difference between the human Slave and the domesticated Animal is as great as that between Slavery and Liberty.

The domesticated animal makes use of its natural faculties within the limits marked out by its situation, in a manner exactly similar to the wild animal in the woods. Being never urged to act except by external causes, or by internal instincts, as soon as its will has conformed itself to the constraints of its situation, it makes no further sacrifice. The animal, in fact, is not in reality in a different situation from what it would have been if left to itself. It lives, without constraint, in society with Man, because doubtless it was naturally a sociable animal. It conforms itself to the will of Man, within certain limits, because its herd would have had a leader in the strongest or most active animal, to whom submission would have been naturally paid. If a Dog is by our care rendered a good comrader, it is because he was a hunter by nature, and we have only developed one of his original qualities. The same rule is observed in all the different qualities which we impart to our domestic animals. They perform nothing which is not agreeable to their nature; in doing so, they only fulfil the original purposes for which they were formed; they never acquire different qualities, and thus enjoy, under Man, a perfect state of liberty.

It is true that Man possesses an immense power over the domestic animals, and one which he often abuses. Yet he usually develops qualities natural to the animal; hence it acquires a degree of improvement unattainable in its original state, and thus its condition really becomes ameliorated. Thus we may see the immenso difference between Slavery and Domestication. The Slave is not only a social being, with the power of willing, but he is naturally a free being, whose mind cannot confine itself spontaneously to the situation in which he is placed. He knows his condition, considers its consequences, and feels its oppression. The natural power which he possesses of reflecting upon his situation, shows it to him in all its degradation. He feels that he is in chains, that he cannot use his natural free-will, and that he is a degraded being. On the contrary, a domestic animal satisfies all its wants; hence it lives in a state of Nature, and is conformable to the situation in which it is placed.

The Slave who is compelled to renounce his free-will is far from being in the same condition. He holds the same rank in the Moral as a mutilated being or a monster in the Physical World.

The essential difference between these two states is further seen in the opposite means which are employed to enforce them. A Man can only be reduced to Slavery, and maintained in it, by violence; because it is the very nature of Liberty to be unrestrained. An animal can only be domesticated by kindness. Its will exists, and shows itself only in its wants, and it can only be acted upon through its necessities, either by satisfying or enfeebling them.

Violence is altogether useless in disposing a wild animal to obedience. As it has a natural aversion to Man, from his being of a different species, it runs away, if at large, upon the first impression of fear which he occasions, and if captive, maintains a determined hatred towards him. It is only by restoring confidence that it can ever be rendered familiar to him, and this can be effected only by kind treatment. It is thus that the social instinct of the animal becomes gradually developed, and its natural feeling of distrust of every thing which is new or strange becomes proportionately weaker.

The methods to be adopted in taming an animal are as various as the creatures themselves. Each process must be adapted to the peculiar likings of the animal.

To satisfy its natural wants is one method which, in the course of time, brings on its entire submission, especially when applied to a very young animal. The habit of receiving its food constantly from our hands renders it familiar, and finally it becomes attached. But, except when very long continued, the attachments thus formed are but slight. The benefits which the animal thus procures it could have obtained of itself, had it been allowed to fulfil its natural disposition. As soon as we attempt to bend it to any particular service it runs away, and quickly returns to its original independence. It is therefore necessary, not only to satisfy its original and natural wants, but, by creating in it new wants and enjoyments, to render the society of Man absolutely necessary to its existence.

Hunger is one of the most powerful means of taming animals. As the extent of a benefit conferred is always in proportion to the want of the person relieved, so the gratitude of the animal is more profound according as the food given to it was the more necessary. This method is applicable to all the Mammalia. It gives rise to a feeling of affection on the part of the animal, and at the same time produces a physical debility which reacts upon and enfeebles its Will. It is thus that the education of Horses begins, when they have passed their first years in a wild state. On being first caught, a very small quantity of food is given to them, and at very long intervals of time. They hence become gradually familiarized to their keeper, and acquire a certain degree of affection for him, which he readily turns to his own advantage, and thus confirms his power.

If to the influence of hunger that of delicious food be added, the empire of kindness becomes greatly extended; and this power arrives to a degree perfectly astonishing, if we can succeed in pleasing the palate of animals by any kind of confectionery or cookery, in a higher degree than could have been done by the best food attainable in their wild state. In fact, it is chiefly by means of dainties, especially of sweetmeats, that the herbivorous animals can be induced to go through those wonderful feats and exercises which may often be witnessed in the Circus.

These delicacies influence the will of the animal to such a degree, that starvation and physical deprivations become no longer necessary. In a short time it acquires a high degree of affection for those who contribute to its enjoyment, and willingly performs whatever they may require.

But the services rendered by animals do not always proceed from so selfish an origin. Caresses are one chief means of gaining their affection, which cannot be termed sensual, because these are addressed to no particular sense. Their fondness for caresses is altogether an acquired taste. No wild animal requires them from others of its own species. Even among our domestic animals, we see the young rejoice at the approach of their mother, the male and female happy in each other's society, individuals accustomed to live together pleased to meet again after having been separated; but these feelings are always accompanied with much reserve, and they never extend to reciprocal caresses. It is from Man alone that they receive them, and their attachment to him increases with the strength of the acquired taste for them. The pleasure of animals may be further heightened by a soft tone of voice, or even by touching their mammae.

All animals are not sensible to caresses in an equal degree. The Ruminating animals seem but slightly influenced by them; the Horse, on the contrary, enjoys them with ecstasy; it is the same with many Pachydermata, and especially with the Elephant. The Cat is not indifferent to them; sometimes even it seeks them with ardour; but it is unquestionably in the Dog that the influence of caresses produces the most marked results; and what is remarkable, all the other varieties of the genus *Canis*, which have been hitherto observed, share this quality with him. M. F. Cuvier mentions, that in the *Menagerie du Roi* there was a She-Wolf, upon whom caresses with the hand and voice produced so powerful an effect as almost to amount to a state of delirium, and her joy was exhibited as much by cries as by movements. A Jackal from Senegal was similarly influenced when treated in the same manner; and a common Fox was so forcibly affected by them, that it was necessary to abstain from all demonstrations of this kind, as the result might have been fatal to the animal. It will be interesting to know that all these animals were females.

It may be doubted whether we should consider the chaunting of airs, or the sound of bells, amongst those artificial pleasures by means of which animals are gratified and captivated. The songs of the Camel-driver are perhaps only the simple signs by which the Camels learn to mend or slacken their pace.

That animals may continue to perform those acts of docility which we require from them, caresses must follow as well as precede their performance. The constraint employed in urging them to act would, if too long continued, have an injurious effect. It is then only by repeating their delicacies or caresses that the calmness and confidence is restored.

When once familiarity and confidence prevail on the part of the animal by means of kind treatment, and that habit has rendered the society of Man necessary to it, we

may then venture to use higher degrees of constraint, and even to inflict punishment. But our means of severity are very limited. We can only use blows, with certain precautions to prevent the chastised animal from running away. Punishment always produces the same effect; it changes the disposition which we wish to suppress into fear. By the association of ideas, the former impression yields, or is entirely merged into the latter.

It is always dangerous to carry the punishment of an animal to excess. Violent fear may either totally intimidate the animal and render it for ever useless, or else it drives it to despair, and it becomes altogether ferocious and unmanageable. A Horse, naturally timid, if corrected imprudently, plunges in the madness of its fright, along with its rider, into the deepest abyss. The Spaniel when kindly treated is intelligent, docile to its master, and in every respect fitted for sporting; yet if an undue severity has been used in its education, it is undecided, hasty, or eringing.

When once the severity of punishment has passed a certain limit, which varies in species and even in individuals, the animal begins to resist. In a moment, the instinct of self-preservation awakes in all its force. Thus we often see our domestic animals, and even the Dog itself, revolt against ill usage, and inflict the most cruel punishment on its perpetrators.

Many instances might be adduced of vengeance inflicted by the domestic animals, especially by the Horse, against those who have ill-treated them, as well as the hatred shown by these animals, and the very long time for which this feeling of aversion has preserved its force. The cases are numerous and well known; and although they have long demonstrated that *brutality is not the way to obtain obedience from animals*, these creatures still continue to be treated as if it were unnecessary to court their compliance. One example of an Elephant may be mentioned here, which happened under the eyes of M. F. Cuvier.

This animal had been entrusted, when three or four years old, to a young man who took charge of it, and had trained it to perform various feats for the amusement of the public. It paid implicit obedience, and seemed to feel a tender affection for him. It not only yielded, without a moment's hesitation, to all his commands, but seemed absolutely unhappy without him. It rejected the attentions of any other persons, and even ate its food with sadness, when given by the hand of any other individual. While this young man remained under the eyes of his father, who owned the Elephant, he always treated it properly; but when it was transferred to the *Menagerie du Roi*, and that the young man was thus left to himself, his attentions diminished, the wants of the animal were neglected, and in a moment of drunkenness he went so far as to strike the Elephant. The poor animal immediately lost its habitual gaiety; it became so sad and dejected that it was supposed to be unwell. It, however, still obeyed the keeper, but no longer performed its exercises with the same alacrity as heretofore. Signs of impatience were sometimes shown, and then suppressed, as if two opposite feelings were in secret conflict; the animal became less disposed to obey, which increased the discontent of its leader. It was in vain that orders were given to the young man on no account to strike the Elephant, whose former docility could only be restored by the kindest treatment. Vexed at having lost his authority, and in not being able to exhibit the feats of the Elephant with his former success, his irritation increased, and one day he struck the animal with so much brutality that it became excited to the utmost pitch of fury, and uttered such a yell that its terrified keeper, who heard it for the first time, was glad to escape its vengeance. Never afterwards would the animal permit him to approach; even at the sight of him it became enraged, and all attempts to manage it were unsuccessful. It became wholly untractable, and no longer could be induced to perform for the amusement of the public.

It thus appears that kindness on our part is absolutely necessary to dispose animals to obedience, and that interest as well as humanity agree in pointing out the same course for the proper management of their instincts.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Taming of the Mammalia—Forced Watches—Castration—Susceptibility of different Tribes to the influence of Domestication—Formation of Domestic Races—Relation to the Social Instincts.

The different methods of taming wild animals pointed out in the preceding section, are completely applicable only to those animals which are susceptible of affection and of fear. When animals feel a certain degree of attachment for kindness received, or when they dread the repetition of punishment, it is sufficient merely to recal these emotions to produce an immediate effect upon their Will.

It often happens, however, from the peculiar nature of individuals or of species, that certain habits or likings have acquired so powerful an influence, that no other emotion can maintain the ascendancy. With animals of this character, neither kindness nor punishment has any effect; and if persisted in, they would tend but to increase their constitutional bias. It is only by acting immediately upon their Will, so as to weaken the force of the ruling passion, that they can be rendered susceptible of gratitude or of fear. With tempers so refractory as these, the only means of domestication hitherto discovered are Forced Watches and Castration.

Without proceeding to actual mutilation, it appears that of all methods Forced Watches exercise the most powerful influence in enfeebling the Will of an animal, and in disposing it to obedience, especially when united to a prudent combination of rewards and punishments. Animals may be prevented from sleeping by applying the whip more or less frequently, or still more effectually by a loud reverberating noise, such as that of a Drum or Trumpet, which must be varied so as to avoid the effect of uniformity. By keeping them long without food, and then feeding them slightly during their usual time of sleep, the same effect may also be produced.

This method is applicable to all animals and to both sexes, although it does not always produce the same result. The other method, that of Castration, applies to male individuals solely, and is absolutely necessary only with certain Ruminating animals, but chiefly with the Bull.

All the other animal appetites, which were given for the preservation of the individual, such as Hunger, Thirst, and the desire of Sleep, when opposed, lead to an immediate physical debility on the part of the animal. Those passions, on the contrary, which were given for the continuation of the species, increase in proportion to the obstacles presented to their gratification. Hence it is only by depriving them of the organs from which these passions derive their source that we can bring them under our power.

In fact, the Bull, the Ram, and other Ruminants, can be domesticated solely after having undergone this mutilation. We may thus perceive the error of holding out the Ox and the Sheep as models of patience and submission. So far from this being really the case, the Bull and the Ram can only be used for propagation; and we have merely succeeded in domesticating the females of these races.

This operation is not necessary for Horses, although such as have undergone it are generally more tractable than the others. The Dog loses by castration his entire vigour and activity; and this appears to be its usual effect upon other Carnassiers, for we find that the domestic Cat is affected in the same manner as the Dog.

It thus appears from the preceding observations, that we can only obtain an authority over animals by means of their natural wants and propensities, by giving them a new direction, by developing, or else by annihilating them altogether.

The very small number of animals which we have hitherto succeeded in rendering practically useful, when compared with the total number of species, renders it extremely probable that we have not yet carried the art of domestication to its extreme limit, and that hereafter we shall discover the means of training new species to our use, as well as more perfect methods of educating the old.

It may easily be gathered from what has been already said, that the arts of taming present very different results when applied to animals of different species. There can be no comparison, for example, between the Dog and the Buffalo. The former is devoted in his attachments, submissive, and grateful; the latter wants docility, and indeed every benevolent affection. Between these two extremes, we may range in their order of susceptibility, the Elephant, the Hog, the Horse, the Ass, the Dromedary, the Camel, the Lamas, the Reindeer, the Stag, the Ram, and the Bull. We shall defer the further investigation of the peculiar characters of all these animals, until we come to describe the animals themselves. At present it is necessary merely to take a rapid glance over the several tribes of Mammalia, in reference to their different susceptibilities for domestication.

It might have been expected that the Apes of the Old Continent, which combine a high degree of intelligence to a structure the most favorable for the development of all their qualities, would have presented conditions well adapted for Training; yet no male adult Ape has yet been induced to submit to Man, however kindly he may be treated. We allude here to the Genera *Cercopithecus*, *Macacus*, and *Cynocephalus*; for the Orangs, with the Genera *Hilobates* and *Semnopithecus*, are still too little known to assert any thing positive concerning them. But in regard to the Genera first mentioned, their sensations are so vivid, their natural distrust so great, and all their emotions so violent, that they cannot be brought to observe any degree of order, or to habituate themselves to any given situation. Nothing can satisfy their wants, which alter with every change of circumstances, and even with the movements of the keeper round their cage. For which reason we can never expect any kind feelings on their part. At the time when they are rendering the most affectionate returns, they are ready in a moment to tear their master to pieces; and this does not seem to proceed from any premeditated treachery, but all their faults arise from the excessive unsteadiness of their tempers.

Yet it would appear that by great severity, and by keeping them almost continually in torture, they can be made to go through certain exercises. It is thus that the inhabitants of Sumatra succeed in training the Maimon (*Macacus nemestrinus*) to climb trees when ordered, and to gather fruits; but these arts always perish with the individual. As this kind of training is conducted solely by force, it cannot be regarded as a real domestication. It is by the same means that we see some of these animals, and especially the Magots (*Macacus inuus*), learn to obey their master, to leap with skill and precision, and to perform those astonishing dances for which they are so well adapted by their organization and natural dexterity. But being subdued by force alone, they are ever ready to run away; and in warm climates where they can obtain food, and do not require shelter, they are never known to return.

The American Apes with prehensile tails, such as the Ateles and Sapajous, are much more tractable, as they combine a great fondness for caresses and some attachment, to a high degree of intelligence and social instinct. With the Lemurs, there are so many difficulties in training from their excessive timidity, that all attempts of this kind must prove abortive.

This last observation is also applicable to the Insectivora, which, in addition to other difficulties, are possessed of an organization and limbs little favorable for training.

All the Carnassiers of solitary habits, such as the Lion, the Panther, the Martins, the Civets, the Wolves, and the Bears, are easily accessible to kindness, but fear has no power over them. While at large, they keep at a distance from all danger; and when confined, ill treatment only serves to enrage them. But if you satisfy all their wants as soon as these become urgent, if they receive nothing but kindness at your hands, and if no sound of your voice or motion of your limbs be threatening, soon will these powerful animals show the satisfaction which they feel at your approach, and give the most unequivocal proofs of their affection. Often the apparent mildness of the Ape is followed by some treacherous act, but the external signs of a Carnassier never deceive. If he be inclined to do mischief, every look and gesture betrays his intention, and it is the same when he is mildly disposed. Lions, Panthers, and Tigers, after having been tamed, may even be harnessed to a carriage, and they will readily obey their keepers. Wolves trained for the chase have been known faithfully to follow the pack of Hounds to which they belong. Every one has witnessed the feats which Bears may be induced to execute. Yet we have not succeeded in bringing these races to perform any actual service. Had this been effected, their superior strength would doubtless have rendered them valuable acquisitions.

The Seals are sociable animals, and in addition are gifted with surprising sagacity.

They seem of all the Carnassiers the most susceptible of kindness, and may easily be induced to perform any thing that their structure permits. Among the Rodentia, the Beaver, Marmots, Squirrels, Dermice, and Hares, are so little gifted with intelligence, that when we say *they feel*, the whole of their acquirements are summed up in one word. It is true that they may be made to go through certain exercises, because they are attracted by pleasure and avoid pain. But none of these animals will distinguish their keeper from any other person, however attentive he may be to them; and in this respect the social are not different from the solitary species. This seems to proceed from the excessive weakness of their memories.

Passing onwards to the Tapirs, the Pecaris, the Cony (*Hyrax*), the Zebra, and other Pachydermata or Solipeda, we find animals associating together in herds, grateful for kindness received, and afraid of punishment, capable of distinguishing their keeper, and often becoming very strongly attached to him.

This is also the case, to a certain degree, with the Ruminantia, but chiefly with the females; for, without any exception, the males of this tribe are possessed of an excessive brutality, which punishment only increases, and kindness fails to improve.

All that has here been adduced only shows the different means which may be adopted in taming these animals, and in attaching them to our persons. Something more than this is required to produce actual Domestication, for it may be seen that animals may be made to feel the influence of Man, and yet they may not necessarily become domesticated.

Had we been compelled, with each generation of animals, to begin anew the process of taming, we should not, properly speaking, ever have had domestic animals. At least their domestication would not have had its full effect, and the important consequences to the civilization of the human race would not have followed in its train. Such would have been the result, had there not existed a most important general law, which is found also to prevail in every department of animated life,—that the changes undergone by the first tame animals did not die along with them, but were transmitted to their offspring.

It is a well-known fact, that the young of all animals bear a great resemblance to their parents. This fact is equally true in regard to the human race, and seems not merely to be confined to their physical qualities, but to extend also to their moral and intellectual capabilities. Yet there are certain subordinate points in which animals depart from their original type, and these arise from the circumstances under which they have lived—such as the quantity or quality of their food, confinement, shelter from the inclemencies of the weather, the attentions or punishments of Man. It therefore follows, that those qualities which parents may transmit to their young are capable of being influenced by accidental circumstances, and hence we are able to modify animals and their descendants within certain limits, or, in other words, to form domestic races. Thus we have given rise to numerous varieties of the Horse and the Dog. Each breed or race possesses some qualities which adapt it for certain purposes in preference to any other race, and these are transmitted to its descendants as long as a course of opposite circumstances do not arise to disturb the effects of the former. For these reasons, we are obliged to adopt various means to preserve the purity of the several races, or else to obtain, by the crossing of races, new or intermediate qualities to those already formed.

We may also observe, that those races which are the most domesticated, and the most attached to Man, are precisely such as have received the action of the greater number of means for attaching them to his person. The Dogs, for example, upon whom, whether male or female, caresses have so powerful an effect, are undoubtedly the most domesticated of all animals; while the Bull, which is only attached to us through its food, and whose females are alone subjected to us, is certainly the least domesticated. This difference between the Dog and the Bull is farther increased by the difference in the fecundity of the two species. The Dog submits to our influence a much greater number of generations, in a given time, than the Bull. We are, of course, ignorant of the circumstances which induced the Dog to attach itself to Man, at the commencement, and also the manner in which he was reduced to his present state of submission; but every thing leads us to believe that his original disposition must have been exceedingly favorable to domestication. From the great facility with which the Elephant is tamed, we may conclude that if he were induced to breed in captivity, a race of domestic Elephants might be formed, rivalling the Dog in submission and attachment. Hitherto this has not been fairly tried; no attention has been paid, until very lately, to the breeding of captive Elephants; and even in those warm countries where their services are most necessary, wild Elephants are caught and tamed, while no efforts are made to transmit these acquired characters to their descendants.

An excessive fondness for society seems, however, to be another quality necessary to form a true state of domestication, besides that power just explained of transmitting to posterity their acquired instincts. There was originally a natural sociability of disposition in all the domesticated animals which assisted our efforts. Had they all resembled the Wolf, the Fox, and the Hyæna, in their fondness for solitude,—had they always avoided the presence of their own species,—it is difficult to suppose that we ever could have been successful in our attempts. Perhaps, indeed, we might have succeeded, by long continued perseverance through a course of generations, in forming a race, domesticated to a certain point only, which would acquire a habit of living along with us, until our luxuries would become almost necessary to it, as has been done in the case of the domestic Cat; but the difference between this sullen state of a mere toleration of Man and a real domestication is very great. We may also rest assured, that had not these animals originally presented some striking partiality for the society of the human race, the attempt to domesticate them would never have been made. It thus appears evident that the possession of great intelligence, of a general mildness of character, and a susceptibility to rewards or punishments, are insufficient of themselves to produce domestication. Without dispositions naturally social, the animals now domesticated never could have been induced to attach themselves to Man, and to place themselves under his protection.

There are many social animals which cannot be domesticated; but it is an observation which holds true without one single exception, that all the domesticated animals form troops or herds, more or less numerous, whether they are observed in the wild state, or whether we consider only those portions of them which, being left to them-

selves, have reverted to their original state of wildness. On the other hand, no solitary species, however easily it may be tamed, has ever given rise to domestic races.

Whenever we succeed by kindness to attach an animal, naturally sociable, to our persons, we merely induce it to transfer, for our own advantage, that allegiance which it would naturally have paid to other animals of its own species. The habit of living with us becomes to it a necessary of life; and the Sheep, which has been brought up by our care, follows its keeper just as it would have followed the flock in which it was born. Our superior intelligence soon destroys all equality between ourselves and these animals; our Will guides them in the same manner as the strongest Stallion of the herd would have become the chief, and be followed by all the weaker individuals of which his herd is composed. The submission with which animals obey us is not greater than what they would have yielded to their natural leader in the field. It is true that our power is greater than his, because our means of persuasion are more numerous, and we are able to suppress the greater number of those wants which, in the wild state, would have estranged them from their leader. It may be said that the Hack-Horse which has passed from hand to hand, and been owned by numerous masters, so that all its natural attachments are weakened, if not altogether effaced, appears to have the same degree of docility to every person, and to be in a manner obedient to the entire human race; and we must admit that this case has no corresponding situation in the wild herd. But this objection will have no weight when we consider, that when an animal, whether isolated or in a herd, has had only one master, it is to him alone that he yields obedience and pays his allegiance. Every other person is disowned or even treated as an enemy, just as a strange animal or the member of another society would be in a wild herd. The Elephant allows himself to be guided solely by the Mohout whom he has adopted. Even the Dog, when brought up in solitude with his master, is fierce to all other Men; and every one is aware of the danger of intruding among a herd of Cows, in pastures which are but little frequented, without being accompanied by the Herdsman.

Thus, every animal which acknowledges Man as the chief of his herd is domesticated. The converse is equally true, as Man could not enter into such a society without immediately becoming the chief.

From these observations it will readily appear, that in domesticating the inferior animals, Man has only become a member of that society which these animals form among themselves, and the authority he has acquired rests solely upon the superiority of his intelligence.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Mammalia can be accurately studied only in Captivity—Popular errors from considering Mammalia when in the Wild State—Importance of Menageries or Zoological Gardens—Several Species of Mammalia now wild are capable of being domesticated.

It is commonly, but erroneously supposed, that the character of the Mammalia can only be studied when these animals are at liberty in their native haunts, and that in a state of confinement, we can learn little of their real nature. Pining under the restraints of confinement, they are supposed to offer for our observation nothing but a series of artificial actions, totally unfit to convey those accurate notions which we should acquire upon seeing them at liberty. According to Buffon, the confinements of slavery are opposite to that state of Nature best fitted to exercise and develop all their faculties. "L'animal sauvage," he observes, "n'obéissant qu'à la Nature, ne connaît d'autres lois que celles du besoin et de la liberté."—(Tom. iv. p. 169.)

This popular error, as to the method of studying the characters of animals, has been repeated on the authority of Buffon by most subsequent writers, and tends very materially to retard the progress of scientific zoology. Its source may be traced, partly in the prevailing notion that domestication is a state of slavery, an error which we have already exposed, and partly in those visionary views of a pristine state of native innocence and simplicity in which Man is placed by the imaginations of our poets. From a natural association of ideas, these views are transferred to those animals which most resemble him. Their mistake upon this important point might have been avoided, if Naturalists had considered that when an animal is at large, it by no means enjoys that fancied independence which is usually connected with our ideas of a state of Nature. Its natural character is as liable to be modified by the irresistible pressure of those circumstances in which it is placed, as it would have been in the iron cage or paddock of its keeper. A wild animal prowling about with unresisted sovereignty in the midst of forests and uninhabited deserts, is very different from the same animal living at large in a thickly peopled country. Its character further changes with the plenty or scarcity of its food—the sudden or gradual variations of temperature—the numbers or vicinity of its own species—the strength and courage of its rivals, and a thousand other circumstances. The same animal when made captive is still further modified; it will scarcely be recognized if we succeed in taming it, and still less so if it become susceptible of a true domestication. But whatever modifications the animal may undergo, it always exhibits certain natural instincts and dispositions which are peculiarly its own. Its condition may be altered, but the original Nature remains the same under all circumstances. If new influential causes come into operation, they produce corresponding effects, but these are always relative to the faculties of the animal presenting them. Hence we consider these successive modifications which it undergoes, however numerous or varied, merely as the means of adaptation employed by Nature for bringing it into harmonious correspondence with the several changes of situation; and we are thus enabled to deduce its real Nature from a proper comparison of the phenomena it presents with the conditions under which they arose.

That this is the only method of ascertaining the characters of Mammalia with accuracy, may be farther seen upon considering fully the situation of an animal in the wildest state of independence which can be imagined. Let us take a Ruminating

animal for example, whose wants are more easily satisfied than those of a carnivorous quadruped, and place him in the middle of the rich savannahs of South America, in the company of animals which are less able perhaps than those of any other country to disturb his repose. This surely would appear at first sight a situation the most favorable for the development of his natural propensities.

As long as all the wants of the Ruminant are satisfied, he remains at rest on the soft couch, which accident or his own choice has assigned to him. He sleeps sound in the consciousness of security, and when Hunger urges him to action, he finds his food spread out before him. If it be Thirst that troubles him, the neighbouring brook suffices to quench it. Thus his life passes on with a perfect sameness, alike uninteresting to the philosophical observer, until the rutting season arrives. Then urged onwards by a blind fury, he seeks the female. Bellowing in the ardor of his pursuit, he follows her traces, kills her if she resist and cannot fly, and either remains the conqueror, or becomes the victim of those rivals whom he encounters on the road. If successful, he is enfeebled by the violence of his passions, his ardour cools, and he returns to his retreat in search of a repose, which to him has now become necessary. There he remains following the same round of animal existence, until the anniversary of the rutting season again urges him on in his temporary career of madness.

If we now consider the life of a Carnassier in the wild state, there is but little to add to the uniform picture which we have here attempted to represent. Instead of pasturing in the savannah, this animal springs upon his prey in the jungle, or else pursues it in the desert. He is thus compelled to make use of other qualities beyond those which a mere vegetable diet would have required. Sleep is perhaps equally necessary to him, and probably as long in its duration as that of the Ruminant. All the difference we find between them is, that the nature of the food with the Carnassier demands the exercise of a greater degree of cunning, sagacity, and strength, more caution in ensuring his own individual safety, or, if a female, also that of her youthful progeny.

Now, we ask is there any thing in the course of life followed by these animals, which cannot be learnt equally well when they are in a state of captivity?

If we succeed in taking both the Ruminant and Carnassier alive, and transport them into some Zoological Garden, we no longer find their Nature stupified with that dull inactivity which has here been exposed. We can now place them in situations much more complicated than any they could have experienced in the wild state. We can vary these situations, we can multiply their wants, or increase the dangers to which they are exposed. It is then that we observe their natural dispositions developing themselves, that we find new propensities arise, new resources expand, and an entirely different view of their Nature arises gradually before us. Then we begin to perceive that the state in which animals are placed by the hand of Nature on the earth, is not the most favorable for the development of their faculties. That constant equilibrium of forces which prevails among all animal societies, gives to the most powerful a preponderating influence over the weaker, which never allows the latter liberty to act. It is only when the industry of Man intervenes, that animals acquire the power of developing their faculties. When the overpowering forces, to which they are subject in the wild state, are restrained, or diminished in their action, we are able to discover the natural instincts and propensities of the animal, and arrive at definite as well as varied results.

The older Naturalists have fallen into many important errors from considering animals only in the wild state, and the characters which they have given to most Mammalia are in consequence imperfect, and in many instances altogether erroneous. The illustrious Buffon, to whom we owe so many glowing descriptions of their characters, adorning with the charms of his eloquence subjects hitherto confined only to the severer studies of the learned, gives many striking instances of these mistakes, which, of course, have been repeated after him by most popular compilers.

"The Lion," he tells us, "unites with a high degree of fierceness, courage, and strength, the more admirable qualities of nobleness, clemency, and magnanimity. Often he forgets that he is the sovereign, that is, the strongest of all animals—and walking with a gentle step, he does not deign to attack Man except when provoked to the combat. He neither quickens his step nor flies, and never pursues the inferior animals except when urged by hunger." Again, on referring to his description of the Tiger, we find the same eminent Naturalist observing, "That the Tiger presents a compound of meanness and ferocity; he is cruel without justice, that is, without necessity. He seems always thirsty for blood, although his hunger may be satisfied with flesh. His fury knows no other intermission than the time spent in ambush for his prey. He seizes and devours a second prey with the same fury, which seems to have been only exercised, and not glutted, in the blood of the first."

These differences which Buffon describes, probably on the authority of travellers, could only have arisen from the different circumstances under which these animals had lived. It is one of the facts which the institution of properly-regulated Zoological Gardens or Menageries has disclosed, that *the Lion and the Tiger have very nearly the same natural dispositions*. When placed in the same circumstances, they constantly present the same phenomena. The one is tamed with the same facility as the other; they have the same attachment to their keeper, they make the same acknowledgments for kindness received, and their hatred or passion is excited by the same causes. Their sports and gambols bear the same resemblance as their fears and desires. They both seize their prey with the same eagerness, and defend it with the same fury. In a word, if we abstract the differences of their form, they seem to be absolutely the same animal, so close do their characters correspond in every respect.

Again, there is the Hyæna. Every one has heard of "the untameable Hyæna, that fierce beast which," according to the Showman, "was never tamed since the memory of Man." Its name has been long considered as the emblem of the most determined ferocity and cruelty. Buffon, and the most eminent Naturalists, lend their names as authorities for the assertion. Yet when we come to submit the Hyæna to the experiments of the Menagerie, its character yields to the influence of science, like the most untractable earth before the galvanic pile of the chemist. We then find that *the Hyæna is a most tameable animal*. When treated with kindness, it

comes like a Dog to the feet of its master, receives his caresses with pleasure, and takes its food mildly from his hand.

These are only a few of the instances which might be brought forward to show the immense importance of Menageries, or Zoological Gardens, to the proper knowledge of the characters of animals. When at large in the desert, it is with the utmost difficulty that we can ascertain the real condition of an animal so as fully to appreciate the influence of surrounding circumstances. On the contrary, when confined in the Experimental Garden, we possess the means of successively abstracting those forces which in its former state constrained and overpowered its natural propensities. We may further submit it to new combinations of influential forces, and we may thence deduce those general laws by which all the productions of Nature are equally swayed.

What, we may inquire, would be the present state of Natural Philosophy, if mankind had confined themselves only to those phenomena which Nature spontaneously presents, if they had not invented complicated instruments and apparatus for the purpose of placing the forces of Nature in new and untried conditions? To suppose that animals, when captive, exhibit actions of a different Nature to those performed in the wild state, would be to assign to Man the absurd power of altering the Nature of animals, of creating in them other dispositions than such as were assigned to them by their Maker; in other words, of subverting the laws of created existence. No person can suppose that the Chemist, however he may vary his experiments, can create a single particle of matter, or alter any one of the laws of inorganic substances. In a similar manner, the Zoologist, however he may vary the condition of the animal under examination, arrives by analysis only at those particular and general laws which Nature has assigned to the animal, but its original constitution remains the same under all circumstances. As long as our observations of animals are confined to those at liberty, this important branch of Natural History will contain nothing but a crude collection of isolated facts often at variance with each other, because they are united by no connecting link. The observers, perhaps, are guided by no sound views of science, or the facts they record are accidental, or arise from local causes, while fantastical hypotheses are formed of the nature of animals, derived from their views regarding the nature of Man. When, however, the captive animals of a Zoological Garden are submitted to a rational course of experiments, that branch of Natural History which considers the actions of animals and their causes, becomes elevated to the rank of a science from the richness and variety of the general truths which it unfolds.*

It is only necessary here to point out, in a few words, some of the important facts which have been brought to light by a properly-regulated course of experimental inquiry into the nature of animals, and to exhibit a few of the subjects which still remain open for inquiry.

For a long time it was imagined that the moral perfection of Man depended upon the development of his organs, and if this error has at length been abandoned by all except a few popular theorists and their followers, it still holds its sway in regard to animals. Those animals which enjoyed the greatest delicacy of sense, with pliable limbs well adapted for rapid motion, ought, according to this theory, to be the most intelligent; and the Monkeys, as well as many Carnassiers, seem at first sight to confirm the rule. But the examination into the intelligence of many species of Seals (*Phoca*) has demonstrated the important truth, that the *intelligent powers of animals are not in proportion to the perfection of their organs*. Of all Mammalia the Seal seems at first sight least fitted by its structure for intelligence. Its limbs are modified into oars or fins, it has no external ears, its eyes are adapted for vision in the dense medium of water, and hence it can see very imperfectly in the air; its nostrils are only opened when the animal breathes; and its body is covered all over with a thick layer of blubber, which deprives it of the exercise of touch, except at the places where the whiskers are inserted. Yet the Seal equals, if not surpasses, the Dog in its susceptibility for attachment, in docility, and in the brilliancy of its instinct. This fact demonstrates that the most exact acquaintance with the organic characters of animals is but an imperfect kind of knowledge, if we are ignorant of the inward principle which animates and guides their external frames. There is another striking instance of the importance of studying animals in captivity. It was always supposed from examining animals only in the wild state, that their intellects were developed in the same manner as those of Man. A young animal born with faculties still in the bud, seemed, during the ardour of its youth, to exhibit vivacity rather than strength; and it was thought that its intellect became matured, as in Man, with increasing years. This prejudice has been altogether overthrown by the examination of animals in captivity. It is there found that in the first ages of youth their intellects arrive at the full development, and that *young animals are beyond all comparison more intelligent than their parents*. It is clear that this fact never could have been ascertained with wild animals, because it was necessary to follow them throughout all the stages of their growth. There were many precautions requisite to ensure the success of the inquiry. All animals were not proper for the investigation; those of very limited capacity presented no apparent result; those modified by domestication could not be relied on; and the Carnassiers being under the continual necessity of using their faculties for subsistence, had their original nature so much altered, through the experience of the individual, as to be unfit for the experiment. It was necessary to confine the inquiry to the Apes, which have been most favored with intelligence, and yet whose existence does not depend upon the use they make of it, as the forests of their native climates yield a continual supply of abundant nourishment.

The fact that young animals are more intelligent than their parents, marks an important difference between the nature of Man and that of the Brutes. While human nature is capable of an indefinite improvement in the lapse of time, the nature of the

* At a time when London, Liverpool, and Dublin, have their own Zoological Gardens, increasing daily in wealth and importance, it seems singular that Scotland should be so far behind her neighbours in this branch of science; that the study of animals should be left to the generous munificence of private individuals, although the establishment of a public Zoological Garden, in Edinburgh, offers a reasonable prospect of remuneration, when considered even in the light of a mere commercial speculation, and without any reference to its important effects in elevating the public taste.

brute blazes forth at once in its greatest brilliancy. The latter, by the continual decay of its original powers, points out that eternal rest to which it will soon be consigned; while the aspiring mind of Man sees, in the gradual perfectibility of his Nature, a glimpse of the immortal existence beyond the grave, on which his hopes love to repose.

These are not the only kind of truths to which experimental inquiries into the Nature of animals lead us. They also give much important information regarding their instincts, those necessary actions to which they are blindly urged by a superior power.

While the examination of the Beavers was confined to those in their wild state, it was remarked that such only as lived together in society, and in uninhabited countries, ever constructed habitations, while the solitary individuals encountered sometimes in densely peopled countries, retired into the natural cavities of the rocks on the banks of lakes and rivers. Buffon says that these animals are not urged to work and to build by that inward instinct, or physical necessity, which guides the Ants or the Bees; but that they act *par choix*, that is, from understanding the design and utility of their work, and that their industry ceases when the presence of Man inspires them with the dread of his power. Of all previous writers upon the Nature of animals, Buffon had probably the most just and elevated ideas concerning them, yet upon this point he fell into a serious error, which subsequent experimental inquiry has not failed to discover. It is found that when one of the solitary Beavers is placed in a convenient situation, when he is supplied with the proper materials for his edifice, such as earth, wood, and stone, neither his solitude nor the presence of Man has any effect upon his industry; he still continues to build. Had Buffon submitted one of these animals to experimental inquiry, he would have regarded the huts and dikes of the social Beavers not as "the result of combined projects founded on the reason and convenience of their ends—of natural talents perfected by repose," but he would have regarded them, as they really are, the result of an industry purely mechanical, as the object or gratification of an internal want wholly instinctive. Numerous experiments made with several of the solitary Beavers, taken from the banks of the Isère, the Rhone, and the Danube, have demonstrated that they are always naturally disposed to build, although they already may have a commodious habitation, and no apparent advantage could result from their labour, except that of blindly satisfying an instinct which they are, in a manner, forced to obey.

We shall only allude here to one more error which the examination of captive animals has completely served to expose. The belief that the herbivorous animals are of dispositions milder, more tractable, and more affectionate than the Carnivora, has infected the works of nearly all our popular writers on Natural History. It has exercised an important influence on philosophical and religious systems, upon the received views of the Nature of Man, or of the effect of food upon the moral development of his Mind, upon the laws of nations, and even upon their poetry. The dark-eyed Gazelle has become the emblem of mildness as well as of beauty, and it has been the same with the Hind and other animals with large eyes and a light or timid step. On the other hand, the Tiger, the Panther, the Hyæna, and the Wolf, are held up as glaring instances of a brutal ferocity as well as cruelty, fitted only to inspire us with hatred and detestation.

But upon a minute and close examination, upon becoming in a manner *personally acquainted* with them—a state of things which can only happen in a Menagerie—we are compelled absolutely to reverse these epithets; in a word, to assign to the Herbivorous tribes these ideas of brutality with which we had been previously taught to regard the Carnassiers. In fact, all the adult Ruminating animals, but especially the males, are rude and brutal in their manners; they can neither be soothed by good treatment, nor attached by caresses. If they have intelligence sufficient to know the hand that feeds them—a circumstance not always the case—they owe him no attachment. The requisite attentions of their keeper are performed only with the necessary precautions to ensure his own safety. The moment he ceases to intimidate them, they are ready for an attack. A secret sentiment urges them to regard every animal as an enemy which is not of their own species. We have seen that it is altogether different, even with those animals which feed most exclusively upon flesh. While the former are of a low and narrow capacity, the Carnivora are equally remarkable for the extent, refinement, and activity of their intelligence. So true is it, even with animals, that the development of their intellectual powers is more favorable than otherwise to the advance of those nobler qualities which attract our regard and esteem.

The importance of Zoological Gardens is not confined merely to the acquisition of scientific truths; they may lead to practical results of the utmost importance to society. There are numerous animals whose powers of becoming domesticated have not yet been fairly tried, and even in the present state of our knowledge, it is more than probable that not a few will be rendered practically available, and become to the next generation as familiar as Steam Boats and Gas Lights are to us.

Upon applying the principles already explained to different tribes of animals, we shall be able to point out some species which may hereafter become domesticated.

Beginning with the Apes, we find qualities highly favorable for domestication, such as the social instinct and great intelligence; but these are entirely counteracted by their excessive irascibility, violence, and fickleness of disposition, which render them altogether incapable of yielding submission. Hence they are entirely excluded from the list of animals with whom Man could associate. A like exclusion must be given to the American tribes of Quadrupeds, to the Males, and to the Insectivora, for the feebleness of their bodies would render them useless to Man, whatever susceptibility their dispositions might possess.

But with regard to the Seals, it seems altogether surprising that Fishermen have not made use of their instincts, or taught them to assist in fishing, in the same manner as the Hunter has brought up the Dog to aid in the chase.

We may pass over the intervening tribes of Rodentia, Edentata, and Marsupialia. The feebleness of their bodies, and their limited intelligence, disqualify them from sharing our labors. It is different with the Pachydermata, as most animals of this order have already been domesticated, or are fit to become so.

The Tapir (*Tapir Americanus*), it is to be regretted, is still in an unreclaimed

state. Being very much larger than the Wild Boar, and at the same time much more docile, it would yield domestic races of far greater value than the common Pig, and of a different quality. Yet, as it presents but few means of defence, this valuable animal is gradually becoming more scarce in America, where it is in great demand for the delicious flavor of its flesh as an article of food. It is probable that this important race, if not previously domesticated, will become totally extinct as America becomes more peopled.

All the different kinds of Solipeda might be rendered, with care, as domestic as the Horse or the Ass. The training and breeding of the Zebra (*Equus Zebra*), the Quagga (*E. Cougga*), the Daur (*E. Montanus*), the Dzhiggtai (*E. Hemionus*), would be a useful labor to society, and probably a lucrative undertaking for the projectors.

Nearly all the Ruminantia are social animals, living together in troops, and thus most of the species of this numerous tribe are fitted by their Nature to become domesticated. There is at present one species, perhaps two, which are now only partially domesticated in South America, and are nearly unknown in our climates. This is much to be regretted, as they would yield fleeces of great fineness, and at the same time be useful as beasts of burthen. The Alpaca (*Auchenia paco*), and the Viengna (*Auchenia viengna*), are more than twice as large as the largest races of our Sheep. The qualities of their fleece are very different from those of the ordinary wool, and might be made into stuffs possessing an intermediate quality between wool and silk. This would certainly give rise to a new branch of industry, and serve to extend the commerce of our nation.

It has often been objected to the domestication of animals inhabiting warm countries, that the difference of climate would form with us an insurmountable difficulty. This error might have been avoided, if the objectors had been more aware of the resources of Nature in adapting animals to differences of temperature, as well as of our extensive influence over all living beings. In reference to the Alpaca and Viengna this difficulty could not exist, and the objection resolves itself into mere ignorance of their habitat; for these animals reside only on the very temperate parts of the Andes, in Peru and Chile. It is not even applicable to the Tapir, although originally from the warmest climates.

The nature of domestication has now been fully explained. We have seen that its foundation exists in the natural disposition of animals to live together in herds or troops, and to form mutual attachments;—that it can only be induced by kindness, chiefly by augmenting their wants and afterwards satisfying them. Yet, by these means, we could only produce domestic individuals and not domestic races, if we were not aided by one of the most general laws of living beings,—the power of transmitting their organic and intellectual modifications to their posterity. This is one of the most remarkable phenomena of Nature, and well worthy of profound attention. That an accidental modification of the body should become a permanent alteration of form is extraordinary, but that a passing desire or habit should become, in the course of time, an original instinct, is without doubt altogether astonishing.

We have also seen the importance of studying animals in captivity, as connected with the progress of Zoological science. However the study of wild animals may serve to point out the part they have to play on the great theatre of Nature, it totally fails to discover their faculties and dispositions: we must resort to captive animals for this information. If it were true that animals must be examined when at liberty in order to ascertain their Nature, then the advancement of this branch of science is hopeless, as the difficulties of studying wild animals are so great as to be equivalent in practice to an impossibility. When at liberty they view with distrust every person whom they do not know, and either fly from or attack all who molest them. Again, animals could not be examined in savage and remote countries with which we are altogether unacquainted. The mere circumstance of pursuing an animal alters its original condition, and even then its natural state is as much disturbed as if it were really in captivity.

If it be true that the state of an animal, in whatever part of the earth it may be placed, is the natural consequence of the faculties and instincts imparted by its Creator, it follows, that if we have ascertained the latter, we may predict the former. As soon as we know exactly the general faculties and dispositions of the species, it is easy to state how it will act in every situation in which it can be placed. It becomes no longer necessary for us to follow the animal into the details of its existence, to visit the country of its residence, to find it out, and to hunt it down. Having once ascertained its Nature by Analysis, we can then apply the principles thus established Synthetically to every other possible case. This is the way in which all the sciences proceed, and Zoology can be properly cultivated only when it follows a similar course.

Under whatever view the subject may be considered, we must arrive at one conclusion—that the examination of animals in Menageries or Zoological Gardens is, of all methods, the best for studying and knowing them, as they ought to be investigated by the lover of Nature.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Analysis of the principles which guide the actions of Animals—Intelligence and Instinct—Effect of Habit in transforming the character of Actions—Intelligence of the higher Animals compared with that of Man.

BEFORE entering upon an analysis of the inward principles which determine the actions of animals, it must, in the first place, be recollected, that our knowledge of the intellects or sensations of animals will rest ultimately upon the consciousness of what passes in our own minds. It is only by examining that internal light which we possess within ourselves that we can arrive at any satisfactory conclusion. We compare our own actions with theirs; we are conscious of the internal cause which incites us to act, and we infer a similar cause in the animal. Should the Creator have be-

stowed a faculty to animals altogether different from those we are conscious of possessing, it must remain concealed for ever from our thoughts. The boundaries of our own intellectual world form the limits of our knowledge regarding the causes which produce the actions of animals.

Some of the principles which urge Mammalia to act are evidently of the simplest kind. The cries of an Infant when in pain, or in want of assistance,—the determination of a newly-born animal to the breast and the action of sucking,—the flight of a young animal when influenced by fear, although it has had no experience of danger,—its resistance when we attempt to seize it,—the attention of an animal just born to the cries of its mother, are all actions of this kind. Whether simple or complex, they arise previous to all experience; and have been regarded, by the common consent of all Naturalists, as purely Instinctive. They proceed from an irresistible and uniform internal power, which leads invariably to the same course of action.

But all the actions of animals are not of this uniform description. The Dog obeys and does not fly from the whip which his master raises to chastise him. He seeks for the object which has been pointed out, instead of remaining indifferent to the order he has received. If he be confined in a cage with wooden bars, he is agitated with rage and attempts to destroy them; but if they are made of iron, he lies down resigned to his confinement. All these actions are Intelligent; and it is the very nature of this Intelligence that it is capable of being modified by experience, and of conforming itself to the variable circumstances which incite it to act.

Other instances of Intelligence may be mentioned. When a Horse has to choose between two roads, of which one is known to him, he always takes the latter, however long the period of time since he may have travelled thereon. The Dog leaps before his master, and loads him with caresses, when he sees him preparing to go out, and wishes to accompany him. The same animal confines the flock, which has been entrusted to his care, within the precise limits marked out by his master. The Wolf attacks his prey openly and by force when in the recesses of the forest; but, if he be in the neighbourhood of a village, he approaches it cautiously, and attacks it by surprise.

All these actions are evidently Intelligent, and not Instinctive. The slightest circumstance would have induced the Horse to take the road which he had not previously travelled. If the Dog, by his disobedience, had offended his master, instead of leaping before him with joy, he would crouch and tremble at his feet. We also know that he acquires the remarkable talent of guarding the flock entirely from a previous education, and in being trained expressly for that purpose.

On the contrary, it is the common character of Instinctive actions to be fixed and invariable; to be constantly produced by the same causes and the same conditions. We accordingly consider the following actions as Instinctive;—the Dog, when he hides under ground the remains of his meal;—the Horse and Reindeer, when they remove with their hoofs the snow which covers the earth, to expose the food of which they are in want;—the Cows, when they come together in a circle, upon the approach of an enemy, with their heads and horns in the circumference, and their calves in the centre;—the Beavers, when they build cabins and construct dikes,—when they cut the wood necessary for their edifices, and repair the ravages which time or an enemy has occasioned to their buildings;—the Rabbit, when it excavates its burrow;—the Bird, when it constructs its nest. All these actions, and many others, are presented to us with a certain degree of uniformity, essentially the same in all its more important particulars. The Dog hides his food with the same blind Instinct, although its superabundant supply renders such a precaution unnecessary. The Horse or Reindeer that uncovers the grass or moss concealed under the snow, does the same thing when he sees the snow for the first time, and prior to all experience; he acts in the same manner after a meal as when oppressed with hunger. The Beaver builds in all situations, under the closest confinement as well as when in the enjoyment of the greatest liberty; when in the possession of the most comfortable abode, as well as when in want of all shelter. The Cows, which exhibit so much ingenuity in defending their young when in a herd, do not change their plan of defence though surprised in a small party, and when this method becomes wholly insufficient. The Rabbit which takes so much pains to burrow its retreat, knows not how to conceal it, or to adapt its construction to the changes of the seasons, to the circumstances of the place, or to the nature of its enemies. The lower classes of animals present instances still more striking and extraordinary of the blindness of their Instincts.

Upon considering all the Instinctive actions of animals, we find that these are of a nature very different from their Intelligent acts. Instincts are exercised or exhibit themselves only at certain periods; they are always of a limited number in each species, but they go on increasing greatly in number and importance among the lower classes of animals, generally in proportion as their organization differs from that of the human race.

Numerous instances might be adduced in support of these views. We at once perceive an immense difference between those intelligent actions which have already been enumerated, alike remarkable for their complexity, and those involuntary Instincts, always of great simplicity, which are occasioned by fear, passion, desire, or hunger. The latter seem purely organic,—that is, they result from the direct influence of a superior Power,—while, to the former, Intelligence appears indispensable. It is also only at certain periods, and for a limited time, that these animals seek their females, prepare their abodes, or construct their nests. The Dog, the Horse, and the Bull present few actions which can be regarded as instinctive; yet their lives pass on with considerable activity. Their intelligent actions nearly fill up their entire course, and are sufficient for the numerous situations in which they are placed. We can perceive a trace, among the Mammalia, of that diminution of Intelligence which results from the prevalence of the Instinctive acts. The Dog presents a great number of Intelligent actions, and only a small number of Instincts. The Bull, on the contrary, leads an active life within very narrow limits; and though his Instincts are not positively numerous, they become relatively so, when compared with the very small number of his intelligent actions.

But the marked difference between Intelligence and Instinct becomes still more striking when we extend our views beyond the limits of the Mammalia, and consider

the entire Animal Kingdom. It is then we shall perceive that the Quadrumana and Carnassiers, which stand at the head of the list, may almost be styled Intellectual, if compared to animals of the lower divisions, whose entire existence appears to be swayed by a uniform and constant force. Indeed, were not all analogies between mental and material phenomena altogether inadmissible, we would be disposed to compare the Instincts of the inferior animals to those inert powers of Nature which form the prime movers of our own machinery. The most complicated Instinct of the Dog, requiring for its fulfilment the concurrence of the greatest number of intelligent acts, appears absolutely nothing in comparison to actions of this nature, which may be seen in the Invertebrated animals, but chiefly among the Insects. In the Dog and other Mammalia of the higher orders, that Instinct which urges them to store up provisions for future want, shows itself only in a few isolated acts. Among the Insects, on the contrary, their entire existence, however varied it may appear, seems composed only of one single invariable action, from which nothing external can divert them, and to which they seem invincibly urged by a superior power. None of the Mammalia exhibit in any of their actions such a combination of sagacity, foresight, and skill, as might have been inferred from the industry of the Bee, did we not see in its actions, proofs of the existence of a Mind not its own. Were Man incapable of receiving evidence of a Creative Power in his own constitution, he must read it in that principle which urges these lower animals to perform a complicated course of actions, continuing for days and months,—ever directed to one end, and that end invariably the same. He must perceive that Wisdom is not the sole property of Man, when he finds profound combinations, calculations of the greatest complexity, and the most ingenious views, urging these lower animals to work with a degree of perfection which all his learning and experience, accumulated for a long course of ages, can scarcely equal.

Although we have said that Intelligent actions may be varied at the pleasure of the animal, while the Instinctive actions are irresistible, these assertions must be understood with some qualification. While performing an Instinctive action, the animal always preserves the power of using its senses, and of exercising its Intelligence to the degree natural to its species, and employs both in the manner most favorable for the execution of that Instinctive action to which it is actuated.

An animal is capable of exercising its Intelligence in a degree inversely proportional to the force of its Instinct. As the Instinctive wants become urgent, its Intelligence appears more fettered. There is no comparison, for example, in the degree of Instinctive force between the Hamster (*Cricetus*), which stores up magazines of provisions for the winter, and the Dog who hides his superabundant food. Nothing could divert the Hamster from its purpose; the slightest circumstance would cause the Dog to neglect that precaution.

Having pointed out the difference between Intelligent and Instinctive actions, we now come to draw the probable line of demarcation between the Intellectual powers of Man, and the Intelligence of the lower animals.

We evidently perceive that animals, especially the higher classes, have the power of Attention; that their senses receive impressions analogous to those we are conscious of experiencing in ourselves; that their ideas follow each other in a certain regular order constituting a train of thought; that a former idea can be recalled; that their ideas are variously associated; and that they can form some conclusions. This seems to be the extent of their powers. We are, of course, reduced merely to conjecture the intensity or qualities of their sensations or perceptions, and are therefore unable to point out those qualities of bodies which can be perceived by Man alone.

There is, however, one curious circumstance which may be noticed in regard to the sense of Hearing. With animals it is a Sensation and not a Perception; in other words, they are unable to refer sounds to an external cause. If a wild Bull or Horse feel himself struck violently, he makes no mistake as to the cause. He rushes immediately at the person who has inflicted the blow, even when struck only with a stone or other projectile, just as the Wild-Boar rushes upon the Hunter, whose ride-ball has struck him. But when captive animals, in course of taming, are tormented by a Drum or Trumpet to prevent them from sleeping, they have no perception either of the instrument from which the sound proceeds, or of the person who plays it. They suffer passively, as if by some internal injury, where the cause of the evil is within themselves. It is curious that their head and ears are notwithstanding directed instantaneously to the precise quarter whence the sound proceeds. It is different with the sensation of Colour. The Bull rushes at a piece of red cloth, in the same manner as he would have done at an assailant; from which we may infer, that when the Horse and Bull are unable to refer a Sound to its proper cause, it is owing less to the distance which separates them from the instrument, than to the peculiar nature of their sense of Hearing.

In other respects, they generally seem to have the same senses as ourselves, and to perceive analogous qualities in bodies. Their motions result from the qualities of their sensations; they attempt to fly, to defend themselves, to seize, or to attack, according as they are moved by pleasure or pain.

Being capable of forming certain relations to Man of a benevolent or malevolent character, they acquire a marked affection for those who treat them well, and a determined hatred to their tormentors. Some species form an attachment for each other solely from the habit of living together for some time, and frequently their mutual hatred arises from mere caprice.

These dispositions presuppose Memory, and at least some confused knowledge of the relations of those qualities which distinguish one person from another. They exhibit the internal affection of the moment by external signs, which are in general very like those employed by Man for the same purpose.

The Mammalia acquire from experience a certain knowledge of natural objects,—of those which are safe or dangerous; they avoid the latter in consequence of this experience, and of that memory from which it is derived, without being determined by an Instinctive Attraction or Repulsion. This experience enables them to infer the consequence of their own conduct, when domesticated. They know that a certain action will be punished by their master, and that a contrary one will be rewarded. Their final determination does not proceed from any internal attraction, but often in direct opposition to some very powerful Instinct, and from the sole knowledge of the re-

ward or punishment which will follow. This knowledge, besides memory, also presupposes a power of reasoning from analogy, or of inferring that similar causes produce similar effects. Knowing well the power of their master, that he can either punish them or not, they assume before him a supplicating air, on perceiving him to be angry.

Their passions and emotions react upon their involuntary functions in precisely the same manner as with Man. Surprise stops their respiration; they tremble with Fear; Terror throws them into a cold perspiration; and Love agitates their frames.

They may be corrupted or improved by Domestication. Habits of ease or luxury create in them artificial wants unknown in the fields or woods. Education may fit them for actions for which they are not adapted by their structure. By proper training they may be rendered docile, mild, and active; or, if improperly managed, they may become more obstinate, passionate, stubborn, or lazy, than Nature had formed them.

Race Horses give evident proofs that they are actuated by Emulation, and Dogs dispute with each other for the caresses of their master. The Jealousy of the latter does not merely relate to the possession of their food or other enjoyments wholly physical, but also to the benevolent affections.

The natural language of the Mammalia enables them to explain to each other the wants or sensations of the moment, and, in their intercourse with Man, they understand that more complicated language by which he makes known his commands. Not only do the young know the cry of their mother when she gives notice of approaching danger, but they comprehend a number of artificial words used by Man, and act in consequence. We have been acquainted with a gentleman who spoke to his Dog only in the French language. The animal would go home, or leave the room at his master's command if announced in the common phrase, but would remain undecided and look into his face with eyes of inquiry when the order was given in an unusual style or language. Some species and genera have very great powers of Imitation.

There can be no doubt that all the lower animals, without exception, are unconscious of their existence, and incapable of reflecting upon their own condition. They cannot turn their thoughts within themselves, and consider what it is that they see, feel, think, and perform. The acts of their Minds, like the movements of their bodies, are the mere result of external causes or of internal Instincts. They cannot form the notion of Liberty, for this can only be acquired by Reflection. For the same reason, they are not Moral and accountable creatures.

Indeed, it is chiefly to the want of Abstraction—of that power by which Man forms general ideas, and arrives at general conclusions, that the inferiority of the lower animals may be attributed.

Many philosophers, and especially Condillae, imagined that animals can reflect; and they founded their views upon those invariable actions which we have regarded as Instinctive. But there appears to be an evident contradiction, in attributing a constant and seemingly necessary action to a power such as reflection, which presupposes Liberty. It is also evident, that if the Dog concealed his food from really foreseeing the chance of future want, or, in other words, from reflecting upon his former necessity, and considering the probability of its recurrence, he would not have confined himself merely to set aside a supply of provisions, but would have taken means to provide shelter, a manger—in a word, to procure a supply for satisfying *all* his wants. This method of reasoning is conclusive against our regarding Instinctive actions, which are always partial and limited in their application, as the result of Reflection.

Other philosophers, imagining that the power of Reflection was usually proportioned to the force of their original desires, thought that the Instincts of animals might still be owing to Reflection, as they might depend for their exercise upon the force of the wants or likings of the animal. But if this were the case, the results of Reflection would be seen in their most trifling attachments or likings, as well as in their most pressing wants; and this does not agree with observed facts. It is certain, that, for animals generally to satisfy their appetite for food is of the greatest importance, and exercises the most powerful influence over each individual. Also it appears much more indispensable for their existence that it should be satisfied than the want of shelter. Yet we see many animals continuing to dig burrows and retreats, or, according to this theory, appearing to foresee the necessity of providing shelter, and yet the same animals do not foresee that which ought to be most urgent with them, the necessity of laying by a supply of food for future use.

All other attempts to explain the actions of animals in a general manner, and without admitting particular faculties, are equally objectionable, and the same thing may be observed in reference to Instinctive actions.

To avoid the contradictions which have been here pointed out, some philosophers have thought that the Instinctive actions of animals proceeded from some peculiar form of the Brain. When stated in the above simple form, this theory presents many difficulties. Its partisans have pointed out what they conceive to be the particular forms which manifest Instincts, and have collected many striking coincidences in support of their views. We find, it is true, in the structure of their brains certain forms which are in some manner connected with the Intelligent functions; but their experiments have not yet demonstrated these functions, and the extreme difficulty of such a task will long render it almost impossible. In the meantime, it is useless to occupy ourselves with suppositions, which are ever liable to be overturned by future inquiries. Natural History justly excludes all consideration of that question, once so much agitated in the schools—Whether animals have Souls.

There is a class of phenomena very different from the preceding, which are founded on more certain analogies, and throw some light upon the connexion between Intelligence and Instinct. We allude to the remarkable effects of Habit in transforming an Intelligent into an Instinctive action.

When a Man, who has perhaps studied with great care some treatise on the Art of Horsemanship, attempts for the first time to mount a Horse, none of his attitudes or movements, notwithstanding all his science, are what they ought to be. His body falls behind or before when it should be in a vertical position. His limbs are shaken when they ought to remain motionless. In a word, there exists no harmony between

his own motions and those of the Horse. At first, it is only by a great effort of the Mind, that he can perform any one of the requisite movements; afterwards he is able to execute two motions at once, and at length he performs them all simultaneously. But after a little practice, the effort of the mind becomes less necessary, he ceases to pay any attention to the act. In a word, it is no longer an Intelligent action, but it becomes Instinctive. If the Horse make a movement in opposition to the Bridle, instantly the motion of the Horse communicates to the body of its rider that counter-motion proper to restore the equilibrium. This is done also without the slightest reflection, like the winking of the eye, or the turn of the head when a blow is threatened. The power of Reflection would arrive too late for the desired purpose, and it is therefore supplied by an action purely Instinctive.

These differ from the other kind of Instinctive actions only in their origin, being acquired by Habit, instead of being imparted by Nature.

The transformation of Intelligence into Instinct is capable among many animals of being transmitted to their descendants. We are assured that when Rabbits are kept for a long course of years in places where they are unable to burrow, they give birth to races which are not naturally disposed to form these subterranean retreats. Lcroy informs us that young Foxes, born in countries which are thickly peopled, show, even before quitting their kennel, a much greater degree of cunning and prudence than those living in countries uninhabited by Man, and where they have few enemies to fear or to avoid. Certain races of Dogs are naturally adapted for Hunting, to which they betake themselves Instinctively, and without any training, while other kinds of Dogs, such as the Bull-dog, do not course naturally. More instances of occasional habits being transformed into permanent Instincts, and transmitted as such to their descendants, might here be enumerated. But having treated of animals as individuals, we must now view them in those societies which they form among themselves, and trace the various forms of the Social Instinct.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

The Social Instinct—Occasional attachments of the Unsociable species—Social habits of a herd or troop of wild animals—All the domestic animals are naturally sociable.

It has long been admitted, that the love of Society is an original principle of the Human Mind, one which precedes all reflection and all knowledge. "Man," says Montesquieu, "is born in society, and there he remains." A kind of Instinct overpowers him, and prevails as well in the most savage hordes as among the most cultivated nations. "Send Man to the solitude of the desert, he is a plant torn from his roots. The form remains, it is true, but every faculty decays; the human personage and character alike cease to exist."

This Instinctive feeling is equally prevalent among the lower animals as with Man, and it is equally an original principle. It can neither be regarded as an intelligent phenomenon, nor as the result of habit. We find but slight traces of the love of Society in many species which possess a very high degree of intelligence, and it would seem that the greatest as well as the most remarkable instances of it are found in the lower classes of animals, such as the Insects.

The proofs that it is not the result of habit are equally convincing. If it proceeded from Education, or from the influence of parents over their young, these causes would act with equal force upon all animals which are dependent for the same period of time upon their parents. The Bears, which tend and bring up their young equally as long as the Dogs, and with the same tenderness and solicitude, ought then to be equally sociable. Yet the Bear is essentially a solitary animal. Further, we find with all Mammalia that the influence of Habit never can prevail over the Instinct of Nature, that the Social Instinct lies dormant in some species of animals, although they have never had an opportunity of exercising it, and that it disappears in those species which are not intended for a permanent state of society, although the utmost care be taken to preserve its existence. The uniform experience of the Menagerie proves that Mammalia, naturally sociable, are always ready to form attachments, although brought up from their earliest moments in solitude. M. F. Cuvier observed this fact on comparing Dogs with very ferocious Wolves, both kinds being reared in the strictest solitude. The Social Instinct showed itself in the Dogs as soon as they had recovered their liberty. On the other hand, young Stags, which, in the first years of their lives, formed herds and lived together in society, separated permanently from each other when they had arrived at the age of puberty. The early habits and the social Instinct of the last mentioned animals became equally effaced by time.

A great number of Mammalia form connexions which are necessarily of a very temporary kind, as they are founded only upon those appetites which disappear when gratified. With these species, the males and females seek each other's society only during the rutting season. The female attends her young with the utmost affection, and defends their lives at the peril of her own, from the moment of their birth; and this affectionate regard continues on her part as long as her breasts are capable of secreting milk. Also the attachment is reciprocal on the part of the offspring, as long as they require her to provide for their wants. But as soon as the rutting season is over, the males absent themselves; as soon as the breasts of the mother cease to secrete milk, and the young can procure their own food, all attachment is at an end; the temporary union is dissolved, and they live apart in the most perfect state of estrangement. Then the slight trace of social habits which they had contracted in their infancy is effaced, each animal becomes a solitary individual, and shifts for itself. The wants of the one animal form the principal obstacle to a neighbour in satisfying its own. This opposition of interest brings on enmity and war, which is the habitual state of all solitary animals in respect to their own species. Among them, force is the only law. The feeblar animal avoids the stronger, and dies in its turn if it cannot find a still more feeble animal to destroy, or another solitude to inhabit. This is the order of things which prevails among all the species of the Cat tribe, among the Martins, the Hyenas, and the Bears. We find it in all those animals which have

no other wants than such as tend either to the preservation of the individual, or to the continuance of the species; and these passions, so far from being the cause of the Social Instinct, as some philosophers have imagined, are manifestly opposed to all social intercourse.

The examples which have just been adduced are afforded by animals presenting habits of the most solitary kind. Nature, however, does not pass at once to the truly Social species. Other animals possess the Social instinct in different degrees, and modified more or less by other instincts. We find traces of a permanent union in that attachment which exists between the Wolf and his female, even beyond the rutting time. The same pair appear to be remotely connected to each other during their entire lifetime, although they only form an intimate union during the rutting season. At other times they go about alone, each seeking its own food, and if they be sometimes seen to bunt in company, it is more from their having the same pursuit than from any Social feeling. The influence of these casual meetings in developing the Social instinct is but slight, and hence the Wolf easily bears a complete separation from his companion.

The Roe-bucks (*Cervus Capreolus*) are an instance of a higher degree of Social Instinct, but still not in its full extent. Among these animals, the male and female continue always together; they share the same retreat, feed in the same pastures, and run the same chances of fortune. If one of them perish the other does not survive, unless it can find consolation in another individual of a different sex, and in the same solitary condition. But the affection of these animals for each other is exclusive; they do not differ from the solitary animals in respect to their young, and they always separate from the latter as soon as their presence is no longer indispensable for their preservation.

In a union such as that last described, the mutual influence of the two individuals is very limited. There is neither rivalry nor subordination, and they acquire habits of the most perfect harmony.

It is different with those numerous animals which are naturally sociable, and live together in bands or troops, although their individual interests are often at variance. We here see the Social principle in its full extent, and to a degree which may almost be compared to human societies. It is not merely confined to the union of individuals in a family; but it holds together numerous families, and maintains peace among hundreds of individuals of either sex and of every age. All the individuals of the same herd know each other, and are mutually attached according to the relations which circumstances and their individual qualities have established among them. Harmony reigns until some foreign cause appears. But this mutual feeling exists only for the other individuals of the same herd. A stranger is at first refused admittance, almost always they fall upon him as an enemy, and ill-treatment usually compels him to fly. On the other hand, with every isolated individual the love of society is a want which must be satisfied. At first he follows them at a distance, he gradually approaches, and for the sake of being admitted, gives up his natural will to that point where the instinct of self-preservation urges him either to defend himself or to fly.

We may be able to exhibit the state of society which prevails in the troops of wild animals by tracing the life of a young individual from its birth until it becomes the leader of the herd. From the moment that it ceases to be nourished entirely by milk, and to venture out of the ring under the conduct of its mother, it begins to recognise the surrounding localities, its food, and the features of the other members of the herd. The mutual relations of the latter had been previously determined by the incidents of their growth and education, and these same causes exercise a similar influence upon the young animal, whose progress we are now tracing. It can neither fight with the older animals to establish its superiority, nor can it avoid them by deserting the herd: it is not strong enough for the former course, and is prevented from the latter by the Social Instinct. Submission is therefore its only resort. Whenever any circumstance arises which places its interest in opposition to that of the others, the most feeble animal is of course sacrificed. In this case, it must either yield to necessity or escape by stratagem. This is, in fact, the situation of all young Mammalia in the middle of the herd. They are very soon taught both the extent of their liberty and of their strength. If they be in a troop of Carnivora, such as the Wild Dogs, when a prey has been hunted down, each individual shares in it, according to the authority which he has been able to exercise over the others. The young animals are left to feed only upon the remains of the feast, or upon such bits as they can carry off by stealth. They attempt to appropriate a few fragments, or to slip in behind the others, happy if they can escape the blows which the older animals deal unsparingly. In this manner, they feed largely if the prey be abundant, but if scarce they die of hunger. By this continual exercise of authority which the older animals sway over the younger, the obedience of the latter is confirmed, and becomes with them a fixed habit.

Meantime, the young animals increase in age and strength. Other things being the same, they do not prevail in a battle with those which have preceded them by one or two years, but they are more nimble and vigorous than the younger individuals which have just made their appearance. If force alone prevailed in these societies, the last-mentioned animals would have to yield obedience to the former, but this does not usually happen. The relations which custom has established are preserved, and if the society be conducted by a leader, it is the oldest animal which possesses the greatest power. His authority, which originated in force, preserves itself by that habit of obedience which the others have acquired through time. His influence obtains a kind of moral force, founded as much upon confidence as on fear. It ceases to be contested; and it is only those single or combined authorities which are in course of being established that meet with opposition, which they always encounter when the object is one that does not admit of being shared. A joint or combined authority of several animals requires only an equality of strength, aided by a strong social instinct, and the habit of living together in the same course of life. The wild and sociable animals do not fight except when excited by some violent passion; and if we except the cases where they have to defend their lives, the possession of their females, or the latter the safety of her young, they feel no mutual rivalry. The absolute superiority of one animal over another is asserted only when it becomes impossible to share the object: then contests begin, especially during the rutting season. Indeed,

it is usually the female, by the marked preference which she bestows upon the younger and more vigorous males, whom she singles out with an extraordinary sagacity, that first induces the latter to assume their proper place, and break through that constraint and obedience which habit had confirmed.

There are probably some herds of animals where age alone acquires the force of authority. That such a state of society should exist, it only requires that all their wants should be satisfied, which perhaps takes place among those herds of Ruminants, living in the rich prairies of Africa and America, which Man has not yet subdued to his use. Their food being always plentiful, could not be with them a matter of rivalry, and but for the females, their lives would pass on in the most profound peace. A contrary effect would be produced where the interests of individuals are at variance; and when food continues long to be scarce, the entire breaking up of the society is the necessary consequence.

Hitherto we have supposed all the individuals composing the herd to be of the same natural disposition. But this is not strictly the case; some are more violent in their passions than others, or their wants are more urgent. One animal is naturally mild and peaceable, another is timid; a third perhaps is brave or passionate, peevish or obstinate; and then the former state of things is disturbed. However, these accidental causes soon produce their effects, each animal obtains its proper influence, and acquires its natural level. New comers gradually become accustomed to yield obedience to those whom they find invested with the command, until their own turn to command arrives, which happens when all the others are newer associates than themselves, or that they are the oldest animals of the society.

The Social Instinct does not only show itself in the mutual affection which the animals of the same herd bear for each other. It is also to be seen in that sentiment of hatred and estrangement which they bear to every unknown individual. Two herds never unite willingly; and if circumstances compel them to do so, violent battles are the result. The males single out the males, the females attack their own sex; but if a single strange individual, especially when of another species, happen to be thrown by chance in the middle of a herd, he can only escape certain death by a timely retreat.

From this it follows, that the tract of country occupied by one herd, is in a manner inviolable to all neighbouring herds. It belongs to them by a kind of right. If they be Carnivorous, it is there they find their prey, if Herbivorous, their pasture. No other tribe in ordinary circumstances ventures to transgress its limits. Any pressing danger, such as a great famine, will, however, serve to break through this natural state of things; and the instinct of self-preservation then bursts through all restraints. But in ordinary cases, the right of property, as well as its effects, may be seen not only in the sociable herds, but even in the solitary species. Every one of the latter considers the place where he has established his residence, the retreat he has prepared, as well as the district upon which he obtains his food, as exclusively his own. The Lion permits no other Lion to reside in his neighbourhood. Two Wolves never inhabit the same district together, except in those countries where they are merely stragglers, and are every moment liable to be hunted to death. The same thing happens with the birds of prey. The Eagle from her eyrie extends her dominion over the immense tract of country within the range of her piercing sight.

The state of society above described prevails in every animal association, if we make allowance for their specific characters, such as the peculiar instincts, likings, or faculties which distinguish any one species from the others. But troops or herds of different species present characteristics which are peculiarly their own, and which serve to modify the Social Instinct. These will fall to be described in their proper place.

In all societies where the natural wants of the individual become very urgent, force prevails in a considerable degree. Among the Carnassiers, which are often pinched by the severest famine, the authority of the leader is much more liable to change than among the Ruminants. The same thing happens with Birds, whose wants and rivalries always proceed to the utmost pitch of fury. On the other hand, particular likings and special instincts may serve to augment and perfect the social sentiment. Many animals unite to the instinct of society that of combining for their mutual defence. Some dig capacious burrows; others erect solid habitations; and it is to the social instinct developed in a high degree that we owe the domestic animals.

By separating a sociable animal from the herd to which it naturally belongs, we may acquire some idea of the force of that instinct which urges it to forsake solitude, and live with its own species. Many instances might be adduced illustrative of the powerful affection which results from that sentiment. A Cow, a Goat, or a Sheep, when separated from its flock, feels an uneasiness often fatal to its life. M. F. Cuvier had a Corsican Ewo (*Ovis musimon* of Pallas) which fell into a declining state, and could only be restored to health by replacing her in the same pen with her companions. Travellers are usually well aware of the danger in meeting a herd of Wild Horses. Without the greatest precautions, they run the risk of losing all their own Horses; for the latter, although domesticated, cannot resist the force of that Instinct which urges them to join the wild herd that surrounds and neighs to them.

The two following anecdotes, illustrative of the force of the Social Instinct, are related on the authority of M. F. Cuvier. A Lioness had lost the Dog with which she had been brought up, and for the purpose of exhibiting these animals together in the public Menagerie, she was supplied with another, with whom, in a little time, she consented to associate. She had not appeared to suffer much from the loss of her former companion, as her affection for it was very slight. In a little time the Lioness died. The surviving Dog exhibited a very different result. He refused to leave the den where they had been confined. He continued two days to take his food, but his illness increased. The third day he refused all nourishment, and he died of exhaustion on the seventh.

The other instance was that of a Roebuck. It was very young, and had been captured during the spring in a forest. A young Lady, who took charge of it during the summer, became a companion, from whom it could not be separated. It followed her every where, and was as little afraid when she was present, as it was wild and fierce, when she happened to be away. On the approach of winter, it became inconvenient to leave the Roebuck in the same place where it had been brought up; and besides it had been unwell. But as the young lady was going to town, it was thought

best to bring it up also, and to place it in a neighbouring garden, with a young Goat for its companion. On the first day, it would not rise upon its legs, or move from its place. On the second it began to take a little food; whether it would have continued is doubtful. However, its mistress visited it on the third day, and it returned with ardour all the carresses which she bestowed; but as soon as she left the animal, it lay down and rose no more.

Our domestic animals have always given striking instances of this deep and exclusive affection, which causes them to die of grief when separated from the object of their attachment. This obviously arises from the circumstance explained in a former section, that all the truly domestic animals are sociable in a high degree.

Without the social instinct, it is impossible to conceive how these animals could ever have become domesticated, if we consider the very early stage of human civilization when they became so. It is true, that by means of kind treatment, continued for a long course of generations, we can succeed in habituating some unsociable animals to live along with us; but this is far from being a real domestication. If Man had been originally placed in an inhospitable climate, the necessity of providing for his daily wants would not have allowed him much leisure for experiments on domestication; and had he been placed in one of those fertile countries where every thing is spontaneously bestowed, he would scarcely have subjected himself to a painful and continual industry for so remote an object. Indeed, no savage nation has been found with animals which themselves alone have rendered domestic. On the other hand, we have in the Cat an evident proof that unsociable animals do not naturally become domestic. It lives amongst us, accepts our protection, receives our kindness, but does not yield an equal submission or exchange of favours with the really domestic species. If Time alone were sufficient to produce domestication, the Cat would be as domestic as the Dog, the Cow, or the Horse.

Confidence, among the animals, is always paid to strength. The one succeeds the other; but it is chiefly by the former that authority is maintained. Nature affords numerous proofs of this. We are informed by travellers of undoubted credit, that the wild Horses have a chief, the bravest of the herd, who walks always at their head, whom they follow with devotion, and who gives the signal either for flight or for battle, according to the estimate which he forms of the strength of his enemies, or the extent of the danger. But if by accident he falls, the herd, being without a leader, disperses; each individual flies at random; some attempt to join other herds, and many fall victims to their indecision and mistakes. The same thing may be seen among our domestic animals; and the shepherd, in relation to his flock, is nothing else than the strongest individual of the herd, whose strength they have experienced, and in whose skill they repose the greatest confidence.

When strange animals first meet together, they are in the same relative situation as a wild animal in the presence of Man. When once the society of Man has become necessary, it is tamed. This fact is shown by the manner in which wild Elephants are captured.

The domestic Elephants, obedient to the Man who conducts them, are in the same state of hostility and estrangement, when placed in the presence of a wild Elephant, as every herd is in respect to an isolated stranger or the member of another herd. The wild Elephant, on the contrary, is urged invincibly by the social instinct to approach the other individuals of his species, and to submit to them within certain limits.

Elephants, like other sociable animals, can be made to use this influence to catch the wild individuals. Some tame Elephants, usually females, are conducted in the immediate neighbourhood of the retreats where the wild animals have established themselves. If they can find near the wild herd any individual, who is compelled by the others to keep at a distance, being perhaps driven out of the herd by some more powerful leader than himself, and thus compelled to live in solitude, so as to do violence to his social principle, the wanderer does not fail to find out the domestic Elephants, and to approach them. The masters of the latter, who are not far distant, run and tie the wild Elephant with ropes, being protected by the tame Elephants which belong to them: and if the stranger attempt to make the least resistance, the tame Elephants compel him, by blows of their trunk and tusks, to submit himself to be led away into captivity.

A most striking instance of the inefficiency of mere force, in comparison to that confidence which is established by time, was often exhibited in the *Ménagerie du Roi*. When the Moors of Barbary catch a young Lion, they are in the habit of bringing it up with a young Dog. These two animals become mutually attached, but especially the Dog to the Lion. As the former grows faster than the latter, it arrives sooner at its adult state, that is to say, at that time of life when carnivorous animals acquire strength and courage. From this difference of growth, it follows that the Dog maintains so great an ascendancy over the Lion as completely to direct the physical strength of the latter, and he always preserves this power, especially if the Lion be of a mild and quiet temper.

Other animals afford instances that muscular strength does not always acquire the ascendancy; courage and perseverance are also means of obtaining the command. M. F. Cuvier had a Cashmere Goat, which was placed in company with three other Goats, each of which was at least twice as large and as strong as the former. Yet the little Goat managed to get the mastery over the others, although in fighting he lost one of his horns, and thus was deprived of the advantage which the others enjoyed of striking both to the right and left. But his fury and obstinacy were so great, that he ended by obtaining, through dint of perseverance, an authority as complete as if it had proceeded from an undoubted superiority of physical strength. Two of the Goats which he had subdued followed their little master every where, and when separated from him could not rest until he was restored to them.

Buffon relates a fact, authenticated in a letter from M. Dumourtier, which shows how much the influence of animals over each other is increased by time. "The paternal authority among the Rabbits is much respected. I observe that all my Rabbits pay a great respect to their grandfather, whom I can easily recognise by his gray hair. His family have greatly increased. Those who have become fathers in their turn still preserve their submission to him. Whenever his sons fight together, whether for the females or for the possession of the food, the old grandfather, when he hears the noise

runs at full speed to the spot. As soon as they perceive him, order is immediately restored; and if he catches any of them fighting, he separates them, and makes an example of the refractory animals by immediate punishment. I may mention another instance of his influence over his posterity. For having always accustomed them to go into their holes on blowing a whistle, whenever I give the signal, however distant they may be, I observe the old grandfather to place himself at their head, and though he arrives first at the holes, he makes all the others desist before him, and is always the last to go in himself."

It cannot be said that this authority on the one hand, and submission on the other, are instinctive. They depend upon accidental and variable causes. They often present opposite features in the same individual; and even the slightest change in the external appearance of the animals is sufficient to dissolve all harmony between them. A trifling circumstance of this kind would cause them not to know each other, and to recommence their battles. If two Rams which have long lived together in the most perfect harmony be shorn, they look at each other with fury, and rush together with such violence, that unless separated, they will fight until one of them either flies or remains dead on the spot. A boy belonging to the *Ménagerie du Roi* nearly lost his life only from changing his dress. He had acquired an absolute authority over a Bison from North America. His command alone was sufficient to make this powerful animal go in or out of his stable, and the mere presence of the Boy made him tremble. One day having obtained from the tailor a new suit of clothes, a little different in its colour and shape from that which he habitually wore, he went into the stable to perform some service for the animal, when the latter, having looked at him attentively for some time, made a sudden attack; and the young lad would certainly have been killed, if he had not had the agility to leap over the gate of the ward into which he had so imprudently entered. Having thus escaped, and suspecting the cause of this unexpected attack, he resumed his usual clothes. The animal immediately recognized him, and regained his former fear and docility.

Force, however, exercises a very important influence in all animal societies. We even see its influence in places where it might be expected that Nature would oppose some obstacle. In a flock of Goats, the She-Goat exhibits a remarkable care for her young, and is ready to defend them with her life from the attack of any stranger. But if one of her kids receive blows from any of the other Goats of her own flock, she shows no opposition to their violence, and takes no notice of the cries of her young one, provided that they proceed only from the blows of the other members of her society.

Cunning is so often the attendant of weakness, that we may readily expect all the young animals of a herd will possess a great share of it. M. F. Cuvier observed a remarkable instance of this in the conduct of a young Rhesus Monkey towards his mother. Although she treated him in the most affectionate manner while he was suckling, she would never allow him to eat any thing. He could obtain nothing except by stealth; and even after he had filled his pouches, she would compel him to disgorge. In this way, the skill and cunning of the young Monkey became developed in a surprising degree. He used to watch the moment for seizing his food, when his mother was about to turn her head or eyes, and he always anticipated her movements with remarkable accuracy.

It may readily be expected that a herd will separate when famine prevails. Then each animal is attentive only to its own preservation. Some species and individuals even devour each other if driven to extremities. This takes place among the Rats (*Mus*), and also, it has been said, among the Field Mice (*Arvicola*). A dissolution of the society likewise occurs, when one of the Instincts essential to its existence cannot be exercised. In densely-peopled countries, the Beavers, instead of constructing habitations, lead a solitary life in the natural excavations of the rocks on the banks of lakes or rivers.

These several facts entirely confirm the correctness of those general views which have here been laid down regarding the Social Instincts of animals; and M. F. Cuvier has contributed more, by his talents and industry, to expose the character and manners of the Mammalia, than perhaps any other Naturalist.

The preceding observations serve to show that there results from the instinctive union of several individuals in herds or troops, a certain mutual dependence, which passes into a habit, and becomes a necessary of life. The authority of one animal over the other originates in force, but when once established, it is maintained by confidence, until passions more powerful than the social instinct arise, and snatch the authority from the chief, to vest it in a stronger and more courageous individual. It is in these mingled states of peace and war that the greater number of animal societies pass their existence, and they are dissolved when the instinct of self-preservation becomes more powerful in each individual than the Social Instinct.

Societies of this description have nothing either Intellectual or Moral in their constitution. We view, with mingled feelings of astonishment and admiration, a state of things in which authority is maintained without force, where harmony exists without the influence of Reason, and a variety of opposite wants and desires, without discord or dissension. We can ascribe this solely to the great First Cause of all things. The animals themselves take no active part in it, and are, under this view of the subject, but the blind and passive instruments in the hand of an invisible and all-powerful Being.

When Societies of Men approach this passive state, they bear a great resemblance in character to animal societies. It is sad to think that human nature can exist in such a state of degradation; yet the accounts of enlightened travellers inform us that the savages of New Holland, for example, lead nearly the same kind of animal life, where those faculties, which distinguish Man from the other Mammalia, have scarcely received any development.

It is only when the activity of Man is roused, that the mere animal societies, which we have here described, assume a new appearance. Phenomena of habit then become phenomena of conscience. The same action which was formerly produced by mere likings or necessities, now results from the light of Reason. The authority of the strong and the submission of the weak become ennobled by the feeling of Duty. Thus Society, which among the other Mammalia is purely Instinctive, is transformed with civilized Man into an Intellectual and Moral condition.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Tame Races have become wild—Alterations and Development of their Instincts and Intelligence under Domestication—Sensibility—Imitation—Sympathy—Inequality to distinguish between Justice and Injustice.

THE Intelligent Powers and Instincts of the Mammalia, which have formed the subject of the preceding sections, may be made to undergo various modifications and alterations. There is a certain degree of perfectibility connected with each animal nature, and the changes induced may either affect individuals only, or be also capable of being transmitted permanently to their posterity. Hence arise the peculiar Instincts and Intelligence of the different races or varieties of a given species.

When the animals of an uninhabited country first encounter Man, they exhibit no fear of his power, nor do they seem apprehensive of danger. The early navigators of the South Seas often allude to this innocent confidence of the Mammalia and Birds. Dr Richardson found the wild Sheep of the Rocky Mountains exhibiting that simplicity of character so often remarked in the domestic animals; and, in the retired parts of the mountains, where the hunters seldom penetrate, he had no difficulty in approaching them. He adds, "where they have been often fired at, they are exceedingly wild; they alarm their companions on the approach of danger by a hissing noise, and scale the rocks with a speed and agility that baffles pursuit." But the young of all Mammalia, which have been much exposed to persecution, exhibit an Instinctive fear for strangers; and this acquired Instinct, perpetuated by generation, may be induced as well by any of the larger and fiercer Carnivores as by Man. Thus Danger, whether proceeding from Man or other animals, may perform the converse of Domestication, and render those races wholly wild which had originally been tame.

It has been often observed, that a certain resemblance exists between the characters of some classes of Men, and of the animals with whom they habitually associate; for example, between the Drover and his Oxen, the Shepherd and his Sheep, the Muleteer and his Mules, the Arah and his Steed. This modification is usually supposed to have been undergone solely by the Man; but this is not strictly correct, as the characters of the animals themselves insensibly approach that of their master and companion.

Ælian has long ago observed the curious fact, that the domestic animals, and especially the Dog, acquire the faults and good qualities of the society to which they belong. "The Molossian Dog," he remarks, "is the bravest, while that of Caramania, like the people of that nation, is the most ferocious and the least susceptible of Domestication." On comparing English Horses and Dogs with those of French origin, M. Dureau de La Malle observed certain well-marked national peculiarities which confirm the truth of Ælian's remark. In this way the habits and manners of the domestic animals may form an index to the civilization of a great nation. Even among the different grades of society in the same country, we find the animals adopting the peculiarities of their masters, and acquiring traces of their vices as well as virtues. The Dog which becomes so docile when brought up in a Lady's chamber, is ferocious with the Butcher, submissive in the poor man's cabin, or thieving and cringing with the beggar. When standing at the Nobleman's lodge, he even adopts the tone and manners of the great man's purser. M. Edwards tells us that he has often seen Dogs, educated by weak females, become excessively timid, and that this timidity was transmitted to their offspring. A Terrier-dog, born in the house of M. de La Malle, and treated like a spoiled child by a kind-hearted woman, who amused herself with speaking to it all day, had its sensibility brought at six months old to such a state, that when its mistress caressed the Cat, or pretended to scold the little animal, its large eyes would fill with tears, and it would end by crying like an infant.

In the wild and savage state, the lower animals and Man are possessed of much less sensibility than when domesticated or civilized. They also retain a much greater physical power in resisting pain, and can endure without complaints the pangs of sickness, of deadly wounds, and all the evils arising from their original constitution or their want of civilization. The fortitude with which the savages of North America and of New Zealand endure torments is well-known. According to Azara, the Charruas, a savage race of Paraguay, do not utter a complaint even while under the knives of their enemies. This feebleness and want of fortitude in civilized nations has many points of analogy among the Wolves, Foxes, and proper Dogs, when they are placed in similar circumstances. The domestic Dog raises a most hideous yelping if a person tread on his paws, pinch his ears, or give him a whipping; but if the wild Dog, the Fox, and the Wolf be wounded or taken in a trap, they suffer the sharpest pangs without uttering a cry, and expire without groans, in the midst of the most cruel torments. The observed habits of the Dingo, or wild Dog of New Holland, perhaps the wildest of the species, bear the same relation to the domestic Dog in the scale of sensibility.

The ancient Greeks and Romans endured pain more patiently than the moderns. The Turks have nearly the same fortitude, and the differences among the tenets of Paganism, Islamism, and our own, are not the sole cause; for the colonists of Africa, America, and New Holland, and the sturdy peasants of our own country, endure pain more patiently, and with less complaints, than the inhabitants of towns. By this circumstance alone, we might almost be able to determine the degree of civilization among the different classes of society, and it will be found to vary usually in the inverse proportion of their capability to endure pain. M. de La Malle says that the English, of all European nations, take the greatest care to preserve themselves from sickness; that they have the greatest dread of pain; and show the least fortitude and firmness when the necessity for enduring the pain is not absolute. This is certainly a high compliment to the civilization of our nation, although made at the expense of our fortitude. The cause is strictly physiological. As the nervous system of Man becomes more susceptible to refined and vivid impressions, it acquires greater irritability; and when the imagination, with the powers of reflection and foresight, are highly developed, we may readily expect that the intensity of the pain will be increased. Habit with the Savage resigns him to pain; the civilized Man either discovers a remedy or roars out with anguish.

Some Instincts do not exhibit themselves until the animals have attained a certain age. When gnawing a bone, the Dog does not know until two months old how

to hold it down steadily with his paws, and he is ten or twelve months old before he hides his superfluous food. The latter Instinct is also seen, according to Azara, in the Puma (*Felis Concolor*), and in several other wild Animals of Paraguay.

Many of the domestic animals, but especially the Dog, express their Contempt or Aversion for any object by rolling themselves over it. If they find the carcass of a Mole, a Shrew (*Sorex*), or other Insectivora, they immediately roll over it, which they never do upon the carcass of a Ruminant or Solipede, of which they are very fond. M. de La Malle had two Spaniels, which devoured with pleasure the bones of Woodcock and Snipe; but when he threw into their mouths the gizzards of these Birds, which had a very strong marshy flavour, they rejected them with well expressed signs of disgust, and when the gizzards fell upon the floor, they immediately rolled over them. On attempting to urge them by commands and threats to eat the gizzards, they smelt them and rolled over them as before, nor could they be diverted from this Instinctive action either by the presence or injunctions of their master. This experiment was repeated several times, and always with the same result.

A remarkable instance of the force of Imitation is related by M. de La Mallo of his Dog, named Fox. This gentleman had a male kitton, aged six months, when the Scotch Terrier, Fox, then two months old, was given to him. It was of that variety with long and rough hair, with straight ears directed forwards, which attaches itself to Horses, and is used for Fox-hunting. This Dog, when two years old, had never been out of the house where he was allowed to run at large; he had never seen other Dogs, and had received his education solely from the three daughters of the porter, and from the Cat. The latter was the companion of his sports, and was with him continually; hence these animals had acquired a singular affection for each other. The Dog had adopted the mildness and timidity of the females, who took charge of him; but the Cat, being older than Fox, was his master in point of muscular force, and the Dog showed, in a marked manner, the influence of his preceptor. He bounded like the Cat, and rolled a ball or a mouse with his fore-paws in the same manner. He even licked his paw, and rubbed it over his ear just as he had observed in his instructor. The imitation was striking; it might have been expected that, in this state of isolation, the Dog being the more intelligent animal, would have acquired the greater influence over his companion; but the contrary happened. This circumstance is easily explained from the power of Imitation being greater in the Dog than in the Cat. But although Fox had showed such an attachment to his friend, it was not powerful enough to overcome his aversion to the species. If a strange Cat presented itself in the garden, Fox immediately put it to the rout. The Cat also manifested his hatred to a strange Dog, which M. de La Mallo brought for the first time into the house. The visitor could not be taught to endure the caresses of Fox, but exhibited the utmost astonishment and aversion for his unnatural and Feline accomplishments. We are informed that M. Audouin had a Dog, which died in the year 1831, and had acquired all the manners of a Cat, particularly that one of licking his paw and passing it over the ears.

It is well known that Dogs can open a latched door, and ring the bell for the porter; this proves the facility with which they imitate the actions of Men. Many Cats are known to leap upon the bell-rope when they wish to have the room-door opened. M. de La Malle had another Dog, which was brought to Paris when eight years old. On the day of its arrival, it went out of the house, but being fatigued it wished to return, and barked at the entrance for a long time without effect. At length a stranger rapped at the door by raising the knocker. The Dog observed the action, and came in along with him. That same day M. de La Mallo saw it come in six times by raising the knocker with its paws. It must be observed, that there were no knockers at that gentleman's country-seat, where the Dog had been brought up from its birth; and also that it had not previously been absent from home.

Signor Bennati, a learned physiologist of Milan, who has written a curious memoir on the mechanism of the voice during singing, and received the favorable notice of the Baron Cuvier in May 1830,—had a Water-Spaniel, which always came near the Piano-forte whenever the S. Bennati struck the chords, and seemed to show a taste for music. The learned Doctor, himself a skilful musician, was then studying the merits of Dr Gall's system of Phrenology, and accordingly searched the Dog's cranium very carefully for the hump of music, but without the slightest success. Not discouraged by this important circumstance, he tried to teach the gamut to the Dog. He began with the Piano, but failed; he then tried the Violincello, the Flute, and the Clarinet, also without success. At length he recollected that Dogs usually bark when a Bell is rung, and, therefore, concluded that Bells exert a peculiar action upon the Acoustic nerve of Dogs. He procured seven diatonic Bells; and, by making them vibrate with the bow of a Violin, succeeded in making the quadruped-musician sing the gamut very correctly after nine days' lessons. He even brought the musical education of the Water-Spaniel as far as to make him sing an accompaniment in thirds to his own voice, which is one of very considerable power.

These several facts show that we are still very far from being able to point out limits to the intelligence of animals possessed of this remarkable faculty of imitation; and, at the same time, they serve to exhibit the influence of a rational course of education upon domestic races so intelligent and so capable of improvement as our Dogs.

The intelligent powers of the domestic animals are thus capable of undergoing a much greater degree of development than is commonly imagined; and this improvement is not confined merely to the faculty of Imitation, but extends also to the other powers of Memory, Judgment, and Reasoning. The facts observed during the training of Pointers, Setters, Shepherd Dogs, and Water-Spaniels, are evident proofs of that development of intelligence which increases with time, and may be induced by the care and skill of their instructor.

One instance of intelligence in a Dog belonging to M. de La Malle may be mentioned here, as it shows that the animal, judging from the impressions of its senses, combined their relations, and drew a just conclusion from the appearances and facts which he had observed:—"I reside," says that gentleman, "when in the country, in a tolerably large Chateau, with a great number of windows, as well in the dwelling-house itself as in the offices. The Spaniel, named Pyramus, to which I allude, sleeps in an open niche in the wall at the end of a very large court-yard, and I am in the habit of introducing him into my room during the night. This animal always finds

some food in my room, and a fire in the winter; he is, therefore, fond of his master, for Dogs, as well as Men, love society. I usually rise at midnight during winter, for I then retire to rest at five o'clock in the evening. As soon as I have risen and have lighted my lamp, I hear the Dog Pyramus under my window whining and howling gently. If I delay in opening the window, his cries become louder, with an occasional bark to give me notice of his presence. On opening the window, and on telling him that I am going to let him in, he is silent; but if I forget my promise, or am long in performing it, he begins in about half an hour his plaintive howls and barking. I have often observed him by moonlight, and when there is no light in the room, sitting with his eyes fixed on my window, but always remaining silent, and neither expressing his wishes by cries nor any other sound. From these facts I draw the following conclusions:—1st, That the Dog, by means of the sense of sight, combined the appearance of the light with the idea of his master, and of the agreeable things he was in the habit of getting from him; 2d, The absence of light indicated that his master either slept or was absent, and that then his cries would be superfluous. I may add, that my room is on an upper story, and though the Dog cannot get at it, except by a staircase and a long gallery with many turnings, yet this animal never mistakes the position of my window, although it is exactly the same as twelve others in front. And whether there be a light in my room or not, he regularly places himself at the same hour under my window, always silent when he perceives no light in the room, but calling me and asking to be let in whenever he observes the light."

It would be going too far to assert that well-educated Dogs can acquire notions either of Delicacy or Decency; but there cannot be the least doubt that they possess powers of Memory, Reflection, Judgment, and Association of Ideas. They can even combine Relations, and draw just inferences from the notions received directly from the sense of sight. Many of their perceptions of sight are also acquired. If a pup of two or three months old he called from an upper story when lying in a court, he knows not how to direct his eyes in the direction of the sound which strikes his ear. He must first learn to combine the relations of these two senses, which in this respect have an intimate connexion. But when once he has by chance directed his eyes to the quarter whence the sound proceeds, he treasures up this fact ascertained by experience; the result is fixed in his Memory, and he does not again make the same mistake.

The Domestic Pig, which is brought up with us only for the market, appears, when confined in its sty, to be excessively stupid and devoid of intelligence. Yet education, and the habit of living in the society of Man, develop his social character, and he exhibits some amiable qualities. At the town of Brives-la-Galliarde, in France, Pigs are domesticated like Dogs, and live in society with the inhabitants. They go up-stairs even in houses of three stories high, and often sleep in the same room with their masters. From this treatment they have acquired singular habits of cleanliness, which are further improved by their mistresses taking them usually twice a-day to the river to be washed and rubbed. While undergoing this operation, it is curious to see them going voluntarily to the water, and turning themselves first on one side, then on the other, and then on their back, to assist her; and M. de La Malle has seen them thank their mistress after their own fashion, when it was all over, by licking her hand. The Irish Pigs have long been remarked for their intelligence, and this is evidently owing to their living so much in the houses of the lower classes, and associating with the children. There is, however, no instance on record of their having been guilty of an equal degree of gratitude with their cleaner brethren of Brives-la-Galliarde.

The Intelligence of the Elephant is capable of undergoing a very considerable degree of development under Domestication. An Elephant, at the *Jardin du Roi*, was brought to understand the meaning of several words. When his guide said "*En arrière*," without elevating his voice or making the slightest gesture, the animal backed immediately. A remarkable instance of foresight was observed in the War-Elephants of Cochin China, which is related here on the authority of an intelligent traveller, and an eye-witness of the circumstance. Seventy Elephants were ranged against a Tiger; and one of them, urged on by his Molout or guide, advanced to the attack. The Tiger waited until the Elephant was in the act of striking with his tusks, and making a sudden spring, alighted on the neck of the Elephant, with his hind paws inserted on the animal's trunk. The Elephant was wounded, and fled; but all the other Elephants who witnessed this conflict profited by the inexperience of their companion, and advanced against the Tiger with their trunks rolled up under their throats in the most careful manner, thus showing a degree of observation, foresight, and judgment, which might not have been expected in so large and heavy an animal.

We shall only add here a few instances which serve to prove that the Domestic Dogs, from their living in society with Man, have acquired the power of reflection, of combining means to an end, and of foreseeing difficulties in their execution. They also learn the meanings of many artificial words. They communicate their ideas to each other by means of natural signs, and assign to each the part necessary to be performed, in a combined plan of action—qualities which require operations of their minds but little inferior to the results of the Human Intellect. We shall even show that they form plans when hunting by themselves, which exactly resemble those ingenious devices invented by Man, and practised by him in the Art of War.

M. de Puymaurin, a *député* or Member of the French Parliament, had a female Water-Spaniel, whose education had been very carefully attended to, and it accordingly showed extraordinary intelligence. During the occupation of Paris by the allied armies in 1814, General Stewart, who lodged in M. Puymaurin's house at Toulouse, remarked that the Dog would take nothing that was offered to it with the left hand, and he tried to deceive the animal by crossing his arms, and even by exciting its appetite by some marked difference in the quality of the food held in each hand, but without effect. Being determined to subject the Dog to a very peculiar experiment, he requested one of his Aides-de-camp (Colonel Cameron), whose right arm had been amputated, to offer the Dog some food. The Dog approached, and without noticing the hand containing the food, rose upon its hind-legs, and applied its nose to the place where the Colonel's right arm ought to have been, as if to be

sure that there was no deception, and being satisfied that the Colonel had only one arm, it passed on to his left hand and took the food. This fact was reported to M. de La Malle by M. Auguste de Puymaurin, the son of the *député*, on whose authority it is inserted here.

A well-trained Dog can often be brought to understand the meanings of words, even though spoken without the slightest gesture or alteration of tone. M. Edwards has been heard to mention an anecdote of a Dog, which was in the habit of seeking and bringing back Gloves. If in the course of conversation, when the Dog would appear to be paying no attention to what was going on, any mention was made of his talents, and the word Gloves (*Gants*) happened to be used, the Dog was off immediately seeking out for them; and when they were found, he again resumed his former position of careless listener to the conversation. Another Dog, which belonged to an aunt of M. Audouin, was excited in the same way when Gingerbread cakes were alluded to, of which he was very fond. If this word (*Gimblettes*) happened to be mentioned in the course of conversation, and without any peculiar emphasis, he was excited and ran to the cupboard where the cakes were shut up. This experiment was often repeated before several people, who would not at first believe the statement.

M. de La Malle informs us, that one of his neighbours, the Count de Fontenay, was engaged in some agricultural speculations relating to the breeding of the Merino Sheep, jointly with the Marquis des Feugerets, whose property was situate about two leagues from his own. The Count had a very fine Pointer, possessed of great intelligence, and as he had educated this Dog himself, it almost seemed to anticipate his wishes. One day he had an urgent message to communicate to his neighbour, and as no one was at hand to whom it could be entrusted, it occurred to him to try whether the Dog would carry it. Accordingly he fastened the letter to *Soliman's* collar, and told him carelessly, and without expecting him to obey the command, "Carry that to Feugerets!" (*Porte cela aux Feugerets.*) The Dog did as he was desired, and would permit no one to touch the letter except the Marquis. "I have seen this Dog," says M. de La Malle, "for four or five years acting as messenger between those two Châteaux with a remarkable quickness and fidelity. When the Dog delivers the letter, he goes to the kitchen to be fed. As soon as he has had his meal, he sits down before the window of the Marquis des Feugerets' study, and barks at intervals, to show that he is ready to take back the answer. On the letter being attached to his collar, he sets off and brings it to the Count his master."

It has been proved, beyond the possibility of doubt, that the property of pointing and setting game, which some races of Dogs are made to acquire by feeding them well, and then exercising a certain degree of constraint and punishment, is transmitted unaltered to their descendants. M. Magendie, happening to hear that there was a race of Dogs in England which brought back game naturally, procured two adult Retrievers. These animals produced a female Retriever, which always remained under M. Magendie's immediate inspection, and though it had received no instruction, it stopped and brought back game, from the very first day that it was led to the field, and this it did with a degree of steadiness fully equal to those Dogs which have learned this art solely under the stern discipline of the whip and collar.

When the Spaniards discovered America, they introduced Dogs as auxiliaries in their military expeditions against the Indians. Columbus first employed them for that purpose, and we are informed in his own Memoirs, that at his first conflict with the Indians, his army consisted of 200 foot soldiers, 20 horsemen, and 20 dogs. These Dogs were employed in the conquest of several parts of the New World, especially in Mexico and New Grenada, wherever the resistance of the Indians was prolonged. We are informed by M. Roulin, that this race is still preserved pure on the Plateau of Santa Fé, where it is used for Stag hunting. This it performs with an extreme ardour, and still uses the same mode of attack, which must have rendered it so formidable to the Indians. It consists in seizing the animal by the abdomen, and then overturning it by a sudden jerk, which is given at the moment, when the weight of its body is thrown upon the fore-legs. Sometimes the weight of the animal thus overturned is six times that of the Dog.

Without receiving any previous education, the Dogs of pure breed, naturalized in South America, bring to the chase certain dispositions which the newly-introduced coursing Dogs, though of a superior European breed, have not yet acquired. Thus, the American Dogs never attack a Stag in front in the middle of its course, and even when the latter comes towards a Dog without perceiving him, the sagacious animal swerves to one side, and waits his opportunity to attack it in flank. A foreign Dog, who is unaccustomed to these precautions, is often left dead on the spot, from having the vertebrae of his neck dislocated by the violence of the shock.

Among the poor people inhabiting the banks of the Magdalena, this Dog has degenerated, partly from the cross of another breed, and partly from the want of sufficient food. Even in this degenerate race, a new instinct seems to become hereditary. It has been long used exclusively in hunting the White-lipped Peccari (*Dicotyles labiatus*). The art of the Dog consists in moderating his ardour, and in not attacking any particular animal, but thus keeping the entire herd in check. The very first time that these Dogs are brought to the chase, they show their knowledge of this art, which has been transmitted to them by their parents. A Dog of a different breed rushes into the midst of the herd, is surrounded, and no matter how great his strength may be, he is devoured in an instant.

Those instances, where different varieties of the Dog unite their several talents while hunting, and form one combined plan of operations, are perhaps still more striking than any of the preceding. "I had at one time," says M. de La Malle, "two sporting Dogs, the one an excellent Pointer with a very smooth skin, and of remarkable beauty and intelligence. The other was a Spaniel, with long and thick hair, but which had not been taught to point, and only coursed in the woods like a Harrier. My Château is situate on a level spot of ground opposite to a copse-wood filled with hares and rabbits. When sitting at my window, I have observed these two Dogs, which were at large in the yard, approach and make signs to each other, and first glancing at me as if to see whether I offered any obstacle to their wishes, slip away very gently, then quicken their pace when they were a little distance from my sight, and finally dart off at full speed when they thought I could neither see

them nor order them back. Surprised at this mysterious manœuvre, I followed them, and witnessed a singular sight. The Pointer, who seemed to be the leader of the enterprise, had sent the Spaniel out to beat the bushes, and give tongue at the opposite extremity of the brushwood. As to himself, he made with slow steps the circuit of the wood, by following it along the border, and I observed him stop before a passage much frequented by the rabbits, and there point. I continued at a distance to observe how this intrigue was going to end. At length, I heard the Spaniel, which had started a hare, drive it with much tongue towards the place where his companion was lying in ambush, and the moment that the hare came out of the passage to gain the fields, the latter darted upon it, and brought it towards me with an air of triumph. I have seen these two Dogs repeat the same manœuvre, and in the same manner, more than a hundred times; and this conformity has convinced me that it was not accidental, but the result of a concerted agreement and combined plan of operations arranged beforehand."

Leroy was of opinion that Wolves do the same thing; but he founded his conclusions solely upon the traces of their foot-marks left on the snow or mud. The same thing has been said by Hunters respecting Foxes, but the truth of it is very doubtful. Indeed, these wild animals which hunt during the night, especially when timid, are so difficult to observe, that these assertions require further confirmation, especially when made of animals known to be of solitary habits.

The fact that the domestic Dogs often combine their different talents to execute one manœuvre, is further corroborated by M. Louis Châteaubriand, nephew of the celebrated writer, who has witnessed the same thing between two Harriers and a Pointer. It is clear, that whatever differences there may be between this contrivance of the Dogs, and the ambuscade of a skilful general who hides his forces in the woods or copses, and sends a small body of troops with orders to fall back before the enemy, and draw them on towards the defiles, they both agree in being an ambuscade—a trick played upon the credulity of the enemy, and require the same operations of the Mind to direct them both.

The workings of Sympathy among the domestic animals are very striking, and the observations of M. de La Malle on this point have served to lead the way towards a better acquaintance with its powerful influence. Having been educated in the country during the earlier part of his life, he had amused himself with imitating the cries of many wild and domestic animals, and from habit he acquired a skill so great, as to deceive the animals themselves. In this way, by expressing after their own manner the external signs of Pain, Anger, or Desire, he could excite the same passions in them, and call forth at pleasure the external signs of those passions. By numerous experiments, he found that the imitation of the sound always produced a sympathetic effect, and he thus succeeded with Dogs, Cats, Asses, Cocks, Hens, &c., in producing the same results as a good comic or tragic actor upon an assembled audience, and in making the house cry or laugh, according as his voice and gestures excited the emotions of Grief or Joy.

By yawning, and at the same time imitating the sound which accompanies the yawn, Dogs may be made to yawn at pleasure; but to succeed in the experiment, the animals must be lying quiet for some time. If they be moving or in the field, their attention will be otherwise engaged. When several Dogs are lying down together, the first that yawns makes all the others follow, except those which have their attention occupied about any passing matter.

In all ages, impostors have not been wanting, who have pretended to know and to translate several words in the language of the Mammalia, the Birds, and even of the Insects. There is, however, a natural language, or language of signs, which can be interpreted, and under this point of view, the animals may be considered as savages, who are visited by civilized men for the first time, and of whose language they are wholly ignorant. It is at first necessary to invent a language of signs for communicating their ideas before a vocabulary has been formed of the most essential words. We are told by M. de La Malle, that in most instances he has completely deceived these animals; and at other times, when the imitation was less accurate, they have perceived the failure, and either treated it with contempt, or received it with an expression of ironic gaiety, as if they understood the joke, but at the same time were not duped by it. These experiments were repeated so often by that able observer, and so frequently produced the same results, that he is of opinion we may interpret the language of signs and the symbols of the passions among Dogs as accurately as we can the cries and gestures of the human race. While entering the house, he one day imitated the cries of fighting Dogs with such accuracy, that his Dog, who was very much attached to him, darted out and bit him in the leg. At the first word the animal perceived his mistake, and threw himself howling on the ground, and asking pardon for the offence in the most affecting manner. Sometimes when behind a screen, on imitating the gentle cries of the female, the Dogs were immediately excited, raised their ears, howled, and gave the usual indications on the approach of the female.

Numerous other instances might here be adduced of an extraordinary development of intelligence in the domestic races, and many of these are so striking, that they have led some philosophers to assign to the animals certain qualities which are properly Moral. Public exhibitions have been made of the extraordinary abilities of some individuals, and interest has not failed to exaggerate their talents beyond all reasonable bounds.

In the year 1830, there were two Poodle-Dogs or Water-Spaniels, called *Fido* and *Bianco*, which were exhibited at Paris as the most learned individuals of their race. They were said to be able to spell in different languages any word they heard pronounced, to tell the name of the reigning sovereign, or to name the card which a visitor had selected. These feats would doubtless have established their claim to the possession of intellectual and moral qualities, but on examination, it was found that their intelligence was even more limited than that of many others of their species, and that all their learning resolved itself into a small matter. It was suspected that their master had some private sign which the Dogs understood, but although the exhibition was attended by several eminent Naturalists, it was long before they could detect it. Those who have not seen the exhibition must be informed, that all the letters of the alphabet, or all the playing cards, were arranged in a circle round the

Dog, at a tolerable distance from each other, and that the Dog kept continually moving round the circle. When giving an answer he carried successively to his master all the letters which composed the proper word or phrase, and he did the same thing with the card on which a visitor thought. The manœuvre, as far as the Dog was concerned, resolved itself merely to bringing objects. We can easily suppose that the animal, passing slowly from letter to letter, and touching each piece with his muzzle, would go on until his master would make the sign which meant "Fetch it." The Dog would immediately seize that particular letter and bring it to his master, and thus entire sentences might be formed without any understanding of their meaning on the part of the Dog. It was curious to find out the sign which the master had invented for the Dog, and it was considered by M. Feullet, librarian to the Institute, and several other members of the *Académie des Sciences*, to consist in a gentle tick of his nail; for it was observed that the master usually kept one of his hands covered by the other, or behind his back, or else in his pocket, to conceal the motion. On listening very attentively, they heard this sound every time that the Dog passed by the letter necessary to form the required word. It would be important to know the plan of instruction adopted by the master in teaching the Dog to obey a sound almost imperceptible to an unpractised ear; but this it was his interest to conceal with the utmost care.

An instance is related by M. Arago, the celebrated astronomer, which induced him to believe that Dogs know the difference between justice and injustice (*du juste et de l'injuste*), yet we cannot help thinking that the facts do not quite warrant the inference drawn by that eminent Natural Philosopher. Several years ago, when about four leagues from Montpellier, he was detained by a storm in an indifferent country inn. Nothing could be had for dinner except a single fowl, and this was ordered to be placed on the spit. The spit was attached to a large hollow wheel into which the Dogs were made to enter, and to turn it round by their weight and motion. One of the Dogs was in the kitchen, and the innkeeper attempted to seize him; but the animal hid himself, showed his teeth, and refused to go into the wheel at the command of his master. M. Arago, surprised at this, inquired the cause; he was answered, "The Dog knows it is his comrade's turn." The "comrade" was sent for at his request, and as soon as the animal arrived, at the first sign made by the cook, he entered the wheel and turned it round for about ten minutes. Wishing now to try the first Dog, the philosopher stopped the wheel, and ordered them to put the animal in which had formerly refused. This Dog being now convinced, according to M. Arago, that his turn had arrived, at once entered the wheel, and continued there till the fowl was roasted.

A similar anecdote is related of four black Mâtin Dogs which turned the wheel in the Jesuits' College of La Flèche. These Dogs, it was said, always knew their turn of service, and invariably revolted, as if against an evident injustice, whenever they were ordered into the wheel out of their proper course. M. du Petit-Thouars, who passed La Flèche in 1767, after the Jesuits were expelled, had this story told of the College Dogs by several inhabitants, who had witnessed the fact.

We must, however, refuse to assign moral qualities, or the faculty of discerning right from wrong, to these lower animals, if the above phenomena admit of being explained on the common principles of habit, or the association of ideas. When a Dog has long been accustomed to perform a disagreeable office every fourth day, he will come in the course of time to know his particular day of service, and a more frequent demand will naturally excite his resentment. To assign moral qualities to the lower animals is a very popular error, and we are inclined to suspect that these eminent philosophers allowed themselves to be deceived by the ambiguous language of the country people. It is a common circumstance to see a Dog, after having committed some fault for which he has often been punished, enter the room slowly and sneak into a corner; some one then observes, "He knows he has done wrong." In this case, the Dog only infers that the same action will be followed by the same punishment; or, in other words, he reasons from analogy. But this is far from entitling him to the rank of a moral being, or one capable of distinguishing right from wrong; and it is plainly unphilosophical to multiply the Mental powers of animals, if the ordinary operations of intelligence are sufficient to explain all the facts hitherto authenticated.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Individual modifications are seldom transmitted to posterity—Connate modifications generally are transmitted—Varieties in the external forms of Wild and Domesticated Mammalia.

ALTHOUGH the original and constitutional powers of animals remain the same under all circumstances, we have now seen that they may undergo some very considerable modifications. It has also been shown that, in many instances, these acquired characters are transmitted to posterity. The latter conclusion has been doubted by several Naturalists, who are inclined to consider these acquired characters as resulting either from the principle of Imitation, the influence of situation, or a combination of these causes. It has been asserted that no modification, induced after birth in the intelligent powers or instincts of an animal, is capable of being transmitted to its offspring, and that all transmitted powers must be connate, that is, imparted with the vital existence. With the human race there must always be an extreme difficulty in ascertaining how far those hereditary characters, so often observed to prevail in particular families, are the result of physical constitution or of Imitation and situation; but it is abundantly evident that the acquired properties of the lower animals are sometimes transmitted to posterity. The races of Rabbits which wholly lose their Instinct of burrowing from confinement;—the young Foxes of thickly-peopled countries which inherit the acquired cunning of their parents;—the young Pointers which set game naturally and without any previous instruction;—and the excessive timidity of young Lap-Dogs, whose parents have been long in the company of timid females;—are instances of this fact. Further, we have, in the docility of those races which have long been domesticated, an evident proof that the modifications of the earlier-tamed ani-

mals were transmitted to posterity, while the Apes of Sumatra, which have not this transmitting power, are wholly incapable of yielding domestic races.

It must, however, be carefully observed, that animals do not transmit to their posterity *all* their acquired modifications. On the contrary, it is only a *very small* number of acquired habits or alterations which are thus transmitted to their descendants. Nearly all those arts which a well-trained Dog has acquired perish with the individual, and the process of education has to be recommenced with the pup. The reverse takes place with the other kind of modifications which are properly connate, or born with the animal; for the latter are very frequently inherited by their descendants, and the instances of their not being so transmitted are by no means numerous. Thus, the artificial modifications of Instincts and Intelligence *sometimes* become hereditary; but connate modifications *usually* are so. The latter is remarkably the case in Man. "We see," says Dugald Stewart, "one race, for a succession of generations, is distinguished by a genius for the abstract sciences, while it is deficient in vivacity, in imagination, and in taste; another is no less distinguished for wit, gaiety, and fancy, while it appears incapable of patient attention or of profound research." We have many remarkable instances of the transmission of connate varieties, in the intellectual qualities of the several races of Dogs. No care or education will induce those qualities in the stupid Greyhound, which we find in the intelligent and docile Water-Spaniel.

Some species have an inherent tendency to produce these connate modifications of intelligence; but unless care is taken to preserve them free from foreign admixture, they soon become blended in the mass of average talent usually found in the species.

Hence connate modifications of Intellect may be either *original* or *transmitted*. The first stupid Greyhound, as well as the first intelligent Water-Spaniel, might have been descended from a pair of average talent; and these qualities, which were *original* connate modifications when they first appeared, have become *transmitted* connate modifications in our present races.

But the changes which the Mammalia are capable of undergoing are not confined solely to their Intelligent powers. We see that their external forms are also modified, and that this sometimes happens to a degree so great, as to render it a matter of considerable difficulty to ascertain whether the animals, so altered by circumstances, belonged originally to the same or to different species. These changes are induced by causes which may affect the individual only, or they may also alter the Offspring. The same law is observed in the changes of external form as in the modifications of Intelligence and Instinct; and while the individual varieties which are induced after birth are but rarely transmitted to posterity, the connate varieties give rise to most of those permanent alterations which distinguish the several races.

"We see no instance of connate variety," observes Dr Prichard, "however trifling, which does not manifest a tendency to become hereditary and permanent in the race. White animals with red eyes produce offspring resembling themselves, and the stock will retain its character permanently as long as no intermixture is suffered to take place. The progeny of black animals have the sable hue of their parents. On this account, black Rams are always killed in this country, and never suffered to remain with the flocks. In other countries black Sheep are preferred, and are bred up, while the white, when that variety springs up, are destroyed; accordingly, the general colour of the flocks is black. All the other varieties, as is well known, have a tendency to hereditary transmission. We may observe, that the disposition to variation is more frequently shown in some species than in others, and requires the agency of less powerful causes to excite it into action. The tendency to hereditary descent also is different, both among the animal and vegetable species. For in some species of the latter class, varieties are observed to reappear in the plants produced from the seed, and to continue constantly in the stock, resembling in this particular the nature of animal varieties. On the other hand, some species of animals approach to the capricious character of the vegetable kinds, and the variations which arise in them evince little tendency to become permanent."

It may be proper to recall to the memory of the student, the definition already given of the term *Species*. All animals are said to be of the same species, when they are descended one from another, or from common parents, or from others resembling them as much as they resemble each other. On the other hand, all those differences which are found among animals, sprung from the same original stock, are termed *Varieties*.

The most superficial characters are always the most liable to variation:—The colour of the hair depends greatly on the quantity of the light,—the thickness of the fur upon the degree of heat,—the size and corpulence of the animal upon the quantity of food, jointly with the degrees of temperature and moisture. Often the variations of colour are wholly connate, and can be traced to no external cause.

Among the wild animals, these variations are very much limited by the natural propensities of the animals themselves, as they never willingly ramble to a great distance from those localities where they find a convenient supply of all the things necessary for the maintenance of their species. Their migrations are therefore limited by the circumstances which unite all these conditions. Thus, the Wolf and the Fox inhabit every latitude from the frigid to the torrid zones, yet they scarcely undergo any alteration, through all the changes of climate, except a greater or less degree of beauty and richness in their fur. The variations are still less among those wild animals, especially Carnassiers, which are confined within a small geographical range. A thicker mane forms the sole difference between the Hyæna of Persia and that of Morocco. These variations would be confined within still narrower limits, if the wild animals were at liberty to choose their own localities. But from the earliest ages, they have been hunted by Man, or by the more formidable Carnassiers, and exiled from their native haunts. Some have been driven into unfavorable situations; those possessed of a sufficient flexibility of form have extended their range to remote distances, while the others were left no other retreat but the pathless deserts bordering on their native country. There are no species which, like Man, have established themselves in every country. A great number are confined to the tropical parts of Asia and Africa, others solely to the warm districts of America. Some are seen only in the Arctic regions; another animal world opens before the voyager towards the South pole. Many islands have their own peculiar creation; and even some chains

of mountains and valleys are seen to abound with animals unknown to every other part of the globe. Among all these species, we find, when all other conditions remain the same, that those confined to a small district exhibit the smallest and least important variations.

The Herbivorous Mammalia are much more liable to be influenced by climate than the Carnassiers, because their food is more variable, both in quantity and quality. For this reason, the Elephants in one forest will be larger than in another. Their tusks will be longer in those places where the food yields a greater quantity of the matter necessary to enter into the composition of ivory. The same thing will happen to the Rein Deer, and to the Stags, in respect to their horns. However, the nature of their food serves to confine the range of the Herbivorous tribes within still narrower limits than that of the Carnassiers.

Thus the entire influence of the climate and food upon wild animals is by no means very great. Some variations are, however, due to another cause. When the same male always continues attached to the same female, as happens with the Roe-bucks, the young exhibit that uniform resemblance to each other, and to the parents, which demonstrates the fidelity of their attachment. It is evident, that where the same female attaches herself to several males, as happens with the common Hinds (*Cervus elaphus*), the varieties must be greatly increased. We must also expect to find considerable variations in those smaller species which are very productive. Females bearing five or six young ones at a birth, and producing perhaps three times a year by different males, must greatly augment the number of these varieties.

Among the wild animals, any connate varieties which may arise from local causes, are soon blended by a continual intercourse with the original race, and in a few generations they wholly disappear. Hence we find in the herds of wild animals characters of marked uniformity, which cannot be discovered among those domestic races where the care of Man has intervened, and rendered the varieties permanent.

Nature has placed a fixed barrier to those variations, which might have arisen from the union of males and females of different species. We usually find that species, nearly allied to each other in zoological characters, bear a mutual aversion of the most marked and decisive kind. It requires the greatest degree of ingenuity and constraint, on the part of Man, to deceive the animals so far as to form these unnatural unions between different species; and when the Hybrids thence produced are themselves productive, which seldom happens, they do not continue so for many generations. Even this partial fecundity would not probably have existed, without the continuation of that care by which the first union had been induced. We never find in the woods any animals of a character intermediate to the Hare and the Rabbit, to the Weasel and the Polecat, or to the Stag and the Fallow Deer.

There are, however, distinct species which are capable of producing by their union fertile individuals. The offspring of the Dog or his female, with the female or male Wolf or Fox, are prolific. The same thing occurs with the offspring of the He-Goat and Ewe. The Mules produced between the Ass and Mare are sometimes prolific, and fertile races may be produced from the unions of several Birds of distinct species. Yet these are merely exceptions to the more general law, that the unions of animals of different species are either wholly unproductive, or the offspring is a Hybrid, and incapable of procreation.

There is a tendency among most animals, whether wild or domesticated, to pass occasionally into White varieties, distinguished by the term Albinos. Their hair is remarkably soft, and perfectly white, the iris of the eye is of a bright red colour, and the sight is acutely sensible to light. These varieties are therefore circumscribed, that is, they appear only during twilight or moonshine. In dark woods, old cathedrals, and obscure subterranean retreats, the common brown Mouse acquires, from the absence of light, the red eyes and white hair of the Albino variety. This property becomes hereditary, and thus races may be formed, as has happened in the case of the common Ferret, which is probably only a variety of the Polecat (*Mustela putorius*). The offspring of two brown Mice are white when the old animals are retained in absolute darkness. These Albino varieties have also been seen in the Bactrian Camel, the Elephant, the Beaver, and in a very great number of other animals.

"By far the most powerful cause of the evolution of varieties in the Animal Kingdom," remarks Dr Prichard, "is Domestication. To be convinced of the truth of this fact, we need only look at the phenomena which surround us on every side. In all our stocks of domesticated animals, we see profuse and infinite variety, and in the races of wild animals, from which they originally descended, we find a uniform colour and figure for the most part to prevail. Domestication is to animals what cultivation is to vegetables, and the former probably differs from the natural state of the one class of beings in the same circumstances, which distinguish the latter from the natural condition of the other class. The most apparent of these is the abundant supply of the peculiar stimuli of each kind. Animals in a wild state procure a simple and unvaried food in precarious and deficient quantities, and are exposed to the inclemencies of the seasons. Their young are produced in similar circumstances to the state of seedlings which spring uncultivated in a poor soil. But in the improved state, all the stimuli of various food, of warmth, &c. are afforded in abundance, and the consequence is a luxuriant growth, the evolution of varieties, and the exhibition of all the perfections of which each species is capable."

Hence it is in Man and Domestic Animals that varieties are most numerous and perplexing. At present, we shall confine our remarks to the changes experienced by the Domestic Animals, leaving the more interesting and difficult consideration of the varieties in the Human Race to a more advanced stage of this work. Indeed, it is only after a careful study of the limits of variation amongst the Domestic Animals, that we shall be competent to consider the varieties of the Human Race in an unprejudiced and impartial manner.

In those species which have experienced an imperfect domestication, the variation is but slight, and it is due chiefly to climate. Thus, we have but few varieties of the Cat, and their modifications are by no means considerable. Some have a softer fur, the colours of others are perhaps more vivid, or their size is greater. These are the limits of their variations, and they are further confined by

the habits of intercourse which the tame Cats preserve with the wild individuals of their species, established in their immediate neighbourhood. In this way, all the tame Cats bear a marked resemblance to the wild Cat of pure breed. The colour of the latter is uniformly gray, with blackish longitudinal bands, while its fur is somewhat rough. When tamed, in some climates, its colours become vivid or the fur grows smooth; in other countries the colours are softened down and become blended together, and the fur grows rough. When the European Cats are removed to the warmer parts of Africa, their form does not change with the climate. Their variations of colour prevail chiefly in Anatolia, Spain, and Persia, where distinct races have been formed. It is said, that there exists in China a variety of the Domestic Cat, with pendant ears, and in the Isle of Man there is a distinct race destitute of tails. These form the extreme limits of variation in a species, which serves to mark the transition from the Wild to the Domestic Mammalia.

We may naturally expect to find a greater degree of variation in the Domesticated Herbivorous Mammalia, which have been transported into every climate for our use, and to whom we allot various portions of food and labour. Their modifications are, however, merely superficial. A greater or less degree of size; longer or shorter horns, or the want of them altogether; or perhaps a lump of fat on the shoulder, or near the tail, are the general limits of their variations. The colour also is ever variable, and often without any assignable cause.

The Goat has experienced many changes of colour, and in Spain it has lost its horns. The different qualities of fleece found in the Cashmere, Thibet, and Angora Goats, are well known in commerce. It is, however, the last of these varieties, which appears, from its pendant ears, to have departed the most widely from the original type. The usual and well-known influence of the climate of Anatolia, joined to the long domestication of the species, in a nation civilized at an early period, has produced this variety by the long-continued action of these causes. Buffon remarked that the Angora Goats born in France were losing those long and pendant ears which characterize the Syrian variety, and it was expected that in a few generations they would acquire ears and fleece resembling those of the common Goats of that country; but, according to Blumenbach, the Angora variety continues permanent when the animals are removed to other climates.

Among the Sheep, the variations are numerous, but these chiefly refer to the fleece, which it has been the constant care of Man to alter and improve. In some districts the sheep are always black, and very often a white Ram and Ewe will produce a black lamb. In other places they may be brown, spotted, reddish, or even yellowish. These varieties of colour are still more accidental than the other differences, which arise among races from alterations of food and climate. The limit of variation among the Sheep may be seen in those enormous accumulations of fat, which swell the tails of a race found in some parts of Africa and Asia. Pallas, who saw the Sheep of the Kirgus, a tribe of Siberia, describes them as being more fat and deformed than any he had ever seen. They are taller than a young calf, very heavy, and somewhat resemble the Indian Sheep in their proportions. Their heads are much swollen, with large pendant ears, and the lower lip extending far beyond the upper. The greater number have one or two bunches covered with hair, which hang down from their neck. In the place where in other Sheep a tail is usually found, there is a round and large protuberance of fat, with scarcely any wool beneath, and these protuberances often weigh from thirty to forty pounds, and yield from twenty to thirty pounds of suet. These peculiarities continue permanent wherever they may be removed. The native Sheep of Ethiopia are covered with coarse hair, and those of Thibet with very fine wool. The Ankon variety of Sheep from Connecticut have the fore-legs bent like an elbow; and this deformity, which is usually communicated to their descendants, as well as the general shortness of all the legs, was at one time much cultivated, from the Sheep being thence unable to climb the fences.

We have already seen, that the Bull can scarcely be considered a domestic animal, when viewed in reference to its disposition; yet its colour varies equally with its more domesticated female. Innumerable varieties of the Cow are distinguished by Graziers; and France alone reckons at least sixteen varieties, deriving their names from the Provinces which they inhabit. The possession of udders of enormous size, and the property of giving milk all the year round, are qualities acquired by Domestication. We are informed by Pennant, that the American Bison is covered in the winter with a long shaggy fleece, which hangs over his neck, and partakes somewhat of the nature of wool; but that in summer he is almost naked. In the island of Celebes there is found a variety of the Buffalo, not larger than our common Sheep.

The Ass undergoes, from domestication, several changes in the colour and quality of its hair; but the wild Asses, inhabiting the country of the Calmucks in immense numbers, resemble each other precisely in all those particulars which are observed to vary among the domesticated species. In other respects, they only differ from the Domestic Asses, in being of a greater size and beauty. The wild Asses inhabiting the deserts of Barbary are uniformly gray, and are said even to outstrip the Horse in speed of foot.

The joint influence of Climate and Domestication seems to have a greater power over the Horse, and its varieties are accordingly almost infinite in number. In some the head is small and slender, the nostrils are wide and easily moved, the ears are slim and directed forwards, and the eyes are lively. In other varieties we have a complete contrast in all these particulars. The head is heavy, the nostrils are narrow and close, the ears are large and directed backwards, and the eyes have a marked expression of dulness. An equal degree of variety is found in their colours, which may be black, bay, brown, or white, or any combination of these shades. In Ceylon there is said to be a variety of the Horse which is not more than thirty inches high; in other climates the Horse is nearly as large as the Bactrian Camel. In bulk it sometimes rivals the Ox, and often it emulates the lightness of the Stag. We are informed, by John Hunter, that all foals are usually of the same colour, and that, though the hair may vary as they become older, still the skin remains the same, being no darker in black than in white Horses, which is contrary to what is observed in most species. There is an exception in cream-coloured Horses, which have the skin of the same hue as the hair. In size, colour, and form, as well as the quality of the hair, they

may differ greatly, but always within certain well-defined limits. We may perhaps consider the Calmuck variety, with very long, thick, and white hair, as the greatest deviation from the original type.

With the Domestic Hog, the extreme points of variation must be placed in its soft and pendant ears, the smallness of its tusks, and the union of its hoofs. This animal appears to depart most widely from its original form, when domesticated in the warmest countries; and then the variations in size and shape are innumerable, and its colour usually changes to white. That variety of the Hog with undivided Hoofs, observed long ago by Aristotle, is sometimes found in England; and in Normandy there is said to be a race of Hogs with the fore legs much shorter than the hinder.

It is, however, in the Dogs that varieties are most striking and important. Man has transported these animals into every part of the globe, and the extent of his power is seen in the extraordinary differences of their forms. As their unions may be regulated entirely by the will of their master, and as the connate varieties of individuals are readily transmitted to their offspring, we find among them singular deviations from the original type. Not only is their colour infinitely various, but their hair becomes more or less abundant, and sometimes it is wanting altogether. The height of some Dogs is five times as great as that of others, and their bulk may, therefore, be more than one hundred fold. These are not the only differences. They seem to be acutely susceptible to all those circumstances which affect the growth of the different parts of the body. The forms of their nose, ears, and tail; the relative height of their limbs; the progressive development of their brain; and the form of their skulls, are alike affected by these sources of variation. Sometimes the head is slim, the muzzle slender, and the forehead flat. Often the face is fore-shortened, and the forehead projects. Indeed, the differences between the French Mâtin Dog and the Water-Spaniel, between the Greyhound and the Bull Dog, are more strongly marked than those among many wild animals of the same genus, but of different species: It is unquestionably in the varieties of the Dog that we see the highest degree of deviation yet ascertained to prevail among the individuals of any species throughout the entire Animal Kingdom.

Of all the characters which the domesticated animals possess, it may be observed that the colour of the hair and skin is the most liable to variation. Being placed externally, this part of the body is exposed more than any other to the influence of outward causes of change. The hair of the different Dogs exhibits this natural versatility in a remarkable degree with respect to colour, quality, length, and arrangement. In cold climates the Dogs have usually two kinds of hair; the one, being short, fine, and woolly, immediately covers the skin, while, in the other, the hairs are long and silky. It is the latter kind of hair which imparts the coloured appearance to the animal. In tropical climates, the fine and warm woolly hair becomes obliterated, and at length wholly disappears. The same thing happens in our houses, when Dogs are protected from the changes of weather and the severity of winter. The skin of the Barbary Dog is naked and oily; the Bull Dog, the Mastiff, the Greyhound, and the Carlin, have the hair short and smooth. It becomes longer in the Shepherd Dog, the Wild Dog of New Holland, the French Mâtin, and the Iceland Dog; it is very long in the Wolf Dog, the Spaniels, and especially in the French Bichon, where it sometimes reaches nearly to the ground. Again, if the hair be viewed in respect to its quality, we find at least as many shades of difference. The Shepherd Dog, Wolf Dog, and the Griffon, have coarse hair, while in the French Bichon, some Water-Spaniels, and the Great Dog of the Pyrennees, it is both silky and soft. In some it is straight and smooth, in others woolly and curly. Many races have the body clothed entirely with long hair, while on the head and limbs it is perfectly thin and smooth. Others, on the contrary, have the head and neck furnished with a mane, and the remainder of the body is covered with short hair. The Wolf Dog is an instance of the former kind, and the Lion Dog of the latter. In these respects, we find in the hair of Dogs all those variations of quality and quantity which can be found in the several genera and species of the Mammalia. Their colours may be white, a deeper or paler brown, fawn, or black. Some Dogs are seen entirely of one of these colours, but most frequently the tints are distributed irregularly in spots, which may be either large or small. Sometimes these spots have a tendency to become symmetrical; at other times the longer hairs are of a different colour from the short ones, and then the joint effect of the two colours produces different shades, according as the white, black, fawn, or brown, predominates. Thus, we may see Dogs with hair apparently resembling that of the Wolf, and upon a closer examination this is found to proceed from the mixture of white, fawn, and black hairs; or more rarely the general effect may produce a gray slate colour. These colours are not connected with any particular variety, nor does it necessarily follow that Dogs of different colours must be further distinguished by the forms of their heads, the quality of their hair, or the proportions of their bodies. It usually happens, in all these cases, that when care is taken always to unite individuals of the same colour, form, and size, that the race perpetuates itself. It is from the constant union of individuals having the same, or nearly the same, colour that the Danish Dog, Greyhound, Bull Dog, and Mastiff, are fawn, the Shepherd Dogs are black, the Wolf Dogs white, and the Gallic Hound, the Braques, Bassets, and Spaniels, have black spots upon a white ground; but when this precaution is not observed, the colours of the above-mentioned Dogs will be modified in proportion to their degree of admixture with other races. However, the connate modifications of colour, as well as the more important ones of shape and size, usually end in becoming hereditary, when they are not counteracted by some neutralizing cause.

Thus we find, upon the whole, that the more important variations of the Mammalia may be ranged under the following heads:—

1. The skull and face may be shorter or longer, broader or higher; the forehead may be elevated as in the Wild Boar, or depressed as in the domestic Hog. Thus, the head of the Neapolitan Horse differs remarkably from that of Hungary and Transylvania in the shortness and breadth of its lower jaw-bone. Camper also remarked, that the lacrymal depressions (*fovea lacrymales*), which can be clearly observed in the Wild Bull, had disappeared by degeneration in the domestic Ox.

2. The general figure and proportion of the limbs may be altered to a most ra-

markable extent. We see striking instances of this variation on comparing the Syrian and Arabian Horses with those of the North of Germany and the Shetland Isles.

3. In stature there may be a singular disparity; thus, the Hogs transported to the Island of Cuba acquire a size nearly double that of the common European Pig; and a very considerable growth takes place among the Wild Cattle of Paraguay.

4. The texture and quality of the Hair may vary from the soft wool of the Thibet Sheep to the dense and almost rigid hair of the Ethiopian variety. In Normandy, the bristles of the common Pig lose all their stiffness. But the most singular instances of variation in the hair are effected by the climate of Anatolia, where this cause equally affects different species of Mammalia, and transforms the short fur of our Cats and Rabbits, as well as the wool of our Sheep, into the long and silky fleece of the Angora varieties.

Lastly, the colour of the Hair may vary from black to white through all the shades of brown or red. The fleeces of Angora often assume a silvery whiteness. Indeed, we have only to look around us to see innumerable instances of diversity in the colours of our domestic animals.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Permanence of Species—Difficulties in distinguishing between Species and Varieties.

As the variations which have arisen among the Domestic animals, and especially in the Dog, appear very considerable, it has been thought probable by many Naturalists that our different races of Dogs have descended from several distinct species. In this way the difficulties of explaining the causes of their variations are wholly avoided, rather than resolved. It remains to be shown, under this view of the subject, from how many species the domestic Dogs have descended. No Naturalist could propose to establish a species for every distinct race, which are upwards of fifty in number. Still less, as all these races are capable of forming crosses with each other, could they institute a species for every combination in pairs; nor could they extend it to those secondary and tertiary crosses which might be formed among their posterity, both with each other and with the original races, thus rendering the number of species absolutely infinite. It has been rather attempted to limit the sources of the several races of Dogs to a small number, marked by important differences. Yet it becomes equally impossible to point out the particular stocks from which these races have descended, or the variations which must be regarded as important, without falling under objections of another kind.

There are several considerations which clearly establish the important fact that Species have a real existence in Nature;—that certain forms have been assigned to each animal from the origin of things; and that although the animals are liable to diverge from their primitive forms, they always possess a preservative tendency, a *nisus formativus*, and are ever ready to revert to the original type when the external causes of change are removed. The entire Animal Kingdom is divided into a number of distinct species, each of which perpetuates its own form, without ever transgressing certain limits, or acquiring the characters of another species.

In all the varieties observed to arise among the Mammalia, the form of the bones preserves a remarkable stability, which would not always be expected from the appearance of the external parts. The Baron Cuvier compared the skulls of Foxes from the North of Europe and from Egypt with those of France and with each other, yet he found no other differences than such as might distinguish one individual from another. The antlers of the Rein-Deer and Stags often vary in size, and the same may happen with the tusks of the Elephant; but two individuals of any one of these species, however dissimilar they may be in size, do not exhibit the slightest difference in the number of their teeth, or the articulations of their smallest bones. This is also observed with the domestic Cattle, which may be destitute of horns, or have them of variable length, and yet they possess an exact correspondence in all the other parts of the skeleton.

Thus the forms of the bones in general vary but little; while their modes of connexion, their articulations, and the form of the great molar teeth, remain constantly the same in each species. The divided Hoof of the Hog sometimes becomes consolidated, and this may be regarded as the extreme limit of variation among the bones of our domestic herbivorous animals.

The variations of the bones in the different kinds of Dog have undergone a special examination by M. Frederic Cuvier, performed at the request of his brother upon the specimens at the *Museum d'Histoire Naturelle*. To enter fully into the details of this investigation would at present be out of place. It will suffice here to mention, that a general correspondence in all the parts of their skeletons was found to exist, and at the same time some important variations, especially in the degree of elevation of the frontal sinuses. The teeth were always of the same number and general form; sometimes an additional false molar, or a tubercle, was observed on one side or on the other. It is well known that all Dogs have five toes on the fore-feet, and only four on the hinder, while there is a slight trace of a rudimental fifth toe in the hinder metatarsal bone, which, however, shows no appearance on the outside. These toes being of unequal length, usually preserve the same relations in all the races; but sometimes a fifth toe exhibits itself on the internal surface of the hinder-feet. It is, however, generally very short and imperfect, and this last is the maximum of variation found in the skeletons of all the races of Dogs.

It thus appears abundantly evident, that animals now possess certain characters which remain permanent, and resist all modifications, whether arising from climate or domestication, or from a natural tendency to run into connate varieties.

Time, however, it has been said, may effect a perceptible modification in the entire characters of species. Fossil remains, and other Geological monuments, appear to show that millions of years have elapsed since the first species of animals inhabited the earth, and it is asked, may they not have undergone many modifications during the interval?

It is evident that we can only ascertain the effect which a very long time will produce, by comparing it with the change actually observed to have taken place during a shorter period. MM. Cuvier and Geoffroy-Saint-Hilaire sought out the most ancient documents which Egypt could afford, for the purpose of solving this question, so important to the Naturalist, and essential to a knowledge of the past history of our globe. M. Cuvier examined with great care the ancient Egyptian obelisks transported to Rome, and found a perfect resemblance between the general form of the animals engraved thereon, and the common species of our own day. M. Geoffroy collected as many mummies of the lower animals and of Man as he could find, and was led to form a similar conclusion. These monuments must have been from 2000 to 3000 years old. "For a long time," says M. Lacépède in the report which he made upon these objects in common with MM. Cuvier and Lamarck,—"For a long time philosophers have been anxious to know whether species change their forms during the course of ages. This question, apparently trivial, is yet essential to the history of the globe, and to the solution of a thousand other questions not far removed from the gravest objects of human veneration. Never were we in a better condition to decide the question upon a great number of remarkable species, and for a long period of years. The superstition of the ancient Egyptians would almost seem to have been inspired by Nature, for the purpose of bequeathing to us a monument of her history. A people of fantastical opinions, by embalming with so much care the brute beings, objects of their stupid adoration, have left in their sacred grottoes complete cabinets of zoology. The climate has united with the art of embalming to preserve these bodies from all corruption, and we have now the means of ascertaining with our own eyes what was the condition of these animals 3000 years ago. One can scarcely restrain the raptures of Imagination upon seeing at the present day an animal preserved, with the smallest bone and hair perfectly distinguishable, which had 3000 years since in Thebes or Memphis its priests and altars. But without wandering into all the subjects to which these associations give rise, we shall confine ourselves to noticing the simple fact—that those animals perfectly resemble those of the present day."

Although the bones of a species do not vary to any extent, yet the identity of osteological characters is not alone sufficient to establish an identity of species; and some species which possess a most exact similarity of structure are held, by the general consent of Naturalists, to be of different species. It is almost impossible to distinguish the skeleton of the Wolf from that of the Wild Dog of New Holland. Their teeth are the same; the vertebrae of the tail are equal in number; the feet have the same number of toes; and the bones of the head exhibit the same relations, except that the orbital fossæ are slightly larger in the Wolf. The same thing occurs in the Wolf of Canada, which is smaller than the common Wolf, and larger than the Dog of New Holland. The Jackal also resembles the Wolf-Dog very closely, especially in the form of the head. There is likewise a most exact similarity in respect to the organs of Sense among the New Holland Dog, the Canadian Wolf, and the Jackal. Again, the quality and arrangement of the hair exhibit no essential differences, for they all may have either woolly or silky hair, according as they have been naturalized in cold or temperate countries. In fact, they only differ in colour. Yet all these genera merely vary from white to brown or black, and excepting the Black Wolf, which has the hair of a uniform colour, the others have hairs of fawn, black, or white so mingled together, that it is difficult to set down any colour as peculiar to either species, and which will not pass by insensible shades into another.

What, then, it may naturally be inquired, forms the distinction between a species and a mere variety; and how are we to ascertain those permanent characters which were assigned to our domestic animals at the origin of things?

If these questions be considered in a purely abstract form, no difficulty can arise, as we have only to include in the same species all those animals, whose differences of external form and garb can be traced to some acknowledged causes of variation; while the animals whose differences cannot be thus explained, must be held to belong to separate species. "Where two races of animals are distinguished by any undeviating marks in such a way that they never will, under any circumstances, pass into each other, or that the progeny of either can never acquire the characters of the other, they are of distinct species, and it matters not how wide or how narrow be the line of discrimination, provided that it never be broken in upon." But when we come to apply these abstract rules to the realities of Nature, we find that they are not always sufficient to distinguish the mere variety from the genuine species.

The difficulty is further increased by the circumstance that many varieties or races of some species differ more decidedly among themselves, than the species of certain genera, where the objects are very numerous. Again, the greater part of our acquisitions are imported from remote and barbarous countries. "A large proportion," as Mr. Lyell observes, "have never even been seen alive by scientific inquirers. Instead of having specimens of the young, the adult, and the aged individuals of each sex, and possessing means of investigating the anatomical structure, the peculiar habits and instincts of each, what is usually the state of our information? A single specimen, perhaps, of a dried plant, or a stuffed bird or quadruped; a shell without the soft parts of the animal; an insect in one stage of its numerous transformations;—these are the scanty and imperfect data which the Naturalist possesses. Such information may enable us to separate species which stand at a considerable distance from each other; but we have no right to expect any thing but difficulty and ambiguity, if we attempt from such imperfect opportunities to obtain distinctive marks for defining the characters of species which are closely related. When our data are so defective, the most acute Naturalist must expect to be sometimes at fault, and, like a novice, to overlook essential points of difference, or pass unawares from one species to another."

Buffon established the criterion for the determination of species in the power of producing, by their union, races equally fertile with themselves, and this rule seemed to be confirmed by the experiments of John Hunter. They were of opinion, that "if a male and female produce an offspring which is prolific, the tribes to which the parents respectively belong are hence proved not to be specifically different, and whatever diversities may happen to characterize them, are in this case to be looked upon as examples of variation. But if the third animal be unprolific, it is to be con-

cluded that the races from which it is descended are originally separate, or of distinct kinds. The fact that most hybrid animals are wholly unprolific, would appear to be a provision for the attainment of this desirable end, and for maintaining the order and variety of Nature. For if such had not been the condition of these intermediate animals, we have reason to believe that all the primitive distinctions would have been long ago totally effaced; a universal confusion of species must have ensued, and there would not be at this day one pure and unmixed species left in existence. The Naturalists above mentioned, inferring, from the apparent utility of this law, that it must universally prevail, obtain by means of it a ready method of determining on identity and diversity of species."

It is very clear that if two animals are prevented by any great disparity of organization or disposition from uniting, that the criterion of generation holds good to a certain extent. The Bull and the Goat, for example, would at once be pronounced to be distinct species. This rule may enable us to assert that two animals are not of the same species, but it does not always serve to discriminate between nearly-allied species. Hence it seems rather to be the first rude attempt at forming a criterion, than one which serves to mark out nice distinctions. The crosses among the Dog, the Wolf, and the Jackal;—between the Goat and the Sheep;—the Horse and the Ass;—the Lion and the Tiger, with the occasional appearance of fertile Hybrids in many, and the possibility of its occurrence in them all, show that the converse often fails. Although animals which do not generate together belong to distinct species, yet it is not true that distinct species must not generate together, nor does it follow that their progeny must always be sterile.

The determination of species by the property of producing fertile races, had previously been restricted by Frisch to such as generate together of their own accord, "von Natur mit einander gatten." Those artificial unions brought about by restraint, artifice, or domestication, were wholly excluded by him. But this restriction renders the rule useless in practice for determining those points where difficulties may chiefly be expected to arise. It is in respect to Man and the domestic animals, or with animals brought from distant and uncivilized countries, that a rule is most required to distinguish the species from the mere variety. Blumenbach inquires, "When will it come to pass that all nearly-allied animals shall be brought together from remote countries, so as to submit them to the requisite experiments,—for example, whether the Chimpanzee (*Troglodytes niger*) from the Angola Coast, will form a fertile race with the Orang Outang (*Pithecus Satyrus*) from Borneo?" This is a desideratum which the general establishment of Zoological Gardens alone can supply, but in the meantime we must seek some other criterion, which shall be applicable to Man and the domesticated animals, for the determination of species.

It is here that difficulties arise in drawing the line between the species and the variety. Tillesius considers that several distinct species are confounded under the name of Jackal or Chacal (*Canis aureus*), while both Pallas and Guldenstaedt regarded the Jackal of Caucasus as the original source whence our domestic Dogs are descended. Others again thought that the different kinds of Dog have diverged from the Shepherd's Dog, while some considered them all but as degenerations from the Hyæna, the Wolf, or the Fox.

Thus it is precisely in those places where a fixed rule is most required that the breeding principle wholly fails, and we may seek in vain for any other. Blumenbach could propose none, but referred the determination of species to Analogy and Probability. "Fere desperem," he observes, "posse aliunde quam ex ANALOGIA et verisimilitudine notionem speciei in Zoologiæ studio depromi." (I may almost despair of being able to derive the idea of species in the study of Zoology from any other source than analogy and probability). Two races of animals which possess a general resemblance, and differ only in those respects which have been observed to vary, and can be traced to some well-known causes of variation, must at once be admitted to belong to the same species; but however near their general appearance may be, if they exhibit any difference which, in all our experience of the Animal Kingdom, has never been known to exist as a variety, they must be set down as distinct species. The proper determination of species rests, therefore, upon the knowledge of an immense number of facts, and forms one of the most difficult, as it is one of the most important, subjects to which the Naturalist can direct his attention.

Thus Blumenbach considers the Ferret to be merely a variety of the Pole-Cat (*Mustela putorius*), not because they generate together, for perhaps the experiment may not yet have been made, but because the former is white with red eyes; and, from that well-known rule of analogy, that the same effects must be referred to the same causes, its origin is the same with those Albino varieties produced daily among the domesticated Mammalia. Again, the Indian Elephant (*Elephas Indicus*) differs remarkably from that of Africa (*E. Africanus*) in the number and form of its molar teeth. Whether these animals will engender together it is perhaps difficult to determine; but on examining every specimen which reaches this country, the same difference is found to exist. Further, we know of no analogous instance of variety in the formation of the molar teeth among wild or domestic animals. We, therefore, do not hesitate to set down these two Elephants as distinct species.

There are other difficulties arising from the want of accurate information; and these, in the present state of the science, occur but too frequently. For example, the skin of an animal arrives from the Cape of Good Hope. At the first glance it appears, perhaps, to be a specimen of the common Cape Otter (*Lutra capensis*), and this opinion may be further confirmed on examining the structure of its teeth. The colour of the breast and throat may seem of a purer white, and to be more extensive than usual, but this is a characteristic which might belong to a mere variety. On looking at the feet, we are much surprised at finding all the toes without nails, excepting on the second and third of the hinder-feet, where only a rude vestige of a nail can be observed. A Carnassier without claws would seem an anomaly in creation. To suppose a being, compelled by its structure to live on animal food, and yet to be refused by Nature the weapons fitted for seizing its prey, disturbs our ideas of final causes, and we delight to trace order and regularity in the works of creation. The specimen must then be imperfect. It belongs to an old individual;—perhaps the claws may have dropped off through age or disease. We set it down, therefore, as a mere variety of the *Lutra capensis*. Some years afterwards, young indi-

viduals are brought with the nails entire; the first view then seems abundantly confirmed; perhaps even we applaud our own sagacity, and our extensive knowledge of final causes,—of those ends and uses for which the Creator designed the various parts of the animal world. Finally, another young individual is imported with all the characters of the original specimen, thus proving it not only to have been a distinct species, but entitling it to the rank of a separate genus—the *Aonyx*, or Nail-less Otter of M. Lesson: and one more instance is afforded of the inexhaustible variety in the works of Nature. When we find that even the possession of Claws is not always indispensable to the subsistence of the Carnassier, we may thence derive the salutary caution, not to confide too implicitly in analogical reasoning, if we wish to form correct views regarding new or unknown natural objects.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Supposed Degeneration of Species—Theory of Original Stocks proposed by Linnaeus and Buffon—Lamarek's Theory of the Transition of Species.

SINCE the supporters of the permanent characters of Species thus find it difficult to fix any very definite rule for determining them, and as the characters themselves are often seen to run into innumerable varieties, two very different theories have been proposed. Linnaeus and Buffon asserted that only a small number of stocks were originally created, from which all the existing species have degenerated and diverged, from the influence of climate, food, and domestication, aided by a promiscuous intercourse, which has been limited only by their progeny ceasing to produce fertile races. On the other hand, Lamarek considered that the form of the body, and all the characters of species, were the consequence of the habits, the manner of living, and other circumstances, which have, in the course of time, given rise to the form of each species. Further, that Man, and each higher animal, has originally arisen from some lower Division of the Animal Kingdom, by the gradual transition of the characters of one species into another, but always from the lower to the higher, with the transmission of such commuted characters to their posterity. These theories both agree in denying the fixed character of species. That of Linnaeus and Buffon would remove the character of durability from the species to fix it in some original stock, the type of the Genus, the Family, the Tribe, or perhaps even of the Order. That of Lamarek would overturn the permanent character of all forms. The first asserts the degeneration, the second the gradual development and perfectibility, of species. While the one reposes chiefly on the phenomena of Variation, the other rests upon those general analogies among species, which have led Bonnet to form his universal chain of existence, and later writers their circular theories.

It is to Linnaeus that we must assign the merit of relieving Systematic Botany from those accidental varieties which spring up daily in our gardens, and had been improperly raised by Tournefort and other former Botanists to the rank of species. But the zeal of this great Naturalist in bringing down Varieties from their undue elevation, led him to conjecture that many of those Plants which had been discovered since the time of Tournefort might have been produced, during the intervening period, by the intermixture of species. From the impregnation of one kind of Plant with the pollen of another, he was induced, not only to suspect that Nature now produced new species by this means, but that, even at the origin of things, there had been created only a certain number of simple genera, the continual crossing of which has given rise to the immense number of species at present known. This hypothesis, which originated from the consideration of Plants, was afterwards extended by Linnaeus even to Animals, and however plausible it may at first sight appear from contemplating those races, by which Nature has so infinitely varied some species in different parts of the globe, it seems, on a further consideration, to be wholly untenable. Contrivance and ingenuity, on the part of Man, are always seen to be necessary to bring about the production of a Hybrid or cross between two different species. There is further an impossibility of perpetuating these crosses as species or distinct races, arising either from their absolute or relative want of fecundity, or from that degeneration and deterioration to which their issue is subject. They always require the assistance of one of their primitive stocks, to prevent the new race from becoming wholly extinct. Further, in those genera and classes where the objects are very numerous, we often see two or more species formed evidently upon the same model, which may be more or less varied, yet they always remain distinct from each other. Examples of this are not wanting from the Quadrumana and Cheiroptera to the lowest species of Zoophytes. We also see that those peculiarities which serve to characterize the several species, genera, or even natural families, continue to exist without there ever appearing before our eyes new links between allied species. For nearly two centuries, Animals and Plants have been observed with great care, yet there has not been one authenticated instance of a distinct and constant species, which has yet been proved to be of modern origin. Finally, those fossil Shells and Bones found in earthy strata, deposited during the earlier ages of animal life, exhibit the same variety, not only of those forms which are found at the present day, but also of many others now wholly extinct. These facts are opposed by a mere probability or conjecture, and we are hence compelled to consider species, although very nearly resembling each other, to have been so formed at the origin of things.

Buffon has carried these views regarding the Degeneration of species among animals to a much greater extent than Linnaeus did in respect to Plants. After reducing the numerous races of domestic animals to certain original stocks, he grouped the allied species of quadrupeds into races or natural families. Assuming certain species to be the primitive stocks from which the numerous allied species at present existing have descended, he thence attempted to explain their degeneration, partly by their close affinities, but chiefly by those causes which are sufficient to vary the domestic animals. He thought that species, such as now are commonly admitted, did not formerly exist, and that we must seek for their characters in those natural groups which have served to form genera or families. The degeneration of species, according to Buffon, was one which preceded all history, and formed the most ancient

of their changes. It appeared to arise in each family, or in each of those genera under which nearly-allied species are usually comprised. Only a few isolated kinds, he remarked, formed, like Man, at once the species and the genus. The Elephant, Rhinoceros, Hippopotamns, and Camelopard, according to him, composed simple genera and species which were continued in a direct line, and without any collateral branches, while all the others appeared to form families, in which a chief and common stock might generally be observed, from which there seemed to proceed different offsets, increasing in number according as the individuals in each species were smaller and more fertile. Buffon on these principles reduced all the species of quadrupeds then known to thirty-eight families. He admits that this state of Nature has not come down to us, but is, on the contrary, the remnant of a former state of things, and that we can only acquire a knowledge of it "by inductions and relations nearly as fugitive as the time, which seems to have obliterated all traces of its existence."

Notwithstanding the opinion which M. F. Cuvier has hazarded upon this theory, "that it even now presents an appearance of the greatest probability," it is one to which we can by no means subscribe. After making due allowance for the influence of climate, food, and the numerous accidents to which all the individuals are subject, these causes are wholly insufficient, however long we may suppose them to operate, to change the entire forms of animals, their proportions, and even their internal structure, to such a degree as this hypothesis would require. We see that those domestic animals which Man has transported to the most opposite climates, have only changed the quality of their hair or their colour. The influence of pasture can only alter the height, the proportion of the horns, or perhaps add some lumps of fat to the body. But a small number of generations spent on another soil are sufficient to overturn whatever this race may have acquired during ages of cultivation. Again, if we consider those species, whether Mammalia or Birds, which are most populous in individuals, and at the same time the most fertile, the entire of their observed variations are by no means great. Some species which are very populous are nearly exempt from varieties, while others, though less fertile, vary much. Thus the common Mouse and the Mulet (*Mus Sylvaticus*) are perhaps as populous as any species; yet their variations are rare, and an infinite number of instances might be brought forward among the Fishes and Insects. There are even species very nearly allied to each other, and almost equally distributed in opposite climates, of which the one has run into a great number of varieties, while the others every where preserve a uniform resemblance to each other. The Polish Marmot (*Arctomys bobac*), and the Siberian Marmot (*Spermophilus etillus*), are striking instances that a vegetable diet does not give rise to greater varieties than animal food. The Polish Marmot lives only on vegetables without ever touching animal substances, yet it remains unvaried, according to Pallas, from Poland to the banks of the Lena. On the contrary, the Siberian Marmot, which is as carnivorous as the Surmulet (*Mus decumanus*), has undergone many important variations of size, colour, and proportion in the same latitudes, and under similar circumstances.

Although the influence of Domestication has a much more powerful tendency to occasion variation, than all those reverses and changes which the wild species can experience, yet Man has not succeeded in altering the Nature of any one of these animals, so as to form a new, distinct, and permanent species. The Horse and the Ass, in their transitions from the wild to the domesticated state, have undergone less variation than some other wild species, which climate alone has been sufficient to modify. The Bactrian Camel and the Dromedary retain their natural forms in the few countries where they are naturalized. Buffon considered the humps of the Camel to have been occasioned by the long habit of carrying burdens; but the wild Camels of Thibet and China have the same humps and callosities as their domesticated brethren. Pallas has correctly observed, that he might as well have regarded the follicle of the Musk, and the dorsal gland of the Peccari, as abscesses arising from disease. The Ass is more harshly treated than the Camel, the Alpaca are as much accustomed to carry burdens, yet they are without humps. The Horse and the Ass have not acquired callosities on those places where they have so long been exposed to the friction of the saddle and harness.

Climate and Food, however long we may suppose these causes to operate, are wholly unable to account for the existence of the numerous species of animals which cover the face of the globe. We see that the preservation of the Races among our domestic animals, and the improvement of the breeds, depend chiefly upon the peculiarities of the individuals selected to propagate. Graziers have long since laid down those rules by which the domestic animals, and especially the Horse, can be rendered larger, more beautiful, or more vigorous than they would have been if left uncultivated. But it is only by continued care that the purity of the breeds can be preserved, and they ever exhibit an inclination to resume the characters of the wild animals. We thus see that the tendency of the offspring to retain the characteristics of its parent is powerful enough to counteract all those causes which may modify the external forms of animals. Thus the introduction of Rams of a good breed corrects the fleeces of the worst flocks in a single generation, and even in the least favorable climates. The Angora Goat has imparted his silky fleece to the Swedish flocks, and they maintain this character for several generations. In Russia also, the Stallions with a frizzled and crisp hair, impart to their foals a similar coat and of the same colour. The wild, as well as domestic animals, also tend continually to maintain their primitive forms in opposition to all the influences of climate and food, which are wholly insufficient to induce this supposed degeneration and degradation of species. Whenever some accidental conatate deformity or partial excrescence becomes hereditary, as sometimes happens, the natural liberty of intercourse soon re-establishes the original form, and it is only by interfering with their unions that we can succeed in rendering permanent the accidental varieties of our domestic animals. In the wild state also, the females are led instinctively to prefer the most courageous of the males, the most perfect, and the most masculine of their species. The males, likewise, instinctively prefer the most beautiful of the females, and thus they both tend to transmit to their offspring the most perfect form of their species.

Since Nature then has placed an instinctive mutual aversion in animals of different species,—since she has rendered Hybrids either sterile or weak and imperfect,—if allied animals distributed in remote parts of the globe are found to be incapable of

yielding fertile races, we have presumptive evidence that this supposed degeneration of species cannot have existed, and we derive from the known insufficiency of the present causes of change a positive ground for inferring their descent from distinct original types. The mere circumstance of our being able to induce by art and contrivance a fertile union between two species, is not sufficient to counteract this evidence, when we see that these same species preserve themselves distinct in the wild state, and continually maintain certain well-defined peculiarities.

Pallas was led to infer that some of our domestic animals, such as the Sheep, the Goat, and the Dog, are factitious beings, not proceeding from any permanent origin, but from the union of several distinct species, such as the Dog from the Wolf, the Fox, and Jackal; the Sheep from the Mouflon and Siberian Argali; and the common Goat from the Persian and Caucasian Goats with the Ibex. We know that these animals have given rise to fertile hybrids; and hence it becomes impossible to say now far their varieties may be owing to foreign contamination, or to the occurrence of connate varieties in the original species. It is, however, useless to indulge in conjecture where data are defective; but from analogy we might infer that a very small part of their varieties have been owing to foreign admixture.

It now remains for us to notice the theory of the successive Transition of Species proposed by M. Lamarck. According to him, the habits and manners of life assigned to each animal do not follow from any original form peculiar to its species; but that, on the contrary, the form of each species is the result of its habits, its manner of life, and other influential causes, which, in the course of time, have constituted the shape of the body and the parts of the animal. With new forms, new faculties have been acquired; and thus gradually Nature has produced the animals as we now see them.

We must in justice remark, that this theory has been censured in this country with undue severity, from its appearing at first sight to dispense with the agency of a First Cause in the creation of the several species of animals. But in reality, a creative power is as indispensable in *maintaining* the successive transition of forms, as in originally *creating* them. Lamarck himself was well aware of this, for he observes, "When I see that Nature has placed the source of all the actions of animals, of all their faculties, from the most simple to those which constitute instinct, industry, and finally reasoning—in their *wants*, which alone establish and direct their *habits*; ought I not to acknowledge in this power of Nature, that is to say, in the existing order of things, the execution of the will of its Sublime Author, who has imparted them the power?"

As an illustration of this supposed transition of species, we shall show M. Lamarck's method of explaining upon his theory, how it comes to pass that some Mammalia can fly. A very ancient race of common Squirrels had long amused themselves with leaping from tree to tree, and thence had acquired a habit of extending their limbs like a parachute. From frequent repetitions of this act, the skin of their sides became gradually enlarged, in course of time, and a loose membrane extending from the fore to the hind feet, embraced a large volume of air, and broke the force of their fall. In a word, they acquired the characters of the Flying Squirrels (*Pteromys*). These animals, however, were still without membranes between their fingers.

But a race of Squirrels of much higher antiquity, after undergoing the preceding metamorphosis, had acquired a habit of taking still longer leaps than the former. Accordingly the skin of their sides became more ample, uniting not only the fore and hind legs, but even the tail with the hinder feet, as well as the fingers with each other. These now form our Flying Lemurs (*Galeopithecus*).

There was, however, a third race of Squirrels vastly more ancient than any of these, which had contracted a habit, in the course of time, of extending not only their limbs, but also their fingers. From this habit, long preserved and become inveterate, they not only acquired lateral members, but an extraordinary elongation of the fingers of the anterior limbs, with large intermediate membranes, so that at length they constituted those singular wings which we find in the Bats (*Vespertilio*).

"So great is the power of habit," observes M. Lamarck, "that it singularly affects even the conformation of the corporeal parts, that it imparts to those animals which have contracted certain habits through a long course of ages, certain faculties which other animals of different habits do not enjoy."

Upon this theory, it was requisite that the higher orders of animals should be regarded as of the greatest antiquity, a longer time being necessary for their transition from those simple forms, which were supposed to have been first created. "I have no doubt," proceeds Lamarck, "that all the Mammalia have originally sprung from the ocean, and that the latter is the true cradle of the whole Animal Kingdom. In fact, we still see that the least perfect animals are not only the most numerous, but that they either live solely in the water, or in those very moist places, where Nature has performed, and continues to perform, under favorable circumstances, her direct or spontaneous generations; and there, in the first place, she gives rise to the most simple animalcules, from which have proceeded all the animal creation."—(*Philosophie Zoologique*, tom. 2, p. 456).

We must remark, that there has never yet been, within the historical era, a well authenticated fact of any animal of one species having acquired organs, or faculties belonging to another; nor are any species known to have lost any of their senses or powers to make way for new ones. It must further be observed that, while we have never found any of these transitions in circumstances within the sphere of our investigations, Lamarck places them precisely in those, where they cannot be proved or disproved by direct observation. Where did these transitions begin? In the abysses of the Ocean, where Man has never penetrated, and where myriads of beings lie concealed from his observation, perhaps for ever. What animals owe their origin to spontaneous generation? Animalcules, a class of beings the most remote from our observation, and whose forms can only be traced through the deceptive medium of the microscope. When did these transitions occur? Before the historical era, in those remote and inaccessible ages, whose existence is alone attested by the organic remains imbedded within the surface of the earth.

But, observes Lamarck, "there is a very good reason why we do not see those changes successively performed, which have diversified the known animals, and brought

them to their present state. We see them only when they are finished, and not when undergoing the change; and we very naturally infer that they always have remained as we see them." This is a prejudice. "If the average duration in the life of each generation of Men were only a second, and if there be a pendulum mounted and in motion, each generation would consider this pendulum really to be at rest, never having seen it change in the course of their lives. The observations of thirty generations would not demonstrate any thing positive concerning the vibrations of this instrument."

We may remark, that our sole means of judging of unknown objects is by comparing them with others which are known, and that it is unphilosophical to found a theory of what occurs, or has occurred, in remote and inaccessible parts of the creation, in direct opposition to what is seen to happen within our own sphere of observation. The earth appears to be at rest, if it be compared with objects on its surface; and we reason correctly, for, *in respect to them*, it is at rest. But on referring it to the Solar System, we at once perceive it to be in motion. Again, if we compare the entire Solar System with the more remote heavenly bodies, analogy would lead us to expect that our system may be in motion towards the Fixed Stars, and that these Stars themselves may only be fixed, relative to our own limited means of observation. To suppose the Fixed Stars to be really motionless, would be as great a violation of analogical reasoning, as those theories inflict which deny the permanent characters of species. All the sciences adopt this mode of reasoning when the contemplated object is inaccessible to direct experiment or observation. On looking abroad into Nature, the Chemist finds every thing in a state of composition. He nowhere discovers pure oxygen, chlorine, calcium, or potassium, because nearly all the unions which simple substances were capable of forming spontaneously have already occurred. The Naturalist is disposed to imagine that something similar to this may have taken place among the species of animals and plants; but the Chemist analyzes the compounds of these substances himself, and he sees their combinations going on before his eyes. The Naturalist cannot bring forward one single instance of the degeneration or transition of species from one form to another.

The weak point of the Lamarckian doctrine, in the absence of positive proof, is a violation of one of the first rules of analogy. Mr Lyell correctly remarks, in his recent criticism on this subject, that "no positive fact is cited to exemplify the substitution of some *entirely new* sense, faculty, or organ, in the room of some other rendered useless. All the instances adduced go only to prove, that the dimensions and strength of members, and the perfection of certain attributes, may, in a long course of generations, be lessened and enfeebled by disuse; or, on the contrary, be matured and augmented by active exertion, just as we know that the power of scent is feeble in the Greyhound, while its swiftness of pace and its acuteness of sight are remarkable;—that the Harrier and Staghound, on the contrary, are comparatively slow in their movements, but excel in the sense of smelling. It is evident, that if some well authenticated facts could have been adduced to establish one complete step in the progress of transformation, such as the appearance in individuals descended from a common stock, of a sense or organ entirely new, and a complete disappearance of some other enjoyed by their progenitors, that time alone might then be supposed sufficient to bring about any amount of metamorphosis. The gratuitous assumption, therefore, of a point so vital to the theory of transmutation, was unpardonable on the part of its advocate."

We have now seen that some Mammalia are capable of undergoing a very considerable variation, not only in their Instincts and Intelligence, but also in their external forms;—that the variations which each individual can be made to undergo by the circumstances in which it is placed are but very rarely transmitted to posterity, while connate modifications usually end in becoming hereditary;—and that there are certain limits beyond which no species has been observed to vary, so that we are fully entitled to conclude, that a certain form was assigned to each species at the origin of things.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Forms to which the Domestic Animals have reverted on becoming wild—Their modifications during the Historical era.

If it be true that the numerous varieties of the Cow, the Horse, the Dog, and other Domestic Mammalia, are the effects of the slow and continued influence of certain causes, which, in the first instance, induce a departure from the primitive type in the evolution of connate varieties, and afterwards transmit these variations to posterity, giving rise to their several distinct races;—it ought to follow, that in all these artificial beings, whose characters Man has for a time rendered permanent, there should be a continual tendency, when left to their own resources, to assume the form of the original type. On allowing the domestic animals to run wild,—on permitting them to substitute the wandering habits and precarious subsistence of mountains and forests for the uniform and regular diet of the stable, we ought to find that their acquired characters disappear, that all the individuals bear that marked resemblance to each other, which will serve to indicate both the identity of their species, and the original form from which the races have diverged.

The experiments confirming the truth of this conclusion have long been performed on the largest scale in the immense continent of America. It is well known that the Europeans, on the first discovery of the New World, sought in vain for any vestige of that animal creation to which they had so long been familiarized. Those useful animals, without whose aid, in the first instance, the civilization of Man might have been indefinitely retarded, had to be transported to America to supply the immediate necessities of the earlier colonists. Soon, however, the accidental flight of some animals to the woods, hastened probably by the abundant supply of food, and a favorable climate, which, in increasing their fecundity, rendered a vigilant care of them superfluous, a large proportion became absolutely wild, and the establishment of wild individuals in the immediate neighbourhood of the tame herds, soon exerted a direct modifying influence over the latter. Hence, in America, we may see performed, on a magnificent scale, the converse of that gradual modification which the domestic

animals underwent in their original transition from the wild state; and may further compare those half domesticated herds, acknowledging only a partial submission to Man, with the humble individuals of their own species, which still yield him a patient and implicit obedience.

It is evident that careful observations should be multiplied over the whole continent of America, in order to render this investigation complete; but we owe to M. Roulin the merit of having traced some changes in a portion of this vast country. That learned physician, during his residence in Colombia for six years, has collected a number of interesting facts which were communicated to the Royal Academy of Science at Paris in the year 1828. These observations were made in New Grenada and a part of Venezuela, from the 3d to the 10th degree of North Latitude, and from the 70th to the 80th degree of West Longitude. However limited this tract of country may appear, it offered unusual facilities for observation, being traversed throughout its entire course by the great Cordilleras of the Andes, which are here divided into three principal chains; so that, within the distance of a few leagues, the same living animals were investigated, though resident in one district, where the medium temperature is only 50° Fahrenheit, and in another where it varies from 77° to 86°.

The Mammalia transported from Europe to America were the Hog, the Horse, the Ass, the Sheep, the Goat, the Cow, the Dog, and the Cat. It becomes important to ascertain whether these animals retain the forms acquired in Europe, or whether they have undergone any considerable change. By carefully comparing these phenomena with the circumstances under which they have arisen, much light may be thrown upon those modifications which probably attended the transition of these animals from the wild to the domestic state.

The first Hogs brought to America were introduced by Columbus, and became established at Saint Domingo in November 1493, being the year which followed its discovery. During the following years they were successively carried into all those places where the Spaniards attempted to fix themselves, and, in the period of about half a century, they might be found wild from the 25th degree of North, to the 40th of South Latitude. In no place do their important changes appear to have been effected by climate, and they have reproduced every where with the same facility as in Europe.

Most of the pork consumed in New Grenada comes from the warmest valleys, where the Hogs are bred in large numbers, from their maintenance costing but little. During some seasons they are even supported wholly by wild fruits, and especially by those of the several species of Palms. From roaming constantly in the woods, the Hog has lost in this district all traces of his former domestication. His ears are straight and erect, his head has widened and become elevated in the upper region. The colour has again become constant, being entirely black. The young Pigs have several fawn-coloured stripes, like the European Wild Boar in its youth, and upon a ground of the same colour. Such are the Hogs brought to Bogota from the valleys of Tucayma, Cunday, and Melgar. Their hair is scanty, and on this account they bear a striking resemblance to the Wild Boar of Europe, from a year to eighteen months old. This deficiency of hair is not, however, peculiar to the Hogs of Grenada, but is also experienced by the common Wild Boar of Europe. M. Roulin observed an instance of it in France, at a farm near Fougères, where seven or eight of these animals were brought up together. One of them, being about two years old, had been fed in a stable from the beginning of spring, with the intention of fattening it for the market. Though the animal had not been closely confined in this place, the good feeding of the stable was sufficient to induce it to remain at home. Its hair had almost wholly fallen off from the effects of the heat, and it exhibited a most perfect resemblance to the Hogs of Melgar above described, except that the two horizontal stripes on the sides of the muzzle were more decidedly marked, and gave it a stronger expression of ferocity. The Hogs of the Paramos, which are mountains at least 8,200 feet above the level of the sea, approach much more nearly in appearance to the Wild Boar of the European forests, from the thickness of their hair, which has even become frizzled. Beneath, in some individuals, it has been observed to assume a woolly appearance. The Hog of these elevated regions is, however, small and stunted, from the want of sufficient food, and the continued action of an excessive cold. In some sultry districts, the Hog is not black like those above described, but red, like the Peccari, during its youth. At Melgar, and in the other places above mentioned, instances have been known where the Hogs are not entirely black; but these are comparatively rare. There is a variety called *Cinchados*, or *girthed*, because they have a large white band underneath, which usually unites on the back, and always preserves a uniform breadth; and the young individuals of this variety bear the same stripes as those of the pure black breed. The only Hogs in Colombia which resemble the common Pigs of Europe, have been imported within the last twenty-five years, and these do not come direct from Europe, but from the United States of America; and it must be recollected that in the neighbourhood of New York, where this race has long been domesticated, it experienced the influence of a climate very nearly the same as our own.

The Horse has become wild in several districts of Colombia, especially in the plains of San Martin, among the sources of the Meta, the Rio Negro, and the Unadea, where small troops of Chestnut Horses may be observed. Their limited numbers, the narrow range to which they are confined, and the immediate neighbourhood of the inhabited districts, have prevented them from acquiring those peculiarities which Azara has related of the Wild Horses of Paraguay. They go about in small squadrons, composed of an old Horse, five or six Mares, with some Foals, and one squadron is completely isolated from another. Instead of approaching the caravans to entice the domestic Horses, they run away on the first appearance of a Man, and do not stop their flight until he is out of sight. Their movements are graceful, especially those of the leader, but their forms, though not heavy, are wanting in elegance.

In the Hatos des Llanos, the Horses are almost wholly left to themselves. The herds are assembled together at intervals to prevent them from becoming absolutely wild, to extract the larva of the Gad-fly, and to mark the Foals with a red-hot iron. From this independent kind of life, they begin to acquire the uniform colour of the savage races. The Chestnut bay is not merely the prevalent colour, but it is very nearly the only one. Something similar to this has probably happened in Spain

with the Wild Horses (*caballos cerreros*) which wander in the mountains; for in the Spanish proverbs, the Horse is often noticed by the name of *el bayo* (the Bay), as well as the Ass by the term *ruico* (Gray).

In the small Hatos which are found on the plateau of the Cordilleras, the effects of domestication are more perceptible. The colours of the Horses become more various; there is also a greater difference in their height; and while many are more diminutive than the average of the species, only a few surpass the medium size. As long as they live continually in the fields, their hair is tolerably thick and long, but a few months' residence in the stable is sufficient to render it short and glossy. It is customary to cross this breed of Horses with the races from the warm valleys, especially with those of Cauca. On some properties where this precaution has not been attended to, the Horses have become perceptibly smaller, though the pastures have long been celebrated for their richness. The hair has grown to such a degree as to render their appearance absolutely deformed. In respect to the useful qualities, this breed has lost but little; and the Horses belonging to one canton are even celebrated for their swiftness.

When a Horse is brought from the Llanos de San Martin, or from Casanare, to the plateau of Bogota, he must be kept in the stable until he is accustomed to the climate. If allowed to run loose at once into the fields, he grows thin, contracts a cutaneous disease, and often dies in a few months. The pace which is commonly preferred in the saddle-horses is the amble; this they are made to acquire early, and the greatest care is taken not to allow them, when mounted, to take any other pace. In a short time, the limbs of these Horses usually become stiff; and then, if otherwise of a good form, they are allowed to run in the Hatos as Stallions. From them a race has descended, in which the amble is with the adults the natural pace. These Horses are called *aguillitas*; and they form a remarkable instance of the transmission of acquired habits from the parent to his offspring.

The Ass has undergone very few alterations in its form or habits in all the provinces visited by M. Roulin. At Bogota it is very common, being there used for transporting building materials; but being badly taken care of, and exposed to the inclemencies of the weather, without receiving sufficient nourishment, the race has become small and pitiful. It is covered with very long and uncombed hair. Deformed individuals are often seen, not only among the adults, which are loaded prematurely, and before they have acquired sufficient strength, but also among the Foals at their birth. Perhaps the latter circumstance may arise from the ill treatment of the dams during the period of gestation.

In the low and warm provinces this animal is less neglected, as it is required for the production of Mules. Being well fed, at least in these districts, it becomes larger and stronger; its hair also is shorter and more polished. In no province, however, has the Ass reverted to its wild state.

The Sheep was originally transported to the New World from Spain; and the earliest importation appears not to have been the Merino variety, but another, which the Spaniards call *de lana burda y basta* (with wool coarse and rude). It is very common on the Cordilleras, at an elevation of 3,300 to 8,200 feet.

In no place do the Sheep appear to have escaped from the protection of Man, and hence we find that their manners have undergone scarcely any change; nor can any alteration in their forms be observed, except a slight diminution of stature. Within the limits above defined, the Sheep propagate readily, and almost without requiring any care; but the reverse happens in the hotter districts. It appears that in the plains of Meta it is very difficult to rear Lambs; and no Sheep are to be seen from the river to the foot of the Cordilleras, although their skin is very much in demand to make a kind of parchment, and that its price is as high as the hide of an Ox. In the valley which separates the most eastern chain from the central, they may perhaps be sometimes seen, but always in small numbers. The females are not very fruitful, and the Lambs are difficult to rear.

There is one very curious phenomenon exhibited by the Sheep of this district. The fleece grows upon the Lambs in the same manner as in most temperate climates, provided they are sheared as soon as it has arrived at a certain degree of thickness, in which case the wool grows again, and continues to observe the same order. But if the favorable period for stripping the animal of its fleece be allowed to pass, the wool thickens and becomes matted together, it detaches itself in flakes, and finally leaves behind—not, as we might expect, a growing fleece, or a naked and diseased skin—but, a short, glossy, and compact hair, exactly resembling that of the common Goat in the same climate.

Although the Goat is evidently best fitted for a mountainous region, it seems to thrive better in the low and sultry valleys than in the more elevated regions of the Cordilleras. In the former districts it multiplies rapidly, generally bearing two young at a birth, often three, but never six, as some have been pleased to assert. Its height is diminutive, but in other respects its form has greatly improved. Its body is more slender, the shape of its head is more elegant, more pleasingly disposed, and usually less overloaded with horns. The agility of this animal, and its taste for climbing and leaping, are also singularly increased. In the public square of a village, M. Roulin has often seen them leaping more than four feet upwards to the mouldings on the pilasters of the church. The projecting place on which their feet rested was not three square inches; yet in this position, so difficult to preserve, they remained for hours together, without any other apparent object than that of warming themselves in the direct solar rays, as well as in those reflected from below. These Goats are covered with short hair, very glossy and thick; and although they may be seen to possess all the shades of colour, yet the most common is fawn, with a brown stripe on the back, and black symmetrical marks upon the face. The She-Goats of Europe strikingly exhibit the influence of domestication in causing a great enlargement of the udders; for this acquired character has entirely disappeared in the She-Goats of America.

The establishment of the larger Cattle in America must be dated, like that of the Hogs, from the second voyage of Columbus to St Domingo. In the latter place they multiplied rapidly, and the island soon became the nursery from which these animals were transferred to different points on the coast of the Mainland, and thence to the interior of the continent. Although these numerous exportations must have

diminished their numbers considerably, yet we are informed by Oviedo, that within twenty-seven years from the discovery of St Domingo, herds of 4000 head of Cattle might frequently be encountered, and that there were even some containing at least 8000. In the year 1587, the number of hides exported from this island alone amounted to 35,444, while 64,340 appear to have issued from the ports of New Spain. This was the sixty-fifth year after the capture of Mexico, before which event the Spaniards were entirely occupied in warfare, and it strikingly evinces the extreme rapidity with which these animals will increase their numbers when placed under favorable circumstances.

While the Cattle were in small numbers, and grouped around the habitations of their masters, they succeeded equally well almost every where; but as soon as their numbers became greatly increased, it was discovered that in certain districts they could not exist without the assistance of Man. Unless they were able to find a certain quantity of Salt, either in the substance of the plants which formed their food, or in the streams which in some districts acquire a brackish taste from the saline particles contained in the soil, it was found to be absolutely necessary to furnish it to them directly. If this precaution were not attended to, they became stunted and poor; many of the females ceased to be fruitful, and the herds rapidly disappeared. Even in those districts where the Cattle can exist without this assistance, it has been found advantageous to distribute salt at stated intervals to the herd. This is one principal means of attaching them to a particular spot; and so great is the avidity with which they take this substance, after being for some time deprived of it, that when it has been distributed to them two or three times at the same place, they are seen running from all quarters to the spot as soon as they hear the horns which the herdsmen sound before making the distribution.

If, however, the country yields a sufficient supply of salt, and if the herdsmen neglect to assemble the Cattle from time to time, they become in a very few years wholly wild. This has happened at two places to M. Roulin's knowledge, the one in the province of San Martin, in a property belonging to the Jesuits, at the time when this religious order was expelled, the other in the province of Mariquita at Paramo de Santa Isabel, in consequence of the abandonment of some works where the natives washed for Gold. In the latter place, the Cattle have not remained in the districts where they were originally placed, but have mounted the heights of the Cordilleras to seek the region of the Grasses, and there live in a temperature almost uniform of 48° to 50° Fahrenheit. To this spot the peasants of the villages Mendez, Piedras, and some others situate in the plains, sometimes come to hunt them. They drive with knotted cords small divisions of the herd towards the places where snares have been previously prepared. Whenever they obtain possession of one of these animals, it is often impossible to conduct it alive from among the mountains. This does not arise from the resistance which the captive makes, for after a little time its violence begins to diminish; but when the animal begins to perceive the futility of its efforts to escape, it is often seized with so great a tremor over the whole body, that it falls to the ground; to make it rise becomes impossible, and it dies in a few hours. The want of salt to preserve the meat, the distance from any inhabited district, and the difficult nature of the roads, prevent the hunters from deriving any other advantage from the slain animal than the portion which they can consume upon the spot. These disadvantages render the hunting of wild Cattle by no means frequent; and the hunters always run the risk of being surprised by the snow, which often falls in these elevated regions. When the snow lasts many days, these unfortunate men, accustomed to the continual warmth of the adjoining valleys, are sure to perish. If, however, they are so fortunate as to bring one of these animals from the mountains, it is not difficult to tame; this is effected by confining it near to the farm, by supplying it regularly with salt, and habituating it to the sight of Men. M. Roulin never had an opportunity of seeing one of these animals alive, but he tasted the flesh of a wild Calf which had been killed on the evening of his arrival. Its flavour did not in any respect differ from that of the common domestic Calf; the hide was remarkably thick, in other respects of the usual size; the hair was long, thick, and rough. In the province of San Martin he, however, saw a wild Bull of a chestnut colour, pasturing in the Llanos in the midst of the domestic cattle. The Wild Bulls pass the morning in the woods which cover the base of the Cordilleras, and do not appear in the Savannah until about two hours after noon, when they come out to feed. As soon as they perceive a Man, they hasten to regain the forest at a full gallop.

The hide of the Wild Bull does not appear to differ in any respect from that of the domestic Cattle which inhabit the same districts. In both they are much heavier than the hides of the Cattle brought up on the plateau of Bogota, and the latter yield in this respect, as well as in respect to the thickness of their hair, to the wild Cattle of Paramo de Santa Isabel.

In the warmest parts of the provinces of Mariquita and Neyha, there are some herds of horned Cattle with their hair extremely scanty and fine; they are given, by antiphrasis, the epithet of *Pelones*. This variety is transmitted to their descendants, but no care is taken to preserve the breed, as the *Pelones* are unable to bear the cold of the elevated regions of the Cordilleras, where the cattle intended for consumption or exportation must remain for some time to fatten. There is also another variety of Cattle in this district called *Calungos*, having the skin entirely naked like the Barbary Dog. As these animals are more feeble and delicate, it is usual to kill them before they are old enough for breeding. These never appear in the cold districts.

In Europe, where the milk of the Cow forms a very important article of rural economy, it is usual to milk her continually from the moment of the birth of her first Calf until she ceases to be fertile. This practice, continually repeated upon all these animals for a long series of generations, has had the effect of producing permanent alterations in the species. The udders have acquired an extraordinary size, and the milk continues to be secreted even after the Calf has been removed. In Columbia, however, the introduction of a new rural system, the abundance of cattle in proportion to the number of inhabitants, their dispersion in pastures of very great extent, and a number of other circumstances which need not here be detailed, have counteracted this effect of domestication. The organization and function of the udder soon resume their original state when freed from the long-continued influence of habit. At present if a Cow of Columbia be intended to yield milk for the dairy, the first

care must be to preserve the Calf; it is allowed to remain along with its mother for the entire day, during which she is permitted to suckle it. They can be separated only at night, and the milk secreted during the interval of their separation alone becomes available for economical purposes, and accordingly it is abstracted every morning. If the Calf happen to die, the secretion of the milk is immediately stopped.

In America, the Cat has scarcely undergone any alteration, except in its having no period of the year corresponding to the rutting season. This peculiarity, which might naturally be expected in a climate always equal, exists also with the Hog, the Bull, the Horse, the Ass, and the Dog. Although Kids and Lambs are born all the year round, yet there are two periods of the year, Christmas and Whitsunday, when the number of births is greatly increased.

These particulars, furnished by M. Roulin, though necessarily defective on many interesting points, enable us to draw several important conclusions, which serve to throw a light upon the past history of our domestic animals, and directly also upon the philosophy of species in Zoology. However, the extreme difficulty of distinguishing those phenomena which are due solely to domestication from those belonging to food, climate, and situation, lead us naturally to inquire whether the records of ancient History can yield us any information regarding the progress of variation among our domestic animals. If we can discover in these writings any traces of their gradual deviation from the form of the wild races, we have an additional evidence in support of those views which have here been laid down.

Unfortunately the notices of the domestic animals in the writings of the ancients are neither numerous nor full; yet however scanty, they possess a peculiar interest and importance. It is true that we find those civil and military events which attend the rise and fall of great Empires, or the establishment of different religions, and other historical events concerning the Human Race, recorded with a scrupulous attention; but the ancients may be said to have wholly neglected the minor histories of the farm-yard and stable. The gradual modifications of their domestic animals presented none of those brilliant events and striking positions which compose the ordinary pages of history, but moving onwards with a silent and almost insensible step, they escaped the notice of their contemporaries. Man, on becoming civilized, soon forgot, with characteristic ingratitude, those early companions of his labours, without whose aid his own progress might have been indefinitely retarded. It is only now by examining the aggregate of their changes through a long course of years, that we are led to perceive the extent of their modifications, and can fully appreciate the importance of their contributions towards the wealth and happiness of society.

Modern Naturalists have commonly supposed that the native country of our domestic Mammalia cannot be ascertained; yet it would appear that these animals were all living in a wild state in Europe at the time of Aristotle. This great Naturalist himself attests the fact, and mentions the Horse, Bull, Hog, Sheep, Goat, and Dog, as familiar instances. We are also informed by Pliny, after having alluded to the intercourse between domestic Pigs and the wild Boar, that there were no domesticated animals in his time, which could not also be found in a wild state. (*In omnibus animalibus placidum ejusdem invenitur et ferum*).

The concordance of these two passages is striking, and they prove that in the 450 years which elapsed from the time of Aristotle to that of Pliny, the domestic animals had not been widely distributed over the globe, nor had they undergone much variation. Indeed, as long as wild animals reside in the immediate vicinity of the tame herds, it is certain that the domestication of the latter will be exceedingly imperfect. The continual intercourse of the wild with the tame animals, and the contagious example of herds running wild in neighbouring mountains and deserts, must have diverted the captive animals from those domestic habits to which the restraints of Man would otherwise have reduced them. In this respect, the partially domesticated races would have resembled those Indians of the United States of America, which are taken from their tribes during their infancy, and educated in the midst of towns, both in the religion and manners of the Europeans. At the age of twenty or thirty years, if they happen to encounter in the woods a tribe of Hunters of their own nation, so hereditary are their propensities, that they at once reject their former peaceable life, with all its advantages, moral and intellectual, and plunge without reflection into the savage and adventurous life of their ancestors.

Varro appears to confirm the opinion of the Greek and Oriental Philosophers, that the Sheep, in consequence of its superior docility and mildness, was the first animal which became domesticated. "The Sheep," says he, "is not only of a very peaceful nature, but it is the animal most fitted to supply the wants of Man, since it yields not only milk and cheese for food, but also its wool and skin for clothing." "In several countries," continues Varro, "there still exist in the wild state some of the animals which we have rendered domestic. In Phrygia and Lycaonia, many flocks of Wild Sheep are to be found. The Wild Goat exists in Samothraee, and there are several in Italy, in the mountains adjoining Fiseellum (now Monte della Sibilla, near Abbruzzo), and Tetrica (near the most elevated point of the Appennines in the Upper March of Ancona). In respect to the Hog, every one knows that he is descended from the Boar, which is found wild in all countries. There are still a great number of Wild Bulls in Dardania, Mysia, and Thrace; there are Wild Asses in Phrygia and in Lycaonia, and Wild Horses in some parts of Iberian Spain." (*Re Rustic*, II, 1, 4-6).

This passage of Varro fully corroborates the testimonies of Aristotle and Pliny, and his evidence is important, as we know that Varro himself travelled through all the countries where he places these wild animals. Modern researches have verified a part of Varro's declaration, and recognize the original localities of the Ass. These are the mountains of Taurus and lower Kurdistan, separating Persia from Afghanistan. Here it still exists in the wild state, and the pursuit of this Solipode has long been one of the chief amusements of the Persian Kings.

Buffon and other modern Naturalists differ in opinion from Varro and the Oriental Philosophers, regarding the priority of domestication with the Sheep. The Dog, according to Buffon, was the first animal which Man acquired for his use; and it was by the assistance of this animal that he was able to seize and subdue all the other species necessary to supply the wants of an infant society. This opinion rests chiefly upon the extreme facility with which wild animals of the Dog Genus are tamed, arising

from their great sociability and their power of imitation. Azara mentions an Aguachay of Paraguay (*Canis cinereo-argenteus*) which became as tame as a Dog, but ate up all the fowls. Yet the opinion of ancient writers regarding the prior domestication of the Sheep seems to be by far the more probable. The Sheep lives habitually in large flocks; the mildness of this animal, its simplicity, and disposition to follow its companions even to certain destruction, must have rendered it an easy prey to the savage in those first ages which followed the creation of Man. Its utility for food and clothing must have been evident. On the contrary, the Wild Dog lives in troops; he is a Carnassier, fierce, and daring; he unites with his fellows to form a combined plan of attack and defence. He is as strong and more to be dreaded than the Wolf. No use could be made of his skin, of his flesh, or the milk of the female. Hence it is not very probable that the savage would have at once foreseen all the future advantages which he would derive from associating the Dog in his labours to reduce and subdue the other animals. Even if he could have entertained this project, the difficulties and dangers with which it was beset would have diverted him from the enterprise. In this case, we must admit, that the more simple and natural idea would first present itself to his mind.

It may easily be imagined, that in those early ages, when the globe was less peopled than it is at present, the great work of Domestication must have been slowly and gradually accomplished. The remarkable property which these animals possess of transmitting their acquired qualities to their descendants, and of perpetuating modifications of form, colour, and even of intelligence, render their races singularly capable of improvement. The several races of Men are far less capable of undergoing this relative improvement than the domestic animals, which receive his influence in innumerable ways. Yet we are not without some striking instances of the transmission of acquired properties even in Man. Among the Negro children of Sierra Leona, the offspring of the Negroes, who have long been liberated, and who are born in the colony, possess an immense relative superiority of intelligence over the children of Negroes which have recently been emancipated from their slavery. Their parents inhabit the same country; but the older liberated Negroes have commenced a moral and intellectual education, while the more recent Slaves have long endured a savage and degraded existence. It has, however, never been attempted to bring the Human race, like the Domestic animals, to a greater physiological perfection, by always uniting individuals, remarkable for the beauty of their forms, the goodness of their temperament, and the extent of their intellectual faculties. Absolute monarchs might, in the course of a long dynasty, have made this curious experiment, and endeavoured to promote the good of their subjects, by improving the breed of their own ministers. Hence Man, considered as a race, that is, in reference to his physiological qualities, is much less capable of improvement than the domestic animals.

In consequence of this remarkable property of transmitting acquired faculties to posterity, the notices of the ancients, which date back perhaps from twenty to twenty-five centuries, however meagre, become peculiarly important and interesting.

Wants, dangers, and necessities, develop the more violent and fiercer passions of animals; the suppression of these exciting causes improves the milder and more useful qualities. From the descriptions of Aristotle, the passions of the domestic animals were formerly much more violent than they are at the present day.

The progress of domestication, as recorded by the ancients, in respect to the Horse, the Ass, the Dog, and the Cow, presents many interesting facts. With the Dziggtai (*Equus hemionus*), domestication seems to have made a retrograde movement.

Herodotus (iv. 52) informs us that Horses existed in the wild state on the banks of the Hypanis (now the Dniester). These Horses, he adds, were white. Further, also, that in Thrace, the Pæonians fed their Horses and beasts of burthen with fish instead of hay. Strabo says that the Wild Horses were to be found in India, on the Alps, in Iberia, among the Celtiberians, and finally in Caucasus, where the intensity of the cold had given them thick coats of hair. The last remark is confirmed by modern observations on the Norwegian and Lapland Horses, which have a thick and woolly hair like the fleece of our Sheep. Pliny says that the North contains herds of Wild Horses. Strabo relates, on the authority of Megasthenes, that the greater number of our domestic animals were wild in India. Ælian makes the same remark for the interior of India.

Since Wild Horses thus existed in great numbers on several parts of the Old Continent, the progress of domestication must have been very slow in all those places where they came in contact with the tame herds. Azara observed, that the Wild Horses which live at liberty in the plains of Paraguay, in herds consisting of many thousand individuals, have an instinctive habit of seducing the domestic Horses. As soon as they perceive one, says this able Naturalist, even at the distance of two leagues, they form into an uninterrupted column, and approach at full gallop to entice him. They either surround him on every quarter, or merely come along side; they caress him by neighing gently, and always end in carrying him off never to return, without his offering them the slightest resistance. The inhabitants of that country hunt the Wild Horses very keenly, to drive them away from their own studs, for, without this precaution, the Wild Horses would seduce away all the tame herds. Gerhillion notices the Wild Horses in the desert of Chamo in nearly the same terms.

This fact may serve to explain one of the causes that in ancient times the herds of Wild Horses disappeared very rapidly when the population increased. According to the accounts of those Missionaries who were best acquainted with China, Wild Horses are still to be found in Western Tartary and in the territory of Kalkas. They live in large troops in the neighbourhood of Hami, and appear to resemble the common Horses. Grosier, in his Description of China, mentions that if they meet a domestic Horse, they surround him on all sides, and, urging him onwards, draw him to their forests of Saghatour.

A passage of Xenophon (*περί ἵππων*, III.) alludes to this characteristic of the Wild Horses, so forcibly described by Azara and the Chinese Missionaries. His remark serves to show that, at the period of 450 years before the Christian era, the domestication of the Horse was still recent, and had not yet overcome this primitive instinct. In speaking of a Horse broken in by the groom, Xenophon observes, "It is proper to ascertain whether, when mounted, he will willingly separate from other Horses, or whether, when passing them at a short distance, he does not attempt to

join them." Another observation of Xenophon, "One can teach nothing to a Horse by word of mouth" (*Ibid.* VIII.), shows how imperfect their domestication must have been in his time. We have so many proofs and examples to the contrary, as to render an allusion to them only necessary at present.

The modero Wild Horse, as described by Pallas, has his tail and mane very long and thick. He carries his ears depressed backwards, like a domestic Horse of the present day when preparing to bite. Xenophon and Varro describe a Stallion, the model of a War-horse, in words nearly synonymous to those used by Pallas in describing the Wild Horse of the Russian Steppes (*juba, cauda, crebra, subcrispa, auribus applicatis*). We have here an evident proof that the Domestic Horse, in the last century of the Roman Republic, still retained the characters now peculiar to the Wild Horses of the old continent.

It must be observed that Herodotus describes the Wild Horses to be white (*λευκοι*), while the dark bay has become the prevalent colour of the Wild Horses in America. Naturalists have generally concluded that the latter was the primitive colour of the species. This difference between the primitive hues of the Old and New World is supposed by some to be owing to the excessive cold of the climate in some parts of the former, where it has been supposed that the temperature might act upon the Solipeda and Ruminantia in the same manner as it is known to do upon Hares, Rabbits, and other Rodentia. But Leo Africanus and Marmol relate that the Wild Horses of Africa are small, and either white or ash-coloured. Pallas also informs us that the Wild Horses which inhabit the country between the Jaik and the Volga are fawn, red, or dun-coloured. Aristotle attributes the changes in the colour of the hair of Mammalia, as well as in the feathers of Birds, jointly to the cold and the influence of the water. The streams of Psychus, near to Chalcis in Thrace, according to him, caused the White Ewes to produce Black Rams. In the neighbourhood of Antandros, he states that there are two rivers, one of which causes the lambs to be white and the other black. We must remember that Aristotle belonged to Stagyræ, and that he here mentions a fact which, it is probable, had fallen under his own observation. The same remark is made by Varro, Pliny, Ælian, and by Anatolius (*Hippiatric*, p. 59). It would be interesting to verify their declaration by observations made on the spot, as it seems to be rather of doubtful authority.

The progress of education with the Horse, and the influence of domestication during 1800 years, are seen in the development of his paces both in number and permanence. The natural paces of the Horse are the walk, the trot, and the gallop; those which he has acquired from education, for the purpose of combining swiftness of pace with comfort to the rider, are the amble, the *pas relevé*, and the *aubin* of French authors.

The *pas relevé* consists in raising two feet on the same side, not at once as in the amble, but successively. It is a close trot which beats the ground, as in the walk, at four successive times. In the *aubin*, the Horse gallops with the fore feet and trots with the hinder. The Greeks and Romans had induced neither the *pas relevé* nor the *aubin*. That pace which they call *tolutarii*, and which the Lexicons give as synonymous with *εὐδρομος*, is evidently the amble, and seems to have been induced during the last century of the Roman Republic. It is described by Varro, Pliny, Nonius, and Vegetius, in a manner which leaves no doubt that the amble (*tolutarem ambulatorem*) was produced by training (*traditur arte*). The race at that period had not been so long domesticated, that this property should have been transformed from an artificial acquirement into a permanent quality. It must then have been in the interval of time which has elapsed since the days of Pliny and Varro, that the amble, the *pas relevé* or trot with four beats, and the *aubin*, where the Horse gallops with the fore limbs and trots with the hinder, all of which are wholly artificial, had become natural paces, and were transmitted as such to posterity. At the present day, these acquired paces are as permanent as the properties of pointing and bringing back game with the Setter Dogs and Retrievers. M. de la Mallo has remarked more than a hundred times in the pastures of Normandy, that the Foals descended from a sire and dam endowed with the *pas relevé*, or even where the sire alone possessed this quality, have exhibited this artificial movement in the meadow before receiving the slightest education, or even leaving the side of their dam.

As we might readily expect, the ancients were acquainted with very few varieties of the Horse. Only two distinct races, the Thessalian and African, can be traced on those ancient monuments which have reached our times. There are, however, two intermediate varieties, the Sicilian and Apulian races, formed probably from crosses between the Thessalian and the Wild Horse of Italy, and between the Italian and the African races. The descriptions of authors agree precisely with the representations on the statues, the basso-relievos, and the medals, at least in respect to the two primitive races. We have the Thessalian Horse faithfully represented on the Parthenon, in the equestrian statues and basso-relievos of the Greeks, and even on the columns of Trajan and other Roman sculptures, where this variety is always adopted as the type of the heroic Horse. The African race is seen on the medals of Carthago and on a medal of Mauritania, supposed to be a Juba (*Catalogue de M. Monnet*, t. vi. Nos. 5 and 6). In the time of Oppian, who was contemporary with Septimius Severus, the races of the Horse had greatly increased in number, and he accordingly enumerates fourteen varieties. The Persian Horse of the age of the Achemenides is figured on the monuments of Persepolis. At the present day, in consequence of the continual crossing of these races during twenty centuries of domestication, and the joint influence of climate and food, this species, so useful to Man, has been transformed into varieties almost innumerable.

The Horse is now reared under domestication with greater facility than formerly. The foal, according to Varro, was suckled by its mother until the age of two years;—we separate them at six months. At three years old the young Horse was exercised, and when he perspired, was rubbed over with oil. If the weather were cold, fires were lighted in the stables. The modern Horses do not require these minute attentions even in our less congenial climate.

The Ass, being less useful than the Horse, has been more neglected by Man, and consequently his physical and intelligent powers are not so highly developed. Yet there are some interesting conclusions which may be drawn from an attentive comparison of his ancient and modern history, and may serve to clear up some obscure

points as to the causes which have served to retard the progress of his domestication. The imbecility of the Ass, and his imperfect education, may partly be owing to the circumstance that the domestic species were continually united with the wild animals during many centuries. This practice was one chief cause of the slow progress of domestication among the ancients. Indeed, their rural system of large commons allowed a liberty almost absolute to their herds. These animals passed the spring in the valleys, the summer on the mountains, and the winter on the plains. It was, therefore, impossible to prevent the wild individuals, which then existed on several points of the globe, from accidentally uniting with several domesticated individuals of their own species or genus. This may probably explain the fable of the Mares of Bœtica, said to have been fecundated by the West wind. Wild Horses were very numerous in Spain, and the ignorant herdsman, seeing products formed with whose origin he was unacquainted, easily resolved the problem by referring it to a miracle. With the Ass, however, it was the constant practice of the Romans, according to Varro and Pliny, to select the Wild Asses (*onagri*) as Stallions. Luitprand, Bishop of Cremona, who wrote in 968, mentions that the domestic Asses of Cremona differed but slightly, in his time, from the Wild Asses of Asia Minor.

The attempts of the ancients to produce Hybrids or crosses between different species were so common, that they had proper names to denote the Hybrids between the Dog and the Wolf, as well as those between the Sheep and the Goat. They also had names for the cross between the Pig and the Wild Boar, and between the Sheep and the Mouflon. To obtain a fine race of Mules, the Romans united the Mare with the Wild Ass. Columella remarks, "that the Mule, the immediate descendant of the Wild Ass, remains wild, difficult to tame, and slender like its father; but that the Stallion of this species is more useful in the second generation than in the first. For when a Mare is united with an Ass descended from a Wild Ass and a domesticated female, the savage nature of the Mule appears to have been softened down by the influence of time, and the product of this union combines the beauty of form and the mildness of its sire, with the courage and swiftness of its grandsire." This important observation of Columella strikingly exemplifies the influence of domestication, as well as the transmission of certain physical and intelligent qualities in the course of generations, and is the more valuable, as we may at the present day search Europe in vain for a Wild Ass to repeat this interesting experiment.

Those Chapters in the writings of Varro, Pliny, and Columella, which treat of the production of Mules, contain minute directions as to the precautions which were necessary in their days to bring about an unnatural union between different species. The Ass, intended ultimately to propagate, had to be taken from its mother the moment it was born, and placed under a Mare without its perceiving the change. The Mare, on the other hand, had to be deceived by keeping her in the dark, and her own foal had also to be removed. She would then suckle the Ass' foal intended for propagating, and treat it as if it were her own offspring. In this way, the foal selected to be a Stallion formed an attachment to Mares from its infancy. It had to be constantly introduced into the society of Mares even while yet at the breast, that it might be habituated to their approach at the earliest age. The above mentioned authors go on to describe that l'accouplement doit se faire dans un lieu étroit, fermé, obscur, avec une jument liée, qui a déjà porté, et dont les desirs ont été d'avance irrités par un âne commun qui les éveille sans les satisfaire.

These precautions clearly show that domestication had not yet induced that kind of depravity which is its consequence, nor had it yet been sufficient to corrupt the manners of the Ass and Horse as at the present day; for we know that these Hybrid unions, formed between different species, can now be procured without the necessity of resorting to the slightest artifice. It must, however, be recollected, that such unions can only arise among domestic animals of nearly-allied species, or between animals of which one sex at least is domesticated.

The Ruminantia, it has been already explained, are those over whom domestication has had the least influence. Yet among the Romans, it was found necessary to employ only the most robust and powerful men, of a loud and menacing voice, to conduct their Herds of Oxen. Before yoking an Ox for the first time to the plough, it was requisite to tie him strongly to his manger, to put the yoke on his neck, to enfeeble him for four days by hunger and forced watches, and then to coax him with cakes, salt, and wine. At the present day these precautions are wholly superfluous; and in any of our modern farms, a girl of fifteen years of age can induce the strongest Bull to obey her commands, although he may have lived for many years at large in the meadows.

There is a singular fact recorded by the ancients respecting the food of the Ox, which was long considered to be of doubtful authority. Ælian and Athenæus have related, on the authority of Zenothemis, that in a lake of Pœonia, certain Fishes were produced, which the Oxen ate with as much pleasure they would have eaten hay, provided the Fishes were presented living and palpitating. When dead, the Oxen would not touch them. The singularity of this assertion, which would serve to break down the usual distinctions between the digestive functions of Herbivorous and Carnivorous animals, has, however, been removed by modern writers, several of whom relate, that in the cold countries of the North of Europe bordering on the sea the Oxen and Horses are fed on Fish. In respect to Horses, there can be no doubt as to the fact, for the Horses which were brought in 1788 from Iceland to France, by M. de Calonne, had no other food than Fish on the passage, as well as during their stay at the port of Dunkirk. M. du Petit-Thouars, who was garrisoned at the latter place, reported this fact to M. de la Malle, on whose authority it is inserted here. Torfaeus (Hist. Norveg.) relates the same fact for the Norwegian Horses.

The more recent experiments of M. Magendie have fully confirmed this omnivorous property of the Domesticated Animals; and it is perhaps one of the most curious consequences of their association with Man. Wild Animals appear, however, to possess this quality to a certain extent. M. Roulin reports that the Martin (*taira*) of Columbia will eat bananas and green maize, as well as Quadrupeds, Reptiles, Birds, and Insects. M. de la Malle has known a Polecat to devour pears, peaches, apricots, grapes, and other fruits of our garden trees, besides its ordinary animal food. These facts appear fully to verify the observations of Ælian and Zenothemis.

Another consequence of domestication, in modern times, may be remarked in the

permanent secretion of milk with the Cows, Ewes, and She-Goats. The wild races only suckle their young during the interval necessary to habituate the digestive organs of their progeny to other food. We have already seen that the domestic species, transported into the New World, have lost this property of their ancestors in acquiring their independence, and only preserve their milk as long as the calves and kids are kept along with their dams. We have a further proof of the imperfect domestication of the Ass, in the circumstance that the secretion of milk in the female Ass does not remain permanent, but continues only during the time that the foal remains with its dam.

An interesting passage of Aristotle appears to show, that one of the most important consequences of domestication, the permanent secretion of milk, which is at present maintained by an irritation of the Mamme almost mechanical, was first induced by a stimulus procured from some plants of the Nettle family (*Urticeæ*). He adds, in reference to the She-Goats, that even when they have not been fecundated, it was customary to rub their udders with Nettles so violently as to excite pain. At first milk was drawn mixed with blood, then a quantity of purulent matter, and finally a milk as pure, as healthy, and in a quantity as copious, as that rendered by a She-Goat which had just produced.

The progress of domestication may, however, be seen more especially in the Dog, who has in all ages been the companion, the guardian, and we almost say the intimate friend of Man. Being possessed of a superior genius, and habituated to the society of his master, domestication has been truly wonderful in developing his natural capacity. The ancients were acquainted with but few varieties of the Dog, as far as we can gather from the descriptions of authors, and the figures on the monuments of antiquity. They had the Watch Dog, the Coursing Dog, the Shepherd's Dog, and the little Maltese Dog, supposed to have somewhat resembled the French Bichon. The intelligent qualities of these varieties had been but slightly developed; and the ancient Greeks and Romans were wholly unacquainted with those Dogs which set game, such as the Pointers and Spaniels, upon whom a modern education can produce results so surprising. The Water Spaniel or Poodle Dog, whose fame is now widely spread for the constancy of his attachment and the extent of his acquirements, was wholly unknown to them.

Aristotle and Xenophon have expressly declared, that animals can be made to understand *nothing* by word of mouth. Those who have witnessed the intelligence and dexterity of the modern Poodle Dog, will be able readily to appreciate the influence of domestication when continued through a long period of time. These animals can be induced, at the word of command, to ring the bell, or perform many of the ordinary duties of a servant, such as to shut and open the door, or deliver a letter. A black Poodle belonging to Robert Wilkie, Esq. of Ladythorn, in the county of Northumberland, would feign all the agonies of death in a very correct manner. When commanded to die, he rolled over on one side, stretched himself at full length, and moved his hinder legs with a convulsive motion, first slowly and afterwards quickly, as if in extreme pain. After putting his head and body in motion with these affected convulsions, he would then stretch out all his limbs, or lie on his back with the legs turned upwards as if he had expired, and remain motionless until the word of his master restored him again to his customary animation.

These instances, and numerous others, which need not here be produced, clearly establish the important fact, that the education of the domestic animals has always followed a gradual progress, which may be either slow or rapid, according to circumstances. We may thence further expect, that future ages, by bestowing more care as well as skill, and being aided by the influence of a longer period of time, may develop the intelligent powers of our domestic animals in a still higher degree.

It appears, that with one species at least domestication has gone retrograde. The Dziggat (*Equus Hemionus*) of Mongolia was once domesticated in Syria. Aristotle declares (Nat. Animal. vi. 30), that "in Syria animals are to be found called Hemionus, a species resembling the mule in appearance, but being in reality different from it. These Hemionus are swifter than Mules. They produce among themselves a constant race. Some animals, which still remain in Phrygia, where they were introduced in the time of Pharnaces, the father of Pharnabazus, prove the truth of this assertion. Three animals now remain out of nine."

Although the later writers among the ancients generally confound the Hemionus with the different kinds of Mule, yet Aristotle carefully distinguishes them. There was the Mule (*ὄνος, mulus*), or the Hybrid between the Ass and Mare; the Bardeau (*ἴβρος, hinnus*), or the Hybrid between the Horse and female Ass; and a cross of the second degree (*γίβρος, hinnulus*), between the Mule and the Mare. From all of these Aristotle separates "the Hemionus (*ἡμιόνος*), which is not at all of the same species as the Mule, notwithstanding its resemblance, since they propagate together, and continue their race." Theophrastus confirms this remark of Aristotle; and more modern writers, such as Constantine Porphyrogenitus, and Eustathius in his Commentary on the Iliad, remark, that the Hemionus was formerly domesticated in that part of Asia Minor called Paphlagonia.

Pallas has recently identified the Hemionus of Aristotle with the modern Dziggat of Siberia. It is probable that this species may have been brought to Syria by some of the Tartar hordes, and that it remained there in domestication until the era of Aristotle; for after this time all notice of it disappears from the writings of the ancients, and its place is supplied by the Horse and Mule. In certain parts of Central Asia, the Dziggat is said to be domesticated at the present day.

Thus, upon considering the domestic animals in reference to those phenomena which have attended their return from the domestic to the wild state, and upon investigating the records of antiquity, we are led to form several important conclusions which it may be proper here to recapitulate.

In the first place, we find that the numerous variations of the domestic animals, in respect to the colour and quality of the hair, are brought back by a state of liberty to a uniformity almost invariable. In the New World the common colour of the hair is a chestnut bay for the Horse, a dark gray for the Ass, and black for the Hog. In the Old Continent it seems to be gray for the Ass as in America, but a different colour for the Horse, which here becomes white. We are hence entitled to infer, that all shades which diverge from these primitive hues are the evident consequences

of domestication. This discrepancy between the original colours of the Horse in the Old and New Continents is not, however, without an analogous instance. The Ox, on becoming wild in South America, appears, from the observations of M. Roulin, to have reverted to a chestnut brown, while in Britain we know that the wild breed of the Ox, now exterminated, was entirely white, excepting a slight tinge of red on the ear, and a black muzzle. Further, we find that the domestic animals on becoming wild reacquire other properties corresponding to their independent mode of life. The ears of the Hog are diminished, and his skull is enlarged; the speed and agility of the Horse are increased; the courage of the Ass reappears especially among the Stallions; and the petulance of the Goat seems to be augmented with the ease and agility of his movements. We also find that the permanent secretion of milk in the Cow and She-Goat is an acquired property of domestication. In conducting these inquiries, it often becomes difficult to distinguish those changes which are entirely attributable to the loss of properties formerly acquired by domestication, from those new changes induced by climate, food, and other physical conditions under which the animals are placed. It is to some accidental influence of this kind, that we must ascribe the difference in the primitive hues of the Horse and Ox, which in America are chestnut bay and chestnut brown; while in the Old Continent white is the original colour. Yet, after making due allowance for the joint or separate influence of food and climate, and after comparing the several races with each other, and with the circumstances in which they are placed, we are compelled to admit the general principle, that habits of independence occasion the wild races to revert continually towards a primitive form and colour, which can be no other than those from which they have diverged in the course of ages.

In the second place, upon examining the writings and monuments of antiquity, we find that all our domestic animals have existed throughout Europe in the wild state. Most of them have undergone modifications dependent on the antiquity of their domestication. This progress can be traced in the Horse which has undergone perceptible changes during the interval of seventeen centuries from the age of Pliny to the present time. The pace of the pas-relevé has been acquired by our Horses since the time of the Romans, and this quality is now transmitted to posterity. We further perceive that while the ancients were acquainted with only four varieties of the Horse, and but few of the Dog, the variations of these animals at the present day are absolutely innumerable. The influence of domestication in developing the milder and more useful qualities of the Horse, the Ox, and the Dog, as well as in perfecting their intelligence, may be clearly traced. There also exists a tendency to break down the original distinctions between the carnivorous and herbivorous animals, by inducing a kind of omnivorous habit, especially when these animals are reduced to extremities.

The dense fleece of the Sheep and the barking of the Dog have been considered to be the acquired results of Domestication. Hereafter we shall investigate the grounds upon which these opinions seem chiefly to repose.

Every where we are struck with that general tendency of the Mammalia, and indeed of all living beings, to preserve the forms impressed upon them at the moment of their creation. As soon as the industry of the Horticulturist, or the skilful precautions of the Grazier and Veterinarian, are suspended, both Plants and Animals alike feel the influence of this *atavism*, which leads them to revert to the forms of their remotest ancestors. The vegetable resumes its rustic garb, or the bitter and useless secretions of its wild condition, the animal loses some of the most important and valuable of its properties. Both alike revert to a uniform type in their external and internal characters. Animated beings are soon stripped of those rich attributes which they had derived from the cultivation of the soil, or from civilization, the abundance of nutritious food, a careful shelter from the inclemencies of the weather, or their habits of intercourse with the superior genius of Man, but above all, from his care in regulating their unions among themselves. A bountiful Nature is ever ready to substitute qualities, which bear relation only to the wants of the animal, and the part it should perform on the great stage of created existence, for those other properties, which doubtless were imparted only for the purpose of administering to the wants and necessities of Man.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Recapitulation—Relations which the dimensions of the Mammalia bear to the peculiarities of their organization, and the stations they are designed to occupy—Occasional Difference of Size between the Sexes.

THAT original types have been impressed upon species at the moment of their creation, seems then to be one of the most general and important laws of Animated Nature. If the preceding observations have any force, the conclusions in which Lamarck and other experienced Naturalists have inferred the perpetual variation of species, and the indefinite extent of their modifications, during the course of ages, become wholly inadmissible. Great as the variations of Animals and Plants may appear upon a superficial consideration, they seem, upon a more cautious investigation, to be in reality confined within certain very narrow and well defined limits. The care of the Horticulturist can modify the secretions of a plant, and the relative magnitude of its parts; he can obtain an extraordinary development of one part, at the expense of another; he can transform the stamens into petals, and occasion a single flower to become double; he can impart a delicious flavor to the fruit; or lead to the development of fleshy and tuberculous roots by suppressing the branches, shortening the stalks, or diminishing the flowers. Availing himself of a corresponding law of Nature, the Grazier can modify the general functions of Nutrition and Generation among Animals. Among the Ruminantia, the cares of Man may lead to the alteration of particular secretions; their milk may be rendered permanent, or their hair fine and silky. By regulating the temperature to which they are exposed, or the quality of their food, by the annihilation of other organic functions, Man can not only succeed in modifying individuals, but Nature lightens the labours of his posterity, in transmitting their acquired properties to future generations. But on abandoning these artificial products to their own mutual action, the original equilibrium of their functions re-

stores itself. The balance of animal forces either becomes rectified in the individuals, or their posterity undergo a course of regeneration in resuming their original habits, or perhaps in uniting with the wild individuals of their own species.

From this invincible tendency of each species to resume its original form, we are led to regard all the variations of Animals and Plants but as the vibrations of a pendulum, which continues to oscillate around a fixed and determinate axis. The original type is continued by generation, according to constant laws, and the innumerable disturbing causes to which it is exposed, whether internal or external, are insufficient to subvert this harmony of parts. The inherent disposition of each specific type reappears after all our attempts to annihilate it, and it is in Natural History as in Morals,

Naturam expellas furcâ, tamen usque recurret.

Nature further prevents all permanent confusion of species by the instinctive aversion of allied animals. Even when Hybrid or adulterous unions do arise, the Mules are usually sterile, and these Mongrel products appear to stand in relation to surrounding beings as something unnatural and monstrous.

The tendency of a species to produce the same form on the one hand, and the causes of deviation on the other, compose two opposite and counter-balancing forces, by the mutual reaction of which each separate force becomes modified, and from their combined action there hence proceed effects which may be regarded as the resultant of the two forces.

The peculiarities of a race are the more decidedly marked according as it is more ancient. Among the domestic animals, there can be no doubt that a great number of these individuals belong to races whose origin dates back from a very remote period of antiquity. Those races, on the contrary, which are known to be of more recent origin, preserve their peculiarities with greater difficulty, and always tend to revert to the forms of those more ancient types, to the crossing or modification of which they owe their own existence. Instances of this law occur daily under our eyes, and indeed are matter of notoriety to gardeners and breeders of cattle. They are, however, most perceptible in the Dog, where there often appears, from the crossing of races, a new variety, which, however, is found to possess a short and fleeting existence, the common lot of all types of modern origin. These considerations would lead us to assign a very high antiquity to the period of the first appearance of the most permanent races.

The attempts of some recent German and French philosophers to explain the immense diversity of animals and plants upon Physiological principles, and without an appeal to an original and specific creation, appear to us to be wholly unsatisfactory. As well might they attempt to resolve by Mechanical principles how it happens that one time-piece shows the day of the month, another only the hour of the day, while a third will point the minutes and seconds,—differences which can only be explained by the intention and design of the Horologian.

Instead of speculating in these inaccessible regions, the Natural Historian endeavours to trace the relations of created beings with each other, and with the general laws of inanimate Nature, rather than to indulge in conjecture upon the physical causes of their diversity.

All created beings must necessarily be formed in direct correspondence with each other, and the places they are destined to inhabit. In the same manner, as particular organs are adapted to particular purposes, so must the general dimensions of the body correspond accurately with surrounding circumstances. We see the eye exhibit different relations in respect to light, according as it is intended to see to a small or remote distance, or through the medium of air or of water. The ear again is organized relatively to the vibrations of the air, to melodious sounds, as in many Birds; the nose to odoriferous effluvia, to animal odours in the Carnassier, to vegetable in the Herbivorous tribes; the organs of mastication and suction to the nature of the food; the arms and means of defence for the preservation of each species, and the destruction of its prey.

It is evident, therefore, that if we can trace design and correspondence between particular organs and functions, a certain general equilibrium of functions and organs must also exist, and each species or original type must possess that general form, dimension, and duration, which will enable it to continue its existence for a limited time, and perform its part among created beings.

On comparing all the Mammalia among themselves, we are at once struck with the remarkable differences in their dimensions, which present a greater amount of variation in these respects than perhaps in any other class of animals. The Minute Shrew (*Sorex exilis*) is the smallest of known Mammalia, and measures only one eight hundredth part of the length of the Basque Whale (*Balæna boops*), while in bulk it is only about one part in half a million. In other words, assuming the dimensions of the smallest species of the Mammalia = 1, then the length of the largest animal of this class is = 800, and its bulk is = 500,000.

This great disparity of size chiefly arises, it must be observed, between Mammalia differing considerably from each other in their external organization. If we compare together animals of the same order only, the discrepancy in their dimensions is brought within much narrower limits. The sizes of these animals approximate still more closely if we descend to tribes, families, or genera; and so invariably does Nature preserve this relation between the bulk of an animal and its external characters, that if we find two congenerous species, which present remarkable differences in size, we may be almost certain that there will also be found important differences in some of these organs which commonly serve to supply the generic characters. Among the Quadrumana, for example, the Apes form a most natural family, and one in which the general height remains tolerably constant. If we except the Orangs and the Cynocephala, which are the largest, and the Ouistitis, whose size is much less than the others, and which almost stand out as an isolated group from the remaining genera in respect to their external characters, we shall find that the remainder differ but slightly in their dimensions. Among all the Cynocephala, the length of their head and body remains uniformly constant, being a little more than two feet. Again, the Ouistitis compose a genus very numerous in species; and yet, when considered by themselves, they present a result much more remarkable. On comparing

together all the known species of this genus, and then taking the mean of their dimensions, M. Isidore Geoffroy found that the largest species only exceeded this mean by an inch and a quarter, while the smallest remained below the average by an equal quantity. If, however, the *Onistitis* be subdivided into those three sections usually received by Naturalists, then the dimensions of the species belonging to each section will differ from the medium magnitude proper to that section only by six lines one way or another.

Among the Bats the genus *Vespertilio*, as formerly established, would seem at first sight to present a striking exception to this rule, in respect to the Roussettes, in which the distance between their expanded wings is four feet, while the smaller species of this country scarcely measure as many inches. But upon investigating the characters upon which the genus had been instituted, M. Geoffroy observed several important points of difference between the organization of the larger and the smaller Bats, which have ultimately led to their being separated into distinct subdivisions and genera. Many other apparent exceptions have also vanished in a similar manner on being examined more minutely, and the consequence has been, that several new Genera have been adopted by the general consent of Naturalists. Indeed, it may be stated generally, that wherever there have existed striking differences of size between nearly-allied species, Naturalists have always felt the necessity of establishing sub-genera, or groups in which these remarkable anomalies are made to disappear.

Since it thus appears that the sizes of the Mammalia bear a determinate relation to those external characters which usually serve to determine the Genera or higher divisions, it will follow that their magnitude must bear a corresponding relation to the conditions of their existence, such as the element in which they move, their mode of life, their food, their climate, and their situation. In all these respects we may expect to find that their sizes will be so apportioned by Nature, as to bring them into harmonious correspondence with the circumstances of their condition.

In reference to the element in which they move, we find that all those Mammalia which dwell in the bosom of the ocean acquire the largest dimensions. The different species of Whale (*Balæna*), of Cachalot (*Physeter*), and of Dolphin (*Delphinus*), attain a bulk to which few other Mammalia can compare. Even among those groups of Mammalia where some genera commonly frequent the water, and others live habitually on the land, we find that the former attain to a magnitude much greater than that of the latter. Thus, among the Carnassiers, no species reaches so great a size as the Sea-Horse or Morso (*Trichechus rosmarus*). Again, among the numerous animals composing the Genus *Mustela* of Linneus, the Weasels, Martins, and other terrestrial species, are much smaller than the Otters. Even among the Otters (*Lutra*), it is precisely those species which are the most essentially aquatic, such as the Brazilian Otter (*L. Braziliensis*), and the Sea-Otter (*L. lutris*), which attain the greatest dimensions. The same observation is also applicable to the Rodentia and Insectivora. The Beaver is larger than the Mouse, and the Water Shrew (*Sorex fodiens*) of greater magnitude than the common Shrew (*S. araneus*), and for a similar reason. This adaptation of Nature seems obviously intended to accommodate their bodies to the density of the medium in which they more habitually reside. A greater bulk, by displacing a larger quantity of water, renders them more buoyant, and leaves the muscular force of their limbs more unfettered to execute the movements proper to each animal. Again, the force of gravity at the earth's surface being counteracted in a more sensible degree by the reaction of the denser fluid, enables some of the aquatic species to attain a bulk which would be impossible in a land animal.

On the other hand, those Mammalia which live more exclusively in the air, such as the Bats, or upon trees, like the greater part of the Monkeys, never attain any very considerable dimensions. The agility which their situation requires would have been inconsistent with a heavy form, and the dimensions of the trees in which most Quadrumana fix their abodes, necessarily confine their magnitude within very narrow limits. Among the remaining Mammalia which commonly live on the surface of the land, and may thence be more particularly denominated terrestrial Mammalia, we find that their average bulk maintains a size intermediate to these lighter forms of the aerial Mammalia on the one hand, and those belonging to the more ponderous inhabitants of the ocean on the other. The relative magnitude depends, however, with the terrestrial Mammalia, upon certain other conditions; for, while we find some animals among them which only yield in magnitude to the aquatic tribes, we at the same time discover in this division the very smallest animals of the entire class without exception. This rule, therefore, does not hold so accurately in respect to those animals which dwell habitually on the ground.

If, however, we investigate the terrestrial and aerial Mammalia in reference to the nature of their food, we find certain constant relations established by the Creator between the quantity of food necessary for their maintenance and that which is supplied to them; in other words, between the demand of their stomachs and the supply of food sufficient to sustain them. The largest of all terrestrial Mammalia are the Herbivorous animals, such as the Elephant, Hippopotamus, and Rhinoceros, because the grosser kinds of vegetable food are supplied in immense quantities throughout many parts of the globe, but especially in the tropical climates. The warmer regions of the globe yield, in a dense and luxurious vegetation, an ample supply of nourishment to these ponderous frames; and supply those succulent plants, soft stems, and leaves, the want of which renders the regions around the poles wholly incapable of supporting the larger terrestrial Mammalia. In the group of Herbivorous Mammalia, while we have the colossal magnitude of the Elephant on the one hand, we have on the other the Java Musk (*Moschus moschiferus*), scarcely the size of a Rabbit.

The Carnivorous Mammalia compose a group which forms, after the preceding, a series of an inferior order. Among them we have the Lion and the Tiger for the *maximum*, and find a *minimum* limit probably in the Ermine (*Mustela erminea*). Although these animals find an abundant supply of nourishment among the inferior tribes of every denomination, it is neither so ample nor so constant as to permit them to attain any very great dimensions. An unwieldy bulk would ill correspond with that activity which their predatory habits seem necessarily to require.

The Frugivorous tribes of Mammalia form a third group confined within much narrower dimensions. On the one hand we have the Orangs, and on the other the

smallest species of Roussette Bats (*Pteropus*). These species are accordingly confined to those more favored regions of the earth, where fruits are to be found throughout all seasons of the year.

Lastly, we see among those Mammalia which feed exclusively on Insects a further instance of the relation which the nature of the food bears to the average bulk of species. While we have the Ant-eaters (*Myrmecophaga* and *Orycteropus*), whose length does not exceed four feet, we have, in the minute Shrews, some of the smallest of known Quadrupeds.

Thus, upon considering all the Mammalia, in a general point of view, in reference to their comparative dimensions, we are led to perceive that there always exists a relation between the bulk of the animals composing an entire group and the conditions of their diet. The more capacious animals feed upon those substances which are found most abundantly on the face of the globe. Those of smaller size usually attain to dimensions proportional either to the magnitude of the animals upon which they are destined to feed, or to the nature of those vegetable substances to which their digestive organs are adapted. Every where we perceive a most exact correspondence between the quantity of nourishment which their constitution requires, and that which is bestowed by the hand of Nature. This method of apportioning to each animal, by an equitable division, its share of the produce of the earth, is surely one of the most admirable and beneficent arrangements of the Creator.

Although the subject of the Geographical distribution of the Mammalia will hereafter receive our most attentive consideration, it may be proper to remark at present, that the dimensions of animals always bear a certain relation to the magnitude of the regions in which they reside. It has long been remarked, that islands which are either very small or much isolated contain very few Quadrupeds, and those only of small dimensions, while some are even wholly destitute of Mammalia. Indeed, the largest animals of this class are found only upon the continents, in the largest islands, or upon those smaller islands which are so near to the larger continents as to be intimately affected by their proximity. Even in respect to the continents themselves, the Mammalia belonging to the Old Continent, which is the larger, surpass in dimensions those of the American, which is the smaller. The Mammalia of New Holland come next in magnitude, then those of Madagascar, Britain, and the lesser islands. A similar law may be traced among the aquatic Mammalia, for those which inhabit the Ocean greatly surpass in bulk the species that frequent the Rivers. The largest of the latter do not exhibit Mammalia which can be compared in any degree with the Morse and the Basque Whale.

Thus, whether we investigate the Land or the Sea, every where we perceive that the dimensions of the Mammalia are proportioned to the magnitude of the regions which they are destined to inhabit. If the Southern hemisphere be compared, as a whole, with the Northern, omitting Africa and those islands which are traversed by the Equator, as the animals must be nearly the same on both sides of this line, we shall find that the Southern hemisphere will contain Mammalia whose size is generally less than that of the corresponding animals in the North. This is, however, only a particular case of that more general law already explained, for the Southern hemisphere contains at most only small continents or large islands.

Differences of latitude and climate lead to many important corresponding differences in the sizes of animals, but these do not admit of being expressed in a general law, but must be noticed in detail. It most commonly happens that genera and species arrive at their *maximum* of size in the hottest regions of the globe, and descend to their *minimum* in the coldest. There are, however, some Mammalia, such as the Bears, which have their *maximum* in the Polar Regions, while their congeners of the tropics are greatly inferior in bulk and strength. But there is no instance in any one genus where the largest species are found alone in temperate or moderately warm climates; and the same observation is equally applicable to the several individuals of the same species.

It commonly happens, when individuals belonging to the same species inhabit both the mountains and the valleys, that the inhabitants of the mountains will be the smaller of the two groups. This probably arises from exposure to cold, and a scanty supply of food. Here again we find that correspondence between the dimensions of the animals and those active habits which a mountain residence demands. A heavy and unwieldy form would have been unsuited to the difficulties of those almost inaccessible heights, where the mountain races are often compelled to gather a scanty and precarious subsistence.

Among the domestic animals, *individual* variations of height happen very rarely, and are commonly confined within narrow limits, while, on the contrary, the variations in the dimensions of *races* are sometimes both very numerous and remarkable. With some domestic animals the primitive height of the wild species is preserved, or it has been very slightly modified. In these instances all the races have the same height, or differ very slightly; and whenever they are found to vary from the height of the wild races, it is always to become a little smaller.

There are some species of domestic animals, such as the Dog and the Horse, which present some races of very large dimensions, and others, on the contrary, are very small. When, however, the medium height of all the races is ascertained, it is found to differ but slightly from the height of the original type, as deduced from measurement or from reasoning. Thus the ordinary height of those species which vary but slightly, as well as the medium height of all the races of those species which vary much, approach very nearly to the dimensions of the height belonging to the primitive type. In other words, species have varied but slightly in their average dimensions from the time when they were first domesticated.

There are certain lesser variations in dimensions, which depend upon the greater or less care which the individuals receive on the part of Man. Those species which have experienced a slight diminution, belong to such as have been generally neglected or badly nourished.

The predominance of the Male over the Female in dimensions is much more general, and more strongly marked among the Mammalia than among the Birds, or in any other class. There is a remarkable disproportion between the size of the Bull and that of the Cow; of the Ram and the Ewe; and of the He and She Goat. This superiority of volume is not, however, essential to the male sex; and far from

being general, it is confined to a very small proportion of the Animal Kingdom. If this superiority of size were characteristic of the sex, the loss of the reproductive organs during early youth ought to prevent it. The effect is, however, precisely the contrary, for castration, which brings the constitution of the male near to that of the female, is highly favorable to the growth of the former; these organs were therefore rather an obstacle to their development.

This disparity seems to arise from the fact, that the nutritive powers of the female are, in the Mammalia, expended upon their offspring. The Cow, whose weight is, perhaps, not one half that of the Bull, lives in a continual state of gestation or lactation; and it is the same with the Ewe and She-Goat. Every Grazier is aware, that the young females cease to grow as soon as they begin to produce; and that yielding milk is still more prejudicial to their growth than gestation.

If we compare the Ruminantia and Herbivorous Cetacea with the Pachydermata, we shall find, that the young of the former consume much more milk than the young of the latter; and, accordingly, it is in the two classes first mentioned that the predominance of the male over the female in size is most decidedly marked. Indeed, the Pig is the only Pachydermata which is very prolific, and it is precisely in this Genus that the male more sensibly exceeds the female in dimensions. Of all the Rodentia, the Rats are the most fertile; and the predominance of the male Rat over his female is more apparent than in any other of the Rodentia.

Those Mammalia which live upon Insects and Fruits, such as the Cheiroptera and Insectivora, do not exhibit the same difference of magnitude between the sexes as the proper Carnivora. The females of the former, from their situation, find an easy and abundant prey either in the larvæ of Insects which hatch around them, or in the Fruits which fall and ripen near their retreats. The female of the latter is obliged, on the other hand, to pursue an alert and nimble prey, which often eludes her pursuit. Her young ones are not deficient in number, and she consequently loses a large quantity of nutritive power. From these causes, the male, who is always at large, and lives for himself alone, is wholly exempt; and hence the female of the Bat, the Hedgehog, and the Mole, is at least as large as the male, while the Lioness is smaller than the Lion.

Among the Marsupialia, where the females produce an embryo, or rudimentary fœtus, which always travels about with its mother, and cannot keep her confined to a spot remote from her food, we find that the female is at least as large as the male.

With the Edentata and Tardigrada, the female is usually larger than the male. It is especially remarkable in the Ant-eaters, where the female, by the aid of her long tongue, an organ usually more developed in the female than in the male, enables her to catch the Ants, her prey, with a superior nimbleness and agility.

Among the domestic animals, whenever it happens that the female is made to work like the male, and that she is not compelled to submit to a continuous and depressing lactation, she does not yield to him in size. The Sho-Ass is as large as the male; the Mare as the Horse; and the Dog is not larger than his female. In these cases, Man provides equally for their wants and necessities.

Some Naturalists have considered the Polecat (*Mustela foina*) to be a domesticated variety of the Martin (*Mustela martes*). In the former, the sexes are of an equal size, while the male is greater than the female in the latter. With the common Hare (*Lepus timidus*) the male is not so bulky as the female; on the contrary, with the Rabbit (*L. cuniculus*) the male is the larger of the two. This evidently may be traced to the superior fecundity of the latter species.

We may easily see how the dimensions of animals should depend so much on the quantity and quality of their food, since all substances do not contribute an equal quantity of nutriment. Vegetable substances, which are mucilaginous and herbaceous, contribute much more powerfully towards the development of animals than those which are fibrous and of an animal nature. These are more favorable than acid substances; and the latter again surpass those which are saccharine. Thus among all the Mammalia it is the Herbivorous and proper Cetacea, the Pachydermata, and the Ruminantia, which attain greater dimensions than the Carnassiers, and these again than the Quadrumana and Edentata. The same thing may also be traced among the Birds, for the Waders (*Gralla*) and the Web-footed Birds (*Palmipedes*) become larger than the Birds of Prey (*Accipitres*), the latter are in their turn larger than the Thrushes (*Turdus*), and these again than the Humming Birds (*Trochilus*).

This advantage in respect to dimensions, to which a plentiful supply of food contributes, is unfavorable to reproduction, and hence acts ultimately against the species; for the difficulties of procuring a sufficient supply of food are always greater in the larger than in the smaller species. Large species are hence comparatively rare upon the earth, except where human industry has ministered to the insufficiency of their own resources. The smaller races of Goats and Sheep might maintain themselves without assistance in our temperate climates, but it would not be possible to preserve the larger races of these animals; and with still greater reason of the Horse, the Cow, or the Ass.

The superiority of the male over the female ought then to be more apparent in the larger than in the smaller species. With our Oxen and Sheep the difference is greater among the larger than among the smaller races. It is greater in the Rat than in the Mouse. This inequality between the sexes would have been still greater in the largest species, if the deficiency of nutrition sustained by the female did not become progressively less according as there exists a progressive diminution of fecundity. Among those domestic animals, whose females supply us continually with milk, the inequality becomes enormous in the largest species, because frequent milking is still more unfavorable to development than a very great fecundity. Good Cows fatten during gestation, and become lean when milking commences, whatever may be the quality or quantity of their food.

The primitive cause of this inequality of size between the sexes seems to show a tendency to return to an equilibrium; and we may thence infer that there formerly existed a greater disparity between the males and females of the Pachydermata than at present, when we find this disparity still existing among the Amphibia, which are more productive than the Elephant, the Rhinoceros, and the Hippopotamus.

When the capacity of reproduction is extinguished, species arrive at their end. We may infer that it is chiefly to the feeble powers of reproduction among the Pachy-

dermata that we find so many fossil species belonging to this order which have no living analogues. Species, like individuals, decline and die, when they have attained the limit of their dimensions.

From what has been said, it may easily be inferred that in those orders of animals where the male is usually monogamous, and shares with the female the care of her progeny, he is not in general susceptible of that superior development beyond the female, as where he is polygamous.

We have now seen that when two or more species of Mammalia resemble each other perfectly in their generic characters, their height is the same, or but slightly different. Those families, genera, or species, which inhabit the bosom of the ocean, or pass a part of their lives in the water, arrive at a large size comparatively to the other families, genera, and species of the same group; and the increment of their dimensions is the greater, all other things being the same, in proportion as their organization renders them more essentially aquatic. The genera with wings, or which live in trees, on the contrary, never attain to any but very small dimensions. Those Mammalia which are purely terrestrial, may be arranged in series according to their dimensions, very large in the first, less in the second, and so on, that is, into herbivorous, carnivorous, frugivorous, and insectivorous. In other words, there always exists an exact co-relation between the volume of the animals and the volume or quantity of organized beings which they are destined, by the formation of their digestive organs, to consume.

It has also been shown that there exists a constant relation between the height of the Mammalia and the extent of the places where they live; the largest species inhabit the oceans, continents, or large islands; the smaller reside in rivers or small islands. Even the Mammalia of a more extensive continent surpass in dimensions their analogues of a less extensive continent, and the Mammalia of the Northern Hemisphere are larger than the corresponding animals of the Southern. In general, also, though not always, the height of Mammalia resident in the mountains is inferior to that of the analogous animals residing in the plains.

The preceding observations are true without exception in reference to the Mammalia, but when applied to lower classes of animated Nature, they gradually lose their general correctness, and are finally lost when we arrive at the lowest classes of all, in an infinity of exceptions. We, however, always find that when other circumstances remain the same, the variations of size observable in any one class are always confined within narrower limits in proportion as that class is more natural.

We have also seen that the size of the body depends upon the quantity of nutritive particles which it is capable of retaining. The female would always attain a larger size than the male, as she is endowed with a greater power of absorbing nutriment, did she not experience the influence of certain counteracting causes which do not act upon the male. She has to submit to a severe lactation, in many cases to a frequent parturition, and is often compelled to undergo privations of food in her cares for her offspring. As these causes do not affect the male, there hence arise inequalities in their dimensions, or relations of volume, and these differences of size between the sexes, when they exist, depend upon the intensity of these causes. It must, however, be admitted, that sometimes the relative sizes of the sexes seem to be inexplicable by any of the causes just enumerated, and in these cases we must infer that differences in the bulk of the sexes have been originally impressed upon the species at the moment of their creation.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Phenomena of Nutrition among the Mammalia—Manner of obtaining their Food.

THAT Animals can only be nourished by substances which have once lived, in other words, by other Animals or by Plants, we have already had occasion to explain. Some persons have hastily concluded, from imperfect observations, that animals can nourish their bodies with inert mineral substances. This opinion is, however, erroneous. That yellow earth which the famished Wolves have been seen to swallow in their rage, serves but to deceive the intensity of their hunger. The Mollusca do not devour the fragments of rocks or old wood which they destroy or perforate, nor do Birds digest those hard mineral substances which are sometimes found broken or pulverized in their gizzards.

The food of the Mammalia is very various, since it takes in all other animals and vegetables. There always exists a certain correspondence between the degree in which the organs of an animal are complicated, and the nature of the food which it consumes; for it has been generally remarked, that the simplest beings always require the simplest food. The Tiger feeds on a living prey, the Wolf upon carcases, the Otter upon fish, the Hog upon roots and animal food, the Myrmecophaga upon ants, the Apes upon fruits, the Rodentia and Ruminantia upon simple herbs, Man and the Bear upon almost any thing.

Thus we may remark among the Mammalia the greatest diversity in their tastes for food. While in some the nutriment wholly belongs to the Animal Kingdom, in others it is as entirely confined to the Vegetable. Others again, whose nourishment is mixed, seem to avail themselves at once, or indifferently, of the produce of either Kingdom. These varieties are usually expressed by the terms *sarcophagous* or *carnivorous*, *phytophagous* or *herbivorous*, *polyphagous* or *omnivorous*.

These first differences of animals in respect to their food, presuppose or draw along with them certain other differences in respect to their organs. A carnivorous animal has more teeth than an herbivorous one; these teeth are more unequal, more fitted for tearing, and more trenchant like a saw. His jaws are more free, more powerful, and moved by larger and more vigorous muscles; his stomach is not so large, and its sides are thinner; his intestines are shorter, and proceed within a smoother form through a less capacious abdomen. His limbs are also differently disposed than in the herbivorous animals, as the voracious instincts require instruments at once fitted for agility and destruction.

Many carnivorous animals will only devour a living prey, which leads them to

continual battles, aggressions, and carnage. Others, again, avoid the dangers of these murderous combats, by feasting on carcases recently dead, or even already putrified. The Lion kills all that he eats, but the Hyæna will extract his meal from the charnel-house or tomb. There are also some Carnivorous Mammalia which confine themselves to sucking the blood of other animals; some species of Weasels and Bats are examples of this, especially the Polecat (*Mustela putorius*) and the Vampire Bat (*Vampirus spectrum*). The Opossums (*Didelphis*) are nourished almost wholly upon the eggs of other animals. The Ant-eaters (*Myrmecophaga*), being destitute of teeth, feed upon Ants and other Insects which adhere to their glutinous tongue.

The Herbivorous animals, on the contrary, as has already been observed, have their jaws less powerful, moved by more feeble muscles, armed with teeth fitted for grinding rather than biting or tearing. Their limbs are less disposed for aggression, but in return, their stomach is more capacious, its sides are more muscular and thick, and sometimes it is multiplied and complex, their intestines are larger and longer, while their forms are more massive. Those animals which Ruminantia (*Ruminantia*), that is, whose food returns a second time to the mouth through the œsophagus, to be again chewed, after having already remained in the stomach, generally have horns on their foreheads, and want the incisive teeth in the upper jaw. They all have four stomachs, or rather one stomach subdivided into four cavities. These divisions are disposed in the following manner. The first is the Paunch (*ventriculus*); this is the largest, and occupies almost the entire left side of the abdomen. The second stomach or Honey-comb (*reticulum*), being the smallest of the four cavities, is placed on the right and before the Paunch. Still further to the right, and almost behind the liver, is the third stomach or *feuillet* (*omasum*), which communicates by a small opening with the fourth stomach or *caillette* (*abomasum*). The last is analogous to that single one found in most other Mammalia, and it communicates with the duodenum or intestine, by a kind of pyloric opening. The separation between the first and second stomach is not very strongly marked; but the others are divided from each other by well defined contractions which prevent any confusion among them. The œsophagus is inserted on the right side of the Paunch, and a kind of prolonged gutter causes it to communicate with the second and third stomachs.

When the food has just been masticated and is swallowed for the first time, it is introduced into the first stomach or paunch; afterwards into the second; and it is only after the food has been submitted to the action of these organs, after it has been impregnated with the juices which are secreted there, and has been softened, that it re-ascends through the œsophagus into the mouth, in order to undergo a new trituration more perfect than the former. When swallowed this second time, the food is placed in the third stomach, without having gone near the Paunch and Honey-comb. The very young Ruminantia, which are still fed alone upon the milk of their mother, have not yet obtained this ruminating power; but the fluid which they suck passes at once into the last stomach, just as happens among the adult animals after they have ruminated.

Several Cetææ have stomachs nearly as complicated as the Ruminantia. The Dolphin (*Delphinus delphis*) and the Porpoise (*D. phocæna*), for example, have, for a stomach, four cavities placed in a row, one after the other. There exists, also, between the first three cavities, a kind of short canal, forming a narrow passage, by means of which the communication is established from one to the other. Yet none of these animals have been observed to ruminate.

Many Rodentia have their stomach divided into several cavities by contractions; some appear to have two stomachs, but this last arrangement is found more particularly among the Marsupialia, and especially in the Kangaroo-Rat (*Hypsiprymnus White*). Those herbivorous animals which do not ruminate, commonly have the œsophagus inserted towards the centre of the stomach. The latter organ is disposed in a manner to prolong the stay of the food on the same side as the spleen, being the left, and the orifice of the pylorus is very narrow. We may remark here, that the Rodentia usually have two incisive teeth in each jaw, isolated from all the other teeth, and their hinder limbs being almost always longer than the fore, dispose them naturally to leap.

The digestive organs both of Man and the Quadrumana hold a medium station between the Herbivorous and Carnivorous animals. Man has all the kinds of teeth, the trenchant or tearing teeth, like the Carnivora, and the molar or grinding teeth, like the Herbivorous animals, without any very sensible inequalities. His lower jaw moves in all directions; horizontally, like those animals which live upon herbs, and perpendicularly, like the Carnassiers. His stomach is single, but tolerably large, and the sides are of a medium thickness. The rest of his organs hold a mean between those two divisions of Mammalia just mentioned.

The Bears (*Ursus*) and the Badgers (*Melis*), which appear specially organized for being carnivorous, will, however, eat, almost indifferently, all kinds of food, drawn indiscriminately from the two kingdoms of organized beings. But generally speaking, it must be considered a rare occurrence to find a carnivorous animal feeding on vegetables, or an herbivorous animal eating animal substances. This is only remarked when they are urged by an extreme famine, or where they have long been domesticated, and have thence acquired the omnivorous propensity of Man himself. Thus the famished Dog eats bread, and sometimes even vegetables. Cats, when deprived of all nourishment, have been known to devour, in the extremity of their hunger, even the flax fibres of a rope. The Rats, also, although organized in every respect for a vegetable diet, will sometimes eat animal substances. It has been remarked, that when flesh is placed in the stomach of a Horse, it remains there without undergoing any alteration, but he has been known to eat fish; and Goats have been seen to devour animal substances, which they manage somehow to digest.

In respect to drinking, the Carnivorous animals, whose digestion is more rapid, generally experience a less urgent necessity for water than the Herbivorous tribes. It has been proved by Marcorelle, that when all the other conditions continue the same, they can remain without water most easily when fed upon fat and oily aliments. The Camel and Dromedary are exceptions; for, though voracious, they can remain without drinking for many days longer than any other animal.

The manner in which the Mammalia drink varies much. Man swallows liquids in

the same manner as solids, but he drinks also by suction. The carnivorous animals lap up liquids, and they could be made to die of thirst by keeping their trachæa open externally, which would take away from them the power of sucking up the liquid. The Bear hites the water like a fruit or any other solid aliment, and neither laps nor sucks. Most of the Herbivorous animals drink by suction, and to make them perish with thirst it is only sufficient to paralyze their tongue. It has been said that Man is the only animal who drinks without being thirsty.

There are some animals which are seldom observed to drink; these are chiefly carnivorous. We have already noticed that the Camel and Dromedary can remain several days without drinking, and this abstinence from liquids does not appear to make them suffer. There are, however, in the stomachs of these animals certain separate cavities, which seem to be intended to keep the fluids in reserve. In other respects, animals appear to fatten in proportion as they drink less, up to a certain limit, after which a too great abstinence from water makes them fall off in bulk. The Horse and the Ass, according to Aristotle, form an exception to this rule, on account of the enormous quantity of fleshy and often dry herbs with which these animals fill their stomachs almost without intermission. It is customary to suppress the drink of Pigs and other domestic animals gradually when it is wished to fatten them.

Marcorelle, a member of the ancient *Académie des Sciences*, made several experiments to ascertain the effect of drinks upon the bulk of the body. He passed two entire months without drinking water, wine, or any other fluid; and he lost, during that interval, five pounds and a half of his entire weight; he at first weighed 120 pounds. After this he resumed his usual diet, eating the same things as before, but adding to it wine, either pure or diluted with water. During six days of this altered regimen he recovered six pounds of his substance, that is, one eleventh part more than what he had lost. He observed also, that vegetables, of all food, were the most liable to excite his wish for drink. We are not, however, to infer from this, that drinking much is favorable to *embonpoint*; for the contrary is nearer the truth. Too much drink fatigues the stomach, and weakens the digestion of the food. Tea, and other hot drinks, hasten the digestion; but it is rather to hurry it on, than to accelerate it beneficially, for such drinks occasion the aliment to pass through the pyloric duct before being sufficiently elymified. In respect to alcohol and other exciting fluids, spicy, salt, or acid, these fluids favor the production of chyle, and, in one sense, they occasion a more abundant flowing of the intestinal juices, gastric, pancreatic, and biliary. But alcoholic drinks ultimately impede nutrition by the excitement which they cause in all the organs, in unnaturally quickening the pulsations of the heart. They are also injurious from interrupting the sleep, which they render either short or troubled.

Whatever may be the nature of the food, or in whatever animal it may be deposited, the alimentary mass accumulated in its stomach usually remains there one or more hours before any considerable alteration can be perceived. After that, the aliments begin to soften, to change their colour, and often their smell. With the exception of those grains which are entirely covered by an insoluble epidermis, the change begins on the surface of the alimentary substances; and it must be remarked, that the properties of the chyme differ exceedingly according to the kind of food from which it results. Those herbs which have been triturated and twice masticated by the Ruminants give a different stomachic product than animal food, or the grains of the Cerealia. It may also be observed, that the digestion of animal substances is more rapid than that of a vegetable diet. Accordingly, the Carnivorous animals digest their food more rapidly than the Herbivorous; and Man, with the Plantigrada, which are omnivorous, digest meat more rapidly than leguminous plants or fruits. It often happens with these animals, that vegetable food will traverse the entire intestinal canal, without having lost its natural and distinctive qualities, or being in any way altered, which happens very rarely with animal substances.

The aliment, when softened and digested by the stomach, being now *chyme*, forms a mass nearly homogeneous, and of a different colour in different animals, but usually grayish in our species, and in several others, of a sharp odour and taste, and, from its acidity, turning all vegetable blues into red.

In the greater number of Mammalia, it is the stomach alone which performs this first part of digestion—the formation of chyme, and the intestines do not proceed to transform the chyme into chyle, until the moment when the stomach has completed this preliminary process. But there are some animals among whom the relative functions of the stomach and intestines are not confined to these definite functions. The Horse, for example, which has a very narrow stomach, and yet will eat without intermission for several hours, cannot retain the food in his confined stomach for a sufficient length of time to be completely chymified. Accordingly, the pyloric duct of the Horse remains continually open, and the food passes onwards into the intestine without interruption, although not completely chymified; and the process is completed by the intestines, without this confusion of functions being in any way prejudicial to digestion.

The time which the food takes to chymify varies much from one animal to another. The Mammalia require only a few hours to perform this function, and the same thing happens with the Birds of Prey; but the Serpents and the greater part of the Reptiles require entire days and weeks to digest a single meal. The period of time which the same animal takes for digestion is quicker or slower, according as the state of its health is more or less perfect, according as the food is more or less abundant, or is in a greater or less state of minute division; and also, according to the peculiar nature of the substance to be digested. The aliment is finally submitted to the action of the intestinal juices, and the surrounding organs continually maintain a degree of heat, which is always very near to 104° Fahrenheit.

The minute division of the food by mastication is a process indispensable to a rapid digestion. While the teeth and jaws are performing their function, the salivary glands of the mouth continue to secrete a fluid in very considerable quantity. In the Ruminantia, and generally in all animals living on a vegetable diet, these salivary glands are very large, while in the carnivorous tribes they are very small.

The entire length of the alimentary canal differs materially among the Mammalia. Its length, with the Ruminantia, is twenty-seven times that of the body, while it is

only from three to five times their length among the Carnivora. In omnivorous animals, such as Man, its length is intermediate to these, being six or seven times that of the body.

Several experiments have been made by Sir Astley Cooper to ascertain the digestive power of the Dog. He found that this animal digested pork more easily than mutton, the latter more rapidly than veal, and beef with greater difficulty than any of the others. He found that fish and cheese were easily digested by the Dog, and boiled veal more readily than roast. The fat of meat seemed more digestible than cheese, codfish dissolved more readily than beef, and beef than potato. The order of digestion for the different parts of the same kind of animal food was fat, muscle, skin, cartilage, tendon, and bone, the last being the least digestible.

Young Dogs, when they have acquired strength, and are in good health, can digest bones; and what is remarkable, Spallanzani has observed that the gastric juice of their stomachs made an impression even upon the enamel of teeth. Boerhaave asserts the contrary, but the observations of Spallanzani have been confirmed. This power of dissolving bone is not peculiar to the Mammalia, but is also possessed by some animals of the other classes. Thus the Falcons, Eagles, and Crows, usually refuse bones; but when introduced into their stomachs, with proper precautions, these refractory substances are digested. Serpents and Adders also digest them, as has been remarked by Spallanzani. Only the smaller bones, however, possessing the least solidity, are dissolved entirely and rapidly; the harder bones require to be minutely divided in order to be softened and dissolved, otherwise they merely undergo a small loss of substance. It must be observed, that before digesting they pass into a cartilaginous state, and resemble indurated gelatine, as if they had been submitted to the action of nitric acid.

The Ruminantia, like the granivorous Birds, can digest herbs and grains, only when these substances have been previously divided, mashed, or ground. When entire herbs and solid grains are introduced into their stomachs, whether uncovered, or inclosed in linen, or perforated tubes, these substances undergo no digestion; they are merely moistened or softened, and this is the extent of their modification. The same result is obtained even when they are moistened with saliva. On the contrary, if bags or tubes of mashed herbs or grains be introduced into the stomachs of the Ruminants, the digestion is then performed in a few hours. These experiments have been made upon Oxen, Sheep, and many other Ruminantia, and they present similar results for all this order of Mammalia. They have also been made upon the Horse, and with the same result, although he does not ruminate.

Many physiologists have attempted, with various success, to effect artificial digestions out of the body, by extracting the gastric juices from the stomachs of different animals, and afterwards mixing them with the food. Spallanzani, by these experiments with the gastric juices of different animals, obtained several important results. When cold, the gastric juice produced scarcely any effect; it merely opposed putrefaction, but did not exercise its dissolving and digestive power until it was raised to its proper temperature. It did not act upon grains and herbs until they were ground, mashed, and impregnated with saliva. The gastric juice of Man softened and seemed to digest beef in about thirty-six hours, when raised to a temperature equal to that of the stomach. He also observed, that the gastric juice of one species often acted upon a great variety of substances, and yet it did not always act upon substances which could be dissolved by the gastric juice of another species.

From these instances of artificial digestion, we may readily expect that the stomach, being lubricated by the gastric juice, will continue to digest after the death of the animal, and even it has been said to digest itself. Hunter first noticed the fact, that the gastric juice will act upon the sides of the stomach after death, and to this cause he attributed the erosions and perforations which are sometimes found in the stomachs of human subjects. Spallanzani made several experiments upon Dogs and Cats with a similar result. He caused the animals intended for trial to fast for a long time, and then to be fed immediately before being killed. Their bodies were placed in stoves which preserved their natural temperature, and in the course of a few hours he found that the food in their stomachs was sensibly digested.

The chyme, after being slowly formed on the surface of that alimentary mass which the stomach contains, accumulates as it forms near the pylorus or intestinal opening of the stomach. It is raised from this situation into the narrow pyloric entrance, by the increased action of those gentle and almost insensible contractions which it had already experienced. The more violent contractions which are necessary to expel the chyme from the cavity of the stomach, usually originate in the duodenum or small intestine, from which they are transmitted to the pylorus, and thence gradually to the entire stomach. But this ascending movement of the chyme, during which some persons experience much uneasiness, is immediately converted into another movement in the opposite direction; and it is by means of this reaction that the chyme finally traverses the pylorus, which is opened for that purpose, and by the same cause. The movement is repeated, and continues as often as the quantity of chyme newly formed in the stomach requires to be removed. In this way, the duodenum is gradually filled in small quantities at each operation by the food chymified in the stomach. Afterwards the course of the chyme is very slow in the intestines, and the same observation applies to the intestinal movements generally, except when excited by disease or mental emotion.

The fulness of the duodenum favors the secretion of the bile and pancreatic juices as well as of mucus and the intestinal juices. All these new fluids being mixed with the chyme immediately change its nature. It almost wholly loses its acidity; its colour changes from gray to yellow, and it becomes bitter to the taste. This bitterness in some animals extends even to the stomachic product itself, especially in Birds, because the bile often penetrates through the pyloric entrance into the stomach. If the aliments contain fat or oily matters, these substances pass into the intestine without having undergone any alteration in the stomach, but the bile uniting with them, forms a kind of soap, which is easily dissolved. With the exception of herbs, and these fat and oily substances, the duodenum permits all bodies, which the stomach has not previously digested, to pass without alteration. The same elements produce a similar chyme in animals of the same species when in health, and the changes which the chyme afterwards undergoes are equally the same. But the chyme produced

from animal food is thicker and more viscid than that produced from vegetables; it is reddish, and does not curdle milk. Vegetable chyme, on the contrary, is almost fluid; it has a yellowish tinge, and curdles milk. Further, the chyme furnished by vegetables is less rich in nutritious matter, and it wants that albuminous substance, which is found in chyme resulting from animal food. Different kinds of gas are disengaged during the process, but their nature varies according to the species of animal, its age and state of health, the kind of food which is used, and especially according to the part of the intestinal canal from which they proceed.

In a short time after the chyme has descended into the duodenum, and undergone the action of the bile, it divides into two parts. The one is a fluid termed *chyle*, which is the part destined to nourish the animal; the other is more solid and coarse, and less homogeneous, and, being the useless residue of the aliment, is finally rejected.

This separation of the chyle, and even its formation, appear to be more especially due to the influence of the bile; at least it is certain that digestion is always imperfect, and that the chyle is either deficient or in small quantity, when the bile cannot mix with the chyme prepared by the stomach.

Among the greater part of the Mammalia, the time which the chyle takes to form, after the chyme has passed from the stomach into the duodenum, varies from two to four hours. This function is much slower among the Fishes, and still more so with the Reptiles. Well formed chyle has sometimes been found in the white vessels which adjoin the stomach, and it has been said in consequence, that the stomach can form chyle. But this has only been seen in certain animals, whose bile frequently mingles with the gastric juice. The Dog appears to be an instance; but it does not seem to be of frequent occurrence among the Mammalia generally.

“Les excréments,” observes M. Isidore Bourdon, “séparés du chyle qui les sur-nage et dont l’absorption s’opère dans le haut de l’intestin, perdent peu-à-peu, à mesure qu’ils descendent vers les gros intestins, la fluidité qu’ils avaient dans le milieu de l’intestin grêle. Le mucus des gros intestins en favorise la marche vers l’anus, mais les loges que présentent ces conduits de distance en distance, en prolongent le séjour et en accroissent la consistance. C’est par l’action des fibres musculuses des intestins que les excréments sont peu-à-peu poussés vers l’anus, et c’est par les muscles abdominaux qu’ils sont finalement rejetés hors du corps. Cette expulsion résulte d’un mécanisme assez compliqué où la glotte, au moins chez les Mammifères, joue un rôle important. Le rejet des matières fécales est beaucoup plus facile chez les animaux ovipares et dans l’Ornithorrhynque; et cette différence résulte de ce que ces animaux ayant un cloaque, leurs urines s’amassent dans ce lieu aussi bien que les excréments; qu’elles délayent. Les excréments diffèrent pour chaque espèce d’animal; mais la plus grande différence s’observe surtout entre les carnivores et les herbivores. Le même animal, s’il est omnivore, a des excréments très différents, suivant qu’il use d’aliments végétaux ou d’aliments tirés de l’autre règne. Les excréments provenant d’une nourriture animale ont la propriété de faire cailler le lait, et il n’existe rien de semblable pour les fécès des aliments végétaux. C’est absolument le contraire de ce que nous avons dit pour le chyme des carnivores et des herbivores.”

Borden has made several interesting remarks on this subject; the curiosity of an ingenious mind having overcome the natural disgust towards a study so repulsive. The researches of Prout are more precise than those of Borden.

Complicated fluids are digested as well as solids, but a large part of them are absorbed directly by the stomach. Water, alcohol, and other simple fluids, contribute towards nutrition, chiefly by imparting their fluidity to some of the animal bodies.

Those movements of the intestines by means of which they are traversed by the stomachic product, are termed *peristaltic*. There are, however, other movements, which are directed from below, upwards, in the contrary direction, and are hence termed *anti-peristaltic*. These movements produce various phenomena, such as Regurgitation, Rumination, and Vomiting. Among the Mammalia no animal vomits more readily than the Cat; there are, however, few Vertebrated animals which do not possess the power of vomiting. The Horse cannot vomit in ordinary cases, because the situation of the cardia opposes an obstacle to the return of the food towards the œsophagus.

It is ascertained that the chyle separates itself from the alimentary mass, after it has remained for some time in the distended cavity of the duodenum, and that in a short time the bile and pancreatic juices act upon it, although we are ignorant of the precise nature of the operation. With respect to the characters and quality of the chyle, this substance is very plentiful in the Mammalia alone. The chyle is always of an opaque white, which has caused it to be compared to milk. When taken from the body, and left to itself, it separates into two portions; the one is serous and saline, while the other is fibrous, in this respect nearly resembling the blood when similarly treated. If placed in an inert vessel, the chyle usually acquires a reddish tinge, which appears to be owing to the action of the oxygen in the air; and a thick kind of cream forms on the surface. This resemblance of the chyme to milk has led some physiologists to consider the one as the product of the other. One thing is certain, that nothing tends more towards the abundant secretion of milk, in the female, than that plentiful production of chyle resulting from the abundant supply of nutritious food. In other respects, the nature of the food with which the animal is nourished greatly influences the chyle resulting from digestion. Different substances do not produce the same kind of chyle; fat matters produce a chyle which is white, and more opaque than that yielded by substances which are not fat. The chyme never acquires the hue of any colouring matter which may have been introduced into the intestine; and it is even with difficulty that it can be made to acquire an odour.

The chyle, when once separated from the chyme, of which it may be regarded as the extract, floats on the surface of this matter, and accumulates by small rivulets in the mucous valvules, with which the interior of the smaller intestines are supplied. It remains in this place for a few instants, when it is absorbed by the small vessels, which serve to bring it into the mass of the blood. It is impossible to say in precisely what manner, or by what force or mechanism, this absorption of the chyle is effected, and to indulge in conjecture would but lead to certain error. On carefully examining, with the naked eye, the interior of the intestine, at the moment when the chyle is

formed, there may be seen, at the surface of the intestinal membrane, small eminences like spongioles, which appear to erect themselves, and become filled with the fluid. On compressing these spongioles or small projections, the chyle exudes; and when they are examined with the microscope, we may perceive them to be ramified with innumerable small vessels, and their surfaces perforated with minute pores like the point of a needle. These pores are conjectured to be the commencement of the white vessels or lacteals, which carry off the chyle, and that by their means the chyle is gradually pumped out or absorbed at the surface of the intestine. We are entirely ignorant of the nature of that power by which this absorption is effected, but it has been ascertained from experiment, that the chyle penetrates into the lymphatic vessels of the intestine, and traverses the glands of the mesentery; that it is conveyed by proper vessels to the thoracic duct, through which it is finally carried into the blood. Once united to the blood, the chyle experiences the propelling force of the heart, traverses the organs of respiration, and comes in contact with the air always existing in the lungs. We may perceive many points of resemblance between the chyle and blood, in the spontaneous separation of their parts, in the fibrine which they both contain, and in their being similarly affected by oxygen, which colours them both red; and we are fully entitled to conclude that this fluid, arising from the digested aliments, is actually changed into blood during its passage through the organs of respiration, for on leaving the lungs, the chyle has lost all those characters which formerly distinguished it from blood.

As the blood is continually undergoing waste in its contributions towards the formation of the several secretions, as well as the reparation of the organs, this loss must be supplied by the aliment, without which life soon becomes extinct. The digested product of the food being altered in its properties, and completely animalized, finds its way into all the organs of the body, which it renovates and repairs. Thus, an identification of new matter with the former substance of the animal body is finally effected, and this process constitutes the essential part of the function of nutrition. All portions of the animal frame undergo continual changes of dimension, form, and structure, from the first period of their formation, until the body is finally subjected to the ordinary laws of inanimate substances. A part of the elements of which they are composed is incessantly dissipated in various ways, such as by respiration, perspiration, friction, and many others. These losses in the human frame amount to as much as several pounds weight of substance in the course of the twenty-four hours. Without an adequate supply of nutriment, the strength of the animal soon becomes reduced, its bulk diminished, and it finally perishes. There appears to exist a constant internal action, by which all the organs appear to be continually worn away and destroyed, only again to repair themselves, when supplied, through the food, with the proper elements for their composition.

Such are the leading facts hitherto ascertained, relative to the obscure function of Nutrition. The necessity for a supply of food is felt by all animals, yet it is not experienced in an equal degree by all species, nor by animals of the same species, nor even by the same animal when placed in different circumstances. This appetite for food is heightened by youth, fatigue, long-continued want of sleep, by violent passions when the paroxysm has passed, by convalescence after a long illness, by a dry and cold air, and the influence of climates and seasons. On the other hand, old age, prolonged sleep, hibernation, perfect repose, and hot baths, diminish the necessity for food. With the human species, luxurious habits lead to a loss of appetite, while it is heightened by labour; and thus Hunger, which declines the invitation of the opulent epicure, comes an unwelcome guest into the hovels of the destitute.

In general, the carnivorous animals endure a long-continued fast with less inconvenience than the herbivorous. This remark must not be confined to the Mammalia, for it extends to the Birds of Prey, especially to the Eagle, to Serpents, and Spiders, all which animals can remain a very long time without food, and do not appear to suffer from their continued abstinence. On this account they are in general of a more meagre habit of body than such animals as live either on herbs or fruits. There are many instances on record of old Men, but more especially of Women, who have lived for several weeks, some say months, without food. A mad enthusiast who imagined himself to be Christ in person, remained, it is said, during the forty days of Lent without using any food whatever; but confined himself, without swallowing any thing, merely to washing his mouth with water or wine. These instances are not, however, always very well authenticated; and it would be difficult to prove, in this case, that the fanatic did not actually swallow some of the fluid. Moisture, darkness, and repose, tend to diminish the usual effects of abstinence. A dog has remained alive under these circumstances for nearly fifty days without food. Persons of a vivid imagination, as well as frantic madmen, have in general a digestion extremely energetic, and they sometimes consume enormous quantities of food. Idiots also are frequently tormented with a devouring hunger. Next to Sleep, which wholly suppresses this appetite for the time, nothing tends more to drive away Hunger than the long-continued exercise of deep thought.

This appetite for food, which Man is enabled to confine within the bounds of Reason and Temperance, becomes in the lower animals one of the leading principles of action. Indeed, if we except the reproductive principle, and the principle of self-preservation from external danger, there are no others which approach in violence to the appetite for food, especially when heightened by abstinence. To obtain a sufficient supply of nourishment, is the great end, to which a large proportion of the instincts of each animal bear an immediate reference; and we commonly find, that those animals which possess the greatest facility in obtaining a subsistence, have the greater number of enemies to avoid. Such instincts as lead immediately to self-preservation from external danger, are more developed in the Herbivorous animals, than those other kind of instincts which relate more especially to their maintenance; and it is among the Carnivorous animals, whose existence depends solely upon their skillful exertions, that we find the most ingenious devices to deceive and destroy their prey.

The Quadrumana, especially the Monkeys, find an easy maintenance in the fruits of those warm countries, where alone they have fixed their abodes. Secure on the tops of trees, they have few other enemies to avoid than the Serpent tribes, which infest the lower branches. If we except those marauding parties, which they are sometimes

compelled to form, in a great measure they are relieved from the cares which harass most other animals. But the Lemurs, being chiefly nocturnal, prey upon the small Birds and Insects while sleeping upon the branches. The Loris, favored by the darkness, steals upon its reposing victim, with a step so noiseless and excessively slow, that it is enabled to secure its prey with as much certainty as those Carnivora which depend for subsistence upon the extreme rapidity of their movements.

Some of the Chiroptera, such as the Roussette Bats, feed almost wholly on fruits; the remainder pursue the Moths and Gnats which fly about during the summer evenings. A few in South America venture to suck the blood of Man, and of the larger quadrupeds, but their bites are neither deep nor dangerous. During the day, and in winter, they hang securely suspended by their thumb-nails to the roofs of caverns, and other obscure retreats. The Galeopithee, or Flying Cats, by means of their membranes, extended like a parachute, dart from the tops of trees, by parabolic leaps, upon the small birds reposing on the lower branches.

The Insectivora, as their name denotes, feed chiefly on Insects; to these they add Worms, Snails, and tender roots. Some of these animals, such as the Mole, seek out their prey beneath the surface, by long mining operations; others, as the *Scalops Canadensis*, or Aquatic Sbrew, add to their subterranean habits a mode of life almost subaqueous.

The Plantigrada, though omnivorous, differ in their tastes; some, as the Bears, are partial to a vegetable diet, while others, like the Glutton (*Gulo arcticus*), prefer animal food. The latter devours enormous quantities of flesh, and when urged by famine, conceals itself among the lower branches of a tree, from which it watches for an opportunity to leap upon the back of some quadruped passing beneath, whose blood it continues to suck, until exhaustion compels the larger animal to yield to its more cunning enemy.

The numerous genera of Carnivora are compelled, by the sagacity of their prey, and their more exclusive propensity for animal food, to resort to many ingenious devices for obtaining it. With the greater number of these animals, the principle of destruction is so strong, that they will destroy every living animal within their reach, although their hunger may be completely satisfied, so well are they disposed to execute the office of Nature's executioners, in curbing the excessive fecundity of the smaller tribes. Animals of the Genus Felis, such as the Lion, Tiger, and Leopard, never attempt to run down their prey by swiftness. Their sense of smell being somewhat obtuse, they rather seek to conceal themselves in a thicket near those places where the herbivorous animals come to drink, and spring upon their prey by one, or at most two or three bounds. If unsuccessful, which seldom happens, they retreat to their covert, or remove to a more favorable spot. On the other hand, the Genus Canis, such as the Jackal and Wolf, are skilful in tracking their game, which they run down by perseverance, or overcome by force of numbers. These animals, with the Hyena, do not refuse carcases, though in the last stage of decay, and disinter human bodies from the sands of the African deserts, or the cemeteries of the East. The Adives collect during the night, like bands of robbers, around the tents of the Moors or the Bedouin Arabs, who remain in momentary expectation of an attack from these ferocious brigands. The "Jaekals' shriek," which is re-echoed by the distant hills, their voracity, and formidable numbers, strike the wanderer with terror; and when once accustomed to human flesh, they cannot enjoy any other. They will assemble at night to the number of two or three hundred, for the purpose of attacking caravans. At their frightful clamour, the Antelope and other herbivorous animals are roused from their coverts, and take to flight, when they fall, perhaps, into the ambuscado of some Lion or Leopard, while the band of Adives witness the success of this other brigand with jealous eyes, and are left only to dispute the mangled remains of the feast.

The Amphibia feed chiefly on fish, which they always devour in the water; though some species seem capable of living occasionally on Fuci.

Those instincts of the Rodentia which refer to their self-preservation from external danger, are more remarkable than any others. No animals are so skilful in forming subterranean retreats, which are usually executed by the combined labour of an entire settlement. One individual props up the earth which threatens to fall, another divides a large cavity into apartments, and a third forms a water-proof roof, with a layer of clay, to preserve the entire dwelling from the rain. One apartment is destined for the nursery, another for the granary. Here these animals amass, during the latter part of the autumn, a plentiful supply of provisions, and they find, on waking in the spring from their long winter sleep, that maintenance which would otherwise have completely failed them, until the returning autumnal fruits and grains again permitted them to amass another hoard. The Squirrels accumulate hazel-nuts, or the cones of the pine; the Dormouse gathers acorns and kernels; the Marmot seeks for different roots; and many species of Rats select bulbous roots in particular. Other species penetrate into our granaries and storerooms, composing a kind of vermin, which nothing can entirely extirpate.

Among the Edentata, the Tardigrada or Sloths feed chiefly on the leaves of trees, while the proper Edentata, such as the Armadillo, prefer insects and carcases, though they all seem on an emergency to be likewise capable of digesting vegetable food. None of these animals ruminate. The Sloth is enabled to endure a long-continued fast without inconvenience, and it never drinks, being supplied only with Vegetable fluids. Prevented by its singular organization from any rapid movement, the Sloth devours every soft part of the tree within its reach, commencing with the leaves, and following on with the buds, tender shoots, and bark, until the whole tree is left entirely bare. Here the animal remains motionless and without eating for many days, until extreme hunger finally compels it to seek for food. Rolling itself in a ball, and falling heavily from the branches upon the ground, it crawls with measured pace to the nearest tree. The Armadillo burrows under ground into the numerous Ant-hills of South America, and the larger species frequent the neighbourhood of burying-grounds in great numbers. By means of subterraneous excavations, they invade the graves of the inhabitants, unless carefully protected by boards from their incursions.

The three tribes of Marsupialia present a great variety in their tastes for food. Among the Didelphida we find a strong partiality for animal food of every kind, yet

they do not refuse fruits. Some live chiefly on the eggs of Birds, or on Crabs and Insects. Others devour carcasses, and even venture to make unwelcome visits into the houses of the Americans in search of food. The Macropoda, on the other hand, live almost wholly upon herbs or fruits. Of the Monotremata, the one Genus (*Echidna*) appears to feed, like the Hedgehog, upon land Insects and fruits; the other (*Ornithorynchus*) upon aquatic Insects, Worms, and Mollusca.

The Pachydermata being in general of great bulk, are obliged, by their organization, to feed chiefly on vegetables, while some of the smaller species, such as the Hog, seem almost omnivorous. The larger species find their food either among the trees of the forest, or in the marshes bordering on large rivers; the smaller generally seek with their snouts for the coarser kinds of fruit which fall from the trees, and lie concealed beneath the surface of the soil. All the Solpoda are essentially herbivorous.

Among the Ruminantia, the taste for food is wholly limited to the vegetable kingdom. The Camels, whose callous feet are well adapted to the sandy soil of Arabia, find in these Deserts a scanty herbage of prickly trees or shrubs; for this purpose their gums and tongue are almost cartilaginous, as a protection against the spinous processes of their food. The Rein-Deer, which is the sole sustenance of the Laplanders, Samoiedes, and Jakutes, scratches the snow for a supply of Lichens and Mosses, which is sufficient for his support. On the other hand, in the sultry plains of Ethiopia, the colossal Camelopard pastures on the foliage of the highest trees. The Ox and the larger Cattle feed on the rich herbage of the plains; some of the smaller, such as the Sheep and Goats, are satisfied with the more stunted plants of mountain regions.

The Herbivorous Cetacea feed in numerous herds on the marine vegetables accumulated at the mouths of rivers, as well as on the terrestrial herbs which float down the streams. Some, however, confine themselves to Fuci. The proper Cetacea are chiefly carnivorous, preying upon Fishes and Mollusca. Some, as the Dolphin, do not refuse vegetable substances; while others, as the Grampus (*Delphinus gladiator*) and Narwhal (*Monodon monoceros*), carry on a deadly warfare against the very largest Fishes, and even upon their own order. Combining together in troops, they do not hesitate to attack the great Whale, apparently for the sole purpose of devouring his tongue, for which the Narwhals seem to have a great partiality, leaving the remainder of his enormous body as a prey for epicures of a lower grade.

In general, animals of the class Mammalia seek their food separately, or in company, in which cases each individual labors for himself alone. It is only in a few species, such as the Beaver, Hamster, and Economic Mouse, all of which construct dwellings of great complexity, that each individual assists in accumulating a common hoard. In this arrangement we see one of the simplest states of society, where there exists community of goods, without any permanent division of labour. It is in Man alone that the Mechanic becomes distinguished from the Agriculturist.

Thus the Mammalia derive their subsistence from all inferior classes of living beings, as well as from their own; and hence they exert a very great influence in regulating the numbers of all other animals, and in establishing a universal equilibrium among living beings in general. The earth, destitute of herbivorous animals, would soon be covered with a rank and dense vegetation. A few luxuriant species of herbs would wholly engross each Botanical province, and annihilate all others. Hence the herbivorous animals are requisite to curb the exuberance of the Vegetable Kingdom; but as the herbivorous animals themselves would multiply, in their turn, to an inconvenient degree, even so far as to devour all plants to their very roots, the carnivorous animals are created to restrain the excessive multiplication of the herbivorous tribes, and thus become the indirect, yet necessary, allies of the Vegetable Kingdom.

In respect to the kind of food which is most suited to each animal, and the relative facility with which different substances are digested, these are questions which apply chiefly to Man. Each wild animal only uses that kind of food which is best suited to it; and its aliments are consequently very much restrained in their number. But Man is omnivorous, every kind of aliment can be rendered suitable to him, and he does not scruple to avail himself even of those which are most prejudicial to his health.

In all species of wild animals, and in some which have been domesticated, we perceive a most remarkable caution in avoiding such kinds of food as are deleterious to them. Nature commonly imparts a special instinct to each animal, in those cases where the ordinary processes of knowledge by experience would arrive too late to ensure the desired effect. "In looking at a pastured field," says Dr Fleming, "we observe that there are some plants which are left untouched, while others are cropped to the ground. But as the tastes of animals in this respect are exceedingly various, we observe that what is left untouched by one species is greedily devoured by another. What is eaten by the Goat, for example, with avidity, and with impunity by the Horse or Sheep, as the Water Hemlock (*Cicuta virosa*), is certain poison to the Cow. Hence it has been called Water-Cowbane, and we have heard a Fifehire farmer, with a sigh, which intimated his experience of its effects, call it 'deathen.'" Cantharides, if taken by the Dog in a very small quantity, produce convulsions and death; yet the Hedgehog, being chiefly insectivorous, devours with impunity these poisonous insects.

Domestication exercises a certain influence over those instincts which lead animals to discriminate between nutritious and poisonous food, for some species are observed to lose, when long domesticated, that instinctive aversion to deleterious substances, so necessary for their preservation in the wild state. Dr Fleming remarks that Cows, which have been kept within doors during the winter, and supported chiefly on dry food, when turned out to pasture in the spring, devour indiscriminately every green herb, and frequently suffer for their indiscretion. Linnaeus relates in his *Lacchesis Lapponica*, that when he visited Tornea, the inhabitants complained of a distemper which killed multitudes of their cattle, especially during spring, when turned out into a meadow in the neighbourhood. He soon traced the disorder to the Water Hemlock which grew plentifully in the place, and which the cattle did not know how to avoid. In the Orkney Islands, the Fox-glove becomes fatal to the Goslins, when first turned out into the hills to pasture. It is probable that, in a wild state, this instinct remains unimpaired, and directs them invariably to avoid those substances which are unsuited to their digestive organs.

Civilized Man appears to have lost, in a greater degree than any other animal, this

power of discriminating between noxious and nutritious food. By means of the art of Cookery, which he alone knows how to employ, numerous substances, though in their natural state they may be nauseous to the taste or even poisonous, are rendered highly nutritious; and thus the original properties of substances become disguised or neutralized in endless variety. Habit soon modifies his taste; and Man, being now left to the suggestions of Reason, is denied that instinctive power of discrimination which the wild animals so largely enjoy.

Many interesting facts relative to the comparative facility with which different substances are digested, have been elicited from numerous experiments made on Man and the other Mammalia.

Milk being a fluid peculiar to the Mammalia, is, of all substances, the most nutritious to them. This proceeds from its containing the three ingredients essential to a perfect regimen. "All other matters appropriated by animals as food," observes Dr Prout, "exist for themselves, or for the use of the vegetable or animal of which they form a constituent part. But Milk is designed and prepared by Nature expressly as food; and it is the *only material*, throughout the range of organization, that is so prepared. In Milk, therefore, we ought to expect to find a model of what an alimentary substance ought to be—a kind of prototype, as it were, of nutritious materials in general. Now, every sort of Milk that is known is a mixture of three staminal principles; that is to say, Milk always contains a *saccharine* principle (sugar), a *butyraceous* or *oily* principle (butter), and a *caseous*, or, strictly speaking, an *albuminous* principle (cheese). Though in the milk of different animals these three principles exist in endless modified forms, and in very different proportions, yet none of the three is at present known to be entirely wanting in the milk of any animal."

It has been remarked, that the following kinds of aliment are the most digestible for Man:—beef, mutton, veal, lamb, and chicken; fresh eggs when half boiled, the milk of the Cow, Mare, Ass, Camel, and Goat; several kinds of Fish, when seasoned only with salt and parsley, but if used with oil or dripping, they are less digestible. Those vegetable substances easiest to digest are spinach, celery (chiefly the root), young asparagus, hop-buds, the plectra of artichokes, the boiled pulp of fruits with stones or pippins, especially if they be sweet and aromatic; the farinaceous seeds of the Cereal plants, wheat, rice, peas, &c.; bread on the day after it is baked, but especially stale bread, and chiefly white bread; turnips; new potatoes; and gum-arabic.

The following substances are less digestible:—the flesh of pork, the different kinds of raw salad, cabbages, beet, onions, carrots, horse-radish, warm bread, figs, pastry, fried fish, and seasonings with vinegar or oil. The stomach can attack these substances but imperfectly; and that digestion which it is unable to accomplish is finished in the intestine.

Finally, we may mention as the most indigestible substances, the tendinous and cartilaginous parts, and especially the membranes of beef, pork, veal, fowls, &c.; bones, even when minutely divided; fat and oily substances; the white of egg hardened by heat; mushrooms; truffles; oily seeds, such as walnuts, almonds, pistachia nuts; the pippins of raisins, apples, &c.; olives; cocoa; the different oils; raisins; grape-skins; the epidermis, or outer skin of different seeds and fruits; the skins of peas; the bark of different trees; and many emulsive and ligneous grains. These last-mentioned seeds undergo so little change from the action of the stomach, that they germinate without difficulty on leaving the intestine. In this way many Plants are disseminated from one country to another.

There are several substances which serve to facilitate digestion, when mixed in small quantities with the food. The Ruminantia cannot exist without a supply of salt; and Man experiences, with advantage, the moderate use of spices, wine, liqueurs, cheese, sugar, and some bitter substances, particularly the products of the Cashew nut.

Numerous other substances are in an eminent degree prejudicial to digestion, and produce a more marked effect; such as the acids, Peruvian bark when taken after a repast, and the several emetics and poisons, in however small a quantity they may be used. Seditary habits, excessive mental exertion, or violent emotions, also disturb or retard the function of digestion. Water, particularly when warm, if taken in large quantities after a meal, occasions the aliments to leave the stomach before they are digested.

It is by means of a well-regulated regimen, that Man and the domesticated animals are brought to the state of the highest possible health. Race-Horses, Greyhounds, and Fighting-Cocks, as well as Boxers, Racers, and other Athlete, acquire by this means an extraordinary increase of physical force, and are enabled to continue their exertions for a very long time. This training of Men to athletic exercises produces surprising improvements in their external appearance. Their appetite is improved by this means, and digestion rendered more perfect. Giddiness of the head, after violent exertion, never occurs. The skin becomes clear, smooth, and well-coloured, and the veins are seen distinctly through it. The bones get harder and rougher; they therefore become less liable to injury from blows and exercise, while the shape is improved. But the most important effects of training are upon the lungs, which acquire a free and powerful respiration, without which no animal can long maintain a vigorous action. The mental powers are also said to become improved; the attention is more ready and the perceptions more acute. These important effects are produced by temperance without abstemiousness, and regular exercise in the open air. "By these processes," says Sir John Sinclair, "the nature of the human frame is totally changed, and in the space of two or three months, the form, the character, and the powers of the body, are completely altered from gross to lean, from weakness to vigorous health, and from a breathless and bloated carcass to one active and untiring. Thus the very same individual, who but a few months before became giddy and breathless on the least exertion, has his health not only improved, but is enabled to run thirty miles with the fleetness of a Greyhound; or, in a shortness of time hardly to be credited, to walk above a hundred; or, varying the object in view, to excel in wrestling, or to challenge a professed boxer. The mind also becomes more courageous, corporeal sufferings are borne with patience; a command of temper, and a presence of mind, are also acquired and preserved undisturbed amidst pain and danger." It

appears that these important results of training are produced by the most simple means, which every man may practise to a certain extent; general ill health might thus be commonly prevented, and many diseases wholly removed.

It will be seen, from the preceding outline, that by far the greater number of Mammalia exist upon more than one kind of food; and even in those species which are more especially restricted to an animal or vegetable diet, a certain degree of variation from their ordinary habits is allowed to them, by means of which they can subsist in unusual situations. Thus the Squirrel will sometimes devour Birds, and the Marten and Pole Cat can subsist upon fruits. Domestication tends greatly to produce this omnivorous habit, yet there are some instincts connected with the food of animals which it fails to overcome. The Dog continues to hide his food, though fed regularly and plentifully; and civilized Man pursues the wild game with alacrity, although hunting has long ceased to be necessary to his subsistence.

When the numbers of herbivorous animals are not kept down by other tribes, or when the carnivorous species fail in finding their prey, food begins to fail, and no resource remains to the famished animals but Migration from their native haunts. Excessive changes of temperature may be the ultimate causes of these migrations, by occasioning the destruction of those insects or plants from which the animals derived their maintenance. The Mammalia are, however, in general sufficiently protected by their covering of hair or blubber from the changes of the seasons. They seek for shelter beneath the surface of the earth or sea, perhaps they sleep or hibernate. But when animals are threatened with famine, either by a season excessively favorable to their multiplication, or any other cause, and their provisions in consequence suddenly become scarce, a simultaneous movement is the certain consequence. Migrations occurring in spring seem to owe their origin chiefly to this scarcity of provisions arising from an excessive population. Dr Richardson informs us that the Black Bears of America migrate from Canada into the United States in very severe winters; but in milder seasons when they have been well fed, they remain and hibernate in the North. Among some of the sociable Mammalia, the force of hunger, the confidence arising from the example of their fellows, and the excitement of the Social impulse, urge even the feeble and more timid animals to attempt migrations on the greatest scale of magnitude, and fraught with the highest danger to themselves. The common Squirrels, compelled by a scarcity of provisions to desert their abodes, migrate from Lapland into lower latitudes in amazing numbers. Onwards they travel in a direct line, nor do rocks, forests, the deepest ravines, or the broadest waters, disturb the invariability or impetuosity of their course. Numbers are drowned in passing large firths and rivers, or fall a prey to their numerous enemies. The Lemmings of Norway and Sweden often pour down in myriads from the mountains of the North and devastate the country. They move generally in lines, about three feet from each other, and exactly parallel. The general direction of their march lies from north-west to south-east, and they pass directly onwards through rivers and lakes. When stacks of hay or corn interrupt their passage, they gnaw through them instead of passing round. Pennant relates, that the Rats of Kamtschatka becoming too numerous at the commencement of Spring, proceed in great bodies westward, swimming over rivers, lakes, and arms of the seas. Many are drowned or destroyed by Water-fowl or Fish. As soon as they have crossed the River Penchim, at the head of the Gulf of the same name, they turn southward, and reach the rivers Judoma and Ochot by the middle of July, a district surprisingly distant from their point of departure.

Mr Lyell has correctly observed, that the large Herbivorous animals which are gregarious, can never remain long in a confined region, as they consume so much vegetable food. The immense herds of Bisons, which often blacken the surface, in the great valley of the Mississippi, near the banks of that river and its tributaries, are continually shifting their quarters, followed by Wolves, which prey on the rear. "It is no exaggeration," says Mr James, "to assert, that in one place, on the banks of the Platte, at least ten thousand Bisons burst on our sight in an instant. In the morning we again sought the living picture, but upon all the plain, which last evening was so teeming with noble animals, not one remained." Vast troops of Dziggai, which inhabit the mountainous deserts of Great Tartary, feed during the summer in the tracts East and North of Lake Aral. In the autumn they collect in herds of hundreds, and even thousands, and direct their course towards the North of India, and often to Persia. Bands of two or three hundred Quaggas are sometimes seen to migrate from the tropical plains of Southern Africa to the vicinity of the Maldeveen river. During their migrations they are followed by Lions, who slay them nightly. Myriads of Springboks or Cape Antelopes pour down like a deluge upon the cultivated regions near the Cape, when the stagnant pools of the immense deserts south of the Orange River dry up, which often happens after intervals of three or four years. The havoc committed by them resembles that of the African Locusts; and so crowded are the herds, that the Lion has been seen to walk in the midst of the compressed phalanx with only as much room between him and his victims, as the fears of those immediately around could procure by pressing outwards.

There are certain secluded spots in the neighbourhood of Melville Island, which are visited annually by herds of Musk-Oxen and Rein-Deer; during the short summer of the arctic regions, various plants put forth their leaves and flowers the moment the snow is off the ground, forming a carpet, spangled with the most lively colours, and these animals travel over immense distances of dreary and desolate regions, to graze undisturbed in these luxuriant pastures.

Mammalia which frequent the ocean, like the Whales and Seals, or the air, like the Dats, possess unusual facilities for executing these periodical migrations. The Whales of the Northern Seas are known to desert one tract of sea and visit another at a very remote distance. The Seals, according to Krantz, retire from the coasts of Greenland, in July, return again in September, and depart again in March, to return in June. They proceed in great droves northwards, directing their course where the sea is most free from ice. This migration of the Seals must, however, proceed from some other object than a mere search for food, as they are observed to be very fat when they set out on this expedition, and very lean when they come home again. The Great Bat (*Vespertilio noctula*) visits England during the summer, but retires in winter to Italy, where it hibernates.

The daring manner in which Land animals attempt to cross large tracts of water is an immediate consequence of the urgency of their wants. "Rivers and narrow firths," says Mr Lyell, "can seldom interfere with their progress, for the greater part of them swim well, and few are without this power when urged by danger and pressing want. Thus, among Beasts of Prey, the Tiger is seen swimming about the islands and creeks in the Delta of the Ganges, and the Jaguar traverses with ease the largest streams in South America. The Bear, and also the Bison, stem the current of the Mississippi. To the Elephant in particular, the power of crossing rivers is essential in a wild state, for the quantity of food which a herd of these animals consumes, renders it necessary that they should be constantly moving from place to place. The Elephant crosses the stream in two ways. If the bed of the river be hard, and the water not of too great depth, he fords it; but when he crosses great rivers, such as the Ganges and the Niger, the Elephant swims deep, so deep that the end of his trunk only is out of the water—for it is a matter of indifference to him whether his body be completely immersed, provided he can bring the tip of his trunk to the surface, so as to breathe the external air. Animals of the Deer kind frequently take to the water, especially in the rutting season, when the Stags are seen swimming about in search of the Does, especially in the Canadian lakes; and in some countries where there are islands near the sea-shore, they fearlessly enter the sea and swim to them. In hunting excursions in North America, the Elk of that country is frequently pursued for great distances through the water."

Without this power of shifting their quarters, a far greater number of animals would have become extinct than has occurred under their present constitution. The mutual action and reaction of species is the necessary consequence of these general laws of Nutrition, by which all Living Beings are governed. Individuals maintain their existence for days or years—species for centuries and ages. Each arrives at its termination when its resources wholly fail, from the influence of surrounding causes of change, and it is to their mutual struggles for subsistence we owe that equilibrium of animal forces which is found to prevail in all parts of the globe. In every place it is decreed that the demand for food shall bear a determinate ratio to the supply, and Nature never hesitates to deal indiscriminate destruction on all individuals or species which transgress this law.

It is evident from the mutual dependence of animals upon each other and upon plants, that the creation of certain species has preceded that of others in the order of time. Vegetables must have become numerous upon the earth before the Frugivorous tribes made their appearance; while the Herbivorous animals must have multiplied upon the earth, and become widely distributed, previous to the institution of predaceous types. The phenomena of nutrition thus clearly point out that the creative power has been exerted successively, and probably at remote periods of time—a conclusion which is fully confirmed by the investigation of Fossil Remains.

The mutual reaction of Animals upon each other, and upon Plants, follows necessarily from the limited duration which is allotted to the existence of individuals and species. Had Living Beings not been subject to Death, there would have been no reproduction; the checks to reproduction would not have existed; in a word, there would have been no activity, no prey to pursue, no enemies to avoid—no mutual reaction, in short, Life would lose that stamp of animation which marks its phenomena so distinctly from those of Inorganic Nature. The liability of Animals to Death is thus the ultimate cause of their greatest enjoyments and sufferings.

"The law of universal mortality," observes Dr Buckland, "being the established condition on which it has pleased the Creator to give being to every creature upon earth, it is a dispensation of kindness to make the end of life to each individual as easy as possible. The most easy death is proverbially that which is least expected; and though, for Moral reasons peculiar to our own species, we deprecate the sudden termination of our mortal life, yet, in the case of every inferior animal, such a termination of existence is obviously the most desirable. The pains of sickness and decrepitude of age are the usual precursors of death, resulting from gradual decay; these, in the human race alone, are susceptible of alleviation from internal sources of hope and consolation; and give exercise to some of the highest charities and most tender sympathies of human nature. But throughout the whole creation of inferior animals no such sympathies exist: there is no affection or regard for the feeble and aged; no alleviating care to relieve the sick; and the extension of life through lingering stages of decay and old age would to each individual be a scene of protracted misery. Under such a system, the natural world would present a mass of daily suffering, bearing a large proportion to the total amount of animal enjoyment. By the existing dispensations of sudden destruction and rapid succession, the feeble and disabled are speedily relieved from suffering, and the world is at all times crowded with myriads of sentient and happy beings; and though to many individuals their allotted share of life be often short, it is usually a period of uninterrupted gratification; whilst the momentary pain of sudden and unexpected death is an evil infinitely small, in comparison with the enjoyments of which it is the termination.

"To the mind which looks not to general results in the economy of Nature, the earth may seem to present a scene of perpetual warfare and incessant carnage; but the more enlarged view, while it regards individuals in their conjoint relations to the general benefit of their own species, and that of other species with which they are associated in the great family of Nature, resolves each apparent case of individual evil into an example of subserviency to universal good.

"The appointment of death by the agency of Carnivora, as the ordinary termination of animal existence, appears therefore in its main results to be a dispensation of benevolence; it deducts much from the aggregate amount of the pain of universal death; it abridges and almost annihilates throughout the brute creation the misery of disease and accidental injuries, and lingering decay; and imposes such salutary restraint upon excessive increase of numbers, that the supply of food maintains perpetually a due ratio to the demand. The result is, that the surface of the land and depths of the waters are ever crowded with myriads of animated beings, the pleasures of whose life are co-extensive with its duration; and which, throughout the little day of existence that is allotted to them, fulfil with joy the functions for which they were created. Life to each individual is a scene of continued feasting in a region of plenty; and when unexpected death arrests its course, it repays with small interest the large debt

which it has contracted to the common fund of animal Nutrition, from whence the materials of its body have been derived. Thus the great drama of universal life is perpetually sustained; and though the individual actors undergo continual change, the same parts are ever filled by another and another generation; renewing the face of the earth, and the bosom of the deep, with endless succession of life and happiness."

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

The internal functions of the Mammalia in harmony with the revolutions of the Earth, and the laws of inanimate Nature—General Relations to Light, Heat, and Electricity.

It has already been shown, that the dimensions and forces of animals bear a certain determinate relation to the circumstances of their conditions;—that the Creator has organized them so as to correspond accurately with their intended habitations. When an aquatic animal removes permanently to the air or earth, it receives an organization suited to that change. The Frog is assigned the characters of a Fish while in its Tadpole state, and acquires those of a Reptile when it is designed also to reside upon the land. But this correspondence of animals to the circumstances of their condition is not confined merely to the media, whether air or water, in which they are intended to move; for their forces also bear a determinate relation to the earth, considered Mechanically as a mass of matter, or Astronomically in its relation to the other bodies of the Solar System.

The dependance of all animal motions upon the attractive force of the Earth is sufficiently obvious. Each animal body is acted upon by Gravity, in proportion to its mass; in other words, it possesses weight; and in order that animals may exercise the power of moving, it is necessary that their forces shall bear a certain relation in excess to that of gravity, otherwise no motion could follow. Their forces must also be proportioned to the resistance which gravity offers to their exertions, or else animals would lose their balance, their motions would proceed by jerks; at one time they would endanger their own safety by an excessive rapidity, at another by an excessive slowness; in all they would be devoid of grace, energy, and convenience. Animals would come into collision with other animals, or with harder substances than their own bodies; and this globe of Earth, like a machine out of order, would soon lie in a state of inactivity and disorganization.

Mr Whewell remarks, that if the force of gravity were increased in any considerable proportion at the surface of the earth, all the swiftness, and strength, and grace of animal motions must disappear. If, for instance, the earth were as large as Jupiter, gravity would be eleven times what it is; the lightness of the Fawn, the speed of the Hare, the spring of the Tiger, could not exist with the existing muscular powers of those animals; for Man to lift himself upright, or to crawl from place to place, would be a labour slower and more painful than the motion of the Sloth. The density and pressure of the air, too, would be increased to an intolerable extent, and the operation of respiration and others which depend upon these mechanical properties, would be rendered laborious, ineffectual, and probably impossible. If, on the other hand, the force of gravity were much lessened, inconveniences of an opposite kind would occur. The air would be too thin to breathe; the weight of our bodies, and of all the substances surrounding us, would become too slight to resist the perpetually-occurring causes of derangement and unsteadiness: we should feel a want of ballast in all our movements. Things would not be where we placed them, but would slide away with the slightest push. We should have a difficulty in standing or walking, something like what we have on ship-board when the deck is inclined; and we should stagger helplessly through an atmosphere thinner than that which oppresses the respiration of the traveller on the tops of the highest mountains.

The force of gravity depends upon the mass or quantity of matter in the Earth. For any reason that we can discover, this globe might have been as large as Saturn or Jupiter, its mean density might have been that of cork or of gold, in any of which cases the force of gravity would have been very different from what it is at present; and we can easily imagine, that if every thing were seven times as heavy, or one-seventh lighter than it actually is, animals could not exist in their present state. The Moon and Planets all differ in size and density from the Earth, and from each other; and in general, the smaller seem to be nearest to the Sun, for our imperfect gaze fails to discover the lesser bodies which probably exist in the outward regions of the Solar System. For this reason, the inhabitants of other globes must be so different from ours, as to render it almost impossible for us to form any conception of their nature.

Thus the Earth is not only the common source whence Animals and Plants derive their subsistence, but it is the common source of all animal motions, not only in the reaction offered by its inertia, but in the looseness of that invisible tie which connects our bodies to its surface. Our relations to the earth are not even confined to the surface, but extend to those remote depths which the miner and geologist contemplates only in imagination; and every particle of matter towards the centre exercises an influence in proportion to its magnitude. The intimate relation of the Earth to the inhabitants of its surface, has led all ages to regard it as the common mother of all; and nations have been proud to consider themselves *αὐτόχθονες* (*autochthones*), or sprung from "the dust of the earth,"—their native soil.

It is, however, in the great phenomena of Astronomy, in those revolutions of the heavenly bodies which have served to mark the epochs of time, that we perceive the more astonishing, because more unexpected, correspondence between these remote phenomena, and the periodical functions of organized beings.

The diurnal revolutions of the globe are always performed in the same time, being that which elapses between the appearance of a star on the meridian until it again returns to the same meridian. This regular and constant movement, constituting a sidereal day, forms the unit or measure of time, and gives rise to the periodical changes of Day and Night. All animals and plants, which decorate the surface of the earth, partake in this revolution around its axis, and to this phenomenon all functions of animals, depending upon the presence or absence of Light, such as Sleeping and Waking, Hunger, states of Exertion or Repose, bear an immediate reference. The internal clock-work of the animal frame has been made to run for twenty-four hours,

when the same states of the animal frame succeed each other in the same order, and in exact conformity with the revolutions of the globe.

Besides this diurnal period of the animal clock-work regulated by the diurnal revolution of twenty-four hours, there also exist periodical functions referring to divisions of weeks and months, as the epochs of menstruation, also the incubations of Birds, which may endure for two or three weeks, and the gestations or internal incubations of the Mammalia, extending from three weeks to nine or eleven months.

The year, or period of the Earth's revolution round the Sun, is the most important astronomical phenomenon in reference to organized beings. It is felt through every portion of animated Nature; it measures the great epochs of their existence, and forms the limit of duration to a multitude of animals of the Class of Insects in particular, and of Plants. All their functions are distributed in reference to the periods of the year. The annual species are born in the Spring, the Summer becomes the period of their puberty and reproduction, their fruits or productions appear in Autumn, and they die on the approach of Winter. Man, and the other persistent beings, from the Mammalia to Trees and Herbs, experience more or less the influence of the seasons over their physiological functions.

Spring, being the morning of the year, is favorable to births and bodily growth; it is in fact the period of youth, expansion, and gaiety. Experience proves that the human frame then undergoes, like Plants, its highest degree of growth and development.

Summer, analogous to mid-day, is the season of heat, ardour, strength, and the highest development of the faculties. It corresponds with the age of puberty, and the impetuosity of the passions. The rutting period, with most animals, happens towards the summer solstice.

Autumn is the evening of the year. Plants then yield their fruits, they afterwards become ligneous and dry, and finally fade away. Animals, after performing the act of generation, cast their hair, skin, or feathers, and undergo that moulting which strips them of their more gaudy attire. This is the epoch when the faculties become concentrated, a period of melancholy and sadness. Vegetation ceases, and plants in general lose their foliage.

Winter, the cold night of the year, renders the vegetable world dormant, and especially the cold-blooded animals. It is the season of repose, of nutrition, and internal repair, preparatory to future action. Animal bodies become inert, moist, and phlegmatic. Life is rendered at this period almost stationary and nullified; it remains either in a state of concentration, or in absolute torpidity.

Thus, besides the nycthemeral periods, or diurnal revolutions, which regulate the daily functions of existence, the crises of maladies, the hours of repast or excretion, we have monthly periods of gestation and incubation, menstruation, rutting, and moulting, corresponding to the flux and reflux of the tides, to the periodical winds of the tropics, and the revolutions of the Moon. Again, the annual periods fix a limit to the lives of all annual and biennial species, and determine the periods of their growth, the metamorphoses of Insects, with the phenomena of reproduction and decay among most animals.

Thus the revolutions of our globe, and its relative situation to the heavenly bodies, maintain the circles of our existence in equilibrium with them. A philosophical Astrology may read our lives and destinies in the stars, which move in their curvilinear orbits by the same force that urges all Living Beings onwards in their physiological periods. Time, measured by the successive revolutions of our planet, draws onwards all the generations of Plants and Animals which decorate its surface; it marks the fatal hour to each individual, as it brings round the periods of love and the necessities of nutrition. The fetus of animals and the fruits of vegetables arrive to maturity at the appointed period. Each species of Mammalia has its fixed time of gestation, sufficient for the proper elaboration of the fetus, which period may, however, sometimes vary by a few days in proportion to differences of food, temperature, or the season of the year. Minerals, on the other hand, are only moved by general impulses, without each of them partaking in a special activity. With them no period of time marks out their duration, whilst, with us, each pulsation of the heart, and every second of time, urges us onwards in the vital career, without the possibility of avoiding or retreating.

The well-being of most animals is intimately connected with the degree in which they conform all their habits and functions to the periods of day and night. This is most remarkable in Man, who in all ages has his fixed periods of the day and night for food and repose, and this regular circle of actions has a direct reference to his internal constitution, and independent of mere external stimuli. "In the voyages recently made into high northern latitudes, where the Sun did not rise for three months, the crews of the ships were made to adhere, with the utmost punctuality, to the habit of retiring to rest at nine, and rising a quarter before six, and they enjoyed, under circumstances the most trying, a state of salubrity quite remarkable. This shows that, according to the common constitution of such Men, the cycle of twenty-four hours is very commodious, though not imposed on them by external circumstances." Some Men are naturally *nyctalopes*, or night-eyed, such are Albinos and white Negroes, Dondos or Blafards, which cannot endure the full blaze of daylight.

Among the Quadrumana, several Howling Apes (*Myectes seneculus* and *Beelzebub*) are either nocturnal or at least crepuscular, preferring the twilight of the morning and evening for their time of feeding and exertion. It is the same with certain Makis, who have thence derived their name of *Lemur*, from their haunting the twilight like the shades (lemures) of the departed.

The Cheiroptera or Bats, especially the Genus *Noctilio*, with the Galeopithecii or Flying-Cats; the Insectivora, such as the Hedgehogs, Shrews, and Moles; the Plantigrada, such as the Bears and Badgers; also the entire genus of Cats; the Weasels, Polecats, and many Opossums, are strictly nocturnal; and this quality seems eminently appropriate to all those Carnivora or Marsupialia, which watch for their prey, and endeavour to surprise them while sleeping. Like assassins and brigands of our own species, they bury themselves in silence and obscurity to render their blows the more deadly.

We find many crepuscular or semi-nocturnal species among the Rodentia, which

move in obscurity through fear of their enemies. Thus, the Rats, Dormice, and Hares, come from their retreats in the evening, or very early in the morning.

The Edentata, such as the Armadillos, Ateaters, and Manis, are also nocturnal, through timidity and their want of offensive arms.

The Pachydermata and Ruminantia, on the contrary, feed only during the day. With all these animals, the remaining part of the twenty-four hours is devoted to sleep and repose. Crepuscular feeders sleep partly during the night and partly during the day, while diurnal sleepers are nocturnal feeders, but in all cases the same round of functions succeeds in equal periods of twenty-four hours.

The time selected by each animal for its period of food or repose is capable of undergoing much modification, from the presence or absence of particular stimuli, such as the different states of the air, the states of electricity, moisture, and heat, at the several periods of the day and night. The presence or absence of Light and Heat seems chiefly to regulate the periods of activity and repose in all animals. The Day being warmer than the Night, tends to establish in some of the bodies a movement towards the surface,—a period of waste and destruction of force,—the Night with this is devoted to a reparation and accumulation of energy.

The dependance of certain functions of animals upon the presence or absence of Light, becomes more perfect when any particular formation of their visual organs specially marks them out for enduring Light of different degrees of intensity. When animals run into white varieties, as may often be observed in white Negroes, Albinos, white Rabbits, Mice, Dogs, Cats, Pigeons, and many others, their eyes are commonly red; and these organs then become so acutely sensible to light, that they are unable to support the full blaze of day; but at the same time, they can see much more clearly in twilight than individuals which have not experienced this degeneration.

The cause of this extreme sensibility in their visual organs is completely ascertained. If we examine the inside of the Sclerotica and Iris, which commonly form the obscure chamber of the eye, we shall find in the leucose individuals, that these membranes are deprived of the black or brown pigment which is designed to defend the eye from the rays of Light, except at the transparent aperture of the pupil. The retina being thus insufficiently defended against the luminous rays, becomes easily dazzled in bright daylight, but receives a sufficient number of rays in the twilight for the animals to see clearly. An opposite effect is produced in black or brown individuals, such as the Negroes, in whom this pigment (*pigmentum nigrum*) which lines the interior of the sclerotica and iris, defends it perfectly from the entrance of luminous rays, excepting at the proper aperture of the pupil. For this reason, Negroes, and generally all individuals with black eyes, can easily support the full blaze of sunshine, while the blue, gray, or ash-coloured eyes of the fairer inhabitants of Europe are so tender, from the intensity of the tropical sun, that they require to be defended by coloured glasses, else they become affected with ophthalmia.

Men and the lower animals, with very white skins and light hair, are thus destitute of that brown or black colouring matter, which not only lines the sclerotica and iris, but also impregnates the mucous tissue under the skin, and, passing onwards, tinges the hair or fleece of different colours. Black or chestnut hair usually accompanies an iris more or less brown. It thus follows, that black and dark-brown animals can endure the blaze of day, and that the light-brown or white animals, which are naturally better adapted for the cold and polar regions of the earth, become the most proper to see during the twilight or at night. All the nocturnal animals are further capable of dilating their pupils largely in the dark, in order to receive a larger pencil of rays than the diurnal animals; the latter, on the contrary, are compelled to close the pupil to avoid being dazzled. The inhabitants of the polar regions possess this power of dilating and contracting the pupil in a remarkable degree, as they experience, at one season of the year, the dazzling reflections of the snow, and at another, the long twilights and Aororæ Boreales of winter.

When deprived more or less of this pigment, Man and the lower animals have a very sensitive skin, the fibres of which are delicate and slim, while their hair is light, fine, and silky. These individuals are easily overcome by the heat of the day and the intensity of its light; they soon become exhausted during the day, and find the feeble rays of the night better proportioned to the delicacy of their temperament. Hence, they transform the Day into a period of repose, the Night into one of activity and exertion.

We have a further confirmation of the accuracy of these observations in the fact, that with the greater part of the nocturnal animals, the colouring pigment of the skin is less vivid than in the diurnal races. It may generally be remarked, that animals with nocturnal eyes are clad in a mournful and dingy vestment of gray or ash-colour, striped with black or spotted, not only among the Mammalia and Birds of Night, but even in the Insects, when we compare them to the allied diurnal species. We see a remarkable contrast between the tints of the diurnal Butterflies and those of the Moths and Spangles. The Owls are sad and sombre birds when placed against the Parroquets or Humming Birds, glittering in the brilliant sun of the torrid zone. Many animals of the Cat kind, the Lemurs and Bats, cannot compare in these respects with the gayer quadrupeds.

Nocturnal animals further possess the peculiar quality of advancing to surprise their prey with a noiseless step. The almost imperceptible flight of Nocturnal Birds of prey is well known to proceed from the soft feathers of their wings; and the same effect is produced by the wings of the Bats, and the nocturnal Butterflies. The crepuscular Sphinges alone produce a humming noise by the vibration of their wings; but they suck the nectar of flowers, and the Bombyx and Cossus do not take animal food. All other nocturnal animals are, for the most part, carnivorous, attack their prey by surprise—and Nature inspires them with the same instinct as the cowardly assassin, who does not dare to face his enemy in the blaze of day. In return, however, they are often impregnated with fetid odours, which serve to announce their approach.

It is thus to the peculiar constitution of their bodies that the nocturnal animals owe their property of sleeping during the day and waking at night, a peculiarity so opposite to other beings. An analogous state exists also in the Vegetable kingdom. Some flowers appear to close and languish during the heat of the day. The sun acts too vividly upon the frail texture of certain petals, and occasions the sap and

nutritious fluids which fill their laminae to evaporate too freely; but during the freshness of night the sap and juices being less dissipated, accumulate in the tissues of these plants, their canals are dilated, and the flowers and leaves expand. Their tender organs of reproduction would soon become desiccated by the heat of the sun; hence the plant withdraws them from its influence, and displays them only before the pale light of the moon. Diurnal flowers also have, with animals, a more solid tissue than the nocturnal. The former require to be stimulated by light and heat, that their reproductive organs may develop themselves, while the more tender nocturnal flowers resemble those animals of the night which shield their eyes from the dazzling influence of the day-light. Further, the sexual organs of Nocturnal Plants fade more rapidly than the diurnal: their monopetalous and polypetalous corollæ are of a texture extremely frail, generally blanché and etiolated. Their evanescent perfume is exhaled only at night; it fails during the day.

In general, all nocturnal beings, whether Mammalia, Birds, Reptiles, Fishes, Insects, or Plants, present sombre and tarnished hues, while the diurnal species, under the fiery influence of the sun, assume garments of dazzling brilliancy. Light thus stimulates to activity, and is one of the principal causes of the development in organized beings of animal and vegetable poisons and perfumes, when acting upon special constitutions. Darkness benefits those acrid, venomous, faded, and inert plants, whose juices, feebly elaborated, require its shelter: it is favorable to the development of animals generally at their birth—to the larvæ of insects in their dark asylums—to mushrooms and lichens, the mysterious product of evanescent sporules, in the depths of forests, and the hollows of caverns—and in general to all feeble and imperfect organizations. The moisture and coldness of night are further unfavorable to the waste of living bodies, and hence it is the period when they experience the highest degree of growth and vegetation, provided that the cold be not too intense. In fact, the internal functions of nutrition and repair are performed more intensely during the repose of night, and the absence of external stimuli. Then the organs grow, and become replenished with nutritious fluids. Thus the mushrooms are mostly the offspring of the night, or multiply in the secret obscurity of subterranean excavations.

Each day, like each season, distributes to every living being some portion of heat, light, and nutriment, and measures the rhythm of their functions of waking or sleeping, nutrition or excretion. When these are maintained in harmony with the movements of the globe, health and regularity are alike maintained. We find the influence of the periodic return of day and night in places where its presence could scarcely have been anticipated. According to the researches of Messieurs Burch, Quetelet, and Villermé, the mortality of the human species increases towards sunrise, diminishes towards sun-set, and almost no deaths happen at mid-day. Further, it is observed that births occur most frequently during the night, and deaths during the day. Births and deaths are generally most numerous between the hours of three and six in the morning, and least numerous from three to six in the evening, corresponding to the maximum and minimum of temperature. This prevails as well in the seasons of the year as in the hours of the day. The greater number of births and deaths occur in the most stimulating periods of the day and year, being at six in the morning, and in the month of April. Those periods, on the contrary, when stimuli begin to fail, are most deficient in births and deaths, such as three o'clock in the afternoon, and in the month of August. The paroxysms of fevers, and the pains of an approaching *accouchement*, usually begin in the evening, while the crisis or result arrives towards the morning.

Thus there exists a remarkable correspondence between the structure of animals and plants, and that periodical order of light and darkness resulting from the rotation of the earth around its axis. Although this succession of functions depends partially on the presence of the external stimuli of light and heat, yet there appears to be a diurnal period belonging to the constitution both of animals and vegetables, and this structure corresponds with the astronomical day. The power of accommodation possessed by living beings in this respect, is not sufficient to allow us to suppose that the periods of the day and night could be very greatly lengthened or shortened without causing their ultimate destruction. "We may be tolerably certain," says Mr Whewell, "that a constantly recurring period of forty-eight hours would be too long for one day of employment, and one period of sleep, with our present faculties; and all whose bodies and minds are tolerably active will probably agree that, independently of habit, a perpetual alternation of eight hours up, and four in bed, would employ the human powers less advantageously and agreeably than an alternation of sixteen and eight. A creature which could employ the full energies of his body and mind uninterruptedly for nine months, and then take a single sleep of three months, would not be a man. When, therefore, we have subtracted from the daily cycle of the employment of men and animals, that which is to be set down to the account of habits acquired, and that which is occasioned by extraneous causes, there still remains a periodical character, and a period of a certain length, which coincides with, or at any rate easily accommodates itself to, the duration of the earth's revolution. We can very easily conceive the Earth to revolve on her axis faster or slower than she does, and thus the days to be longer or shorter than they are, without supposing any other change to take place. There is no apparent reason why this globe should turn on its axis just three hundred and sixty-five times while it describes its orbit round the sun. The revolutions of the other planets, as far as we know them, do not appear to follow any rule by which they are connected with the distance from the Sun. Mercury, Venus, and Mars, have days nearly the length of ours. Jupiter and Saturn revolve in about ten hours each. For any thing we can discover, the Earth might have revolved in this or any other smaller period, or we might have had, without mechanical inconvenience, much longer days than we have. But the terrestrial day, and consequently the length of the cycle of light and darkness, being what it is, we find various parts of the constitution, both of animals and vegetables, which have a periodical character corresponding to the diurnal succession of external conditions; and we find the length of the period, as it exists in their constitution, coincides with the length of the natural day."

The want of colour, or *Albinism*, in animal and vegetable bodies, when they are said to be *leucose* or *white*, has its proximate cause in the original want, or the diminished secretion, of the coloured layer of mucous net-work placed immediately

under the epidermis, or outer skin of animals. With Plants, this is owing to the inert secretion of the green matter, or *chromule*, and its ceasing to colour the cuticular tissues. In all species, softness and moisture are the results of this albinism or whiteness. Its ultimate cause is the want of vital energy, arising either from the prolonged absence of the influence of Light upon the organic structure, or from the intensity of a long-continued cold. Its effects may be either absolute and total, or merely partial and local, even among the white varieties of animals and plants. Its general tendency is to effeminate all beings.

Accidental albinism may arise from old age, or the want of a continued renewal of this coloured layer, which communicates its hue to the Hair, Feathers, or Scales. It may be even induced before old age by disease, or by the absence of the usual supplies of nutriment, or, among animals, by the violence of fear or any sudden emotion, which may serve to withdraw from the exterior of the body its secretions, and render the skin pale, or the hair white. There is also an accidental albinism from the mechanical injury of the mucous pigment, arising from the bruising or tearing of the skin, and on these spots, white hair or feathers will arise in the place of coloured appendages.

An opposite state of deep blackness, or *Melanism*, when the surface is said to be *melanose* or *black*, arises from the superabundance of the mucous subcutaneous tissue in animals and plants, in which carbon exudes towards the exterior. Such are Negroes, and all black or dark-brown animals, lurid and venomous plants, as the Solanæ. This state of the skin is well fitted for skies, resplendent with Light and Heat. It is attended in individuals with dryness, rigidity, and shortness of stature.

Excessive cold, combined with the absence of Light, serves to drive the nutritive and repairing juices far from the skin. This kind of albinism is especially remarked in animals inhabiting the highest mountains and the polar regions, where they become white in winter and coloured in summer. The large species of the Poreupine exhibit these alternate annulations of white and brown, which are due to the alternations of summer and winter. A similar effect might be produced on live Sparrows, by plucking the feathers, and rubbing their naked bodies with Spirit-of-wine. The feathers which then succeed remain white, because the alcohol prevents the secretion of the colouring subcutaneous matter, in the same manner as an excessive cold. A corresponding effect may be produced by similar means upon the Mammalia.

The colours of animals are intimately connected with the latitude of the place as well as with the changes of the seasons, and seem, in general, delicately sensible to the external stimuli of Light and Heat. In Mammalia and Birds, we find that the hotter regions of the globe, as well as the summer months, are favorable to deep and bright colours.

Sir John Leslie's experiments on colour, as affecting the radiation and absorption of Heat, afford the best explanation of the final causes of these changes. "The rate at which bodies cool is greatly influenced by their colour. The surface which reflects heat most readily suffers it to escape but slowly by radiation. Reflection takes place most readily in objects of a white colour, and from such, consequently, heat will radiate with difficulty. If we suppose two animals, the one black, and the other white, placed in a higher temperature than that of their own body, the heat will enter the one that is black with the greatest rapidity, and elevate its temperature considerably above the other. These differences are observable in wearing black and light coloured clothes during a hot day. When, on the other hand, these animals are placed in a situation, the temperature of which is considerably lower than their own, the black animal will give out its heat by radiation to every surrounding object colder than itself, and speedily have its temperature reduced; while the white animal will part with its heat by radiation at a much slower rate. The change of colour in the dress of animals is therefore suited to regulate their temperature by the radiation or absorption of caloric. While it is requisite that the temperature of some species should be preserved as equally as possible, the cooling effects of winter are likewise resisted by an additional quantity of heat being generated in the system. An increase in the quantity of clothing takes place, to prevent that heat being dissipated by communication with the cold objects around, and the dress changes to a white colour to prevent its loss by radiation. In summer, the pernicious increase of temperature is prevented by a diminished secretion of heat, or the secretion of cold, increased perspiration, the *casting* of a portion of the winter covering, and by a superior intensity of colour in the remainder giving it a greater radiating power. The last character would, in the sunshine, by absorbing heat, prove a source of great inconvenience, were its effects not counterbalanced by other arrangements, and by the opportunity of frequenting the refreshing shade, or bathing in the stream." Animals become light or gray in old age, and thus the too great dissipation of heat in their systems is prevented.

If it were possible for any one to doubt the fact that the functions of animals and plants correspond with the movements of the terrestrial globe, he would find a convincing proof in the influence of the seasons, upon the casting of hair among the Mammalia, the moulting of Birds, the changes of skin among the lower animals, and the defoliation of Plants.

In the Spring, all Nature is living and vegetating, expanding and developing its productions; the earth is clothed with verdure, the animals are dressed in their nuptial garbs, and their amours commence. The cause of this external expansion of all beings originates in the circumstance that their functions, long oppressed by the cold of winter, have acquired a superabundance of juices, sap, and nourishment, which only await the favorable moment of external heat to expand. Their germs are developed with extreme vigour. In the human race, there is at this season a determination towards the skin, eruptive maladies become more prevalent, and exanthemata sometimes appear as though budding were not exclusively confined to the vegetable kingdom. The Hair, Feathers, Horns, Scales, and Epidermis of animals, as well as the Leaves, Flowers, and Fruit of vegetables, which have grown and expanded during the Spring, assume their most glittering hues, if not during Summer, at least during the six months of the year, when in our climate the sun is most above the horizon. But at the approach of the autumnal equinox, living bodies, whether Animals or Plants, are exhausted by the excessive action of their vital forces during summer, and their functions become less vigorous, in proportion as Light and Heat

diminish with the enfeebled rays of the Sun. Those external parts, produced in the preceding Spring, cease to receive nutriment from the body; they have further arrived at the full period of their growth, and are incapable of receiving any more. Hence they dry up or fade away; others become detached and fall. Sooner or later at this season, we invariably witness the casting of hair, feathers, scales, horns, and epidermis, as well as the dropping of flowers, leaves, and fruit, when each Living Being enters into a kind of autumnal concentration preparatory to the rigour of winter.

In the southern hemisphere, our winter being then its summer, and reciprocally, the periods of casting or moulting are in each year opposite to ours.

In the Torrid Zone, the Sun passes twice a year from the one tropic to the other, so that it produces, to a certain extent, two winters and two summers. The winter is there the season of continual rains; it also determines twice a year the casting or moulting period of animals and plants, and doubles the number of the rutting seasons. From these circumstances, it arises that Living Beings experience a two-fold waste of vital force, and live in these warmer regions at a faster rate than elsewhere. They are continually producing or wasting; new flowers spring up next to the fruit; new leaves replace the old and faded; the Bird prepares its nest of eggs, and sings new carols within the hearing of its brood of six months old; and the Quadrupeds consume in a continual state of generation, gestation, and lactation.

In colder countries, and on the summits of elevated mountains, there exists another kind of change in the feathers of Birds and the hair of Mammalia, which arrives at the period of winter. The white robe, the symbol of elasticity and sexual indifference, is particularly fitted to these cold regions, in the same manner as the brilliant robe of summer is in correspondence with the full vigour and activity of the reproductive system. Thus the Hare of the Alps (*Lepus variabilis*) and the Ermine, as well as a great number of other Mammalia, with an immense multitude of Birds of the Northern Regions, especially the Waders (*Grallæ*) and Web-footed Birds (*Palmipedes*), which are covered in the summer season with hair or feathers of brown and more brilliant hues, acquire a pale gray or uniform white during the winter.

It has been considered by some, that the white garb of arctic animals serves to protect them from their enemies, by assimilating their colour with that of the snow. But Nature, pursuing a fair system of reciprocity, imparts the same colour to the beasts and birds of prey, so that, in reality, this provision is less effectual than has been commonly supposed.

Dr Fleming has made the following observations on the cause of the change of colour in those quadrupeds, which, like the Alpine Hare and Ermine, become white in winter:—"It has been commonly supposed that these Mammalia cast their hair twice in the course of the year; at harvest, when they part with their summer dress, and in spring, when they throw off their winter fur. This opinion, however, does not appear to be supported by any direct observations, nor is it countenanced by analogical reasoning. If we attend to the mode in which the human hair becomes gray as we advance in years, it will not be difficult to perceive that the change is not produced by the growth of new hair of a white colour, but by a change in the colour of the old hair. Hence there will be found some hairs pale towards the middle, and white towards the extremity, while the base is of a dark colour. Now, in ordinary cases, the hair of the human head, unlike that of several of the inferior animals, is always dark at the base, and still continues so during the change to gray; hence we are disposed to conclude from analogy, that the change of colour, in those animals which become white in winter, is effected, not by a renewal of the hair, but by a change in the colour of the secretions of the *rete-mucosum*, by which the hair is nourished, or perhaps by that secretion of the colouring matter being diminished or totally suspended." An Ermine shot by Dr Fleming in May 1814, in a garb intermediate to its summer and winter dress, confirmed this view of the subject. In all the under parts of its body, the white colour had nearly disappeared, in exchange for the primrose-yellow, the ordinary tinge of these parts in summer. The upper parts had not fully acquired their ordinary summer colour, which is a deep yellowish-brown. There were still several white spots, and not a few with a tinge of yellow. Upon examining those white and yellow spots, not a trace of interspersed new short brown hair could be discerned. This would certainly not have been the case if the change of colour is effected by a change of fur. Besides, while some parts of the fur on the back had acquired their proper colour, even in those parts numerous hairs could be observed of a wax-yellow, and in all the intermediate stages from yellowish-brown, through yellow to white. These observations leave little room to doubt that the change of colour takes place in the old hair, and that the change from white to brown passes through yellow. If this conclusion be not admitted, then we must suppose that this animal casts its hair at least seven times in the year. In spring it must produce primrose-yellow hair, then hair of a wax-yellow, and lastly of a yellowish-brown. The same process must be gone through in autumn, only reversed, and with the addition of a suit of white. The absurdity of this supposition is too apparent to be further exposed. Thus the hair, as long as it remains connected with the body, participates in the general life of the system, and is influenced in respect to its colour by the secretions of the mucous net-work of the skin.

There exists a general tendency in all living bodies to develop themselves from within, outwards. This evolution of living bodies is the ultimate cause of those changes which the external surface of their bodies undergoes during the several periods of their existence, and determines the variations in the quantity of their clothing: the proximate causes of change are the external stimuli of light and heat. As each appendage of the animal body is endowed with a vital power peculiar to itself, it must have its peculiar periods of youth, perfection, decay, and death. When any organic portion of the body is completely dead, it separates and falls, because a living substance cannot co-exist with a dead one. The casting of hair, and all other kinds of moulting or external change, is nothing more than the natural death of a certain portion of an animal body, in consequence of the development of other parts interior to it, and this kind of function is regulated by fixed laws.

The external parts of animals and plants which are renewed each year are of two kinds. They may have a peculiar organic conformation, as we find in hair, horns, teeth, feathers, and leaves, or they may have a simple structure, scaly or foliaceous, as we find in the epidermis or outer skin, shells, and membranes.

The changes of all these bodies partake more or less of the same general character. A tree may be considered as a body composed of an infinite number of germs which are successively developed. Besides the fruit produced each year, it pushes forth an immense number of leaves, which extract their nutriment from the sap, expand, and arrive at their full growth. Then having received all the nutriment which the arborescence of their tissue can maintain, they dry up, become yellow or brown, the leaf ceases to extract the sap, and dies of old age. The vessels of the petiole are broken by this drying up and obstruction, and the leaf falls. This is observed generally in autumn with the trees of our climates, and happens also in the ever-green trees, the only difference being, that in these the new leaves are repaired as fast as the old ones fall, so that the tree is not at any one time completely destitute of verdure.

The same thing happens with the feathers of Birds, and the hair of the Mammalia. The bulbous root of the hair is penetrated by a blood-vessel, and that portion of nutriment and growth necessary to its development is thence communicated to the shaft. When the root dries, and the canal ceases to admit nutriment, the hair falls; the nutriment finds its way to other bulbs, the germs of hairs yet in embryo, concealed beneath the epidermis; and a new coat of hair succeeds to the former. Thus the hair is a kind of plant, which has its bulb or root, and its shaft or stalk, composed of long sheathy tunics, one within another, like the tubes of a telescope.

The casting of hair among the Mammalia arrives at different seasons, according to the peculiar constitution of each animal in reference to Heat, and in general its degree bears an immediate reference to the temperature of the district, whether arising from the season of the year, the latitude of the place, or the degree of elevation. "In the warmer regions," says Dr Fleming, "it is requisite to have the temperature of the body diminished, in the colder regions, the very opposite object is aimed at. In the former case the hair or feathers are thinly spread out, while in the latter, they form a close and continuous covering. In the Dogs of Guinea, and in the African and Indian Sheep, the fur is so very thin that they may be almost denominated naked. In the Siberian Dog and Iceland Sheep, on the other hand, the body is protected by a thicker and longer covering. The clothing of animals, living in cold countries, is not only different from that of the animals of warm regions in its quantity, but in its arrangement. If we examine the covering of Swine of warm countries, we find it consisting of bristles or hair of the same form and texture; while the same animals, which live in colder districts, possess not only common bristles or strong hair, but a fine frizzled wool next the skin, over which the long hairs project. Between the Swine of the South of England and the Scottish Highlands, such differences may be observed. Similar appearances present themselves among the Sheep of warm and cold countries. The fleece of those of England consists entirely of wool, while the Sheep of Shetland and Iceland possess a fleece, containing, besides the wool, a number of long hairs, which give to it, when on the back of the animal, the appearance of being very coarse. The living races of Rhinoceros and Elephant, inhabitants of the warm regions, have scarcely any hair upon their bodies; while those which formerly lived in the Northern plains of Europe, the entire carcasses of which have been preserved in the ice of Siberia, were covered with fur similar to the Iceland Sheep, consisting of a thick covering of short-frizzled wool, protected by long coarse hairs. These species, now extinct, possessed clothing, suiting them to the climate where they lived, and where they became at last enveloped in ice. Had they been transported by any accident from a warmer region, they would have exhibited in the thinness of their covering, unequivocal marks of the climate in which they were reared. By means of this arrangement, in reference to the quantity of clothing, individuals of the same species can maintain life comfortably, in climates which differ considerably in their average annual temperature. By the same arrangements, the individuals residing in a particular district are able to provide against the varying temperature of the seasons. The covering is diminished during winter, and increased in summer, as may be witnessed in many of our domestic quadrupeds. Previous to winter, the hair is increased in quality and length. This increase bears a constant ratio to the temperature; so that, when the temperature decreases with the elevation, we find the Cattle and Horses, living on farms near the level of the sea, covered with a shorter and thinner fur than those which inhabit districts of a higher level. Cattle and Horses, housed during the winter, have shorter and thinner hair than those which live constantly in the open air. The hair is likewise shorter and thinner in a mild, than during a severe winter."

The approach of the hot seasons of each year, by occasioning the development of new hair, transfers to them that nutrition which the former coat was in the habit of receiving. Hence, as the summer advances, the hair falls off, and the animal becomes sleek; and the warm covering of winter is exchanged for a lighter and more commodious garb. The Sheep in our climates casts its fleece before the end of June, and the Mole about the end of May. The time when the wild animals, whose furs are used in commerce, acquire their winter coats, corresponds with the hunting season. "During the summer months the fur is thin and short, and is scarcely ever an object of pursuit; while, during the winter, it possesses in perfection all its valuable qualities. When the beginning of winter is remarkable for its mildness, the fur is longer in ripening, as the animal stands in no need of the additional quantity for a covering; but as soon as the rigours of the season commence, the fleece speedily increases in the quantity and length of the hair. This increase is sometimes very rapid in the Hare and the Rabbit, the skins of which are seldom ripe in the fur until there is a fall of snow, or a few days of frosty weather; the growth of hair in such instances being dependent on the temperature of the atmosphere. In the northern islands of Scotland, where the shears are never used, the inhabitants watch the time when the fleece of their Sheep is ready to fall, and pull it off with their fingers. The long hairs, which likewise form a part of the covering, remain for several weeks, as they are not ripe for casting at the same time as the fine wool. The operation of pulling off the wool, provincially called *roving*, is represented by some writers, more humanely than well-informed, as a painful process to the animal. That it is not even disagreeable, is evident from the quiet manner in which the Sheep lie during the pulling, and from the ease with which the fleece separates from the skin."

The shedding of those antlers, which are produced each year on the Stags, and other Deer, may be explained on the same principles as the shedding of hair, and other

external appendages. As long as the bony protuberances on the forehead of the Stag continue to absorb the nutritive fluids holding phosphate of lime in solution, and permit them to penetrate abundantly into the parts yet soft and gelatinous, the horns grow in the form of antlers of various shapes. But when these horns, being completely filled with phosphate of lime, refuse to admit any more, the latter accumulates in a lump at the root of the horns, and obstructs the nutritive canals. These soon die, and the passage from within outwards, being thus interrupted, the antler dies and falls like the withered leaf or the dead feather.

In a similar manner we may explain the shedding of the milk teeth in the Human infant and the other Mammalia. The germs of the second teeth, before they appear externally, exist at the root of the gums, in the form of small capsules, which receive their nutriment from the blood-vessels of the maxillary arteries, and their sensation from the dentary nerves. When the first teeth have attained their full growth, and cease to admit any more nutriment, the latter is diverted to the other germs of teeth situate below. The second teeth, having thus acquired more force, expel the others and assume their place.

From these instances, it may be seen that the shedding of teeth, horns, hair, feathers, or scales, is the same phenomenon of organization; and that these bodies resemble leaves, or rather those parasitical animals and plants, which draw their nutriment from a body larger than themselves, on which they grow or live. So exact is this comparison, that the Hair and Nails maintain a separate Life on the corpse of Man or other Mammalia, and continue their growth until the dead body, by being entirely decomposed, ceases to supply them with a nutritious lymph.

Thus the moults and changes which living bodies undergo at the surface, in different periods of their existence, depend upon the general fact that organized bodies develop themselves continually from within outwards, so that the matter composing them never remains the same. The nutritive particles derived from the food, after being assimilated to our bodies, and incorporated into our proper substance, are ever transitory, and tend to undergo decomposition and waste at the surface, so that as fast as the internal organs are repaired, the vital force impels the nutrition towards the exterior, where it is decomposed and finally rejected. Each portion of the individual participates in the general nutrition; but besides this general life which the organs enjoy in common with the entire frame, each organ partakes of a special living power, which can maintain itself distinct from the whole, or even occasion a growth at the expense of the other parts. Hence each animal appendage has its special birth, age, and limited duration, besides those which it derives from the entire body, as we find in the organs of generation, the teeth, hair, feathers, and the leaves of plants. These appendages, though developed a long time after the birth of the individual, perish notwithstanding before it, and various external germs develop themselves successively. Thus, the special vital forces of particular parts possess a much shorter duration than the general life of the body. Further, these productions which succeed each other, whether hair, feathers, or teeth, may neither have the same form nor colour. The radical leaves of Plants often have forms and colours very different from those of the branches and floral peduncles. The feathers of the winter plumage are more downy and thick than those of summer, or the nuptial period of Birds. The second teeth of the Mammalia have very different roots from the former; an old Stag receives a more formidable defensive weapon than the Fawn whose first horns are beginning to shoot. Thus, Nature has implanted in animals and plants different kinds of germs, appropriate to the several epochs of Life, as well as the external circumstances of their situation, and even in reference to their relative situation in respect to the heavenly bodies. The rich variety which we find in these arrangements at once demonstrates the admirable economy of Nature, which operates incessantly in evolving or developing, according to fixed and determinate laws. Every one is compelled to acknowledge that organized bodies are formed in exact correspondence with the physical agents which surround them, otherwise the harmony and concurrence of all portions of Nature could not subsist. Living bodies are not only formed in direct co-relation to Air, Food, and Moisture, but also with the laws of Light, excepting, perhaps, in certain subterranean animals and plants, and require the influence of a moderate Heat.

Electricity, and that form of Electricity which we commonly term Magnetism, may also contribute towards the vital action in certain circumstances. So close is the co-relation of Electricity with the vital power, that several later writers have confounded the one agent with the other. Although it is impossible to admit that Life is the same as Electricity, yet their intimate connexion is undoubted. Animal bodies are in this respect delicate electro-vital machines, and acutely sensible to the electrical state of surrounding bodies.

Animal electricity has been shown by Mr Faraday to be identical with all the others, only that it resides in those imperfect conductors which compose the animal tissues, in the same way as Voltaic Electricity penetrates into the metallic substance, and the ordinary Electricity exists at the surfaces of bodies. In fact, all these Electricities may be converted into each other, and Magnetism itself is only a particular form of Electricity.

There is no phenomenon among the Mammalia which can compare in intensity to the electric batteries of certain Fishes. The presence of Electricity is, however, demonstrated in various ways. The Hair and Skin of Man, when heated, have been accompanied, under certain circumstances, by remarkable electric and luminous sparks. Hales and Bellingieri have shown the different states of Electricity in the humours of the Human Body. Friction can draw electrical sparks from the Fur of the Cat and several other Mammalia, chiefly carnivorous. The same thing has been found with the plumage of certain Birds, as the Parrots.

It was conjectured by Humboldt, and confirmed by the experiments of MM. Prévost, Dumas, and Edwards, that every muscular contraction, and every act of the Will or volition, is accompanied by a kind of electrical discharge of the nerves which animate it, and that the nerves serve to deposit and distribute an electro-vital fluid.

The scintillations and corruscations which emanate from the eyes of certain Mammalia when in the dark, are phenomena of a very different kind from that general phosphorescence which prevails over the entire bodies of many Fishes, Molluscs, Crus-

tacea, and Zoophytes. They seem to depend upon a certain state of the nervous expansion of the retina, when the animal is under the influence of rage, love, hunger, or any violent emotion, especially in the more furious species of Carnivora. This property of the retina is not peculiar to the Mammalia, but is also found among the Mollusca, Arachnides, and Crustacea. The enormous eyes of certain Cephalopoda, as the Cuttle-fishes (*Sepia*), appear luminous in the middle of the Ocean, and terrify the Fishes, their prey. The eight eyes of the Tarantula Spider, a voracious and nocturnal species, are also luminous, according to M. Léon Dufour. We also find this property among several Saurian Reptiles, such as the genera Anolis and Gecko, whose eyes scintillate in the darkness of night, and the same assertion has been made regarding the Alligators, which are thus said to frighten their prey. The ancients have related many fables concerning the piercing looks of the Basilisk Serpents, and modern authors have given credit to the fascinating powers of the Rattlesnake. Certain credulous believers in Animal Magnetism have also attributed the most terrific effects to the glances of the Tonds, and have illustrated their credulity by examples. When carefully considered, these examples only prove a nervous state of the imagination when under the influence of fear. Such effects may be induced in sensitive fraoces by the approach of a hideous or dangerous object, and may be observed in the lower animals where these involuntary sensations occasion them even to tremble and faint. The effect which the Pointer Dog produces upon the Partridge is a striking instance. But the greater part of the Carnivora being nocturnal in their habits, such as the Cat genus, as the Lions, Lynx, Ounce; the Dog genus, as the Wolves, Foxes; the Martens, and probably also the Bats, with the Nocturnal Birds of Prey, have luminous eyes in the dark, whether during the night, or during the day, when confined in a dark chamber. These animals then dilate their pupils, so that the expanded surface of the retina at the back of the eye shines vividly, and illuminates the external chamber of that organ. Light is thus projected from within upon those objects on which the animal fixes its gaze, that one can distinguish them very well at the distance of more than a foot and a half. This emanation appears clearly to proceed from the expanded extremity of the optic nerve. It lasts nearly for a minute at the pleasure of the animal, or even involuntarily when under the influence of violent emotions. Certain Apes, as the *Nocthora trivirgata*, and the Howlers (*Myecetes*), have nocturnal eyes possessed of this radiating property. Inflammation, in various diseases of the Eye, gives to some Men a temporary power of seeing in the dark, or of emitting luminous rays. The eye when rubbed, or when it receives a blow, becomes dazzled by the sudden influx of blood into this organ, and not only do scintillations appear, but there is a luminous emission when these animals are enraged, like that proceeding from an electrical discharge.

The luminosity of the retina does not proceed from a simple reflection of those scattered rays of Light which may chance to fall upon the Eye, as Tréviranus and Benj. Prévost have considered probable, for these phenomena can be observed in the most perfect darkness. The Cat, when irritated, darts forth fiery rays of light; its eyes sparkle intermittently when enraged, according to Esser and Rengger; and Gruithuisen remarked that the rays acquired a greenish tinge when the animal was caressed. Dogs, when enraged, impart to their ocular radiations a tinge sometimes yellowish and sometimes blueish. Their coruscations vary with individuals, but the luminous emanations appear to be most brilliant in animals with black or ash-coloured hair. They neither proceed from the crystalline nor vitreous humours of the Eye, for these can be altogether removed without destroying their luminous property, which only then acquires a more greenish hue. But on wounding the optic nerve, or on scraping the retina, the radiation becomes extinct; thus proving that it proceeds neither from the cornea or uvea, or indeed from any of the transparent portions of the Eye.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Phenomena of Sleep—the Hibernation of some Species.

THE phenomena of Sleep bear an immediate relation to the most general laws of Nature, and form an important illustration of the fact, that the periodical motions of the animal economy are in direct correspondence with the movements of our planetary system, and especially with our situation relative to that Sun which regulates the periods of the day and year. "All our wants reappear," says Cabanis (*Rapports du Physique et du Moral de l'Homme*), "and all our functions execute themselves, in fixed and iso-chronous periods. The duration of the functions is the same in each period; the same appetites or the same wants have the hours marked for their return; and it commonly happens, when these wants are not immediately satisfied, they diminish and disappear for a certain time, only to return again with the greater force and importunity at the next succeeding period, which ought to produce a return of the impression. This character of periodicity is particularly remarkable in the returns and duration of sleep, which commonly reappears during each astronomical day at the same hour; continues nearly for the same period of time; and according as it is regular in its periods, slumber is the more easy, while the repose which follows is the more salutary and refreshing."

There are two principal states of vital activity, of which all animals partake in different degrees. When the vital excitement exists to its full extent, the animal is said to be *awake*; when the functions of life are suspended, either wholly or partially, it is said to be *asleep*. From this waking state, when life exists in all its plenitude, there may be many degrees of its diminution, called *Reverie*, *Delirium*, *Dreaming*, *Sleep*, *Torpor*, *Stupor*, *Asphyxia*, *Lethargy*, according to their intensity, of which states the last is but one degree removed from absolute death.

The principal occasions on which these states of vital repose naturally present themselves to our observation are, 1st, When the body and mind of an animal languish either from the return of their period of natural repose, or through excessive exertion. 2d, When the cold of winter, or perhaps also the heat of summer, acting on special constitutions, suspends the animal functions of life either partially or entirely. The former phenomenon appears daily, while the latter is of annual recurrence.

The first of these occasions, or Sleep properly so called, differs from Death, with which it has often been compared, in the circumstance that all the involuntary

functions of life continue their action uninterruptedly. It may be recollected that animals have two kinds of vital functions; the one vegetative and internal, which continue, with the exception of generation, to exert themselves during the entire existence of each individual, and the other purely animal, which refer to external objects. The former being essential to their existence, are never suspended; the latter are intermittent in their action. If the heart ceased to propel the blood through the arteries, if the lungs ceased to respire air, if the functions of nutrition and secretion were discontinued, or if they depended upon the mere Will of the animal, life would soon become extinct. But all these internal actions are involuntary, and hence it is only the external and purely animal functions of life which can have their periods of action and repose, of waking and sleeping. These latter actions are therefore less essential to life than the former. An animal, when profoundly asleep, is reduced to a state very analogous to that of a plant. Though dormant, he is still a living being, for he continues to perform the functions of nutrition and secretion even more perfectly than when awake; but he is destitute both of sensation and motion, and must awake before he can fully resume these functions peculiar to animals. Thus animals have two states of existence, waking and sleeping, while a plant has only one. The state of the latter may, however, be more or less active, according to the different degrees of heat or light to which it is exposed. There can be no difference with plants between the activity of the internal and external functions, and they always appear to be plunged in a state of repose more or less profound. Many of the lower animals, such as an Oyster or a Zoophyte, when considered superficially, appear to exist in a continued state of torpor, rather than to possess an active life, because they maintain but few relations to external objects, and hence are commonly considered rather as vegetating than as living, although Plants are possessed of life as well as animals, but only in different degrees.

Sleep, in fact, consists in the suspension of the organs of sense and voluntary motion, qualities which chiefly serve to distinguish animals from plants. All the voluntary muscles repose completely, and the sleeping animal maintains no active relations with external objects. The functions belonging to vegetable life continue their existence, but the consciousness of existence is lost. The heart and the lungs continue to act without interruption, while the organs of thought and sensation possess but a temporary action. It is thus precisely those organs which are the most intimately connected with the Mind, namely, the organs of thought and sensation, which most require repose, and the human Soul, though immortal, when entirely separated from the Body, cannot now maintain its consciousness uninterruptedly for twenty-four hours together.

Night, or the absence of light, is favorable to the sleep of all animals not naturally of nocturnal habits. Silence, repose, the absence of noise, and in general every thing which interrupts the relations of the animal with external objects, are favorable to sleep. As long as the purely animal functions continue to be stimulated, they maintain their action, until an excess of action produces a contrary effect. A violent exertion of the body, profound thought, or any powerful sensation, disposes for sleep. Often the fatigue of a single sense brings on the sleep of all the senses, through that intimate connexion maintained among all the parts of the body. The monotonous murmur of a brook, the howling of a forest, bad music, protracted reading, bad verses, or a long lecture on an uninteresting subject, gradually fatigue the sense of hearing or sight, and lead the vital forces of these organs to seek in sleep for an accession of energy, and the repose of the entire animal functions speedily follows.

The inclination to Sleep is announced by a slowness of motion, by languor of the Attention and Will, and by the gradual stupefaction of the senses. But the different kinds of functions are suspended in a certain order of succession, according to their nature and relative importance. The muscles which move the arms and legs are relaxed and cease to act before those which sustain the head, and the latter before those which support the spine. When the sense of sight is first suspended by the falling of the eyelids, the other senses still maintain their action. The sense of Smelling is obliterated before the taste; Hearing after smelling; and Touch last of all. Even during the most profound sleep, the sense of touch continues to suggest different movements and changes of position, when the long duration of the same posture renders it disagreeable. At length animal exertion is at an end; the muscles, excepting those of Circulation and Respiration, cease to act; and the body sinks down, obedient to the ever-acting force of Gravitation.

These phenomena of Sleep are very analogous to that insensibility of particular organs, during our waking moments, when the Attention is fully engaged. A profound Mathematician, when absorbed in a calculation, neither sees, hears, nor feels; all the functions are asleep except the organ of thought. Other Men, like mere machines moved by habit, perform the same operation a thousand times with their hands, while the thinking principle remains buried in a profound lethargy.

At the precise moment when the Mind loses its consciousness, there results a general relaxation of all the muscles. If the body be at rest and in health, this sudden change in its state of obedience to the Will is attended with no marked result. But if the body be fatigued, or in an uneasy posture, or if the joints or muscles be painful, this first result of Sleep has the effect of removing it entirely. Hence arises the difficulty of sleeping in a sitting posture, or during an attack of gout or rheumatism. The pain which the sudden starting of the muscles occasions is often so great in these diseases, that Sleep can only be induced by strong doses of opium or some other narcotic. It also follows from this relaxation of the muscles, that the limbs become bent during Sleep, and that a substance grasped firmly in the hand, falls at the instant when consciousness is lost.

During Sleep the character of the Respiration is altered; it becomes less frequent and deeper. The heart also beats more slowly, but the pulse is stronger. The Heat of the surrounding air, when imperfectly renewed, tends, however, to increase its movements.

The heat of the body is not naturally higher during Sleep; on the contrary, a diminished respiration tends to lower the temperature. It usually happens, however, from external circumstances, that there is an apparent rise of temperature, from the body being surrounded by imperfect conductors of heat, and from the circumambient air being but slowly renewed.

As the stomach is a muscular organ, and as the passage of the food through the pylorus depends upon the rapidity with which the almost insensible contractions of the Stomach are performed, it follows that Sleep retards digestion, while, at the same time, it renders it more complete. This slowness of digestion is further increased by the state of rest in which the body remains, as nothing tends more to excite a rapid digestion than the gentle motion of the limbs, or of the entire body. The same phenomena take place in the intestines, where the aliments remain almost inert in the several portions of the alimentary canal. However, the slowness of this movement favors the formation of chyle, and renders its absorption more complete.

Absorption is very active during Sleep, and the danger of slumbering in noxious air hence becomes very great. Travellers are usually advised to avoid sleeping in marshy situations, such as the Pontine Marshes of Italy, especially in the warm season of the year. Perspiration also is performed more easily, because the pores remain open during the state of muscular relaxation. "Une nutrition plus efficace, la réparation graduelle des forces qui en résulte, et aussi la réplétion de la vessie, toutes ces choses réveillent en nous, durant le sommeil, des idées de jouissance et des souvenirs de volupté."

As all the senses do not fall asleep at the same time, so they differ in the order in which they awake. Taste and Smell commonly resume their functions last of all. The sense of Sight is roused with greater difficulty than that of Hearing. An unexpected noise will often awaken a Somnambulist from his lethargy, upon whom the strongest rays of light will have had no previous effect, although his eyes continue open. Touch, as it was the last sense to become dormant, so it appears to be the most easily roused. The same person who cannot be awakened by very loud noises, will rise instantly on being gently tickled on the soles of the feet. Often the mere approach of the respiration of another will be sufficient to rouse the soundest sleeper.

The positions which the Mammalia assume during Sleep are very various. The young animal sleeps with its limbs gathered together, in a posture most resembling that of the fœtus in the womb. This situation is very favorable to the renewal of the animal forces, by permitting the relaxation of all the articulations, and in preserving the heat of the more sensitive parts. For the latter reason, the Dog and Cat sleep with their bodies formed into a circle. Some Mammalia sleep in the open air, while others retire to caves and sheltered places. Many repose without any covering, while others prepare a bed of some imperfectly-conducting substance, to preserve the temperature of their bodies, which would otherwise fall during Sleep below the natural standard. It is usually on the right side that Man reposes. This posture favors the action both of the heart and stomach, as the vibrations of the former would reverberate through the body from the reaction of the substance upon which it reposes, and the latter would be compressed by the weight of the liver. After sleep, all the organs, being refreshed, repaired, and completely nourished, acquire a greater size; thus Man and other animals which commonly hold the spine more or less erect, are taller in the morning than in the evening after the fatigues of the day.

Sleep is not always profound; some of the animal functions continue to act; ideas succeed each other, and the animal is said to dream. The power of dreaming is falsely ascribed to Man alone; other Mammalia dream likewise, because they are capable of thought, and possess a certain degree of intelligence. Sometimes the Dog is observed to howl, struggle, and perspire copiously. Moving his tail and limbs rapidly, he pursues the Hare in imagination, and, on the point of seizing it, closes his teeth and lips as if in the act of dyeing them in blood. Some Birds are also known to dream, as the Parrots. Those animals which are most easily excited dream more frequently than the others; thus the Horso is more liable to dream than the Bull. According to Chabert, this phenomenon among Cattle is observed only in the Bull, the Ram, or in Cows which are suckling.

It is possible to protract the usual period of sleep by an unusual excitement; but if the stimulus be long continued its effect goes off, and then nothing can prevent sleep as long as the health continues good. In fact, sleep, once in the twenty-four hours, is as essential to the existence of the Mammalia as the momentary respiration of fresh air. The most unfavorable conditions for sleep cannot prevent its approach. Coachmen slumber on their coaches and couriers on their horses, while soldiers fall asleep on the field of battle, amidst all the noise of artillery and the tumult of war. During the retreat of Sir John Moore, several of the British soldiers were reported to have fallen asleep upon the march, and yet they continued walking onwards. The most violent passions and excitement of the mind cannot preserve even powerful minds from sleep; thus Alexander the Great slept on the field of Arhela, and Napoleon upon that of Austerlitz. Even stripes and torture cannot keep off sleep, as criminals have been known to slumber on the rack. Noises which serve at first to drive away sleep, soon become indispensable to its existence; thus a stage-coach stopping to change horses, wakes all the passengers. The proprietor of an iron forge, who slept close to the din of hammers, forges, and blast furnaces, would awake if there was any interruption to them during the night; and a sick miller, who had his mill stopped on this account, passed sleepless nights until the mill resumed its usual noise. Homer, in the Iliad, elegantly represents sleep as overcoming all men, and even the gods, excepting Jupiter alone.

The length of time passed in sleep is not the same for all men; it varies in different individuals and at different ages; but nothing can be determined from the time past in sleep, relative to the strength or energy of the functions of the body or mind. From six to nine hours is the average proportion, yet the Roman Emperor Caligula slept only three hours. Frederic of Prussia and Dr John Hunter consumed only four or five hours in repose; while the great Scipio slept during eight. A rich and lazy citizen will slumber from ten to twelve hours daily. It is during infancy that sleep is longest and most profound. Women also sleep longer than men, and young men longer than old. Sleep is driven away during convalescence after a long sickness, by a continued fasting, and the abuse of coffee. The sleepless nights of old age are almost proverbial. It would appear that carnivorous animals sleep in general longer than the herbivorous, as the superior activity of the muscles and senses of the former seem more especially to require repair. Satiated with their prey, they

are obliged to seek repose to digest those very substantial matters which compose their aliment.

In general, it may be stated, that during sleep the internal functions predominate over those relating to the exterior of the body. Every thing which tends to interrupt the relations of the external with surrounding objects serves to induce sleep. On the contrary, the existence of external stimuli tend to expel it, until at length they lose their effect by long-continued exercise.

From this it ought to follow that excessive cold, which honumbs the external powers, ought to occasion sleep. When exposed to the action of a low temperature, animals experience an irresistible desire to sleep, which soon terminates in death. Of this there are frequent examples in the inhospitable climates of the north, Siberia, Lapland, and Kamschatka, or on the tops of high mountains, as the glaciers of Switzerland. Dr Solander and party nearly lost their lives from this cause among the hills of Terra del Fuego. Surprised by an excessive cold, he was with difficulty prevented by his companions from yielding to this impulse of nature, although knowing well the consequences of sleeping.—(See Captain Cook's First Voyage). Travellers on horseback are peculiarly liable to be overcome by this propensity to sleep, when the cold is very intense, in which case they are sure to be frozen to death.

There prevails among many Mammalia a singular internal modification, which cannot be explained by any cause more general than itself, but must be referred to some unknown original constitution. We refer to that state of torpidity commonly called Hybernation, into which some animals fall during a part of the autumn and in winter, but from which they escape early in spring. Although we are wholly ignorant of the cause of this winter sleep, the effects and design are well known. It seems obviously intended to preserve the animals in situations where they could not have maintained their existence, from the impossibility of finding an adequate supply of food. Accordingly, all the active functions of life are suspended, where their exercise would be incompatible with more general laws.

At a more or less advanced period of the autumn, depending on the degree in which the temperature is lowered, animals possessed of this peculiar constitution seek to shelter themselves from the cold and wind, by retiring into holes excavated in the ground, walls, trees, or among the bushes. These retreats they line carefully with grass, green leaves, moss, and other bad conductors of heat. Hybernation occurs among several of the Mammalia, as in the Fat Dormouse (*Myoxus glis*), the Garden Dormouse (*M. nitela*), the Common Dormouse (*M. avellanarius*), the Hedgehog (*Erinaceus Europæus*), the Bats, the Alpine Marmot (*Arctomys marmota*), the Hamster (*Cricetus vulgaris*), the Jumping Mouse of Canada (*Meriones nemoralis*), and some others. Animals with cold blood hybernate as well as some of the Mammalia. Many Reptiles become torpid in cold climates, as well as some Insects, Mollusca, and Worms; but in general the degree of their lethargy is much less profound than that of the hybernating Mammalia. They pass their time of hybernation without food, but are not always deprived of sensation and motion, even at the freezing point.

"It is highly important," observes Dr Marshall Hall, "to distinguish that kind of torpor which may be produced by cold in any animal from true hybernation, which is a property peculiar to a few species. The former is attended by a benumbed state of the sentient nerves, and a stiffened condition of the muscles; it is the direct and immediate effect of cold, and even in the hybernating animal is of an injurious and fatal tendency; in the latter, the sensibility and motility are unimpaired, the phenomena are produced through the medium of sleep, and the effect and object are the preservation of life. Striking as these differences are, it is certain that the distinction has not always been made. In all the experiments which have been made with artificial temperatures especially, it is obvious that this distinction has been neglected. True hybernation is induced by temperatures only moderately low. All hybernating animals avoid exposure to extreme cold. They seek some secure retreat, make themselves nests or burrows, or congregate in clusters; and if the season prove unusually severe, or if their retreat be not well closed, and they be exposed, in consequence, to excessive cold, many become benumbed, stiffen, and die. To induce true hybernation it is quite necessary to avoid extreme cold, otherwise we produce the benumbed and stiffened condition to which the true torpor or torpidity may be appropriated. I have even observed that methods which secure moderation in temperature lead to hybernation. Hedgehogs supplied with hay or straw, and Dormice supplied with cotton wool, make themselves nests, and become lethargic; when others, to which these materials are denied, and which are consequently more exposed to cold, remain in a state of activity. In these cases warmth, or moderate cold, actually concur to produce hybernation."

The kind of retreat which each animal prepares varies with the species. The Bats, besides hybernating in holes, also hang suspended in grottoes and caverns, where the temperature is milder than in the open air. Other hybernating animals are satisfied with bringing their head nearer to their lower extremities, so as to present a surface of less extent to the cold. On discovering them in their retreats, they are found rolled up, cold to the touch, motionless, stiff, their eyes closed, their respiration slow, interrupted, scarcely perceptible, or none at all. Their insensibility is sometimes such that they may be moved, rolled about, and shaken in every possible way, without being disturbed from their torpor.

During the spring or summer, when these animals enjoy their full activity, they possess an elevated temperature, which may vary according to the species and individuals, between 95° and 98½° Fahrenheit, and consequently is between those limits which characterize the animals with warm blood. When examined in the autumn, with the view of ascertaining the changes which they then undergo, it is observed that their temperature falls rapidly as the cold season advances. Their respiration gradually becomes impeded, their movements are less rapid, and their appetite diminishes; but these animals still maintain the use of their senses and the power of locomotion. This intermediate state, between the full possession of life in all its vigour, and absolute torpidity, may continue for one or two months.

The degree of external temperature at which they become absolutely torpid varies with the species, and even according to the individual. In general, the disposition to hybernate follows in a descending scale of temperature, of which the follow-

ing is the order:—The Bat, the Hedgehog, the Dormouse, the Marmot, and the Hamster; the comparison has, we believe, not yet been instituted for the other species. Although there is no precise degree at which these animals lose the faculties of sensation and motion, it has been remarked that the Bats become torpid between the temperatures of 50° and 44½° of Fahrenheit; the Hedgehog about 44½°; the fat Dormouse at 41°. The Marmot and Hamster cannot become torpid except at a temperature considerably below the freezing point; and they further require that their respiration should be impeded by diminishing, or altogether preventing, the accession of fresh air in the boxes or holes where they are confined.

Absolute torpidity can only be said to belong to these animals when their temperature has been fully reduced, and their respiration diminished, so that they at length come to be wholly deprived of sensation and voluntary motion. Hibernation is, however, susceptible of different degrees, which are characterized by the number of inspirations made in a given time; the absence of all respiratory movement marks in this case the highest degree of torpidity. All the species do not partake of it in the same degree. The Bats experience a very slight lethargy. On the other hand, the Marmot undergoes the most profound torpidity.

The pulsations of the heart and arteries become greatly enfeebled during torpidity. In the active state of the Hamster, the heart makes 150 pulsations in a minute, while in its torpidity it beats only 15 times. Bats, during summer, have about 100 pulsations in a minute. When they begin to grow torpid they have only 60; and as their lethargy increases, the action of the heart is so feeble that only 14 beats have been distinctly counted, and these were at unequal intervals. Dormice breathe so rapidly when they are awake, that it is scarcely possible to count their pulse; but as soon as they begin to grow torpid, 88 pulsations may be counted in a minute, 31 when they are half torpid, and only 20, 19, or even 16, when their torpor is not so great as to render the action of the heart wholly imperceptible.—(Reeve's Essay on Torpidity.)

The results of the recent researches of Dr Marshall Hall regarding the sensibility of hibernating animals are at variance with those of preceding observers. According to him, the slightest touch applied to one of the spines of the Hedgehog immediately rouses it to draw a deep inspiration; the merest shake induces a few inspirations in the Bat, and the slightest disturbance is felt, as appears from its effect in inducing motion in the animal. In fact, he considers the sensibility of these animals during hibernation to be in the same condition as in ordinary sleep. On the other hand, according to MM. Pruvette, Spallanzani, Mangili, Legallois, and Edwards, the strongest stimuli, with the exception of heat, make no impression upon them. Marmots are not roused from their torpid state by an electric spark strong enough to give a smart sensation to the hand, and a shock from a Leyden phial excited them only for a short time, as Spallanzani relates in his experiments made upon them jointly with Volta. They are insensible to the pricking of the feet and nose, and remain motionless and apparently dead. Bats are insensible also to every kind of stimulus except heat, or to a stream of air blown upon them, which affects their sensations powerfully. Wounds have been inflicted, and their limbs broken, without the mutilated animals exhibiting any external signs of pain.

The internal temperature of these animals during their lethargic sleep chiefly depends upon that of the external air, yet it is usually from 5½° to 7° more elevated than the latter. Hence their temperature is very variable; it may descend to 37½° without changing the state of the animal; but the internal temperature cannot go below 32°, the freezing point of water, without either waking the animal or occasioning its death.

There exists, therefore, a degree of external cold, which is incompatible with the torpidity or life of these animals. Species which most easily become torpid, such as the Bats, Hedgehog, and Dormice, cannot support an external temperature of 14°, and a heat of 50° to 54° likewise awakens them.

They may also be aroused by different mechanical means, such as by shaking them either gently or violently, according to the depth of their torpidity, without it being necessary at the same time to change the degree of external temperature. But if capable of resuming their activity in this way, they cannot long maintain it without the aid of a gentle heat. On being roused from their torpidity, they present all the phenomena of waking from ordinary sleep. When the torpid Hedgehog is touched it coils itself up more forcibly than before. The Dormouse unfolds itself when similarly treated, and the Bat moves variously. There is no stiffness nor lameness in their movements, and the Bat even flies about with great activity, although exhaustion and death are the certain consequences. Dr Marshall Hall thinks that those physiologists who assert the contrary have mistaken the phenomena of torpor from cold for a true Hibernation.

From what has been said, it is evident that the repose of the hibernating Mammalia is neither uniform nor constant in its duration. As it is influenced by the changes of the atmosphere, it may be continuous or interrupted according to the variations of the weather, or the precautions which the animals have taken to shelter themselves from the sudden changes of temperature, as well as their individual susceptibility.

When these animals are very liable to be awakened, either from their constitution or habits, they instinctively take the precaution of amassing stores of provisions to supply their future wants. The Hedgehog, for example, has been seen to form several separate stores, and to resort to them at different periods of the torpid season. Its traces have also been observed upon the snow.

When torpid animals are suddenly and frequently awakened, their respiration becomes heightened, and death soon follows. "All those Bats which were sent me from distant parts of the country," says Dr Marshall Hall, "died. The continual excitement from the motion of the coach keeping them in a state of respiration, the animal perished. One Bat had, on its arrival, been roused so as to fly about. Being left quiet, it relapsed into a state of hibernation. The excitement being again repeated the next day, it again flew about the room; on the succeeding day it was found dead." We may thus see one reason of the precautions which these animals take to preserve themselves from being suddenly disturbed or excited. They select sheltered spots, such as burrows or deep caverns, at once secure from their enemies

as from the inclemencies of the weather. The Common Bat (*Vespertilio murinus*) hangs itself by the claws of the hinder feet, with the head downwards, while the Horse-shoe Bat (*Rhinolophus ferrum-equinum*) spreads its wings to protect and embrace its companions. Many other animals form nests, and some congregate together. The Hedgehog and Dormouse roll themselves in a ball;—all which dispositions are evidently intended to preserve them from being disturbed by a low temperature.

There is no external character by which the hibernating animals can be distinguished from the others. Though some species belong to the same genus, such as the several Dormice, yet this phenomenon is also found in the Bats belonging to a family, separated by a wide interval, and Comparative Anatomists have sought in vain in the internal structure of these animals for an organization peculiar to them.

It might, however, be expected, that their organization would approach to that which these animals possessed when in their embryo state; and this actually happens to a certain extent. A large quantity of fat is lodged in different parts of the body, but especially in the appendages of the peritoneum, which are always more numerous and extensive than in other species. The sub-renal capsules, of whose use we are ignorant, but which we know are more developed in the fœtus than in the adult, are stronger and obtain some growth in these animals of which we are now treating. It is the same with the thymus gland and its appendages; that is to say, those granulous organs which are found to surround the necks of the torpid animals, such as the Marmots, Dormice, and Bats, and may even extend between both shoulders, as in the Bat, according to the observations of M. Jacobson of Copenhagen. Those are nearly all the peculiarities yet observed in the hibernating animals, and they are very far from explaining the causes of this singular phenomenon.

Hibernating animals are not found in all orders of the Mammalia. None of the Quadrumana become torpid, probably because none of them are designed to inhabit a cold climate. The order of Carnassiers, on the contrary, contains several, especially among such as reside in cold countries; several are also found among the Rodentia, but the remaining orders do not contain any torpid animals.

We cannot by any means agree with M. Edwards in thinking that no species of animal is condemned by its nature to hibernate, and that the state of hibernation depends upon external circumstances, so that we can make it come and go by regulating the conditions under which animals are placed. On the contrary, we find that the nearer hibernating animals are permitted to approach to their natural mode of life in a domesticated state, the more they are disposed to follow their natural habits. Thus, torpidity seems perfectly congenial to the nature of the Marmot, and if any animal can be said to be naturally torpid it is this. Although it can live during the whole winter without becoming torpid, it by no means follows from this that its tendency to become torpid is artificial. We could no more compel other animals to become torpid on the approach of winter, to whom such a state was unnatural, than we could assign to ourselves a new organ of perception. The circumstance that we have not yet succeeded in referring the phenomena of hibernation to any cause more general than itself, only proves that the ultimate cause is complicated and obscure, but ought not to lead us to doubt of its existence.

In the preceding observations, reference has been made to those species only of whose hibernation there can be no doubt. Some species of Bears and Badgers, however, undergo a kind of lethargic sleep, termed *quiescence*. This state differs materially from that of ordinary hibernation, as the females bring forth their young during their interval of retirement. The common Bear (*Ursus arctos*) is always loaded with fat in the autumn, when he retires to a den previously lined with branches and soft moss. Here he sleeps but little if the winter should be mild, and licks his fore-paws and soles of the feet continually during the intervals of repose; but when the winter is severe, he sleeps much. This state of quiescence cannot be studied with the same facility as that of hibernation, as these animals never become quiescent when in confinement, but remain as much awake during the winter as in the spring and summer.

Some writers maintain that the number of animals susceptible of hibernation is very great; others are inclined to extend this supposition to all, even to Man himself. Thus, Addison mentions an Englishman who underwent a lethargic sleep from the 5th to the 11th of August annually. Sheep in Iceland have been known to live under the snow; and instances often occur in Cumberland, Westmoreland, and the Highlands of Scotland, of sheep existing for four or five weeks under drifts of snow, where they can procure little or no food, and must, it is supposed, have become torpid. Persons have been known to continue asleep from seven to fourteen days, and some much longer, apparently from the influence of fear, anxiety, or other causes which tend to weaken the vital powers. Yet these and other instances are far from establishing the fact of torpidity, when we are unable to induce that state in any of these animals, under circumstances which would be certain to bring it on in those predisposed to hibernate.

Had Man not been exempt from that unknown law of Nature which compels certain of the lower animals to become torpid, we should find it exemplified in all those cases where men have been exposed to cold, and no allusion to such a fact is made in the history of the human species. Yet Gmelin measured a natural cold of 120° below zero, at Jenislisk, lat. 58° N., long. 110° E., in the year 1735; and Pallas, in 1772, found the temperature at Krasnojorsk, lat. 56° N., and 110° E., to be 80° below zero, so that a mass of quicksilver exposed to the air was frozen and became malleable. The Greenlanders go about with very light clothing, and the Norwegian peasants work during the winter with their bosoms bare, or roll themselves in the snow.

It would appear that there are certain animals which experience a corresponding state, that cannot properly be termed hibernation, as it happens during the hottest months of summer, and in tropical climates. The Tenrecs, or Madagascar Hedgehogs (*Centetes caudatus*), are asserted by Brugière to undergo this summer torpidity or aestivation, but his statement has more recently been called in question by Mr Telfair, in an account of that animal. Humboldt, however, has observed this remarkable state in the hottest parts of South America, in certain Reptiles which pass a part of the year buried in the earth, and do not leave their state of torpor until the rainy season drives them from their retreats. The singular state of torpidity, induced by the excitement of a high temperature, may be considered as analogous to

that daily sleep of Man and the lower animals during the hottest parts of the day, and called the *sieste* in Spain and Italy.

Neither cold nor heat can thus be said to be the cause of hibernation and aestivation, although they are auxiliaries to those states. In the same manner as it is neither cold nor heat that compels us to sleep every night, but a constitutional fatigue, and the necessity of repairing our forces; so in these annual sleeps the absence and presence of heat are merely proximate causes. Nature has wisely constituted these animals thus; for it is probable that their feeble constitutions would have otherwise failed to resist the cold, or they would perhaps have been unable to procure an adequate supply of food. When the period of torpidity is over, the rutting season usually commences, and these animals then enter anew upon the functions of life with renovated faculties.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Phenomena of Reproduction—Growth—Duration of Life.

SCARCELY have the Mammalia attained the full period of their growth, when another order of functions make their appearance. Their animal forces then acquire a new direction, and Life, which was formerly confined to the development of the individual, now applies itself towards the continuation of the species.

The time when the phenomena of reproduction first exhibit themselves is termed *Puberty*. Then the reproductive organs, which previously were but slightly apparent, acquire a remarkable development, and in some species obtain certain external characters which remain during the whole course of their lives. Infancy is the period comprised between birth and puberty. It is during the time preceding puberty that the growth of the body chiefly takes place, although it may continue for some time afterwards. The length of the period of infancy bears to that of life a certain relation, which may be regarded as almost constant. Buffon remarks, that in our climates, for the largest animals, it is about the one-seventh part of their entire life.

At the age of puberty, the Mammalia assume the characters of maturity. Their height attains its greatest limit, and the distinctive marks of each animal become bold and well-defined. The physiognomy assumes a more animated expression; their voice becomes hoarser or stronger, and the fur handsomer; while the vivacity of their movements marks the impetuosity of those passions which animate them at this epoch. The male becomes distinguished from the female by colours which are commonly darker or browner, and in many species by certain definite external characters. Thus, some male Apes acquire a beard and a coat of long hair; the Lion obtains a mane; and the Stags and Roebucks are armed with branching horns, of which the females are nearly always deprived. The He-Goats and Rams are at once distinguished from the females by their horns, their masculine gait, and combative disposition. This superiority in the males is most marked among the Ruminantia, which are commonly polygamous, and where each male having several of the other sex to keep in subjection, it becomes necessary to assign him a physical superiority, unnecessary in the monogamous species, where the sexes are always more equal in strength.

Puberty constantly exhibits itself much sooner in females than in males, although the reproductive power remains longer with the latter than with the former. In our climates Man attains this condition at the age of fifteen or sixteen, and Woman at that of fourteen or fifteen; in warmer climates it exhibits itself at the age of twelve to fourteen in the former, and at ten to twelve in the latter. With most of the other Mammalia, excepting the domestic animals, we are still ignorant of the precise periods when puberty commences. Dogs are capable of reproducing at the age of nine or ten months; Cats from a year to eighteen months. A Lioness of the "Ménagerie" at Paris was six years old when she exhibited these phenomena for the first time. Rabbits can procreate at the age of five or six months; Hares a little later; and Guinea-Pigs at five or six weeks. Sheep show signs of puberty when one year old; Rams, He-Goats, and Stags, at eighteen months. Horses produce at two years and a half, and Mares a little sooner. Camels, according to the ancients, at three years; Wolves at two years; Cows at eighteen months; Bulls six months later; the She-Ass from eighteen to twenty months; and the Ass at two years. It is, however, the interest of the Grazier to prevent the domestic animals from procreating before they have attained their full growth, otherwise the deterioration of the races is sure to follow.

There are certain seasons of the year when most Mammalia become susceptible of the instincts of reproduction. This is termed the *rutting* season, during which the usual character of the animals is totally changed, especially of the males. The most timid animals, being excited by the abundance of food and the internal suggestions of instinct, acquire a degree of courage and even fury, which urges them on in a career of madness, which can be compared only to the habitual ferocity of the most formidable species. The females also, at this period, lay aside their habitual reserve, and are seen to provoke the males by biting, teasing, and following them everywhere.

Some Mammalia in our countries, as well as in those of the south, whether males or females, remain always in a state adapted for procreation, after having once attained the age of Puberty. With the exception of the Monkeys, this happens only to those species, which either receive an abundant nourishment from Man, or else obtain a plentiful supply by plundering his stores. Of the first kind are the Dog, Cat, Rabbit, Guinea-Pig, Hog, Bull, Buffalo, Horse, and Ass; in the second division must be placed the common Rat, the common Mouse, the Wood Mouse, the Economic Mouse, and the Hamster. With the animals of the Ménagerie, the change of climate which they experience, and the constraints of confinement, occasion them to undergo certain deviations from their natural period of rutting. Among these may particularly be enumerated, the Lion and other Cats from warm climates, the Cape Ichneumon (*Mangusta grisea*), and the Cape Genet (*Paradoxurus typus*), the Ichneumon of Egypt, the Gnu Antelope, and the Zebra; also the Axis Deer from the banks of the Ganges, and the Kangaroo of New Holland.

It commonly happens, however, with the Mammalia, when they have not been modified by domestication or confinement, that each has a peculiar season when the phenomena of the rut more especially present themselves. Thus, winter is the rutting time of the Wild Cat and Martens of Europe; of the Wolf, from December to February; of the Jaekal and Corsac Fox (*Canis Corsac*), only in winter. The Arctic Fox (*Canis lagopus*) is in season at the end of February; the Bear, in summer; the Hedgehog, at the end of winter; and the Hare in February or March. The Beavers seek the females in the beginning of January; the American Ondatra and the Common Squirrel, in spring. The Dromedaries seem to be more in season about the month of January than at any other time. Camels begin about the middle of November, and end at the commencement of February. The month of September is the chief time for the Sheep and Goats, although the males of both species are always fit for procreation. In the Stags of our countries, the Roebuck, and other Deer, the rutting season succeeds to the period when the horns are renewed, that is in November, and after this time the horns fall. The Rein-Deer are in the same case.

Thus the season of the rut varies with the species; but it is always so arranged in reference to the term of gestation, that the young may make their appearance at a favorable season of the year, when the heat of summer will serve to aid their growth, and assist in developing their forces. At this season, also, a luxuriant vegetation supplies the herbivorous animals with abundance of food, which favors the secretion of milk, and ensures its continued supply.

The external signs of the rutting period vary greatly with the several species. In those which are capable of procreating at all seasons, such as Man, the Monkeys, Dogs, Cats, and Horses, no particular sign is observed. It is different with the Rodentia. "Daus la plupart des Rongeurs (Rodentia), les testicules, ordinairement petits et comme cachés dans l'abdomen, prennent un volume très considérable et deviennent fort apparens. C'est en particulier, ce qu'on remarque dans les Rats, les Surmulots etc. où ces parties font, à cette époque, une saillie très-remarquable à la base de la queue, et donnent au corps une figure pointue vers cette extrémité." At this period the Elephants secrete, on the side of the head behind the ears, a brownish fluid, which proceeds from glands situated under the skin. The Bactrian Camel diffuses a most disagreeable odour at this season. At first he undergoes a violent perspiration, which lasts for fifteen days; then a blackish and viscous fluid exudes from the neck, not through any particular opening, but merely from the pores of the skin, so that the Persians are obliged to cut his hair very close. In the Dromedary, also, the male presents at this particular season a similar phenomenon. We find, likewise, that all those odoriferous Mammalia, which are supplied with pouches from whence the odours emanate, emit their perfumes at this time with unusual force. In the greater number of animals belonging to the Deer Genus, and in several Antelopes, the larynx or windpipe of the male projects considerably; and it cannot be doubted that the change of tone which his voice undergoes is owing to this cause.

It usually happens that the females exhibit the external signs of the rutting season in a milder and more subdued form than the males. "Alors seulement, observes M. Desmarest, les organes externes de la génération se tuméfient légèrement, s'entr'ouvrent, et sont continuellement humectés par un fluide plus ou moins visqueux, qui, chez les jumens, où il est particulièrement abondant a reçu le nom d'hippomanès. Neanmoins, la tuméfaction et la rougeur excessive des fesses de certaines femelles de singes doivent être considérées comme un signe du rut, et sans nul doute aussi, les écoulemens sanguins qui ont lieu à des époques régulières et plus ou moins rapprochées, mais fixes chez celles de quelques espèces." These appearances may present themselves in the females at intervals more or less considerable in the course of the year.

Among the Mammalia, and indeed in all living beings, the period of puberty and reproduction is one of energy and strength; all their affections become more ardent, and their wants irresistible. The term *rut*, from *ruere*, to rush headlong, serves to express the fury which transports these lower animals.

In furias ignesque ruunt, amor omnibus idem.

Alike ferocious and untameable, they are susceptible at this period neither of fear nor any other passion, and seem deaf even to the calls of hunger or sleep. The Bull forsakes the meadows, and rambles everywhere in search of his mate. The forests resound with the howling of contesting Wolves, and the Lion, with a deafening roar, defies his rivals to the combat. We may easily perceive the final cause of these contests among the lower animals during the rutting season. Nature ever sacrifices the interests of individuals towards the perfection of species. The most vigorous males always possess the most formidable weapons of attack and defence, while the more effeminate individuals exhibit their feebleness at once in their horns and their want of courage. It is especially among the polygamous races where these combats of the rutting season are more conspicuously observable, because each male fights for several females. In the monogamous species, on the contrary, where the numbers of the sexes are nearly equal, these battles seldom occur. Again, in the Carnivora, when the number of the males surpasses that of the females, duels become both frequent and sanguinary. The Seals (*Phoca*) are perhaps more polygamous than any other of the Mammalia. Each maintains a kind of seraglio or family, composed, perhaps, of one hundred and twenty females, which he defends from the approach of any other male, with the utmost jealousy and rage. Other species, less faithful or more complaisant, pass from conquest to conquest, and pay their court to all the beauties of the neighbourhood.

The duration of this season varies with different species; but, in general, among the wild animals it ceases as soon as the females have been fecundated. With most of the latter, the external signs of the rut immediately disappear; the females resume their usual reserve, and repel with rudeness the approaches of the male. There are exceptions, in the Monkeys, the Mare, and in our own species. The female Rabbit is likewise an exception, though only an apparent one; as from the peculiar formation of the matrix, she is susceptible of a twofold impregnation, or superfetation.

"Le mode d'accouplement varie peu dans les Mammifères; en général cet acte a lieu comme dans nos espèces domestiques d'Europe. On avait dit, que ceux de nos

animaux qui, dans l'état ordinaire, ont la verge dirigée en arrière, comme les Rhinocéros, les Chameaux, les Lamas, les Dromadaires, etc., s'accouplent en arrière; mais il n'en est rien; dans l'érection, leur verge reprend sa direction en avant, et le coït a lieu comme à l'ordinaire, mais, à la vérité, avec plus de difficulté. Les singes seuls s'accouplent à la manière de l'homme, mais c'est à tort qu'on a prétendu que l'éléphant en faisoit de même. Selon Buffon, le mâle et la femelle du hérisson ne peuvent s'accoupler comme les autres quadrupèdes; il faut qu'ils soient face à face, debout ou couchés. Les rats s'accouplent en se mettant debout, ventre contre ventre. Dans beaucoup d'espèces chez lesquelles, comme les chats, les lions, les gorboises, etc., le gland du mâle est muni de pointes cornées plus ou moins longues, et quelquefois dirigées en arrière, l'accouplement est très-douloureux. Chez les chiens il dure fort long-temps, ce qui est dû à une conformation particulière du vagin de la femelle. Dans d'autres, comme dans l'espèce du taureau, il est terminé en quelques secondes. Tantôt la femelle se tient debout, tantôt elle s'accroupit sur ses deux jambes antérieures; tantôt le mâle se maintient à l'aide de ses deux mêmes membres de devant, ou saisit la peau du cou de la femelle avec ses dents, etc. On a cru long-temps qu'un sixième organe surnuméraire, qui se trouve au côté interne des pieds de derrière des Echinés et des Ornithorhiques étoit destiné à faciliter l'accouplement; mais on a découvert depuis peu que ces organes avoient un tout autre objet, et qu'ils étoient des armes empoisonnées dont ces animaux se servoient contre leurs ennemis; et c'est ce que M. de Blainville a confirmé. (Desmarest in Nöuv. Diet. des Sciences Nat.)

In some species of domesticated animals, especially in the Dog, copulation is maintained for a long time after the emission of the fecundating fluid; whilst among the greater part of the Birds, especially in the Galline, the union is instantaneously dissolved. It is always dangerous in the former cases to force a separation, which is sometimes attempted, although opposed by the peculiar organization of the sexual organs; the intention of Nature apparently being, by this extraordinary prolongation of the union, to render conception more certain. "L'étroite conjonction paroit destinée, dans le principe, à produire l'irritation nécessaire à l'émission de la semence; et le plaisir qui en résulte est le ressort qui détermine le plus puissamment les animaux à la propagation, quoiqu'elle paroisse douloureuse d'abord dans quelques espèces, comme dans le genre chat, dont les femelles poussent souvent alors des cris aigus. Dans quelques oiseaux polygames aussi, comme les faisans, l'accouplement paroit être un acte plus violent que voluptueux; car on voit les femelles redouter l'approche du mâle, qui fait usage de sa force pour les y contraindre." (Yvart.)

The older females of each species exhibit an attachment for the males, at an earlier season of the year than those of a less advanced age. After conception, as has already been observed, the females, in general, repel the approaches of the male. In all cases where the races are peculiarly ferocious, as in the Lion, Tiger, Panther, and other large Cats, the females are the first to solicit the approaches of the male. Had this not been the case, it is difficult to conceive in what manner their races could have been continued. In species of a milder disposition, the males endeavour to please the other sex, and often exhibit a strongly-marked feeling of jealousy towards their own. The Monkeys remain attached to one or two females, rarely to more. Their union seems to be a kind of marriage; they require fidelity, are exceedingly jealous, and severely punish their female companions, who are well-disposed to coquetry, on finding them in company with other males.

The phenomena of generation must, however, be considered in another point of view, at once singular and surprising. It seems now beyond a doubt, that the power enjoyed by male animals of continuing their species depends upon the presence in the spermatic fluid of a certain kind of animalcules, which have thence received the name of *Zoospermata*. The testicle, or secreting organ, is well known to be the means by which the ovaria are fecundated; and it is remarkable, that within this organ alone *Zoospermata* have been hitherto observed.

All animals, before arriving at the age of puberty, are incapable of reproduction, and they are accordingly wholly destitute of *Zoospermata*. M. Dumas informs us that he has made a considerable number of experiments upon young animals, and that he found all of them to be destitute of *Zoospermata*. He particularizes the young of the Rabbit, Calves, Foals, young Asses, Guinea-pigs only a few months old, Mice of the same age, a great number of Norwegian Rats, with Pullets, young Ducks, and even Frogs. The fluid extracted from their organs contained the same kind of irregular globules which are found in the testicles of the Male; but it was wholly deprived of moving bodies, and nothing was found which could in any way approach to the peculiar form of those animalcules proper to fertile animals.

It is well known that animals become sterile at a certain period of life, varying with the species. To ascertain whether the presence of these animalcules is essential to fecundity, it becomes necessary to investigate whether very old animals possess them or not. This, to a certain extent, has been done. M. Dumas examined a Stallion aged twenty-five years, and which had been incapacitated through age for about four or five years, as well as some Dogs of a very advanced period of life. Their sexual organs were perfectly healthy, yet he found them to be destitute of animalcules, and the fluid within them resembled in every respect that of the young individuals already mentioned.

These facts serve to establish the importance of animalcules, and appear to show that their presence is essential to the fecundating power of animals.

With the view of setting this interesting point beyond a doubt, many experiments have been instituted. The spermatic fluid of a Dog was placed in two silver capsules in equal quantities. In one of these, a metallic rod, polished at its extremity, was plunged, in such a manner, that the rod and capsule might be placed in communication with the two surfaces of a Leyden phial, strongly charged. An electric spark was then made to pass through the fluid, but not at its surface. After a few discharges, the animalcules became entirely motionless, while the other capsule, which had not been electrified, was animated with them as completely as it had been previously to the experiments, which did not last for five minutes.

The result of this and other experiments, which cannot be detailed here, appear to show that these animals possess irritability, and are destitute of the muscular system of other animals. It is, however, certain that all male animals hitherto ex-

amined, possess spermatic animalcules when in a state of puberty. Young individuals, as well as those that are aged, exhibit no traces of them, and even it is remarked, that Birds are destitute of spermatic animalcules, except at those particular periods of the year which Nature has fixed for their procreation. The domestic Cock and Pigeon, being fertile all the year round, are, of course, exceptions.

These spermatic animalcules exist within the testicle in a state of complete perfection; they are transmitted to the deferential canals, without undergoing any alteration during the transition. Neither their motion nor their form is influenced by the mixture of fluids from the other glands, so that, on being emitted, they appear in the same state as when in the spermatic vessels themselves. The spontaneous movement of the animalcules is intimately connected with the physiological state of the individual which supplies them. Each species possesses a species of animalcule, of a form peculiar to itself, and no two species hitherto examined have the same kind of animalcules, although they always remain the same in the same species. The electric spark kills them, but they are not affected by the galvanic current, even when used in a degree of intensity sufficient to decompose water and the salts which it contains.

Whatever opinion may be held as to the part performed by these animalcules, in the function of generation, it cannot be doubted that they exist solely in the essential part of the generative organ, in all animals which do not reproduce by buds or offshoots. On the other hand, they are wholly wanting in animals incapable of generation, and their presence in the seminal fluid may thence be assumed as the index of its fecundating power.

With the exception of a few solitary instances of superfetation, it is always found among the Mammalia, that the fecundation of the male refers only to one birth, being that which next immediately follows the union of the sexes. On the contrary, with the Birds, a single union may influence several successive broods. Thus, the domestic Fowl will produce fertile eggs at tolerably remote periods of time, after having once received the influence of the male. A young and vigorous Cock is adequate for fifteen fowls, and serves to fecundate all the eggs they may produce during twenty days. Hence one male may be sufficient to give existence in a single day to three hundred chickens.

The phenomenon of gestation can only be observed in the Mammalia and other viviparous animals. The term *Gestation*, from the Latin *gestare*, to carry, denotes the period of time which elapses between conception and birth. Among Birds and all other oviparous animals, a real gestation cannot exist, because the eggs detach themselves from the ovaries, pass along the oviducts, and are deposited as soon as they are formed. With these animals, gestation becomes superseded in general by incubation, to which it is greatly analogous, and the former function may thus be considered as little else than an internal incubation. The apparent design of Nature, in both cases, is to favour the gradual development of the embryo or fœtus—the first rudiment of the new animal resulting from conception. It is also observed, that the rapidity of growth in the fœtus, whether during the gestation of the viviparous animals, or the incubation of the oviparous, always diminishes in proportion as the fœtus approaches the time appointed by Nature for its birth.

The length of the period of gestation, like that of incubation, varies greatly among the several genera and species. It further obtains certain accidental variations, which appear to depend upon the age of the mother, her state of health, an increase or diminution in the velocity of the circulation, the quantity or quality of the food, and all those causes, derived from the influence of climate, soil, shelter, and the different kinds of treatment which these animals receive from Man. The period of gestation may also be either shortened or prolonged, according to the temperature which prevails during that interval. It is a matter of common observation among graziers, that two cows, though fecundated on the same day, will yet produce at an interval of several weeks. The variation among sheep under similar circumstances amounts to a few days, but in general, this difference among domestic animals of the same species may extend as far as twenty days.

It commonly happens in all those species, where the individuals take a long time in arriving at their full growth, that the period of gestation is considerably prolonged; and the converse is equally true; for in all those species which are very precocious, the time of gestation is extremely short. This rule is not, however, without many exceptions. Thus, the Goat and Sheep are capable of reproducing at the age of two years, and have commonly attained their full growth at this period, while their ordinary time of gestation is about five months. On the other hand, a Lioness at the *Ménagerie du Muséum*, in 1801 and 1802, seemed unfit for procreation before the age of two years, and yet she produced after a gestation of 108 days only, or rather more than three months and a half.

The duration of gestation seems further to depend upon the comparative volume of the species; this rule, however, is by no means invariably preserved. Thus, the Ass and Zebra, though less in volume than the Cow and Buffalo, employ less time in performing this function than the latter species.

It hence appears that the duration of gestation varies in different animals, and the empirical laws deduced from multiplied observations are not without many exceptions. By combining, however, the general organization of the Mammalia, with the time necessary for each animal to arrive at its full growth, as well as with the comparative bulk of the females, it is possible to obtain a general and definite result; while the characteristic thus obtained may, with propriety, be added to those which commonly serve to distinguish the leading groups of Mammalia. Thus in Man, nine months is the well-known period of gestation. Among the Quadrupeds, it is also nine months for the larger species, but only seven for the smaller. In the Carnassiers, gestation endures six months with the Bear; 108 days with the Lion; nine weeks with the Arctic Fox (*Canis lagopus*); from 55 to 56 days with the Cat; the same period for the Martens and Weasels; from 62 to 63 days with the Dog; and nine months with the Mole. Those Mammalia which experience the shortest term of gestation are unquestionably the animals belonging to the Order Marsupialia. Among the large Kangaroos, for example, the young are scarcely more than an inch in length, when they first attach themselves to the breasts of their mother, although the full-grown animal is at least five feet in height. Gestation is also of short duration in the Rodentia, being only four months in the Beaver, one of the largest animals of this order. It is still less in the smaller Rodentia, being from 30 to 40 days in the

Hares and Rabbits; 31 days in the Dormice; four weeks in the Squirrels and Rats; and three weeks in the Guinea Pig. Among the Pachydermata, gestation is of much longer duration; it endures with the Elephant from 22 to 23 months; it lasts from 11 to 12 months in the Horse and Ass; in the Zebra for a year and some days; in the Tapir, from 10 to 11 months; in the Hog and Boar for four months. Further, it endures among the Ruminantia, for twelve months in the Dromedary; for nine months in the female Buffalo and Cow; for eight months and some days in the females of the common Red Deer (*Cervus elaphus*), the Fallow Deer (*C. dama*), and the Rein Deer (*C. Tarandus*); five months and a half for the Roebeek (*C. capreolus*); five months for the Goat, the Sheep, the Mouflon, and several Antelope. We are hitherto without any positive information regarding the period of gestation among the Cetacea.

It is evident that the number of births appropriate to each species will mainly depend upon the average length of each period of gestation. On this account, the larger species do not produce every year, especially when a long term of lactation also intervenes. The smallest species, on the contrary, multiply most prodigiously, and it may be generally stated that, if we except the Rabbit and Hog, both the number of births, and the number of young ones at each birth, are in general more considerable in proportion as the size of the animal is less. The Guinea Pig can produce every two months; the Hamsters, the Rats, the Mice, the Field-mice (*Arvicola*), and the Shrews, do not produce less than three or four litters in the course of the spring, summer, and autumn. With respect to the exceptions above stated, it may be inferred that the abundance of food which those animals obtain from Man has modified their nature; for we find that in all the wild species which approach nearest to these domestic races, the number of young produced at each birth is always less, as may be remarked in the Hare, producing only from three to four young at a birth, and the female of the Boar from three to eight.

The number of young in each litter also bears an immediate reference to the length of gestation. At each birth, Man and the Quadrumana commonly produce only one, very rarely two or more, and the Cheiroptera bear two. Among the Carnassiers, the Tiger produces one; the Lion, three or four; the Cat, four or five; the White Bear, two; the Brown Bear, from one to three; the Wolf, the Fox, and the Adiva, from four to five; the Arctic Fox, from five to seven; the Badger, from three to four; the Mole, from four to five; and the Seals, one or two. Among the Marsupialia, the Opossums produce from eight to ten, but the Kangaroos only one or two. Of the Rodentia, the Beaver bears two or three at a birth; the Rabbit from four to eight; the Hamster from five to six; the common Rat, the Mouse, and the brown Rat, or Surmulot, from eight to ten. The Agouti bears four, according to Laborde, or only two, according to Buffon and d'Azara. The garden Dormouse produces five or six young ones at a birth; the common Dormouse three or four; the Guinea-pig from seven to ten; the common Squirrel from three to five; and the Marmot three or four. Among the Edentata, the Sloths produce only one, as also the Ant-eaters, while the Armadillos bear four at each of their births, which occur pretty frequently. With the exception of the Pig, the Pachydermata produce but few young at a time; thus, the Elephants, Rhinoceroses, Hippopotamus, Tapir, and all the Horse genus, have only one; the Peccari has two, while the female Pig will bear as many as twelve, and even twenty. All the Ruminantia produce two or more, excepting the largest species, which have only one. The Cetacea produce, in general, but one young one at each birth. It most commonly happens that the first and last litter of each animal are deficient in number, and often also in strength.

It thus appears, that the largest and most formidable species are far less fruitful than the smallest and weakest. Not only are the former longer in arriving at their age of puberty, but their periods of gestation and lactation are prolonged, and the number of young at each birth is, in general, less. Thus, while the Tiger produces only one Cub at a time, the Wild Cat will bear four or five. "In this manner, the lower tribes become extremely numerous; and, but for this surprising fecundity, from their natural weakness, they would quickly be extirpated. The breed of Mice, for instance, would have long since been blotted from the earth, were the Mouse as slow in production as the Elephant. But it has been wisely provided, that such animals as can make but little resistance, should at least have a means of repairing the destruction, which they must often suffer, by their quick reproduction; that they should increase even among enemies, and multiply under the hand of the destroyer. On the other hand, it has as wisely been ordered by Providence, that the larger kind should produce but slowly; otherwise, as they require proportional supplies from Nature, they would quickly consume their own store; and, of consequence, many of them would soon perish through want, so that life would thus be given without the necessary means of subsistence. In a word, Providence has most wisely balanced the strength of the great against the weakness of the little. Since it was necessary that some should be great and others mean, since it was expedient that some should live upon others, it has assisted the weakness of one, by granting it fruitfulness; and diminished the number of the other by infecundity."

Thus in general, it would appear that the fecundity of animals is greater in proportion as they are more liable to perish from external causes. Insects, plants, and the smaller species of Mammalia, which cannot escape from danger, are exceedingly fertile, because Nature diminishes the chances of death by those of life, so that the species may exist continuously. The number of young at a birth thus serves as an index to the probable perils of each species, as well as the voracity of its enemies.

Among all the monogamous species, such as several Rodentia, Bats, and Moles, a kind of family is established during the interval, necessary for the support of the young, when the father and mother divide the cares of their family between them. A mutual tenderness seems to prevail in these little societies, which are connected by affection alone. Each animal shares in the common labour, and each partakes in its share of the produce. These societies, among many Rodentia, are almost as intimate as those of Man, whose articulate language is here supplied by a natural system, where cries and gestures supply the place of words. But when once the young have become strong enough to maintain themselves without the aid of their parents, they become estranged, and form other family connexions. They cease to recognize each other after a certain time, and become wholly indifferent to the nearest ties of

blood. They even do not scruple to contract alliances with their nearest relations of the other sex. It is seldom, however, that the young show any partiality of this kind towards their older relations. On the contrary, this anomalous feeling nearly always exhibits itself in the attachment of the older for the younger animals.

With polygamous species, such as the Ram, Goat, and Bull, there exists no attachment of relationship on the part of the male. Possessing several females, he has no affection for his young, and the mother alone takes charge of them, during their unprotected state of infancy. In these species, the mother bears a much less number of young at a time than the monogamous kinds, and hence the female suffices to nourish and protect them. The polygamous species being generally also herbivorous, and the young being capable of walking from the moment of their birth, they are sooner able to subsist without the aid of their parents than the Carnassiers. The latter, accordingly, are monogamous in general. Their young are often born with their eyes closed, and with imperfect senses.

It may be remarked, that although the Herbivorous animals produce, in general, only one or two young ones at a birth, this limited power of production is compensated by the greater number of females which the males are capable of fecundating; thus, a single Bull or Ram is sufficient for a flock of twenty Cows or Ewes. But the Carnivorous animals, being chiefly confined to one female, produce a more numerous race. It thus results in animals, as well as in man, that fruitfulness is the common attendant of monogamy and chastity.

Animals of different species are destitute of the power of producing fertile races. Not only are the individuals themselves naturally averse to unite, but there is found a great variety in the forms of their organs of generation, and in their different periods of gestation, while the Hybrid produce, or Mule, is, in general, unfruitful. These adulterous unions can hence only take place between animals which are very nearly allied to each other, as between the Horse and Ass, the Buffalo and Cow, the Bison and Zebu, the Camel and Dromedary, all the combinations in pairs among the Wolf, Fox, Jackal, and Dog; between the Ram and Goat, the Hare and the Rabbit. These animals are capable of mutually fecundating each other, whenever man can succeed in overcoming their natural antipathy. But there are certain disparities of organization, which wholly prevent the Dog from uniting with the Cat, the Bull with the Mare, the Ass with the Cow, although some examples of the last kind of union have been imagined. The unions between the larger species of Apes and the human species, as well as their fabulous product, are not authentic, as some have credulously supposed.

Animals which produce more than one young one at a birth usually bear an even number. This proceeds from the circumstance that each ovary supplies its contingent of ovaria to be fecundated. In the same manner, Nature assigns an even number of Mammæ to these viviparous quadrupeds. Human twins are most commonly both males or both females, although sometimes they are male and female, but these last happen more rarely. Four at a birth is very uncommon in the human species.

This gemelliparous property is often peculiar to particular families. Twin brothers are often the fathers of twins at several successive births, and in one case, a second marriage having taken place, the latter wife produced twins likewise. In this kind of generation, it is probable that the impregnation of the two ovaries happens at the same moment, especially as we know that animals, habitually multiparous, only require a single union, although doubtless superfetation may also be induced by subsequent unions.

The young of nearly all Mammalia are born with their eyes closed, and do not open them for several days. The mother cuts the umbilical cord with her teeth, and, even without being carnivorous, devours the membranes or after-birth, as in the Cow, the Sheep, and many others.

As soon as the young are born, their mother takes a peculiar care of them, until they are sufficiently strong to find a maintenance without her aid. The female Rabbit prepares a bed of fur for her litter, which she tears from the under part of her body a few days before producing. The She-Bear collects hay and other soft substances in her retreat for a similar purpose. "Whatever be the natural disposition of animals at other times, they all acquire new courage, when they consider themselves as defending their young. No terrors can then drive them from the post of duty; the mildest begin to exert their little force, and resist the most formidable enemy. Where resistance is hopeless, they then incur every danger, in order to rescue their young by flight, and retard their own expedition, by providing for their little ones. When the female Opossum, an animal of America, is pursued, she instantly takes her young into a false belly, with which Nature has supplied her, and carries them off, or dies in the endeavour. I have been lately assured," continues Goldsmith, "of a She-Fox, which, when hunted, took her Cub in her mouth, and ran for several miles without quitting it, until at last she was forced to leave it behind, upon the approach of a Mastiff, as she ran through a farmer's yard. But if, at this period, the mildest animals acquire new fierceness, how formidable must those be that subsist by rapine! At such times, no obstacles can stop their ravage, and no threats can terrify; the Lioness then seems more hardy than even the Lion himself. She attacks Men and Beasts indiscriminately, and carries all she can overcome recking to her Cubs, which she thus early accustoms to slaughter. Milk, in the Carnivorous animals, is much more sparing than in others; and it may be for this reason, that all such carry home their prey alive, that, in feeding their young, its blood may supply the deficiencies of Nature, and serve instead of that milk, with which they are so sparingly supplied. The choice of situation in bringing forth is also very remarkable. In most of the rapacious kinds, the female takes the utmost precautions to hide the place of her retreat from the male, who, otherwise, when pressed by hunger, would be apt to devour her Cubs. She seldom, therefore, strays far from the den, and never approaches it while he is in view, nor visits him again, till her young are capable of providing for themselves. Such animals as are of tender constitutions, take the utmost care to provide a place of warmth, as well as safety, for their young. Some dig holes in the ground; some choose the hollow of a tree; and all the amphibious kinds bring up their young near the water, and accustom them betimes to their proper element. The rapacious kinds bring forth in the thickest woods."

The young are at first nourished entirely by the Milk secreted from the Mamme or breasts of their mother. Each mamma is a conglomerate gland, covered with a tenacious cellular tissue; it is formed of rounded grains, separated from each other by fat, and surrounded by spongy and cellular tissues. In the midst of this gland, a number of lactiferous canals cross each other, being semi-transparent, susceptible of dilatation, and re-uniting in several leading branches towards the nipple. Besides this general conformation, there are several thoracic, epigastric, or hypogastric arteries, independently of numerous lymphatic vessels, which carry their ramifications throughout these organs. They are also very numerous supplied with nerves, for their sensibility is very great. The nipple, which is only covered by a mucous tissue, with a very fine skin and epidermis, is delicately sensible to the slightest touch. "Elle est formée d'un tissu vasculaire particulier qui jouit de la propriété d'entrer en une véritable érection analogue à celle de la verge et du clitoris; car ces organes ont beaucoup de sympathie entre eux. Elle reçoit de sang et devient rouge et très-sensible alors. Les conduits s'ouvrent et sont prêts à faire jaillir le lait du même que le sperme est éjaculé par les canaux excréteurs des vésicules séminales. En effet, il y a une grande ressemblance entre l'action de la glande mammaire et celle des organes de la génération."

The mamma may be placed, according to the species, on the breast, the groin, or the abdomen. Their number is often relative to that of the young. In the larger species, which have only one or two young at each birth, there are usually but two mammae, whether pectoral or ventral. With the species of medium size, there are most commonly eight; although some may have as many as fourteen.

The Carnivorous animals most commonly have from six to ten placed longitudinally under the abdomen; the Opossums and Kangaroos have four to eight, fixed within a fold of skin, or inguinal purse, within which the young lodge securely. The Elephant, as also the Quadrumana, usually have two upon the breast, as in Man. The female Hog has from ten to twelve, and the Ruminantia, whose milk seems to be more substantial than that of any other domestic animals, have generally two to four mammae. These numbers point out the maximum limit to the number of young, which each female, when in a healthy state, is capable of nourishing without inconvenience. Among the gregarious tribes of Mammalia, the young recognise their mother with surprising accuracy by the sound of her voice, or by the smell, in the midst of the most numerous flock. Those young possessed of the greatest vigour will, however, take milk from several mothers, at the expense of the weakest, which are thus deprived of a portion of the food intended for them by Nature. Some unnatural mothers drive their young away on first approaching their udder, without exhibiting the slightest compassion for the unprotected state of their offspring, which are thus in general left to perish.

With the greater number of Mammalia, the young take and leave the breast according to their wants; but it is different with the Marsupialia, the young of which attach themselves so forcibly to the mamma, that they would rather permit themselves to be decapitated than leave the nipple. They remain continually in this position until their bodies become entirely covered with hair, and they possess strength sufficient to gambol around their mother. Among most species of this singular class of Mammalia, the skin of the abdomen forms a purse or pocket containing the mamma, and to which cavity the young resort for refuge, even after the time when they cease to derive their sustenance from their mother's milk alone. Only two species of Mammalia, the Ornithorynchus and Echidna, are without any apparent mammae; but many interesting questions regarding their habits, and especially the cares which they bestow upon their young, still remain unsolved.

It has been said that the young Elephant sucks with its trunk. This, however, is an error, as it makes use of its mouth, in nearly the same manner as other Mammalia.

The time of suckling varies with the period of gestation, as well as with the time necessary for the growth of the young. Thus it is prolonged as long as the ninth or tenth month in Man, the Horse, and the greater part of the larger quadrupeds, while it is very short with the Rodentia, which have in each year a considerable number of births. With the Guinea-pig, which is the most fertile of known Mammalia, the period of lactation terminates in about twelve or fifteen days.

After having fed their young during the days immediately succeeding to the period of birth, entirely with the milk of their mammae, the females of the Carnivorous animals take themselves to the chase, and bring home to their young different kinds of prey, so as gradually to accustom them to the use of a more solid food. At this time they seem to lose their natural ferocity, and gambol with their young; but on being attacked, they are only thereby rendered the more formidable. After having tried every possible means to place their family in a place of security, they fight with the most determined obstinacy and courage. The particular history of each species exhibits, in general, many interesting details relative to the care which the female takes of her young, until they are sufficiently strong to provide for themselves. As soon, however, as they have attained this period, the mothers are often seen suddenly to change their feeling towards their progeny, and drive away, with the greatest obstinacy, the same young ones which had so long been the continual objects of their warmest attachment. This is particularly observable in all those species which experience a rut at a particular period of the year, and also most remarkably among the larger Carnivorous animals, who would soon become pinched for want, if too many were permitted to reside together in the same district.

It is commonly during the interval which elapses between the termination of lactation and the commencement of puberty, that the first or milk teeth are replaced by others. This only happens to those species which have simple teeth, fixed by true roots. It begins with the incisors, and ends with the molars, while it often happens that the latter are not changed until long after the age of puberty. The Hog never loses its first teeth, as they do not fall, but always continue growing. In certain other quadrupeds, the teeth continue to grow during the whole course of their lives, such as the incisors of the Rodentia, the compound molars of some animals of the same order, and those of the Elephants. The same property is observed in the teeth of the Kangaroos as well as in the Elephants, but with this difference, that the molars are developed from the back of each jaw forwards, and do not grow out of the

gums as in most other Mammalia. There are, however, numerous variations in these respects among the several genera and species, as well as in the forms, which the teeth present, according to the respective ages of the animals. Those Mammalia which change their teeth, and especially the Carnassiers, experience at this critical period the most painful nervous affections, which often prove fatal.

In general, the term of life among the Mammalia is in direct proportion to the time which they severally take in arriving at their full growth, exclusive of the period of gestation. Buffon calculated, from many observations, that they lived seven times the period of growth; but it is very often only six times this period.

Among the most remarkable exceptions to the above rule, we find Man, with whom the average duration of life is far less than that of other species, relative to his time of growth. As he does not attain his full size until about the age of twenty years, his life ought to average a duration of 120 to 140 years. Several individuals have attained these ages, and some have even passed them; but of those few who survive the first years of infancy, by far the greater number do not pass beyond the ages of seventy or eighty. This anomaly to the rule of Buffon is due to a multitude of circumstances, which it would be premature to detail at present; such as the mode of life, the abundance and excess of food, the want of temperance, and other results of an imperfect and misdirected civilization.

For the same reason, the relation which the period of growth bears to the whole term of life, is not without many exceptions among the domestic animals. On the one hand, they receive the influence of a superabundant nourishment, and on the other, are more frequently preserved from those excesses to which this abundance might have given rise. Hence, the duration of life is often prolonged among the domestic animals beyond the term already specified.

The growth of the Horse being commonly completed in about four or five years, it lives twenty-five or even thirty-five, provided the natural term of its existence has not been shortened, as happens too frequently by ill treatment of every kind, by violent fatigues, as well as the want of attention and suitable nourishment. This animal presents, notwithstanding, several instances of remarkable longevity, and some individuals have been known to attain the advanced ages of sixty and even seventy years.

As the Ass takes nearly as long as the Horse in reaching its full growth, the duration of its life ought to be nearly the same; yet it often breaks down before that period through injuries or neglect, which it receives most undeservedly from all quarters. It is observed that animals, naturally disposed to chastity, live longer than those of different propensities. The Mule and Bardeau are usually unable to procreate, and accordingly they live longer than either the Horse or Ass. Very frequently Mules die at the age of forty, and one has been known to attain the age of eighty years.

The Bull takes about two or three years in growing, and the natural period of its life terminates at fifteen to twenty years. The Buffalo approaches the former very nearly in both of these respects; yet it appears to take a little longer time in reaching its full growth, and hence lives to a more advanced age. The Sheep has nearly the same period of growth, and also a corresponding period of life. The Goat approaches to the same terms, both in respect to its growth, and the duration of its existence; yet the extreme attachment of these two last-mentioned species to sexual propensities serves to abridge the ordinary period of their lives, in those few cases where Man does not terminate their existence suddenly for his own advantage.

The Hog being two years in attaining its full development, may reach the age of fifteen or twenty years, if not fattened before the term of puberty, as is most commonly done, though some old Boars have been known to pass far beyond the above-mentioned terms.

We may thus perceive that the relation of the period of growth to the duration of life does not remain constant among the domestic animals. It is, however, more precise with the wild Mammalia. The Lion lives twenty-five years according to Buffon, though several Lions of the Tower Menagerie of London lived in confinement to the extraordinary ages of sixty-three and seventy years, on the authority of Shaw. The Mocooc (*Lenur catta*) lives at least twenty years, the Rabbit eight or nine; the Hare seven; the Mouse only a short time. The Elephant, it is said, lives for two hundred years; the Bear thirty; and the Wolf fifteen or twenty.

Further, the Dog usually lives fourteen years, though the lives of some individuals have been prolonged to twenty; the Cat lives nine or ten years, and the Dromedary forty or fifty.

Nothing positive is known regarding the ages to which the Seals and the Cetacea respectively attain; it is, however, probable, from their near approximation to the Fishes, in external characters, that they resemble them also in the average duration of life; in other words, they live to a very advanced age. This presumption is further confirmed with the Seals, by the fact that they take a very long time in growing.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

The Structure of Teeth—their growth—the phenomena of successive dentition—their varieties of form.

THE teeth among the Mammalia are always found upon the jaws or maxillary bones, which is far from being the case with the lower classes of vertebrated animals—the Reptiles and Fishes. Though useful auxiliaries of digestion, they are by no means essential to that function; for some animals are wholly destitute of teeth, and in others, they are far removed both from the mouth and the intestinal canal. Their existence is not exclusively proper to the vertebrated animals, nor are they always confined in them to the bones of the mouth.

The teeth of animals may be defined as bodies, generally hard or of a calcareous appearance, produced by the secretion of special organs, fortifying the anterior parts of the alimentary canal, and by the assistance of which, the greater part of these animals seize, retain, or divide the food with which they are nourished, while some employ them further as weapons of offence and defence. The teeth of the Mammalia,

with which alone we are at present concerned, may further be restricted by the circumstance already alluded to, that they are only found upon the margins of the maxillary bones.

It was for a long time supposed that the teeth were bones, that they were produced in the same manner, and had a similar structure. This view of the subject has been wholly abandoned, since the publication of the admirable treatise of the Baron Cuvier upon the grinders of the Elephants, in the *Annales du Muséum d'Histoire Naturelle*, tome viii, in the year 1806. Although the differences between teeth and bones appear to be very numerous and essential, there seems, however, to be a considerable analogy between them, especially when considered in a point of view purely anatomical. When physiologically considered, they possess many peculiarities in common with the horns, nails, and hair.

At first, the constituent matters of the teeth and bones are precisely the same; and if we revert to the first formation of these bodies, it appears that they are equally secreted and deposited by proper vessels. Under this point of view, the teeth may be considered as bones, the vessels of which are united in a single mass, and deposit the osseous matter around them; while the bones may, on the other hand, be viewed as teeth, within which the minute subdivisions of the vessels cause this matter to circulate in every direction.

At their origin, and during the greater part of their existence, the teeth are composed of a secreting organ and a secreted substance. The former, or secreting organ, is always concealed in the lower part of the tooth, or in the interior; and when entirely formed, consists of three, or at least two other organs. It is essentially composed of vessels and nerves, which communicate directly with the remainder of the organization. The latter, or secreted substance, is merely deposited outside the first. It is composed of a greater or less number of different substances, and being deprived of all vessels and nerves, bears no necessary or immediate connexion with the other organs.

The secreted substance is of a calcareous appearance, and composed of two parts; the one external, called the *crown* (*just* or *couronne*) of the tooth; the other being more or less concealed, is termed the *root* (*racine*). The intermediate point is distinguished by the appellation *neck* (*collet*).

The crown of the tooth may be composed of different kinds of matter, deposited one over the other. In the most complicated kinds of teeth, three of these may be obtained by a mechanical analysis. The central part is termed the *ivory*; the second the enamel, and the most external part the *cortex*. These three substances are found combined in four different ways. Some teeth are composed of ivory, enamel, and cortex; others only of ivory and enamel. Some, again, are formed of ivory and cortex, the enamel being wanting; others of ivory alone, this last being never observed to be deficient except in those Mammalia which are wholly destitute of teeth.

The root may be real or apparent. In the first case, it is formed of ivory alone, as in Man, the Carnassiers, and the Ruminantia; or of ivory and cortex, as in the Cachalots. In the second case, the root is merely a continuation of the crown, and has all the characters of the latter. Such are the roots of all tusks properly so called, the incisive teeth of all the Rodentia; the molars of Hares, of Guinea-pigs, and of the Cabiais (*Hydrocharus*).

The secreting organ of the tooth or dentary capsule, according to M. Frederic Cuvier, appears to be dependant on, or produced by, the nerves and maxillary vessels. It is not, however, without relation to the contiguous parts, being even united to the gums; but much less than some authors have imagined. It is certain that the secreting organ of the second teeth, for a long time after its formation, is altogether independent of these parts, and it is only subsequently that it becomes united to the gums.

The dentary capsule corresponds, both in its structure and functions, with the substances or materials of which the teeth are composed, in such a way, that it is more simple in teeth formed of one substance alone, than in those composed of two or three. It is the same with its forms, as well as its growth, in relation to the forms and growth of the teeth, the one always being the consequence of the others. The most complicated kind of dentary capsule, being that observed whenever the teeth are composed of three substances, is itself formed of three very distinct secreting organs. The central one, called the *bulb*, produces the ivory; the second, under the form of a membrane, secretes the enamel, and may thence be termed the *enamellating membrane*; and the third, which surrounds all the other parts, produces the cortex or external ivory. The last may be termed the *external membrane*.

The bulb which secretes the ivory by its external surface, appears to be entirely composed of nerves and vessels. Several arterial trunks, which extend from the one extremity to the other, are ramified infinitely before arriving at its extremities, where their divisions sometimes form tufts and fringes of an almost imperceptible degree of fineness. This part of the teeth may be studied with the greatest facility when they first begin to form; it is then found to be naturally injected, and is not exposed to injury during the abstraction of those bony portions in which the teeth are enclosed, while a very slight degree of maceration is sufficient to extract the bulb from the coating of ivory by which it is surrounded. It seems to be homogeneous throughout, and always has the same shape as the tooth will ultimately have. In fact, it is the mould upon which the tooth is modelled.

The enamellating membrane produces the enamel by its internal surface. It surrounds the bulb entirely, and follows all its sinuous outlines, thus possessing the same form, except at the base of the bulb, corresponding to the neck of the tooth where it abuts and terminates. M. F. Cuvier was unable to detect any vessels in this membrane. It is transparent and brittle when thick and about to deposit enamel; but it soon softens, becomes of a milky whiteness and great elasticity. Finally, it ends by disappearing altogether, when it has no longer any function to discharge, that is, when the external membrane, by depositing the cortex, resumes its place. The transparency of this membrane, its extreme thinness thereafter, and its final obliteration, in those teeth where the ivory is formed, have been the cause that many Naturalists have failed to observe it. But it may be seen very easily upon the parts contiguous to the molars of the Ruminantia, and especially on the hinder ones, at the moment when these animals are born; and, if once remarked here, it becomes easy to detect it upon all teeth possessed of enamel.

The external membrane, like the bulb, is of a nature essentially vascular, and may be considered as an external bulb. It is homogeneous in respect to its intimate structure; but its two faces have not always the same forms, nor do they perform the same functions. It deposits the cortex by its internal surface, and follows all the contortions of the tooth. In the compound teeth it juts outwards, whenever they present any hollows. The parts which line these cavities are not merely membranes, at least when the cortical matter is about to be deposited, for they then have the same thickness as these cavities, and this gives them all the appearance of bulbs. Before the above period, it is sufficiently thin upon the surface of the compound teeth, and this observation is applicable to most teeth. But it may be presumed that the external membrane is always of a great degree of thickness in the capsules of those teeth where the ivory has to be covered with a great thickness of cortex, as may probably happen in the molar teeth of the Cachalots. Its external surface is always simple, being merely the protecting and uniform envelope of the entire dentary organ, and its form when complete is always more or less spherical. It is pierced at its summit by the evolution of the tooth; but its margins are attached to the gums, and become in some measure a continuation of them.

These three parts, composing the dentary capsule, are intimately united, and become confounded together towards the inferior part of this organ, at the point where the vessels and principal nerves are introduced, at least from the time when the roots begin to develop themselves, and to become distinguished from the crown. It appears that all the three parts originate from this point, and likewise all the essential vessels which traverse and nourish them pass from thence. Their other portions are from the very commencement entirely independent of each other. The external membrane may be raised without occasioning the slightest injury to the enamellating membrane, which detaches itself without effort from the layers of enamel just deposited; and the bulb may be separated from its cones of ivory like a blade from its scabbard; or if the cones be broken, it may be disengaged and displayed without being destroyed, or in any way injured.

This capsule, however, is not entirely formed before the teeth are secreted, in those at least which have roots. It develops itself successively, and in proportion as the different parts are formed, beginning from the summit of the crown, and finishing by the extremity of the root.

The bulb and enamellating membrane seem to deposit simultaneously the matters which they respectively secrete; and the first molecule of ivory receives the first molecule of enamel. It is only at a later period, that the external membrane deposits the cortex, being at the time when the crown is already formed, and when the bulb, as well as the enamellating membrane, cease to deposit matter in this part of the tooth, for these secreting organs have still to give birth to the roots.

The above detailed analysis of the most complicated kind of dentary capsule, enables us to pass rapidly over those destined solely to secrete the ivory and enamel, or the ivory and cortex, or the ivory alone, and being consequently of a more simple structure.

Those capsules intended to form teeth composed of ivory and enamel alone, are not, on that account, deprived of the external membrane, but this body always appears to be thinner, instead of being thick, as in the preceding kind of teeth, when about to deposit the cortex. It is raised with difficulty and by shreds, and seems only to be intended to protect the function of dentition; it accordingly envelopes the organ in every part. The enamellating membrane presents itself in these capsules with all the general characters which have been assigned to it. The bulb does not differ from that belonging to teeth composed of three substances.

With respect to those teeth which are composed of ivory and cortex, such as the molars of Cachalots, we also find the external membrane in them to be of a certain thickness, in addition to the bulb, which is never wanting.

Having thus shown that the dentary capsule of the most complicated kind of teeth, produces three distinct and different substances which can be accurately separated from each other, it now remains for us to consider the secreted bodies themselves, composing, as they do, the proper substance of the teeth.

The ivory forms the essential and fundamental part of the tooth. As it covers the organ by which it is secreted, it is deposited from without, inwards, and does not appear to be absolutely identical in all kinds of teeth. In some, as the tusks of the Elephants for example, it is deposited by concentric beds, in such a manner that they are composed of cones, the one encasing another, and being numerous in proportion to the length of the tusk. This conical appearance is especially shown in fossil tusks, as the cones themselves do not appear to have been separated artificially. Other teeth have a more homogeneous kind of ivory, but the differences of texture which this substance presents are very numerous. These tusks of the Elephants show on their transverse sections a number of segments of circles regularly disposed, which intersect each other, and form a waving mark, by which the true ivory may always be recognised. The teeth of Man, the Quadrumana, and Carnassiers, possess an ivory of a silky appearance, apparently composed of fibres. Those of the Cetacea, the tusks of the Hippopotamus and others, have their ivory simple, and of the most uniform texture; those of the Rat-Moles (*Platyrogus*) seem formed of longitudinal and parallel fibres, like those of a rush. These characters arise doubtless from the peculiar structure of the bulbs which secrete these different kinds of ivory; yet their essential differences have not been determined by experiment, but will probably be ascertained hereafter, when these bulbs are submitted to a more minute investigation.

This central part, being the most important and considerable portion of the crown of the teeth, is chiefly formed of a very compact gelatinous substance. The calcareous matter which gives it the external appearance, is merely deposited in the meshes of this substance, and composes only the smallest portion. It may be abstracted by means of a small quantity of dilute acid, and the gelatine remains pure, and of the same form as the ivory. This calcareous matter, the only part of the tooth really destitute of life, is a phosphate of lime.

The Enamel is deposited in a manner contrary to the ivory, being from within, outwards, and always immediately over the latter; this it appears to do by a kind of crystallizing process. On being examined upon a section of a tooth, it is found to

have the appearance of brilliant needles, perpendicular to the surface of the ivory. The ivory and enamel do not form one body, although they are united together very closely, for the enamel can be detached from the ivory without injuring the latter, and reciprocally. But the essential distinction between them consists in the circumstance that the enamel does not possess gelatine for its base; for, although it contains some traces of that substance, they are always very minute in quantity. The enamel, on the other hand, is essentially composed of fluato of lime, which contributes its stony character, and imparts a degree of hardness superior to that of any other portion of the teeth, and indeed of any animal substance.

The Cortex, like the Enamel, is deposited from within, outwards; but it cannot be discovered upon teeth possessed of enamel until the latter is entirely formed. M. F. Cuvier is of opinion that, in teeth composed of ivory and cortex alone, it is deposited over the ivory like the enamel. The intimate nature of cortex is absolutely the same as that of ivory, on which account it might with propriety be termed the *external ivory*. Gelatine forms its principal base, and phosphate of lime is deposited between the meshes of that substance. The cortex is found in layers more or less thick. It is of an extreme thinness on the projecting surfaces of the molars in the Ruminantia, but is much thicker in the hollows found on the summits of their crowns. It is observed, however, to possess a still greater thickness in the crowns of the teeth belonging to Chæmalots. In this place it equals the ivory in quantity and thickness; for the whiter substance, which surrounds the central part of these teeth, is not enamel, as some Naturalists have supposed, but a true external ivory.

It commonly happens that the cortex contains nothing but gelatine and phosphate of lime. In some cases, however, it contains some colouring matter in addition to these, as may be seen in the teeth of several Ruminantia, and in the incisors of the Beavers, Pacas, Agoutis, Porcupines, and some others. The colour of the anterior part of these teeth depends upon a very delicate layer of true cortex, as M. F. Cuvier ascertained by many careful experiments. The colour becomes brown only on that part of the tooth which projects from the gums, while the portion within them is of a dark green. It has been said that this colour is owing to the presence of iron, and that the change which it undergoes from the contact of the air is a true oxidation.

The above details regarding the structure of the dentary capsule, which produces the teeth, as well as the composition and structure of the teeth themselves, have been hitherto demonstrated upon a very small number of Mammalia, and they are applied only by analogy to the remainder. In fact, the teeth of Man, of some Carnassiers, Rodentia, and Ruminantia, with the Solipeda and the Indian Elephant, have alone been studied in respect to their dentary capsules, and the substances of which the teeth are composed. It is probable that a special investigation of teeth belonging to other Mammalia may lead to the restriction or extension of some of the preceding observations.

The above remarks explain to a certain extent the manner in which the crown of the tooth is formed. As the dentary bulb is the mould of the crown, and as the matter which it secretes is deposited upon its surface, the crown cannot fail to exhibit the same projections, hollows, and angles—in a word, to have the same identical figure; but there is nothing in the structure of this bulb which can explain the form of the roots.

By the term *root* is commonly understood, that part of the tooth contained within the gums; but it is essential, as has already been explained, to distinguish those insertions which differ from the crown neither in structure nor form, from the roots properly so called, which begin from the neck of the tooth, and diminish gradually, until they terminate in a point more or less obtuse, and more or less irregular. The first are not real roots, but are formed merely by the prolongation of the crown within the gums.

When the time at which the true roots have to be formed has arrived, the enamellating membrane ceases to maintain its activity, and even becomes wholly obliterated. The bulb and the external membrane alone continue to grow and to produce roots, which usually correspond, in number and situation, with the principal tubercles of the crown, and appear to be numerous in proportion to the number of leading branches which the maxillary arteries transmit into the bulb. It seems probable that these vessels and their branches form an inferior prolongation of the bulb, as soon as the crown has been deposited; or, in other words, that the bulb continues to develop itself under their influence, which is restricted to the points immediately surrounding them. Under this point of view, the roots of the teeth may be regarded as the evanescent crowns of the same teeth, reduced to a rudimentary state; for we can easily see how they might be continued, if the vascular system did not become obliterated. In fact, those teeth, where the capsule never ceases to reproduce the crown as fast as it wears away, and which are consequently destitute of true roots, only become such in consequence of the undiminished vitality of their bulb, which continually maintains its vigour and activity as at the commencement. Thus we see that teeth possessed of roots, obtain them at periods of their existence more or less advanced. Among the herbivorous animals, the Horse for example, the vitality of the bulb continues for several years, while it ceases in a very short time with the Carnassiers. In this respect, the Mammalia offer a great variety of examples.

There are several circumstances which serve to confirm the accuracy of these views. As long as the dentary capsule is wholly occupied in depositing the crown, we see, at the precise point where the membranes composing it reunite and become confounded, a uniform disc, supplied with an immense number of vessels, which distinguish it readily from all the adjacent parts. It is from this surface that the capsule continues to grow uniformly, until the crown has acquired its entire height. At the latter period, however, it undergoes a total change; the isolated portions of the vessels disappear, and those which remain compose little circles, more or less numerous, and distinct from each other. From these circles the roots grow; during which operation, the external membrane detaches itself from the bulb on all the intermediate points of the partial circles. The crown is then terminated by the deposition of ivory between the roots and beneath both the crown and the bulb; further, as this deposition takes place from different points of the circumference of the tooth,

it is at the internal surface of the roots that it reunites. The little circles continue to diminish; sometimes they divide after a certain growth has taken place in the root, causing them to appear more or less forked; and they end in disappearing gradually, so as to occasion all the roots to terminate in a point or thin layer. By this growth, the bulb, now reduced within very narrow dimensions, remains inclosed within the crown, and the roots are found to be pierced through their entire length by those vessels and nerves which formed them; thus connecting them with the bulb on the one hand, and on the other with the maxillary vessels and arteries.

The first traces of the dentary capsule can be discovered in the fœtus, it is said, during the earliest days of its life. There can be no doubt, however, that the teeth are in a great measure formed at the period of birth in a large portion of the Mammalia, and the young animals are even compelled to use them before the period of their lactation has entirely terminated. Physiologists are not, however, agreed as to the nature of the process carried on within the jaws, in those parts which are traversed by the teeth, before leaving the gums. Some have supposed, that there exists a natural passage, leading from the capsule, out of the gums; and it is imagined, that this cavity is enlarged by the expansive force of the tooth, aided by the elasticity of the adjacent parts. Others have conceived, that the tooth tears everything which opposes its passage; and they have even attributed to this cause, some of the accidents which occasionally accompany the dentition of young animals.

The former of these views is opposed by the observed phenomena of the second dentition, where another set of teeth is developed immediately beneath the first, in such a way, that the second cannot appear before the first have fallen. No such natural passage has been observed; and it ought not to be presumed before adequate proof, that Nature has employed two different methods of evolving these organs. It should rather be inferred, that if the second teeth are able to surmount the obstacles presented to their growth by the first teeth immediately above them, these will also be able to overcome the resistance of the membranes and cartilages, when they are required to leave the jaws, to satisfy the new wants of the young animal. It further appears, that teeth of the most complicated form, having their crowns terminated by many tubercles, and having between them many intervals of considerable depth, obtrude themselves, by the summits of their tubercles, on several points at the same time, beyond the gums; yet the gums still continue to occupy the intervals which separate their tubercles.

The hypothesis of a violent tearing is still less admissible than that of a natural passage. During the time that the teeth are growing, not the slightest trace of such a phenomenon can be observed; and analogy does not appear to justify this second supposition. Nature appears to have a surer and more effectual means than these mechanical hypotheses would lead us to infer; for the present is, in reality, only a particular case of a very general law, of which it forms one of the most exact applications.

There is no truth in Physiology better established than this, that the nutritive power of any organic part is enfeebled, when it receives the continued mechanical action of any foreign body whatever, and the nutrition of the part may even be wholly interrupted, if this action acquire a certain degree of intensity. It seems, that in the perpetual interchange of particles which constitutes life, the new molecules become incapable of replacing the former, whenever a foreign body compresses the parts from which the others have escaped. It may be said, either that the place of the first bodies has ceased to be occupied, or that the assimilating force, which ought to have supplied new molecules, has ceased to act. The consequence is, that the part becomes obliterated; and the molecules, which should have nourished it, are dissipated, or go to supply the adjacent parts.

There can be little doubt that the development of the teeth is a phenomenon of this description. When the crown of a tooth begins to be formed, and still more, before this period, all that part of the gum, which is intended to be opened for its passage, is thick and filled with vessels. As the tooth grows, this part becomes smaller, and the time at length arrives, when it consists of nothing more than a compact and dry skin, which soon disappears in order to allow a free passage to the tooth. This view of the subject is, however, incapable of explaining how it happens that the pressure of the teeth is exerted contrary to the gums, rather than in the opposite direction. Although the tooth begins at first to form only on the side next to the crown, this circumstance does not completely account for the fact that the tooth tends exclusively to emerge on this side. The reaction of a tooth growing in the direction of its root, is equal to its action in the direction of the crown; and if the degree of firmness possessed by the adjacent parts be regarded in this question, instead of piercing the gums, the teeth ought to descend on the side where the roots are afterwards found; for the inferior parts of the capsule and its bulb would offer much less resistance than the denser structure of the gums. It is therefore probable that we ought to attribute the natural direction of the teeth to some special impulse which the circulation impresses upon the dentary organ, as well as to the mere growth of the capsule by its interior part. The addition of matter to the inner extremity of the crown is far from being sufficient of itself to explain this phenomenon. The pressure of the gum upon the teeth would even be sufficient wholly to arrest it, and it is, on the contrary, the life of the gum which would then have to be suspended. While the teeth are growing, the vital action of their capsules is raised to an intense degree, the blood is directed towards them with great force, their irritation becomes extreme, and hence probably result the fatal consequences which frequently occur to young animals during the period of their dentition.

The protrusion of the teeth from the sockets, in consequence of their secretion and growth, is not the sole movement which these organs present. Other changes succeed, the object of which being the mastication of the food, is rather more obvious than the causes which produce them.

Among these may be considered, in the first place, the secondary movement of the crown in teeth with distinct roots, after they have emerged from the sockets. The capsules of all these teeth being entirely inclosed within the jaws, have their lower parts, which correspond with the neck of the tooth, much below the dentary margin of these bones; but when the teeth are entirely formed, the neck is on a level with this same border—that is to say, the inner part of the crown, which in some manner

has been formed in the bottom of the jaws, ultimately finds itself on a level with their exterior margin. This protrusion of the crown appears to be owing, at first, to the growth of that part of the capsule which is about to give birth to the roots—a growth which does not make its appearance until after the formation of the crown. Subsequently to this, it must be attributed to some special impulse of the circulation, which maintains itself in a high degree as long as the dentary capsule preserves its secreting power. Further, at this particular period of its growth, the gum no longer opposes any resistance to the growth of the teeth.

There is seen in the molars of the Horse a second kind of movement, which they probably possess in common with all other herbivorous animals as well as the Ruminantia. It consists in the continued obtrusion of their teeth, even when completely formed, and opposed by others in the opposite jaw, against which they act during mastication. This movement was fully demonstrated by Tenon (Académie des Sciences, an. G), who, however, did not investigate its cause. It may be regarded as a continuous ossification of the jaws,—an operation which only ceases with the life of the animal. In fact, a third movement of these teeth exhibits this ossification tending continually to expel the teeth from their sockets; and this occurs when a tooth, not being opposed by others, is pushed out of the jaws. As no force then opposes the continued secretion of bone, the sockets become filled, and the teeth are driven from the place which they occupied, as if they were foreign bodies. This movement, which is prejudicial to most animals, has one advantage for those which are obliged to wear out their teeth in grinding their food; for, although the wearing out of the teeth in these Mammalia is often very unequal, the dentary organs do not on that account remain uneven at their summits; and the consequence is, that the grinding of the food may be continued to the most advanced periods of life.

There is a secondary movement in the incisors or front teeth of the Rodentia wholly opposite to the preceding, and still more difficult to explain. That part of the tooth which corresponds in situation with the root, is placed much less towards the front of the bones containing them, among young animals, than among the old. These teeth continually fall back at their extremity where the bulb is placed, in proportion as the animal grows, while they advance forward by the other extremity. M. Frederic Cuvier, who observed this singular phenomenon in the Rabbit and Guinea-Pig, supposes that the bulb continues to grow by its hinder part, being influenced by the nerves and vessels which thence derive their life; and this phenomenon appears to be common to all teeth approaching to tusks in their general character.

Another problem connected with the incisors of the Rodentia is much less difficult to solve,—we mean their curvature, and the peculiar curves which they affect. To produce an arched tooth, it is sufficient that the capsule be arched; but if the curvature of the capsule remain always the same, these teeth, which can grow indefinitely when no obstacle arrests their course, would present in this case the form of a regular circle, of which frequent examples are found. Instead, however, of this curve, the incisors of the Rodentia exhibit one nearly approaching to a spiral, where the first portions of the teeth are inclosed in those that follow. It is necessary, therefore, that the capsule producing the teeth should change its curvature, and that it should approach continually towards the right line, as these animals advance in age, up to a certain point, perhaps, when it ceases to be further modified. We may also remark, that these changes of curvature are the same in the incisors of both jaws; for these teeth, at all periods of life, preserve among themselves the same relations.

The appearance of the teeth beyond the gums usually commences, among the Mammalia, with the period when the milk begins to be insufficient for the nourishment of the young animal; but it very rarely happens that they are all developed at the same time. In this respect, great differences are found among them; and Nature, in most cases, fails to impart at one time all the teeth necessary for the use of each animal. There are very few, we may almost say, no Mammalia, where some of these organs are not renewed; that is to say, that certain kinds of teeth fall, and are reproduced, or rather replaced, once or oftener, by the successive growth of other teeth beneath, behind, or before the former.

These first teeth, which give place to new ones, are distinguished by the term *milk teeth*, or teeth of the first dentition; those which succeed are termed the *second teeth*. But these terms, founded upon what has been observed in the human species, ought not to be taken in the strict sense when applied to other Mammalia; for among these, it will be seen that the milk teeth may fall before birth, or a long time after the adult age. To avoid the mistakes to which the ambiguity of these terms might give rise, it will be proper to employ the terms *first*, *second*, and *third* teeth, to denote the order of their appearance.

This department of Natural History, which shows the succession of the teeth, their mutual influence, the coincidence of their appearance with other parts, and with the new wants of each animal, as well as the relations of form and number between the teeth of different dentitions, has, unfortunately, been much neglected, and it is only now beginning to receive that attention which it merits. In a Zoological point of view, a knowledge of the dentary system in different ages is almost indispensable; but we are still without a series of drawings, showing the teeth of young Mammalia, corresponding to the valuable lithographic sketches of M. Frederic Cuvier (Sur les Deuts des Mammifères), made from adult specimens.

Before explaining the few particulars that have hitherto been ascertained on this subject, it will be proper to premise a few words respecting the different kinds of teeth, as well as to explain the system of notation which we intend to use in describing them.

The teeth of the Mammalia emerge solely from the inter-maxillary and maxillary bones. The incisors, or front teeth, make their appearance first; and these may be followed either by the canines or molars. The last are subdivided into false molars, carnassier molars, and tuberculous molars: while the tuberculous molars themselves may be further distinguished by their having simple, compound, or proper tubercles.

(1.) The Incisor, or Cutting Teeth (*Incisores* or *Primores*), are somewhat broad and long, with their margins often parallel, and cut away obliquely at their free ex-

trinity. We see them so, for example, in the front teeth of Man; but this form is still more strongly marked in the Rodentia or Gnawers. This term *Incisor* ought properly to be applied only to those teeth which have a form especially fitted for cutting; but it has been extended not only to all such as are found in the incisive or inter-maxillary bone, but even to those opposed to them in the lower jaw, although the latter often have neither the form nor use of true Incisors.

(2.) The Canines (*Laniarii*), or Tearing Teeth, have the general form of those teeth which appear most prominently in the Dogs. They are longer than all the others, and always have a single root and a single point to the crown. As these teeth are usually placed in the upper and lower jaw, immediately behind the Incisors, the term Canine has been extended to all teeth which appear to occupy this place. They are likewise called *Corner* teeth; and, from the chief use to which they are applied, have obtained the name of *Laniarii*, from *laniare*, to tear.

(3.) As the names of most parts of animals are derived from the corresponding parts in Man and the Ruminantia, which were principally dissected by the ancient Anatomists, the term *Molar* (*Molares*) is correctly applied only to those which act, as we may remark in the Ruminantia, almost like a mill-stone—(in Latin *mola*, a mill). Hence, we understand Molar teeth to be compound, semi-compound, or even simple teeth, having the crown broad and flat, with broken projections and small eminences corresponding to each other in both jaws. Afterwards, however, the term has come to be applied indiscriminately to all teeth situate behind the Canines, and occupying the entire inner extremities of the dentary lines, although they sometimes possess no other character of molars than the place they occupy. Thus, in the Cats, where these teeth are trenchant, and correspond in each jaw, so as, in fact, to act in the same manner as true Incisors, they are not on that account deprived of the common appellation of Molars.

Hence it becomes necessary further to distinguish the different kinds of Molars from each other. In many Mammalia, the Molars differ greatly both in size and form, and have on that account been divided into False and True Molars. By *false* Molars, being most commonly the anterior ones, we understand such as are small and pointed. *True* Molars are considered to be thicker and larger, with their crowns studded with several points, or altogether flat. In the Carnivorous animals, there is found a very large Molar, which more especially fulfils the tearing purposes of these animals; and this tooth is further distinguished by the terms *carnassier Molar*.

The importance of possessing a good system of Nomenclature for the teeth becomes sufficiently obvious, as soon as the necessity of defining clearly the different kinds and combinations of teeth, both in respect to their forms and relative position, has been made apparent.

In stating the dentary systems of animals, two methods of notation have hitherto been employed; for example, the adult teeth of the human species, being eight incisors, four canines, eight false molars, and twelve tuberculous molars, have long been represented thus:

$$\text{Incisors } \frac{4}{4}; \text{ Canines } \frac{1-1}{1-1}; \text{ Molars } \frac{5-5}{5-5} = 32.$$

In his work on the Teeth of the Mammalia, M. Frederic Cuvier expresses the same thing, under the following form:

$$32 \text{ Teeth. } \left\{ \begin{array}{l} 16 \text{ upper.} \\ 16 \text{ under.} \end{array} \right. \left\{ \begin{array}{l} 4 \text{ Incisors.} \\ 2 \text{ Canines.} \\ 10 \text{ Molars.} \\ 4 \text{ Incisors.} \\ 2 \text{ Canines.} \\ 10 \text{ Molars.} \end{array} \right.$$

The former expression, besides its inconvenience from the smallness of the figures, does not represent the nature of the Molars. The latter is not compact. In both, the teeth on each side are confounded together unnecessarily.

As a new system of notation, which will combine the advantages of brevity and clearness, yet remains to be proposed, we venture to suggest the following, which possesses, in our opinion, some of the most essential requisites. Let *M* represent any Molar tooth; *C* a Canine; *F* a false Molar; and *C'* a carnassier Molar. Let a number annexed to an explanatory letter denote that there are as many teeth of the kind represented by the letter, as there are units in the number. Further, let a number without an explanatory letter denote an Incisor, or front tooth, and a Molar, unless otherwise expressed, be always understood to be tuberculous. Then, adopting the ordinary signification of the Algebraical symbols, the dentary system of the Adult Man will be conveniently represented as follows:

$$\frac{2 \left\{ 2 + C + (2 F + 3) M \right.}{2 + C + (2 F + 3) M} = \frac{16}{16} = 32.$$

where the numerator denotes the number, nature, and relative position of the teeth on one side of the upper jaw, and the denominator of those on one side of the lower. The small figure in the corner indicates that each expression must be doubled to represent both sides of each jaw, and the vertical line on the left hand shows the medial axis of the body, passing in the middle of the front teeth.

To avoid repetitions, only one side of either jaw is alluded to in referring to particular teeth; and what is said of one side must be understood of the other, which precisely resembles the first in all its relations. It is always customary to count from the anterior extremity of all the parts which bear these organs. Thus, the first Incisor among the Mammalia is that tooth found nearest to the suture, by which the inter-maxillary bones are united. This suture is represented in the formula by the vertical line. All extraordinary cases are excepted, such as the appearance of teeth before birth or in extreme old age, while the ordinary and most natural process of development is always understood to be meant, unless otherwise expressed.

In the human species, the first dentition generally takes place from the sixteenth or eighteenth month to the age of two years or two years and a half, and it usually commences with the lower jaw. The first Incisors precede all the others, and these are followed by the second; so that, towards the end of the first year, all the incisors are developed. The first tooth which pierces the gums after the incisors is a molar; and it is subsequent to this that the Canine, though placed before it, makes

its appearance; finally, the first dentition is terminated by a second Molar. It must be remarked that Molars, and not false Molars, immediately follow the Canine; and this is contrary to what is observed in the final dentition of the human species. The general law, of which this is only a particular case, will come afterwards to be explained.

The formula for the Milk-teeth, or first teeth of the Infant, is therefore

$$\frac{2 \{ 2 + C + 2 M \}}{2 + C + 2 M} = \frac{10}{10} = 20$$

All the teeth of the first dentition fall exactly in the same order as they have appeared. The Incisors and Canines are replaced by Teeth of the same nature as themselves, only stronger and larger than the first. On the contrary, the two first Molars are replaced by false Molars only. This operation is finished towards the twelfth year, and the first tuberculous molar, being the third in the order of time, shows itself about the sixteenth or eighteenth year. This tooth is larger than any which preceded it, or even than those which follow. Finally, the last of these teeth, commonly termed *wisdom teeth*, and which may not improperly be styled a third dentition, make their appearance a few years later, though sometimes they are delayed as long as the thirtieth year.

All the teeth of the second dentition are formed, according to the important researches of M. Serres, by the vessels and nerves of a special dentary canal, developed beneath the first, and which replaces it as soon as the first set of teeth begins to fall. We may thence conjecture that, at the time when the other Mammalia change their teeth, an analogous phenomenon takes place.

When the teeth of the first dentition fall, it is observed that the greater part of them have lost their roots, and that the lower part of the crown is tinged black, and covered with asperities which seem to be the effect of a species of corrosion. It will be proper, however, to postpone further notice of this curious phenomenon until the subject of successive dentition has been concluded.

The Apes of both continents present nearly the same phenomenon as the human species, in respect to their first and second dentition. The Makis and Insectivora have not yet been studied in these respects, but some Carnivora have been satisfactorily examined, and especially the Dogs and Cats, in which two dentitions are recognised.

The first dentition of the Cats consists in the upper jaw of three incisors, one Canine, one rudimentary false Molar, one carnassier, and one small tuberculous Molar; in the lower jaw of three incisors, one Canine, one false Molar, and one carnassier. Or,

$$\frac{2 \{ 3 + C + (F + C' + 1) M \}}{3 + C + (F + C') M} = \frac{14}{12} = 26$$

In the second dentition of the Cats, the incisors and canines are replaced without any important changes, by teeth similar to them in nature. It is also the same with the first two false Molars; but the carnassiers are replaced by the second false Molars, and both are developed immediately after the others, so that, from being second Molars in the first dentition, the carnassiers pass onwards to be third Molars in the second; that is to say, in the upper jaw, the carnassier Molar has taken the place of the tuberculous Molar, which in the second dentition appears in the fourth and last place, while the carnassier of the lower jaw is developed in the place where no tooth was found in the first dentition. This will be readily understood on comparing the following formula of the second and adult dentition of the Cats with the preceding.

$$\frac{2 \{ 3 + C + (2 F + C' + 1) M \}}{3 + C + (2 F + C') M} = \frac{16}{14} = 30$$

In the dentition of the Dogs we find phenomena very analogous to the above. On completing their first dentition, they have in the upper jaw three incisors, one Canine, one false Molar, one carnassier, and one large tuberculous Molar; in the lower jaw, three incisors, one Canine, two false Molars, and one carnassier. The formula for the first dentition of the Dogs is therefore

$$\frac{2 \{ 3 + C + (F + C' + 1) M \}}{3 + C + (2 F + C') M} = \frac{14}{14} = 28$$

In the same manner as among the Cats, we find that the incisors and canines of the Dogs are renewed, at the second dentition, in both jaws, without any important change. Immediately after the canine, in the upper jaw, there appears a rudimentary false molar in a spot where no tooth had previously existed. The false molar of the first dentition is replaced by a tooth similar to itself; the carnassier by a third false molar, and the tuberculous molar by a carnassier. Finally, a tuberculous molar, with a second or smaller one, appears after the carnassier. In the lower jaw, as in the upper, there occurs a rudimentary false molar after the canine. The two false molars of the first dentition are replaced by teeth which resemble them, and the carnassier by another false molar. Next follows the new carnassier, and immediately behind it, one large tuberculous molar, and one rudimentary, in a place where no tooth had appeared during the first dentition. These changes appear obvious to the sight, on contrasting the following formula of the adult dentition in the Dogs with that last given.

$$\frac{2 \{ 3 + C + (3 F + C' + 2) M \}}{3 + C + (4 F + C' + 2) M} = \frac{20}{22} = 42.$$

It follows from this, that in the second dentition of the Dogs and Cats, the teeth are not only more numerous, but the carnassier molars are placed at a much greater distance from the canine teeth than in the first dentition.

This observation is equally applicable to all Carnassiers, and it is not difficult to perceive the design of Nature, in thus altering the position of these teeth, which are most important to animals feeding almost exclusively on flesh. To render the action of these teeth always powerful, they are brought nearer to the fulcrum or hinge of the jaw; and thus the effect which the jaw would otherwise produce from its growth, in diminishing their power, is effectually counteracted.

As the Rodentia do not possess different kinds of molars, they cannot present these changes which we observe in the Carnassiers. Excepting the Cabiais (*Hydrocharus*), their teeth of the second dentition are developed immediately under those of the first, and the latter entirely resemble the former. The Cabiais, on the contrary, possess a peculiar mode of dentition, in common with the Elephants and Ethiopian Hogs (*Phacocharus*).

It has not yet been ascertained, whether the incisors of the Rodentia fall, and are replaced. The Baron Cuvier has proved, that all species of Rodentia which have only three molars, possess only a single dentition; and that there is a second dentition only among those species which have more than these three teeth; that is to say, all molars surpassing three in number, and placed before them in the jaws. He has further made the singular observation, that the teeth of the first dentition fall, in the Guinea Pigs, while these animals are yet in the womb of their mother. In species of the Hare genus (*Lepus*), the first teeth fall a few days after birth, and this phenomenon is found even in those rudimentary incisors, which are known among all animals of this genus to develop themselves behind the principal incisors.

We proceed to the Pachydermata, as the Edentata have not yet offered any important observation in this branch of the subject. The first dentition of the Hippopotamus consists of two incisors and one canine in each jaw, of three false molars and three tuberculous molars in the upper jaw, and of two false molars and three tuberculous molars in the lower. Or,

$$\frac{2 \{ 2 + C + (3 F + 3) M \}}{2 + C + (2 F + 3) M} = \frac{18}{16} = 34$$

In the second dentition, the incisors and canines of both jaws experience no change. The first of the three false molars in the upper jaw falls, and is not replaced; the two others are replaced by teeth the same as themselves, and a false molar succeeds to the first real molar. But, at the same time, another molar is developed at the extremity, so that the number of these real molars remains always the same, notwithstanding the fall of the first real molar. In the lower jaw, the first false molar falls without re-appearing; the two following are replaced by teeth of the same kind, and then, as in the other jaw, the last molar appears. The second dentary system of the Hippopotamus may, therefore, be represented thus;

$$\frac{2 \{ 2 + C + (4 F + 3) M \}}{2 + C + (2 F + 4) M} = \frac{20}{18} = 38$$

We may apply the same observation which has already been made regarding the Carnassiers to the Hippopotamus; and it is, probably, for a similar reason, that the first real molar of the first dentition is replaced by a false molar in the second.

The Ethiopian Hogs (*Phacocharus*) exhibit a new mode of change, which they possess in common with the Cabiais (*Hydrocharus*). Their last molar possesses a movement from behind towards the front, so that, when entirely grown, the two small teeth which preceded it have disappeared, and it alone occupies the jaws.

The Elephants have a mode of dentition resembling the Cabiais and Phacocharus. Their molars begin to shew themselves by the fore part, and continue to advance from behind forwards; from which it follows, that these animals have at first only one molar in each jaw, afterwards two, then only one, then two again, and so on. It appears that this movement is the consequence of the growth of eight teeth. The first, which occurs soon after birth, has not fallen when the second makes its appearance. At the age of two years, the latter remains alone; and this continues until the appearance of the third, which remains alone until the sixth year. At nine years of age, it also disappears to give place to the fourth, and so on. It should be noticed, that these teeth always appear at first by their fore part, which, on that account, is much sooner worn out than the hinder.

Passing to the Horses, we return to the mode of dentition first described. The teeth of the second dentition develop themselves immediately under such of the first as are intended to fall; that is to say, under all the incisors, the canines, and the first three molars. The only particulars requiring notice at present are, that the first teeth are narrower than those which succeed, and that the last molars appear as soon as the first have fallen.

The Ruminantia present analogous phenomena. All the incisors and canines of the first dentition give place to teeth of the same nature as themselves; and of the six molars found in each jaw, the first three are replaced by the same kind of teeth, being only less complicated. It is then, also, that the last molars, which are very complicated, present themselves; and we may thus perceive the same design of Nature, already noticed, in respect to the Carnassiers and others.

Among all these animals, the greater part of the teeth, at the time of falling, present nearly the same appearance as those of Man. Their roots have disappeared; and from the irregularities in these teeth at their innermost surface, it might be imagined that they had been corroded: and further, that being composed of different substances, some of them were less accessible than others to the action of the corrosive substance. As spots or black stains are perceived on the whole extent of this surface, they might appear to exhibit manifest traces of a kind of corrosion, and forcibly recall the appearance of caries, or decay of the teeth, as has often been remarked.

Many hypotheses have been proposed to explain this singular phenomenon. Yet it is not easy to perceive how a corrosive fluid, if it really existed, could spare the adjoining parts, and especially the teeth of the second dentition. The mechanical action of the second teeth upon the first has also been supposed, and of all attempts to explain the phenomena, this is undoubtedly the most unfortunate. One tooth cannot wear out another without wearing itself out likewise; and the second teeth are always in their most unblemished state at the time when the first have fallen: finally, this has been attributed to a power of absorption; and the last opinion is most generally adopted. It is not unlikely that caries, or decay of the teeth, may be produced by a similar cause.

From the observations which have already been made, on the complication of the dentary capsules, on the variety of substances of which the teeth are composed, on the care which Nature takes in supplying the places of those teeth destined to fall, on the different situations which they occupy, and the names they have received, will

lead the student to perceive the importance of these organs, and the different functions which they are destined to fulfil. But a much more enlarged view is acquired by studying the different forms of the teeth, in their relations to each other, as well as to the nature and habits of the animals possessing them. It remains for us to give a rapid outline of this part of the subject.

On placing before our view the teeth of all known Mammalia, we soon perceive that they admit of being classified under a small number of different forms. With some of them, as we have already remarked, there is no difference between the root, or rather, the parts inserted within the bones which bear the teeth, and the crown, or part beyond these bones. Teeth of this nature have no real roots, in the proper acceptation of the word; that is to say, the crown is continued inwards as far as the dentary capsule, which never produces anything but the crown, as long as it remains free and active—a circumstance occurring with some animals during the whole course of their lives. Among others, on the contrary, the roots are very distinct from the crown; they may be either simple or complex, but do not, in general, exhibit in their forms that constancy of character which is always to be recognised in the forms of the crown. This circumstance arises naturally from the different manner in which each of them is formed.

Restricting, therefore, our view of the teeth solely to their crowns, we find that there exist three principal forms among them. These may be almost infinitely modified, and some transformed into others, in such a manner, that it becomes impossible rigorously to determine the precise point where the one form passes into the other. This manner of classifying the teeth must be regarded as nothing more than a purely artificial method, for enabling us to speak of their forms without too much obscurity and confusion, by restraining, within their proper limits, the observations necessary to be made. The crowns of all teeth may be regarded as conical, trenchant, or tuberculous.

(1.) The Conical Teeth vary in form from the cylinder, more or less compressed, terminated by a point, more or less obtuse, to the oval or ellipse. Some are straight, some angular, others curved. Those of an elliptical, or oval form, are the least common, and are observed among the Cachalots. The conical teeth, which comprise the Canines of the Carnassiers, the tusks of the Elephants, Hippopotamus, &c. are the most numerous. Finally, the cylindrical may be seen in the molars of such Edentata as are possessed of teeth. Among the Conical teeth, only two kinds of composition can be observed. Some are formed only of ivory and cortex, such as the Molars of the Cachalots; for although the external part of these teeth possesses a whiter tinge than the central, it is not formed of enamel, as some have thought. Both substances are ivory in reality, and it is the same with the tusks of the Elephant. Others are covered with enamel, such as the Canines of the Carnassiers, and many others. In this class of conical teeth are found by far the greater number of those destitute of roots, such as nearly all tusks; and of those, wherein the root is distinct from the crown, only a small number have been observed with many roots, as the Canines of the Moles, for example.

(2.) The Trenchant or Cutting Teeth may be presented under a simple or compound form. Among the former may be placed the Incisors of the Rodentia, which

belong as much to the first division as to the second, the Incisors of the Quadrumana, the Carnassiers, the Ruminantia, and others. In this division we may place the false and carnassier molars of the Carnivorous animals. There are, however, many among the former which approach nearer to conical than to trenchant teeth. All teeth of this class are composed of ivory and enamel, though some also have cortex. These last are the incisors of the Rodentia, which present the singular anomaly of having enamel only on their anterior surface. They are with simple or multiple roots; and those of the Rodentia alone are possessed of the same peculiarity as tusks, in having no roots properly so called.

(3.) The Tuberculous Teeth present the greatest variety of form, and are all Molars. The simple tuberculous Molars are those of the Quadrumana, the hindmost molars of some Carnassiers, the grinders of Squirrels and Rats, those of the Babyroussa, or Indian Hog. The proper tuberculous Molars are found in the Insectivora, &c. The compound tuberculous molars belong to a great number of Rodentia, such as the Beavers, the Pacas (*Culogenys*), the Agoutis, the Hares, the Guinea Pigs, and others. The simple tuberculous molars are always formed of ivory and enamel, while they are all possessed of several roots. This observation is equally applicable to the proper tuberculous molars.

Among the compound tuberculous molars there are perhaps none which do not possess the cortex, in addition to the ivory and enamel. Some of these teeth are found with several roots, as in the Beavers, Elephants, Horses, and Ruminantia; and without roots, as in the Hares, the Cabiais, the Lagomys, and other Rodentia.

The uses which animals make of these different forms of teeth are exceedingly various. To some they are powerful arms, by means of which they attack their prey, or any enemy that threatens them, or also defend themselves when attacked. In others they seem rather to be intended to retain a prey, which has already been seized. Some kinds are used for dividing the food like pincers; others for cutting it like scissors. Again, we find another class of teeth which grind like the stones of a mill, or which triturate their food, like jagged pestles fitting into mortars as jagged as themselves. Sometimes they crush by a single jerk, or pressure. All these forms and different modes of action find their final object in the ever-varied substances, which may serve for the nourishment of animals. The kind of food which each animal requires is determined by its nature; this again regulates the influence which it exercises upon other beings, and determines its station in the scale of creation.

The different kinds of teeth are found combined together in different manners. In many Carnassiers, we find conical, trenchant, and tuberculous teeth, all united in the same individual. Among the greater number of the Ruminantia, we can discover only the trenchant and tuberculous teeth. The conical teeth alone are found in some Edentata, and in the Cachalots and Dolphins, while only the trenchant and conical teeth are found in the common Seal.

In fact, we find in almost all Mammalia at least some of these forms—simple teeth, semi-compound, or compound, with one or more roots—conical, compressed, pointed, with flat crowns, tuberculous or trenchant. At present it is unnecessary further to enumerate the different possible combinations of teeth. A general idea of the subject may be obtained from the following

SYNOPSIS OF THE MAMMALIA, EXHIBITING AN OUTLINE OF THE NATURE, FORM, AND POSITION OF THEIR TEETH.

					<i>Instances.</i>			
Teeth	<ul style="list-style-type: none"> Calcareous Horny Wanting 	<ul style="list-style-type: none"> in both jaws in one jaw only 	<ul style="list-style-type: none"> of various forms of one form only 	<ul style="list-style-type: none"> completely lining the margins of both jaws not completely lining the margins of both jaws, leaving a vacant space 	<ul style="list-style-type: none"> of three kinds not very strongly defined (Anomalous) of three kinds, well defined (Normal) 	<ul style="list-style-type: none"> tubercles blunt pointed very sharp 	<ul style="list-style-type: none"> Man, Orang-Outang. Lemurs, Flying-Cats. Hedgehogs, Shrews, Moles. Auoplotherium (fossil). 	
						<ul style="list-style-type: none"> in the middle, both above and below in the front 	<ul style="list-style-type: none"> really apparently 	<ul style="list-style-type: none"> RODENTIA, Asiatic Rhinoceros. Horse, Kangaroo-Rat.
						<ul style="list-style-type: none"> both above and below below, and in the middle above above, and in the middle below 		<ul style="list-style-type: none"> Sloths, Morsc. Elephants, Mastodon (fossil). Dugong (adult), Manatus (young). RUMINANTIA.
						<ul style="list-style-type: none"> all Molars all Conical or Canines 		<ul style="list-style-type: none"> Armadilloes, Orycteropus, Megatherium (fossil), African Rhinoceros, Manatus (adult).
						<ul style="list-style-type: none"> the upper the lower 		<ul style="list-style-type: none"> Dolphins generally. Narwhal, some Dolphins. Cachalots? Ornithorhynchus. Whales.
								<ul style="list-style-type: none"> Manis, Ant-eaters, Echidna, some Dolphins?

These varied forms and positions, and even the number of the several kinds of teeth, often afford the best specific characters for determining the Mammalia; in all cases they offer the surest characteristics of the genera, and even of other divisions of a higher order. In this way, one of the Mammalia may be immediately recognised by a simple inspection of its teeth; and, reciprocally, we may determine the nature of the animal to which a single isolated tooth has belonged. The importance of this study towards the knowledge of fossil animals, as well as for establishing the generic groups of fossils, has been forcibly illustrated in the celebrated work of the Baron Cuvier, on the

Fossil Bones of Quadrupeds (Sur les Ossements Fossiles), and by MM. Frederic Cuvier and Illiger. The teeth may, indeed, be regarded as one of the most important subjects in Zoology, and one of the most certain marks for ascertaining the nature of animals, and the relations established among them. They are, in fact, the foundations of the science; and, hence, should occupy an important place in any system of classification, as they serve as an index to the order of facts and their relations; and, hence, may be considered as indispensable to the existence of the whole science.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

The Structure of Skin, Hair, Horns, Nails, Scales, and other integuments.

THE entire surface of all organized bodies is terminated by an envelope of a peculiar nature, varying in thickness according to the species of animal or plant, or the different parts which it covers. In animals, this integument commonly receives the name of *skin*, and seems to be essentially the same in all the Vertebrated animals, the external differences being merely owing to the development of certain additional parts. One of its surfaces is always intimately united to the body of the animal or plant; while the other, remaining unattached, bears immediate and various relations to the surrounding bodies.

In the Mammalia generally, the skin is composed of four substances, more or less distinct, and varying in their properties. The most external is termed the *epidermis* or *cuticle*; the second from the surface is the *mucous tissue* or *rete mucosum*; the third is the *papillary* or *nervous substance*; and the fourth, or innermost, forms the true skin, *chorion*, *cutis*, or *dermis*. These successive layers may be of greater or less thickness, and some of them may not always be present in the several species of animals belonging to this class.

The epidermis or cuticle is the most universal of all the layers, being found on the bark of trees, the stalks of herbs, the petals of flowers, the pellicle of the fruit,—as well as upon the entire surface of all animals. It appears to be an intermediate substance between horn and true skin, being nothing more than a thin membrane, formed by the hardening and drying up of the most superficial layer of the mucous tissue immediately beneath it, and of the albuminous fluids with which the latter is impregnated. It does not possess life in common with the other animal tissues, being merely composed of a greater or less number of inanimate layers placed one over the other. This cuticle is not confined to the surface of the body, but extends into its several apertures, protecting them, as well as all the nerves of the body, from a prejudicial contact with the media of air and water, to which they are continually exposed. The consistency of the cuticle varies with the nature of the circumjacent fluid; thus, it is observed to be dry and almost horny in animals living permanently in the air, while it is viscous and mucous in the aquatic species. The cuticle appears to be folded in a variety of ways, among those Mammalia, which remain continually exposed to the drying influence of the air. Sometimes these folds take the form of circles, wrinkles, or spiral curves, corresponding to the elevations and depressions of the skin, or that part of it called the mucous tissue. The thickness of the cuticle becomes considerable whenever a part of the body is exposed to a continuous friction; for example, upon the sole of the foot, the palm of the hand, and other parts used for holding or grasping, such as the prehensile tails of some American apes. The holes through which the hairs protrude may be perceived in the furrows of the cuticle. These appear to be conical elongations, forced outwards by the hairs, to which they serve as rudimentary sheaths.

The epidermis is very thin in Man, excepting on those parts which cover the palm of the hand and the sole of the foot. Yet it may be considerably hardened, and even changed into a substance nearly approaching to horn in consistency, either by friction, long exposure to a dry air, or to certain chemical agents, while the sense of touch becomes deadened in consequence, and almost wholly obliterated. We see frequent instances of this in the hands of hard labourers, of blacksmiths, dyers, or in those natives of Africa who walk barefooted upon burning sands. On the back of the human hand the furrows of the cuticle exhibit angular figures of various forms; on the palm they assume the appearance of parallel and elongated lines; while under the extremities of the toes they take the form of arcs of circles, curves of different kinds, and especially some very remarkable close and symmetrical spirals.

Among the other Mammalia, the cuticle, being always thinner in proportion as the hairs which protect it are more compact, is found to exhibit nearly the same appearance as in Man. The epidermis, covering the wings of the Bat, is very thin, and possesses furrows of many angles, very similar to those seen on the back of the human hand. This integument is thin in the Porcupine, and not very distinct from the other strata of the skin, which, in these animals, is always gelatinous. In the tails of the Beaver, Rats, Ondatra, and others, the epidermis is remarkably dry and scaly, as well as upon the surface of those scales which cover the body of the Manis and the Armadillo. Where the skin is very thick and deeply furrowed, as in the Elephant, Rhinoceros, and Hippopotamus, the epidermis is likewise thick, being covered with small plates, which sink into the several furrows, and may be separated like scales. The soles of their feet exhibit a remarkable structure in respect to the cuticle, being divided externally by deep depressions, nearly circular, with six or eight surfaces more or less regular, each of which contains an infinite number of small polygons of great irregularity. The entire surface of the skin thus acquires the appearance of shagreen. When separated from the foot, the epidermis exhibits elevated lines upon its external surface, corresponding to the furrows of the greater polygons, as well as smaller ones, corresponding to the lesser polygons. This arrangement gives it the appearance of net-work *in relievo*, of a pretty regular design, and resembling lace with large points. The Cetacea are covered with a very smooth epidermis without any remarkable fold, and are always moistened with a mucous oily secretion, which prevents the surfaces of these animals from becoming macerated by the action of the water.

The rete mucosum, or mucous tissue, is situated immediately between the epidermis and the villous surface of the skin. It is not membranous, but forms a mucous layer, the colour of which varies in different species and races of animals, and sometimes in different sexes and individuals, or even in the parts of the same animal. This apparent colour of the surface depends upon that of the mucous tissue; for the epidermis when removed is almost transparent, and the cutis or true skin is also destitute of colour.

The villous or papillary surface of the skin is placed between the cutis and mucous tissue, and immediately beneath the latter. It does not possess the membranous structure of the epidermis, but is a surface produced by the aggregation and approximation of a number of minute papillæ or small tubercles of various shapes, and formed

apparently by the external extremities of the cutaneous nerves. The figures of these nerves are exceedingly various, but their structure is nearly the same. They are easily exhibited on being macerated in water for some days. Each tubercle may then be observed to consist of a bundle of minute fibres, united at their base, like the hairs of a pencil. The fibres of the centre are sometimes longer than those of the circumference, and then the papilla assumes the form of a cone; often they are of the same length, in which case it appears flat. As the sense of touch resides more particularly in these papillæ, they are accordingly found in the greatest number, and most conspicuously, on the tongue, the lips, and at the extremities of the fingers. In Man, the papillæ on the soles of the feet and the palms of the hands are particularly remarkable, as they are placed close together in a compact manner, and distributed in lines corresponding to the external grooves of the epidermis already noticed. The papillæ under the nails present a villous surface, the minute and compact fibres of which are all directed obliquely towards the extremity of the fingers. The minute fibres of the lips are disposed in the same manner, but are still longer, closer, and more delicate. In the other Mammalia the same rule is constantly observed, and the papillæ are always more developed in proportion as the parts to which they belong are employed in touch. Thus, the nervous papillæ are very visible on the snout of the Moles, the Shrews, and the Hogs, where they form tufts consisting of very close fibres. They may also be remarked on the proboscis of the Elephant, and very distinctly on the tail of the Cayenne Opossum, and it is probable that they exist in the same manner in all Mammalia with prehensile tails. Cuvier was unable to detect them on the skin of the Dolphin and Porpoise.

The cutis or true skin is situated most internally. Its structure has been developed by anatomists in a very distinct manner, by certain modes of preparation, and especially through maceration in water. They have demonstrated that it is composed of a tissue of gelatinous fibres, crossing each other in every direction, and so interwoven that the substance may be compared to felt. Among these fibres may be observed a great number of fine ramifications of nerves, as well as arterial, venous, and lymphatic vessels. The organization of the cutis is such, that the fibres composing it are capable of elongation and extension in every direction, and we may easily perceive that these qualities were necessary to give the surfaces of animals the power of evading the mechanical action of other bodies. These properties of elongation and extension, possessed so remarkably by the skins of the Mammalia, have enabled manufacturers to apply them to different purposes, where strength and flexibility are necessary, or where great friction has to be sustained; and the process of inducing these requisites constitutes the art of the currier. The fibres are further approximated or separated, to form the leather and adapt it for different uses, and this again is the foundation of the arts of the tanner, skinner, parchment and morocco-maker. The cutis in Man is from a line to a line and a half in thickness in certain parts of the body. From maceration, as well as the process used by skippers, we perceive that the fibres which enter into its composition are long, fine, and very solid, but united in a lax manner. In the Mammalia generally, the cutis is thickest on the dorsal, and thinnest on the ventral region. It is also much thinner on birds than on the Mammalia.

The obvious intention of Nature, in providing Animals with a skin or epidermis, was to protect them from an injurious contact with surrounding bodies. For some purposes this covering is insufficient, in which case other appendages are added, differing in form and consistency, and suited to their several purposes. These integuments have received the names of Hair, Horns, Nails, Scales, &c.

Hairs are filaments of a horny substance, more especially intended to cover the skin of the Mammalia. One extremity of each hair is implanted in the cutis, and sometimes penetrates even as far as the muscular layer beneath. This extremity is enlarged into a bulb, more or less thick, sometimes containing a small drop of blood, the whole being inclosed in a membranous sheath. When the hair is young this cell is large, and its size diminishes in proportion as the hair grows older. If punctured during its earlier stage, the blood flows, and it becomes soft and flaccid.

That entire portion of the Hair placed externally to the skin, is termed the Shaft. It forms a very elongated cone, the free extremity being the apex. The hairs grow from their base, and hence are finer in young Animals than in the old; for a similar reason, they appear to augment in number when cut, though in fact their extremities only are increased in diameter. When the nails rise out of the skin, they carry with them a small portion of the epidermis, which forms a kind of sheath around their base; this becomes gradually detached, under the appearance of transparent and whitish scales.

Some Animals have the hair in some parts of their bodies more or less developed at the time of their birth. In other parts no hair appears until a more advanced period of life.

Linnaeus remarks that "Mammalia have hairs, Birds have feathers, and Fishes have scales." These assertions, as we have already remarked, are true only in a general manner, for many Mammalia either want hairs altogether, or are furnished with a very small number. This fact did not escape the observation of Linnaeus himself, who alludes to it in another part of his *Systema Naturæ*. Some species, such as those of the genus *Manis*, are in fact covered with true scales, and others, like the Cetacea, have a naked skin. These exceptions are, however, more apparent than real in respect to the *Manis*, in which the scales are little else than compound hairs. According to M. Blainville, the last remark is equally applicable to the Cetacea, where the hairs, becoming blended together, unite in forming a kind of crust or general envelope. This celebrated Naturalist is even of opinion that the term *Pilifères*, or hair-bearers, might form an advantageous substitute for that of *Mammifères*, an observation with which we can by no means agree, as true hairs are also found on many Birds, so that the term *Hair-bearers* would apply equally to them.

In general, the Mammalia have two kinds of hair; the one bristly, more or less stiff, and external; and the other woolly, very fine, soft to the touch, and commonly hidden beneath the stronger hairs. The domestic species of Sheep form a remarkable exception to this observation, on account of the abundance and length of the woolly hairs, and at the same time of the almost total disappearance of the coarse hairs.

Animals of cold countries approach towards this peculiarity of the Sheep. In warm regions, on the contrary, the bristly hairs are more strongly developed, and the woolly hairs become almost wholly wanting. The quantity, or rather the proportional abundance of the latter, is generally in the inverse ratio of the temperature, while that of the former is directly proportional to it, or nearly so.

The climate has a great influence on the nature of the hair, especially among the domestic animals. It becomes long and rigid in cold regions, as we remark in the Siberian Dog and Iceland Ram. Syria and Spain produce an opposite effect, and these more favoured climates produce a corresponding change in the hair, which may become tufted, fine, and silky. These qualities may be remarked in the Spanish Sheep, the Maltese Dogs, as well as in the Goats, Cats, and Rabbits of Angora.

The coarser hairs bear a greater predominance in certain parts of the body, especially among the Males, such as in the cervical region of the Lion and Horse, where they form a mane, and on the tail in many species. Other animals are covered in every part of the body by very long hairs; such, in particular, is the Bear of India (*Ursus labialis*), in which the hairs are almost every where from seven to nine inches in length, and in some places even a foot long.

In some species the fur is mixed, and in others it is sometimes composed entirely of spines, more or less abundant, and of various structure; such are the Hedgehogs, the Tenrecs, the genus *Echimus*, the Porcupines, and many others. These spines or prickles are usually pointed, as their name indicates, and each is composed in general of a single hair. A great development of the muscles of the skin is always found in all species armed with spines, and this arrangement is especially remarkable in the Hedgehog. It may also be observed, on comparing different species, that the spines are arranged in small and regular groups, the disposition of which is peculiar in each species.

It becomes difficult to examine the structure of the hairs on the human body, because they are slender; but the bristles of the Hogs or the whiskers of the Cats are better adapted for this kind of inquiry. On examining the bristle of a Wild Boar with the microscope, we observe that it is grooved throughout the whole of its length by about twenty furrows, formed by an equal number of filaments, and the union of which constitutes the surface of the hair. In the middle of the bristle there are two canals, which contain a humour called the pith or marrow. The filaments of the hair separate on being dried, as may be remarked in the bristles of brushes, where the cavities may be observed to be empty, and a few laminae cross each other in different directions.

The hairs of the Elk and Musk, with the spines of the Hedgehog, the Tenrec, and the Porcupine, are not altogether similar; their surfaces being covered with a horny lamina, varying in thickness, and a few furrows only can be observed. Internally they contain a white spongy substance, which appears at first sight strongly to resemble the pith of the Elder-tree (*Sambucus nigra*).

The colour of the hair appears partly to depend upon that of the mucous tissue; for where animals have differently coloured spots upon the hair, these usually indicate corresponding colours below them in the skin. Even in the human species, many striking relations of this kind may be remarked. Thus, Negroes in general have the head black. Persons with red hair often have the skin freckled or covered with reddish spots, while black hair usually accompanies a dark complexion.

The external colours of Animals depending on those of their respective mucous tissues are exceedingly various. Among the Mammalia, it is very seldom that they appear of a vivid hue. On some species of Mandrills, the nose and hips are bright red, violet, and carmine. The mucous tissue is also pure white on their cheeks; and of a beautiful silvery whiteness on the bellies of the Cetacea. In the Mammalia generally, the mucous tissue imparts its hue to the hair and nails. It is often observed to be coloured within the cavities of organs, into which it has been prolonged, such as on the palate, the tongue, the ear, the conjunctive and nasal membranes of the Quadrumana, Dogs, Ruminantia, and Cetacea. The mucous tissue appears to be thickest in the class last mentioned. On the backs of the Dolphins and Porpoises it is very thick, and of a deep black.

The colours of the Mammalia have not that metallic lustre which characterises a large number of the genera of Birds, there being one solitary exception to this observation in the brilliant lustre of the Chrysoloris, or Cape Mole. We do not find among these animals the dazzling brightness of the Parroquets, the Tanagers, or the Flamings, nor can we discover anything analogous to those ornamental appendages which adorn the plumage of many Birds. There is another peculiarity in the colours of the Mammalia, that they are in general much paler and fainter beneath than on the back or flanks. This may be observed not only in the true Quadrumeds, but even in those species, such as the Kangaroos, which more or less are in the continual habit of maintaining an upright position. Yet, without enumerating all those species which are entirely of one colour, such as the Coaita (*Ateles paniscus*), the Polar Bear (*Ursus maritimus*), we find some exceptions among the Rodentia, and especially in the order of Carnassiers, such as the Hamster, the Gluttons, the Badger, and some other species, while many even have the belly absolutely black. In particular, we may notice a Carnassier recently described, for the first time, by M. Frederic Cuvier, who has assigned to it the specific name of Panda.

The colours of the males among the Mammalia are most commonly the same as those of the females, excepting perhaps that the shades of the latter are not quite so deep. In this respect they differ remarkably from the greater number of Birds, in which the colours of the female differ almost wholly from those of the male. However, all the other circumstances which influence the colours of Birds act equally upon those of the Mammalia, although most commonly in a different manner. Age, for example, varies the colours of the fur only in a small number of species, as among the Stags, the Tapirs, and the Lion, all of which are clothed at their birth in a kind of livery, or peculiar arrangement of colours. Their coats, instead of being uniform, as in the adults, are at first ornamented with spots, regularly disposed, and analogous in their arrangement to those observable in the adult animals of other species belonging to the same genus. Thus the spots of the young Fawns are white, similar to those of the adult Axis; while they are black in the Lioness' cubs, in the same manner as we see in most adult Cats. This very remarkable relation between the system

of colouring belonging to the young individuals of one species, and that observed in other species of the same genus, may also be traced among the Birds. But the young of the Mammalia differ from those of Birds in this respect, that—while the plumage of the latter, most commonly resembling that of their mothers, is duller in its hues than at a more advanced period of life—the livery of the young Mammalia is, on the contrary, an ornament which they gradually lose as their years advance, until they finally resign the spotted and agreeable garb of youth for one of a more simple and uniform character.

The colouring matter of the hairs resides in the horny part of their substance, and not in the pith, which is commonly white. We can observe this structure most conveniently in the spines of the Porcupine, from their unusual magnitude. Some hairs are coloured differently in several parts of their length, while the colours themselves may be infinitely various, both in quality and intensity. In general, the hairs of the Mammalia are round, and this form is observed more especially in the hair of the head or mane. On the tail of the Hippopotamus, as well as on the body of the Great Ant-eater, and especially on the Ornithorhynchus, they assume a flattened appearance; and in several species of the Ruminantia, especially the Musk (*Moschus moschiferus*), the hairs appear as if they had been crimped. In some varieties of Goats, Cats, and others, the hairs are fine, long, and silky; they appear both crisped and frizzled in the Rams. From their great thickness, stiffness, and elevated position in the Hogs, Hedgehogs, and Porcupines, they have received the name of *Spines* in the two last-mentioned animals, and of *Bristles* in the first.

All Mammalia possess a certain quantity of hair, without excepting the Cetacea, in general destitute of this covering. Man is covered in almost every part of the body by scattered hairs, although they are not easily perceived in some places from their excessive fineness. Those of the head and beard are the longest; those of the axilla and pubes are next in length. On the interior of the nose and ears they are shorter, and on the remaining parts of the body they appear of a still more diminutive length. Contrary to the arrangement in the other Mammalia, the hair is longer on the breast and abdomen than on the back. There is never any hair on the palms of the hands or on the soles of the feet.

Among the Quadrumana, the true Apes have the hair of the head in general of the same length as that of the body. The hairs which cover the fore-arm point upwards towards the elbow, instead of being directed towards the hand, as we may see in the Orang-Outang and some other species. The buttocks are callous in a great many Quadrumana, and entirely deprived of hair.

In most species of Cheiroptera, a few scattered hairs only can be seen on the membranes of the wings, the nose, and the ears. One species of Bat (*Vespertilio lasiurus*, Linn.) has also a few upon the tail. The remainder of the body is covered by short, fine, and villous hair, as may be seen in the Flying-cats (*Galeopithecus*), and other animals of their order.

The spines of the Hedgehog are found only upon the head and back; the limbs and lower parts of the body are covered with stiff bristles. In these respects, the Tenrecs resemble the common Hedgehog. In some species the spines and bristles are mixed together indiscriminately.

The hair is fine, short, and close in the Moles and Shrews, so that their skins seem as soft as velvet to the touch.

Among the Carnivora the hair varies considerably. There are two kinds of hair in the Weasels, Sables, Ermines, Martins, and others; the one being very fine, thick-set, intermixed, and placed close to the skin; while the other, which is longer and stiffer, alone appears at the surface. These two kinds constitute the *finer furs*. The amphibious Mammalia have short, rigid, and very close hair.

The arrangement found in the Carnivora may also be remarked among the finer haired Rodentia. The spines of the Porcupine are more slender, short and flexible on the head, neck, and belly, than on the back. There are about ten or twelve placed upon the tail, and resembling the tubes of quills, truncated at the free extremity. A rustling sound is emitted from these spines when the animal moves its skin.

Among the Edentata there is found a considerable diversity in the quality of the hair. It is broad and flat in the great Ant-eater (*Myrmecophaga jubata*), and has a longitudinal furrow in both surfaces, so that each hair presents the appearance of a dried blade of grass. The two-toed Ant-eaters are covered, on the contrary, with very fine wool. Several have hard and sharp-edged scales placed one over another, like the tiles of a house, as we see an example in the Manis. Others are covered with prickles, like the spinous Ant-eater (*Echidna*). The Armadillos (*Dasybus*) have, in addition to the scales or osseous bands, which cover the back and head in regular compartments, some scattered hairs, which are short and rigid like those of the Elephant. These hairs drop off, however, as the animal advances in age.

The Hogs, of all Pachydermata, have the greatest quantity of hairs, which in them are called bristles. These are scattered and frequently bifid at their free extremity. The other genera of this family are comparatively almost destitute of hair. It is in general short in the Solipeda, excepting on the mane and tail, where it receives the name of Horse-hair (*crines*).

The Bulls, Deer, Antelopes, and Giraffe, have short hair in general. In the Camels it is very fine and soft, and remarkably so in the Lamas. All of them may have callosities, which are destitute of hair, on the knees and breast. Goats' hair is long and fine, extending to a pointed beard under the chin. The hair of Sheep is long, and readily distinguished by that crisp and frizzled appearance, well known in the wool of commerce.

The Hair of all these animals, when submitted to a chemical analysis, yields nearly the same results, whether it be examined under the form of wool, bristles, spines, or scales. On being subjected to the action of Heat, in open vessels, it fuses or liquifies at first by swelling up. It subsequently emits a white flame, and resolves into a black carbon, the incineration of which is very difficult. Hair yields, on distillation, a reddish liquor, containing prussiate of ammonia, and another salt of an ammoniacal base, combined with a peculiar animal acid, which Berthollet has named *Zoonate of Ammonia*. The carbonaceous residue at the bottom of the still is light, and contains carbon and phosphate of lime. The Hair does not dissolve completely in boiling water, a mucilaginous matter, which is the pith or medulla, being separ-

rated from it. Caustic alkalis and some acids dissolve it entirely. Sulphur, silica, iron, and manganese, may be traced in the hair.

There are certain prolongations of a horny substance, which grow upon the heads of some species of Mammalia, especially the Ruminantia. These also appear on several other parts of animals.

The term *Horn*, as applied in the arts, would exclude the excrescences of the Stag, Deer, Rein-deer, Elk, and others, which consist rather of a bony substance, distinguished by the term *antler*. The horns of this division of Ruminants are true bones, and composed like them of a cartilaginous matter, within the meshes of which, particles of phosphate of lime are deposited, constituting a kind of earthy salt, commonly known as earth of bones or hartshorn.

These antlers, in their perfect state, are true bones both in their texture and elements, the external part being hard, compact, and fibrous; the internal spongy, but very solid. There are no large cells, medullary cavities, or sinuses. The bases of these antlers adhere to the frontal bone, forming one body with it, in such a way as to render it impossible to point out, at certain ages, the limits between them. The skin which covers the forehead does not extend farther. It is surrounded by a denticulated bony substance, called the *burr*. Neither skin nor periosteum covers this substance or the rest of the antler. Furrows more or less deep, which are the vestiges of vessels distributed along their surfaces while they were yet soft, are alone to be traced on the exterior. These hard and naked horns remain only for one year on the head of the Stag. The period of their fall is varied according to the species; but when near, there appears, on sawing them longitudinally, a reddish mark of separation between them and the supporting eminence of the frontal bone. This mark becomes gradually more apparent, and the bony particles at length lose their adhesion at that part. A very slight shock then makes the antlers drop off at that period, and two or three days commonly intervene between the fall of the one antler and that of the other.

The eminence of the frontal bone resembles, at that time, a bone broken or sawed through transversely, and its spongy texture is exposed. The skin of the forehead soon, however, covers it; and when the horns are again about to shoot, tubercles arise, which remain covered by a production of the same skin until their perfect size has been attained. During the whole of this operation, the tubercles are soft and cartilaginous. Under the skin a true periosteum is found, in which vessels, sometimes of great size, are distributed, and penetrate the mass of cartilage in every direction. The cartilage ossifies gradually, and, passing through the same stages as the bones of the fetus, ends in becoming a perfect bone. During this time, the burr at the base of the horn penetrates the indentations through which the vessels pass, and also develops itself. The indentations by their growth confine the vessels, and finally obstruct them. Then the skin and periosteum of the bones wither, die, and fall off. The bones, now become bare, in a short time fall off, only to be renewed by others, but always of a larger size than the first. The antlers of the Stag are subject to diseases equally with other bones, and of the same kind. In some the calcareous matter is extravasated, and forms different exostoses; in others, on the contrary, it is found in too small a quantity, and the bones continue porous, light, and without consistence.

The true horns, such as those of the Bull, Ram, Goat, and Chamois, are formed upon processes of bone, and differ materially from antlers in this respect, that they grow at their root or base, and bear a great analogy to the other integuments.

This view is established by investigating the manner in which the horns of the Calf exhibit themselves. In the third month of conception, while the fetus of the Cow is still inclosed in the membrane, the cartilaginous frontal bone presents no mark of the horns which it afterwards bears. It becomes partly ossified towards the seventh month, and presents in its two portions the small tubercle, which appears to be produced by the elevation of the osseous laminae. These bony tumours soon after appear externally, and raise the skin in proportion as the tumour grows. At last it becomes horny as it elongates, and forms a kind of sheath which covers externally the process of the frontal bone. There are numerous branches of blood-vessels, which serve to nourish the bony part, and are placed between this sheath and the frontal bone.

Thus, the horns are merely solid, hard, elastic, and insensible sheaths, which protect the osseous prolongation of the frontal bone. These sheaths, generally of a conical figure, are broadest at the base, or extremity from which they grow. The curvatures assumed by the horns are different in the several species; they also present different channels or transverse furrows, depending on the age of the animal; and these denote, in a very certain manner according to the species, the number of years it has lived. The horns grow in precisely the same manner as the nails of animals and the beaks of birds; that is to say, from the bone which serves as a base there exudes a gelatinous matter, which takes the form of the horn, and hardens on coming in contact with the air. M. Vauquelin has found this gluten, or animal mucus, to be of precisely the same chemical nature as that found in hair.

The texture of the horns appears to be much the same in the Ram, Goat, Antelope, and Bull. They consist of fibres of a substance very analogous to hair, and appear to be agglutinated in a very solid manner. These fibres in the two genera first mentioned are short, and covered by superincumbent layers like the tiles of a house. In the last two they are longer, more compact, and form elongated cones, the one being incased within the other.

It appears that the horns of the Rhinoceros differ materially from those of the Ruminantia. They have no osseous part, and are not placed upon the frontal bone, but upon the ridge of the nose. They are formed, however, of the same substance, and we observe fibres analogous to hairs more distinctly in this animal than perhaps in any other. The base of the horn presents externally an infinite number of rigid hairs, which seem to separate from the mass, and render that part rough, like a brush, to the touch. When sawed transversely, and examined with a magnifying glass, we perceive a multitude of pores, seeming to indicate the intervals resulting from the union of the agglutinated hairs. When divided longitudinally, there are numerous parallel and longitudinal furrows, which demonstrate a similar structure. This kind of horn is attached solely to the skin. The horns of the Two-horned

Rhinoceros (*Rhinoceros bicornis*) always appear in some degree movable. When fixed, as in the Indian Rhinoceros (*R. Indicus*), there is a thick mucus interposed between its base and the bone over which it is situated.

The whale-bone, which lines the interior of the upper jaw in the Whales, also consists of hair united into laminae.

The colour of horns depends, like that of the hairs, on the colour of their mucous tissue. Heat softens bone, and even fuses it; hence this agent is largely employed in manufacturing them into different articles.

It appears from these observations, that true horns differ essentially from the bony prolongations called *antlers* in the Deer. The latter increase at their extremity, and are covered with skin during their growth. They fall off when their growth is completed, and are replaced by others. The true horns are developed at the base, are covered with skin, and remain permanently.

The Nails of the Mammalia form, with the preceding, useful arms of attack, or necessary shields against external injury. These horny prolongations are generally equal in number to that of the fingers and toes, whose extremities they serve to arm and protect. Their form depends upon that of the last phalanx of each finger or toe, and they bear the same relation to these phalanges, as the hollow horns to the processes of the frontal bone which they cover.

The nails seem to be incased in a fold of the skin, the portion covered by the latter being called the *root* of the nail. They grow by this part precisely in the same manner as hairs, but the opposite extremity wears away by friction, from the various uses to which animals apply their nails. Accordingly, they are observed to grow exceedingly long in animals that are confined, and have few opportunities of motion. No part of a nail is sensible, except that which adheres to the skin, and the free extremity may be cut or broken without occasioning the slightest pain. The colour of the nails depends upon that of the mucous tissue.

The human nails appear in the third month of conception; and their development takes place nearly in the same manner as in the common horns. They appear at first like a kind of cartilage, which gradually acquires a proper consistence. Almost all animals have the nails formed, in some degree, at the time of their birth. The nails of Man, as well as the greater part of the Unguiculated Mammalia, appear to be formed of extremely thin layers, placed one upon another. The external laminae are larger than those of the inferior surface; on which account we do not readily perceive this kind of imbrication which actually takes place. When diseased, however, or upon making a transverse section of the nail, after it has become completely dried, this structure becomes evident. Often we observe striae, or very fine longitudinal and parallel lines, apparently resulting from the manner in which this part is moulded upon the laminae beneath it.

Nails are generally wanting in animals which do not employ their extremities either in walking or grasping, as we may remark in the Cetacea. When analyzed chemically, the nails afford nearly the same results as hair, to which they bear considerable analogy, both in structure and their mode of growth.

Hoofs surround the phalanx entirely, in which respect they differ completely from nails. They are neither pointed nor cutting at the extremity, and both surfaces meet to form a round and blunt edge. Their interior is rendered remarkable by deep and regular furrows, which receive projecting laminae not observable in nails. In the Elephant and Rhinoceros these furrows are very strongly marked. They are also conspicuous in the Horse, but do not appear very prominently in the Ruminantia. A layer of mucous matter may always be observed between the nails and the soft parts of the phalanx. In hoofs there is found a soft substance abounding in nerves, which serve to maintain a certain degree of sensibility in these parts.

Scales may be regarded as very flat horns, in the same way as hairs admit of being considered very slender horns. They bear a great resemblance to hairs, feathers, horns, and nails, both in their mode of growth and use, as well as in respect to their chemical analysis. Only a very few species of Mammalia possess scales on some parts of their body, and in Birds they are found on the feet alone. Reptiles and Fishes are, on the contrary, almost wholly covered by them.

The term *scales* is applied to a variety of substances of very different natures. In general, they consist of laminae or small plates of a substance which may either be horny or bony. The scales of the animals belonging to the Genus *Manis* consist of a kind of flat nails of a horny substance, but of considerable thickness; their anterior third, which is bevelled and sharp edged, is free, while they adhere to the skin by the other portion. The external surface is channelled longitudinally, particularly in the Long-tailed *Manis* (*Manis tetradactyla*), in which animal they usually terminate in three points. They are furrowed transversely on the side next the skin, and appear to be formed of imbricated laminae. In the Armadillos, the scales consist of small compartments of a calcareous substance, covered with a thick, smooth, and apparently varnished epidermis. The scales covering the tail of the Beaver consist of thin laminae of a horny substance, similar to those on the feet of Birds. The tails of Rats, Opossums, and most animals with prehensile tails, are covered with scales of the same nature.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Their Organs of Voice.

MAN alone of all Mammalia possesses the exclusive privilege of uttering articulate sounds, to which the great flexibility of his tongue and lips, as well as the general form of his mouth, alike contribute. The power of communicating his ideas by artificial words, forms a means of communication of the greatest value; and there are no signs capable of being employed with the same convenience for this purpose, or which could be perceptible at so great a distance, or in so many directions. This faculty of speech, joined to the perfection of the hand in Man, contributes largely to his power.

The other Mammalia can express their wishes by cries alone; yet these natural signs are themselves subject to many modifications. Although incapable of communicating any complicated idea, they at least serve to express the passions by which

the lower animals are agitated. Thus, we can readily distinguish the cry of rage, when an animal threatens his prey; that of distress in the unfortunate victim; the amorous cry of one sex for the other; the rallying cry of the female, when she wishes to assemble her young ones around her; the bursts of resentment; and in some species, even a cry of gratitude towards Man.

The larynx of the Apes greatly resembles that of Man in many respects; yet in those species which approach most nearly to him in organization, there are found membranous sacs of a greater or less extent, where the air becomes stifled, and hence they are rendered incapable of producing any other than hoarse and inarticulate sounds. The large Apes of Africa, such as the Mandrills, merely emit a low sound, resembling *aou, aou*, pronounced in the throat, and never very loud. Animals of the genera *Cercopithecus* and *Macacus* utter very sharp and disagreeable cries. The Apes of the South American Continent, belonging to the genus *Myctes*, have received from travellers the appellation of Howlers. These unite together in troops, and each Ape utters a continuous howl, which can be heard for at least a mile in every direction. For this purpose, they are supplied with a laryngeal apparatus of a remarkable appearance. Their lower jaw has its branches very distant from each other and much elevated, for the purpose of receiving a honey drum in the interval which separates them. The extremity of this organ is marked externally by a line across the skin of the throat, it being nothing more than the hyoid bone greatly enlarged and rendered hollow. This drum is the chief cause, in the Howlers, of the frightful noises which are re-echoed continually through the forests of those remote regions. The Sapajous also, from South America, merely utter a soft sonorous cry, for which reason they have been called *Weeping Monkeys* by some travellers.

The Varied Lemur makes, it is said, a great noise in the woods of Madagascar; however, the other species of this genus only emit a low and continuous grunt when in confinement.

The Bats, as well as the Shrews and other Insectivora, have no other voice than a very sharp and feeble cry.

The sound of the Bear is a growl, or loud murmur, often intermingled with the gnashing of his teeth. That of the Kinkajou (*Cercoleptes*), when alone at night, resembles the barking of a very small Dog, and always beginning with a kind of sneeze. On being injured, its cry changes to the note of a young Pigeon. When threatened, it hisses like a Goose, and if irritated, utters a noisy and confused cry. The Badgers and Weasels, whether Martens or Polecats, always walk in silence, until they meet with some injury, when they emit a sharp and hoarse cry, expressive of resentment or pain.

The yelping of the Fox consists of a kind of barking howl, which forms the proper cry of that animal. It is chiefly in winter, especially during frost and snow, that the Foxes yelp, at which season their cry becomes further distinguished by a sharper and more elevated tone of voice. The howling of Wolves, and of many other Carnivorous animals, is a mournful and prolonged cry, which they utter either when pressed by famine or transported with desire. It is more especially during the night that the Wolves howl, and remarkably so in the long nights of winter. The Dog, on losing his master, utters a melancholy and plaintive noise, which is in fact a kind of howl. The barking of this animal is better known than the cry of any other species. An attentive ear can distinguish the bark of pleasure on again meeting his master; the bark of pain when wounded or struck; and that of joy when playing with other animals of his own kind. These varieties commonly called Watch-dogs are generally silent during the day, but bark more especially at night. When a pack of hounds are in pursuit of any animal, it is easy to tell, from the different modulations of their cries, at what point the hunt has arrived.

The sound of the Hyæna, when at large in the woods, has been compared by some Naturalists to that of a Man when vomiting with great difficulty. In the Menagerie, however, this animal emits a cry of that kind only when irritated, at which time it is also accompanied by a sound expressive of resentment, very similar to that used by other Carnassiers on the same occasion. In the mewling, or rather the *miauling* of the Cats, it is very easy to distinguish the attracting cries of the females; the cries of pain with which they repel the approaches of the males; and the low and soft sounds with which they invite their young ones to follow them. The males, during their nocturnal combats, interrupt the silence of the midnight hour with their noisy sounds, preceded or followed by smothered hisses and growls more or less prolonged. When these animals are at their ease, especially when warm and after a repast, they produce a continual noise or *purr*, similar to that of a spinning-wheel when in motion, which sound is due to a peculiar formation of the larynx.

The roar of the Lion and Tiger is a frightful and imposing cry. The former consists of prolonged and rather grave sounds, intermingled with others of a sharper tone, and a kind of tremor, and is susceptible of numerous variations, according to the age, sex, as well as the passions which animate the Lions. All African travellers agree in representing the deep terror which suddenly seizes the other animals, and especially Horses, when, in the depths of the forests, they hear this dreadful cry around them. The roar of the Tiger is also very powerful and continuous for four or five minutes; that of the female is more plaintive, less interrupted, and of a much longer duration. According to Azara, the roar of the Jaguar may be represented by the words *houa, houa*. There is something plaintive in it, and, at the same time, strong and grave, like the lowing of a Bull, while that of the Panthers, with which the Jaguar has often been confounded, resembles the noise of a saw.

The voice of the adult Seals may be compared to that of a hoarse Dog. The cry of the young is much clearer, approaching more nearly to the mewling of the Cat. On separating the young from their mothers, the former *miaule* continually; while the old ones bark furiously at those who molest them, and use every exertion by biting to avenge the loss of their offspring. When attacked by Man, the Morses low in a most dreadful manner.

All the Marsupialia, with which we are acquainted, appear to possess merely a low and feeble voice; but the sounds emitted by many of them still remain unknown.

The Rodentia in general emit no other sound than a whistle. The common Squirrel, as well as the Palm Squirrel, has a strong voice; and these animals emit a

kind of murmur, or grumble of discontent, with the mouth shut, on being irritated. The Striated Squirrel, and the Pteromys or Flying Squirrel, when unmolested, appear to have no kind of voice, but in other circumstances, they utter a cry like the scream of a Rat. The Marmot and Bobac, when playing or being caressed, have the voice and murmur of a young Dog; but on being irritated or frightened, they utter a whistle so shrill and piercing as to offend the ear. According to Erxleben, the sound of the Hamster is a kind of bark. The Campagnol Water-rat, when pursued so that he cannot escape, makes a cry resembling a snore. The Guinea-pigs have a grunt similar to that of a young sucking Pig, and a kind of purring noise when pleased; their cry expressive of pain is very acute. The Agoutis and Pacas have also a grunt like that of a Pig, while the Cabiai brays like an Ass. The voice of the Rat-moles is merely a snore. The Ondatras make a kind of groaning, which is especially remarkable in the females. The Siberian Jerboas, when irritated, have a cry similar to that of a young Dog just born, and sometimes a kind of snore, whilst the Common Jerboa raises a sharp cry. The Hares and Rabbits pass their lives in silence, and cry only when wounded or tormented; on these occasions, the former of these animals emits a sound which bears some resemblance to the human voice. The note of the Alpine Hare (*Lagomys Alpinus*) is a simple and acute whistle, much resembling the cry of a young bird; while that of the Calling Hare (*L. pusillus*), another species of the same genus, is a very strong and grave note, somewhat similar to that of a Quail. This voice is composed of simple sounds, but repeated at equal intervals, three, four, and often six times, and it can often be distinguished at the distance of half-a-mile, although the animal which produces it is of very small dimensions. Finally, the Porcupine has a grunt similar to that of a Pig, from which circumstance it has in part derived its name.

Among the Edentata, one animal has received the name of *Ai* from its cry; in the same manner as one of the Rodentia has been assigned the name of *Aye-aye*. The Unau or Two-toed Sloth, which belongs, like the Ai, to the genus *Bradypus*, cries very rarely. Its note is brief, and is never repeated twice consecutively. Although plaintive, it bears, however, no resemblance to that of the Ai. It is not known whether the Ant-eaters, the animals belonging to the genera *Manis*, *Orycteropus*, *Echidna*, and *Ornithorhynchus*, have any peculiarity in their voice.

The ordinary cry of the Elephant is a grunt, which he changes into a whistling noise when irritated. The appellation of River-horse, applied to the Hippopotamus, derives its origin from the neighing noise made by this animal: its cry of pain is a kind of lowing, which bears much analogy to that of the Buffalo. The Rhinoceroses emit a grunting noise, somewhat resembling that of the wild Boar and domestic Pig; that is to say, a series of hoarse, short, and rough sounds, following each other at short intervals of time. The Tapirs have no other cry than a sharp whistle, which might not have been expected from an animal of its magnitude. The Daman has only a very feeble cry, and of short duration.

The Camels and Dromedaries are commonly silent, if we except the period of the rutting season, at which time they emit a very disagreeable rattling noise in the throat. The voice of the Lamas appears to be a gentle moaning like the word *he-em*, pronounced in the tone of voice of a complaining female; and some interval of time usually elapses before the animals repeat this sound. The Stags during the rutting season emit their rough bellow; it is a hoarse and disagreeable sound, which reaches to a great distance. The Antelopes, the Goats, and Sheep, bleat; and it is remarked, that the bleating of the Rams is stronger and graver than that of the young, the Ewes, or the Wethers. It has also been observed, that the bleating of the Goat is shorter than that of the Sheep; and that all these animals, when domesticated, are most clamorous on leaving the stable for the fields, and in the evening on their return. The greater part of the animals belonging to the Bull genus low or bellow; that is to say, they emit a very grave, powerful, prolonged sound. There is one exception, however, in the Yak, which grunts like a Pig. On this account it has been called the Grunting Bull or Cow (*Bos grunniens*). The Zebu, which is usually considered as a simple variety of the common Bull, grunts likewise, which circumstance, according to M. Desmarest, renders it probable that it should be regarded rather as a variety of the Yak. The voice of the Buffalo is a frightful bellow, much more forcible and clamorous than that of the Bull.

The neighing of the Horse is emitted whenever he experiences any vivid sensation, or is animated by some passion. He utters this cry alike when inspired by courage, pride, or desire; and neighs in the battle as if courting danger; or during the race, as though he defied his rivals to the contest. The braying of the Ass is a well known discordant sound, which it emits when pressed by any want, or inspired by passion.

Finally, the Cetacea, on happening to run aground, signify their consciousness of danger by uttering a very strong howl, with but few repetitions.

The voice of the Mammalia is not always confined to the simple purpose of expressing externally the interior or moral state of the individual; it is also occasionally employed as a means of preserving the species. While the Marmots are feeding on herbs in some elevated meadow of the Alps, one of them placed on a rock surveys in security all the others; and this advanced sentinel gives notice to his companions on the approach of an enemy by a loud whistle, which is the signal for immediate flight. In the same way the Wild Horses collect together in a dense troop, as soon as some of them, on being apprised of the danger, give notice of their fear by a peculiar neigh. The voice also serves to attract the sexes during the rutting season. At this period it usually changes its nature, as we may remark in the Stags, whose throats swell, and impart a graver tone to their cries. The peculiar sounds of the carnivorous animals further serve as a warning note to the feeble quadrupeds, and may thus contribute indirectly towards the preservation of the latter.

It can be readily perceived from the preceding observations, that the greater part of the Mammalia are generally incapable of producing any other sounds than such as are either noisy or disagreeable. Yet after having once heard each particular noise, we can easily recognise these animals by their respective cries. The variety of sounds is so great, that it often becomes very difficult, if not impossible, to convey, by any form of words, an adequate idea of the peculiar sensations which many of them occasion.

The Mammalia differ considerably from Birds, in respect to their organs of voice. In the latter, the several varieties of sound are produced in a more simple manner; and, from the organs of voice in the Birds approaching very near, in the principles of their structure, to several well-known musical instruments, they are, at the same time, more fully understood. But the cries of the Mammalia are most commonly of a very complicated and discordant nature, so that we may attempt in vain to imitate them by any mechanical means.

In ordinary language, we understand by the term *voicé*, those sounds which animals produce in expelling the air from their lungs, through the opening of the glottis. From the above definition, it follows, that animals with lungs, being the first three Classes of Vertebrated Animals, the Mammalia, Birds, and Reptiles, can alone enjoy this power.

The voice, being formed of vibrations communicated to the air, consists, like all other sounds, of three orders of properties, perfectly distinct from each other: (1.) The *tone*, or the different degrees of depth and acuteness, which depend on the slowness or rapidity of the vibrations; (2.) The *intensity*, or different degrees of loudness, regulated by the extent of the vibrations; and, (3.) The *quality*, which depends upon a variety of circumstances hitherto undetermined, relative either to the internal structure, the substance, or the figure of the sonorous body. Man alone being capable of speech, becomes susceptible of a fourth order of modifications, which we represent by the letters of the alphabet. These may be further divided into two sub-orders—the one, relative to the principal sounds, which we represent by *vowels*; and the other dependant upon their mode of articulation, and distinguished by the *consonants*. Those circumstances which give rise to the several qualities of tone, and the articulate words of Man, are still involved in great obscurity, although the investigations of De Kempelin in 1791, and the more recent experiments of Messrs Willis and Wheatstou, demonstrate that it is not impossible to imitate the sounds of the human voice by certain mechanical contrivances.

In respect, however, to the tone and intensity of sounds, the theory has long been well understood. We know that the rapidity of the vibrations of cords is inversely proportional to the length of the latter, and directly proportional to the degree of their tension. It is also ascertained, that a cord producing a tone will give at the same time others corresponding to the aliquot parts of its length, such as the half, the third, or the quarter; and the sounds thus formed are termed harmonic tones or chords. The vibrations of the entire cord coincide with the smaller but more rapid vibrations of the aliquot parts, and the sounds thence resulting are found to be harmonious, or agreeable to the ear. We further know that wind instruments of music can produce sounds corresponding to their total length, at the same time that they emit others relative to the lengths of their aliquot parts; and that it merely requires some apparently very slight cause, whether with cords or wind instruments of music, to occasion one of these partial or harmonic tones to prevail over the whole or fundamental tone. It has also been remarked, in respect to the tubes of wind instruments, that their form, in most cases, does not affect the tone. If the extremity opposite to the embouchure be closed, they produce a sound corresponding to a tube of twice their length, but when it is only partially closed, as in the chimney or funnel-pipes of the organ, the tone is always more grave than if it had been open, but less so than when entirely closed. Wind instruments of music can emit no sound by simply blowing into the tube. There must be at the entrance of the tube some sonorous body, that is to say, a thin plane capable of vibrating, or at least of breaking the current of air against its edge. This condition is absolutely essential to the production of sound, properly so called.

The organ of voice, being found only in animals possessing lungs, always consists of the canal formed by the bronchial tubes, the trachea, and the mouth; in other words, of an irregular tube to which the lungs act as bellows. The planes capable of breaking the air and producing a true sound may, however, be placed in different positions relative to the length of the tube. The entire portion comprised between the vesicles of the lungs and these vibrating planes, which have received the name of *glottis*, may be considered as nothing more than the nozzle of the bellows. That portion of the tube placed beyond these planes, being the *larynx*, must alone be regarded as the sonorous instrument, whose length and other circumstances serve to influence and modify the voice.

Many Birds are found to possess, in the interior of their bronchial tubes, small planes, being a kind of rudimentary glottis; but all of them have a complete one at the point where their bronchial tubes unite in forming the trachea. On this account we should thence regard the trachea itself in all Birds as a true musical instrument. In the Mammalia and Reptiles, on the contrary, no glottis is found except at the upper extremity of the trachea, where it enters the mouth. We must, therefore, consider the mouth in these animals as the real instrument of music, and the trachea with them is merely a wind-pipe or *porte-vent*.

It thus appears that the voice of animals is formed by the air which is discharged from the lungs by the muscles of expiration; that it traverses the bronchial tubes, and sometimes also the trachea; and arrives at a contracted portion, edged with two thin and flexible planes, called the glottis, where the sound is really produced. It then traverses a second tube, consisting either of the trachea and mouth or of the mouth solely, where it receives the last modifications, from the length, the form, and the differences in the complication of these cavities. Finally, it passes between the lips, which may be more or less opened or differently formed.

The possible intensity of the voice depends upon the proportional volume of the lungs and aerial cavities, and hence results the extraordinary volume of voice possessed by most Birds. The facility of modulating the voice during singing depends upon the facility of motion possessed by the muscles which contract the lungs. That portion of the trachea or the bronchial tubes, situate within the glottis, cannot influence the quality of the sound, excepting, perhaps, that the proportion of its diameter, in respect to the glottis, may influence the possible velocity of the air in its passage. The glottis itself affects the sound like the embouchure of a wind instrument of music, while that portion of the canal situate externally to it acts like the tube of the instrument, inasmuch as its several lengths determine the respective fundamental tones which the animal can assume; while the glottis, by its tension and the shape of its

orifice, occasions the several harmonic tones of the fundamental note belonging to each particular length. The external opening may lastly be compared to the remote extremity of the organ-tube, which may be more or less closed. Upon the facility with which an animal can vary these three conditions depends the extent and flexibility of its voice.

Those modifications which we represent by the letters of the alphabet, are formed in the mouth, and depend upon the greater or less power of motion possessed by the tongue, and especially by the lips, to which circumstances Man owes the superior power of speech. Some animals which seem to possess considerable flexibility in their organs of voice have certain additional parts, nullifying the advantageous form of the others, such as cavities, in which the air is obliged to circulate after leaving the glottis.

In respect to the Mammalia generally, we are far from having a complete knowledge of their manner of producing those disagreeable and complicated noises which our musical instruments fail to imitate. A few general facts have, however, been ascertained. Thus, the interval of the fibrous, and more or less sharp, cords of the larynx, placed on the upper extremity of the trachea, and called the vocal cords, is the place where the sound is formed; while the size, freedom, and tension of these cords influence the sound at its very origin. As the entire trachea serves merely as a wind-pipe, it varies little in its form. The rings are scarcely ever complete, but leave behind them a simple, membranous band.

The sound produced by the vocal cords, or inferior ligaments of the glottis, may be modified,

1. By the form and dimensions of the passage opened for it as it traverses the remaining parts of the larynx;

2. By the resounding or dispersion of the sound in the cavities contiguous to the larynx, such as the ventricles of the glottis, the furrows and pouches which sometimes communicate with it, or the pouches which occasionally open in front of the larynx;

And, lastly, By the form and dimensions of the double passage furnished by the mouth and nostrils, or by the different positions of the tongue and lips.

It would be inexpedient to pursue this subject in detail at present, and our further observations upon those modifications which influence the voice will be found under the specific descriptions.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Anomalous adaptations for motion and prehension.—Special organizations for digging, flying, and swimming.

ALTHOUGH some Mammalia possess the power of plunging in the water, of elevating themselves in the air, or of burrowing under ground, these seem rather to be anomalous states of existence. The normal or proper state of their organization fits them more especially for terrestrial animals.

Among those destined to reside upon the earth, Man alone has his fore extremities adapted solely for prehension, and his hinder limbs for maintaining the body in an erect posture. We shall merely remark at present, that he owes this vertical position chiefly to the size of the soles of his feet; the largeness of the muscles belonging to the legs and thighs; the breadth of the pelvis; the position of the head upon the neck; and the shortness of the arms when compared with the length of the legs. It follows from these arrangements, that his forward movement consists simply in the successive position of the lower extremities one before the other and in parallel lines; while running differs but little from walking, except in the greater rapidity of the action.

It is different in the true Quadrupeds, where the extremities are very nearly of equal length. In these we have a variety of modes of progression; such as the walk or pace, where the two diagonal feet, either the right fore and the left hind foot, or the left fore and the right hind foot, act successively, but in such a way that the advance of the fore foot is almost instantaneously followed by the advance of the hind foot on the opposite side, so that the four feet are raised and set down one after another. In a more rapid pace, being the trot, the two feet diagonally opposite rise and are set down at the same instant. The canter or common gallop, the full gallop, and the amble, have been already explained (see page 26), as well as the *aubin*, or Spanish amble, and the *pas relevé* of French authors (see page 63).

The greater number of Quadrupeds, when they wish to advance slowly, go at a simple walk. The trot is the proper motion of certain species, such as the Horse, the Fox, some races of Dogs, the Bear, and of the Elephant when hurried. The amble is the natural pace of certain races of the Horse and Dog, and invariably so with the Hyena, which circumstance gives a singular and striking appearance to the gait of that animal. The canter, and especially the full gallop, are used by most land Mammalia when hotly pursued, or when they are in pursuit of any prey.

Those Mammalia having the fore extremities much longer than the hinder, are prevented from walking upright like Man, or on the four feet like the Quadrupeds. The position of their body is therefore oblique, and their speed on a flat surface being very limited, they are more disposed to climb trees than to use any other kind of exercise. There are other Mammalia, such as the Jerboas, the Gerhils, the Kangaroo, and the Kangaroo-Rat, where the hinder are very considerably longer than the fore legs, which seem by their excessive shortness to depart as much in defect from the ordinary size as the others do in excess. These animals walk with great difficulty. The Kangaroos in particular make use of their tail, which is of considerable strength and size, either to counterpoise the weight of the fore extremities, or to assist in raising the body, while the fore paws touch the ground. When they run, or rather jump, for such is their real motion, the hinder feet alone act, and propel the body to a considerable distance in advance. The tail, however, follows to their assistance, and the moment the feet touch the ground, it extends and forms with the two metatarsi a kind of tripod, which maintains their upright position, and enables the animal to execute a new leap. As another instance of this kind of movement, we may adduce the Jerboas, animals about the size of a Rat, with their hinder feet much longer in pro-

portion than those of the Kangaroo. As the soles of their feet are very small, the metatarsi elevated, with the tail very long and hairy at its extremity, we perceive a striking difference in their mode of progression from that of the Kangaroos. At each leap the Jerboas fall upon their small fore feet, but they raise themselves very quickly by means of a long and heavy tail, serving as a counterpoise, and preventing the body from falling backwards, which accident happens whenever the tail has been lost.

Among the Rodentia, and especially with the Hares, where this disproportion between the hinder and fore feet is not excessive, the animals usually run at a full gallop; but they avoid descending the declivities of the mountains at this pace, as the forcible action of their hinder legs, aided by the inequality of the ground, would occasion them to perform a somerset. In ascending, they possess, on the contrary, a considerable advantage over an ordinary quadruped, for the gradual rising of the ground counteracts the inequality in the length of the legs, and brings their body more nearly into the horizontal position.

In the Martens, the Pole Cats, and the Ferrets, which have their feet small, and placed very far apart, the advance is always effected by a full gallop, the back being curved into an arch, in order to bring the two extremities nearer to each other, and to prevent the abdomen from trailing on the ground.

Among the terrestrial Mammalia, a great many species are obliged to seek their food among the branches of trees. The greater number of these have their thumbs opposable to the other fingers, either on the four feet, as in the Apes and Makis, or on the hinder feet alone, as in several Marsupialia. This arrangement gives to these animals the power of seizing the branches with facility, and of applying the entire palm of the hand to the inequalities of surfaces. Other Mammalia, being deprived of moveable fingers, make use of their long nails as hooks, which fulfil the same purpose, although rather in an imperfect manner, such as we find in the Sloths and Ant-eaters.

Finally, among the climbing species we find many which make use of their tail as a fifth limb, on account of the surprising flexibility which it possesses, as well as its power of rolling itself round the branches, and even of picking up very small and slender bodies. This tail, termed prehensile (*Cauda prehensilis*), belongs more especially to some American Apes, to the Opossums, the Phalangiers of the islands in the Indian Archipelago, to the Brazilian Poreupine (*Hystrix prehensilis*), and a few others.

All those Mammalia, which, like Man and the Apes, have the anterior extremities supplied with hands, possess at the same time complete clavicles, and one hand alone is sufficient to seize the food and bring it to the mouth. It is different with all the other animals destitute of thumbs, and whose fingers, being moveable all together, and in one direction, are armed with crooked nails. In these animals, such as the Squirrels and Rats, the assistance of both hands is necessary to hold an object. Hence, while feeding, they are in the habit of sitting down, which enables them to use both of the anterior extremities with freedom. Those Carnassiers which have rudimentary clavicles, and whose paws are well furnished with claws, are obliged to hold their prey between the two fore paws, and tear it with their teeth. The Cats alone are able to carry with one paw to their mouth a very small portion of food by means of their sharp claws.

Some Mammalia dig in the earth with great facility, and among them the extremities are specially adapted for this purpose. The nails of the fore feet among the digging Mammalia are commonly very strong and short, so that these animals are rarely swift runners, excepting perhaps the Jerboas, which hollow out their dwellings in the loose sands of the steppes. The Mole, the Scalops, and the Chrysochloris, are especially remarkable for the strength of their hands, where all the fingers are united together, and form a kind of shovel or spade, very well adapted for removing the earth. In these animals the abdomen trails upon the ground.

In general, we find that all the anomalous points in the organization of these animals adapted for digging, may be reduced to two particulars—to modifications in the anterior extremities, and proportional differences in the organs of sense. The first traces of these anomalies may be found in such Mammalia as burrow in the earth to shelter themselves and their young ones; but they are most clearly seen in those animals which scarcely ever come from beneath the surface of the ground, but are continually in the habit of seeking a subterranean subsistence, whether vegetable or animal.

The first and most striking examples may be observed among the insectivorous Carnassiers, such as the Mole, the Chrysochloris, and a few neighbouring genera. Among these animals, we find that the anterior limbs are proportionably much more developed than the hinder, which are very slender. The thorax forming the point of insertion for the muscles of the shoulder, acquires a peculiar solidity by the speedy ossification of the cartilages of the ribs, the pieces of the sternum, and by the existence of a kind of breastwork or medial crest. The clavicle being very strong and solid, projects much in front. The shoulder-blade is very broad, with the acromion and coracoid processes distinctly pronounced, and indicating the presence of muscles of a proportional size. The shoulder loses much of its usual length to acquire a breadth so considerable, as almost to make it square. The two bones of the fore arm, though less strong, are yet tolerably so; and, finally, the hand, which is shaped like a shovel, is very short and broad, terminated by five very thick and cutting nails, and is still further augmented by a sharp hone as a supernumerary, which occupies the cubital margin. It may be added to this description, that the entire limb, which bears, at its insertion, upon the lateral parts of the neck, is turned beneath and behind in such a way, that the hand acts constantly in those directions.

There is another modification in these animals, which properly belongs to the organs of motion. The nose or muzzle is modified to be an instrument fit for excavating or digging, at the same time that it serves as a sifter through the delicacy of its olfactory organ; hence result the ossification of the cartilage separating the nostrils, the great development of the muscles of the nose, and, finally, the great force of the extensor muscles of the head.

In respect to the organs of sense, we may readily expect that the hearing will be

developed to an extent proportionably greater than in the other Mammalia, by means of a larger drum, a very short auditive canal, a very wide orifice, and no kind of concha. On the contrary, the senso of sight continually diminishes, until it ends by scarcely existing except in a rudimentary form, as is found in many of the Rodentia, and especially in the Zemni (*Spalax typhlus*). In those species where the anterior limbs are a little less adapted for burrowing, the eyes disappear almost wholly, and the organ of hearing appears, on the contrary, to develop itself in an inverse proportion to the former sense.

In respect to the Mammalia capable of flight, these are of two kinds. Some have simply the skin of the sides extended behind the fore feet and before the hinder, as we see in the Flying Cats (*Galeopithecus*), the Squirrels, and the Flying Squirrels (*Pteromys*). The effect of these expansions of the skin merely consists in preventing the body, when darting from a very elevated situation, the top of a tree for example, from falling too heavily, and hence their function confines itself to that of a parachute. Other Mammalia, on the contrary, do really fly, that is to say, they can elevate themselves by means of the movements of their anterior extremities, which are prodigiously developed and furnished with long fingers, united together by expansions of a very fine skin; these are the Bats.

The first tendency towards the anomalous organization for flight is seen in those Mammalia which are disposed to seek their food in trees, and hence are constituted so as to climb with facility. In fact, there is no Mammiferous animal, before sustaining itself in the air, which is not obliged to elevate itself to a height more or less considerable. The latter movement may be effected by a mere digital compression of the fore and hind feet, as we see in the Apes; or by embracing the tree, as in the Bear; or, finally, by means of hooks, such as we see in the Cats, the Sloths, and even in the Squirrels. The first traces of that disposition by which these animals are enabled to leave their elevated position, and maintain themselves wholly in the air, is found in some Rodentia nearly allied to the Squirrels, being the Pteromys or Flying Squirrels, which have on their flanks a fold of skin, as already described, and likewise in the Phalangista or Flying Opossums. A still more perfect state of this organization is found in some species of Carnassiers nearly allied to the Apes, such as the Galeopithecus. In these animals, the fore extremity is considerably elongated. The fore arm has acquired that peculiar ginglymoidal arrangement, which has been assigned to the Cetacea for a different purpose; and, as may be easily supposed, the principal moving, and especially the pectoral, muscles are very largely developed. On the other hand, the hinder limbs have diminished very sensibly, and also the tail, which is almost wanting, in order to throw the centre of gravity of the body within the axis of the fore extremities. The most perfect form of this anomaly is, however, seen in the Bats.

The aquatic Mammalia are of two kinds; some frequent the margins of lakes, rivers, or streams, into which they plunge occasionally to seize their prey, or to find the aquatic plants on which they feed. Their extremities are either wholly webbed, as in the palmated feet of the Ornithorhynchus, in which the expansion of the skin is that of the palm or sole of the foot, and not merely of the fingers, as we find in the Otters and Cabiais. These animals have webs upon all the four feet, being different from the Beavers and Cheironeetes, whose hinder extremities alone are webbed, while the skin extending between them is entire. In the Desmans, the feet are only semi-palmated, and in the Hydromys, they are palmated for two-thirds of their length.

The Ondatra, whose mode of life is so analogous to that of the Beaver, has its hinder feet fitted for swimming; but instead of having the feet united by a membrane, each of them is bordered on the right and left by a row of elongated, stiff, and serrated hairs, which cross each other by the points with those of the adjoining fingers, thus forming a surface capable of offering sufficient resistance to the water.

Among the marine Mammalia, the Seals and Morses deserve to be noticed in the first place, because they are supplied with all the four extremities, of which the anterior have the fingers united, and armed with claws. In some species of Seals, being the Otaries of Peron, the skin on the tip of each finger is prolonged into a long and narrow strap, forming a band. The hinder feet, placed entirely at the extremity of the body, also have apparent fingers, but these are united together by the skin. Others, such as the Lamantins and Dugongs, are destitute of the hinder extremities; but all the fingers of their limbs are invested by a thick skin, on which vestiges of nails are to be found. Finally, the proper Cetacea, which also have the hinder extremities wanting, depart still more widely from the quadrupeds, as we here fail to discover the slightest trace of nails. Those differences in the organization of the extremities occasion corresponding variations in their mode of life. The Seals are very agile when in the water, and execute a number of evolutions and movements in consequence also of the extreme flexibility of their vertebral column; but they walk with much apparent difficulty on the land. The Lamantins, Dugongs, and Stelleres (*Rytina*), have still greater difficulty in leaving the water, and remain like inert masses whenever they chance to run aground upon a bank. The proper Cetacea do not voluntarily leave the sea, where they swim with a prodigious velocity, by means of the movements of their tail and fins. In consequence of the former being flattened from above downwards, and not compressed from right to left, this organ moves chiefly in the vertical direction, instead of horizontally, as we find in the greater part of the Fishes.

On comparing all aquatic Mammalia with each other, and with the remaining animals of their class, we find that the organic modifications which have been experienced by those Mammalia destined to reside more or less in the water, consist essentially in the following particulars:—The Hairs which, in the amphibious animals, are observed to be short and exceedingly numerous, terminate in the Cetacea by forming an agglutinated or universal envelope, as we see in the Lamantins and Whales. The external Ear diminishes in size, until it ends, in certain Cetacea, by disappearing almost wholly, so that it is scarcely possible to discover any vestige of the concha. The crystalline lens of the Eye is observed gradually to become more convex, and to approach insensibly towards the spherical form, which it acquires most completely in species residing constantly in the water. We may further, remark the absence of

lachrymal ducts and pores. It may also be noticed, that the olfactory system tends gradually to diminish.

In the organs of locomotion, it is observed that the bones lose their medullary cavity, and become spongy throughout their whole extent in the Cetacea. But the most remarkable part of their conformation consists in the general fish-like shape which the true Cetacea exhibit. Their bodies usually ending in a point both before and behind, and expanded in the middle, approach nearly in form to the solid of least possible resistance. Already we remark a tendency towards this form in the Otters, and still more so in the Seals, although these animals possess four complete limbs. Their resemblance in shape to the Fishes is, moreover, most perfect in the Lamantius and proper Cetacea, where there exist only a few slight rudiments of a pelvis, and where the vertebral column is terminated by a powerful and broad tail, formed externally by a large horizontal expansion, sometimes bifurcated and acting as a fin.

GENERAL REVIEW OF THE MAMMALIA CONTINUED.

Relations of the Mammalia to Man—Their injuries and depredations—Economic purposes to which their products are applied—Management of the domestic Mammalia, relative to Station, Soil, and Climate.

As the other Mammalia are influenced by the same wants and necessities as Man, as they are under an equal necessity with him of seeking their own preservation, of finding their food, and reproducing their kind, it will often happen that these instincts will run counter, and appear in opposition or competition with the corresponding wants of Man. Hence result those injuries to his person and property which some of them inflict.

The Tiger, the Panther, and Jaguar, are the principal carnivorous animals which venture to attack our species by open force, in the forests of those warm countries which they inhabit. It has often been said and repeated, that the Lion is generous towards Man; but his generosity is that of a Cat, and there are few who would be disposed voluntarily to place their persons within his reach. The Wolves, Hyenas, and Bears, do not attack Man except when pressed with hunger, or when they have young ones, which they think it necessary to defend. The greater part of the remaining Carnassiers confine themselves in all cases to a defensive combat. Certain foreign Bats are said, probably with some exaggeration, to be capable of inflicting death on a sleeping person, by opening a vein, and then sucking the blood, through means of certain horny papillæ with which their tongue is supplied. In our own country, and on the continent of Europe, it sometimes, though very rarely, happens that a Weasel or Pole-cat insinuates itself into the cradle of a newly-born infant, and sucks its blood, so as to occasion death. It is well known that the domestic Pig, which devours flesh with avidity, often occasions similar accidents. In general, we find that the Carnassiers attack women and children, with whose feebleness or tenderness of flesh they seem to be instinctively acquainted, in preference to the adult Man.

Some of the larger herbivorous animals, such as the Buffalos, in the neighbourhood of the Cape of Good Hope, and certain Elephants of a savage disposition, and known in the East Indies by the name of *Grondahs*, as well as the Rhinoceros, do not hesitate to attack Man, if they happen to meet him in their road, and speedily put him to death, by trampling him under foot.

Certain Mammalia maintain a continual war against those flocks of herbivorous animals, or domestic fowls, which Man has tamed for his own use. The Wolves on the continent of Europe roam continually round the parks where the Sheep are assembled, and carry off all stragglers. The Foxes, Weasels, and Polecats, introduce themselves into the farm-yards, where they destroy the fowls, and devour their eggs. Many other species of Martens, as well as the Opossums of North America, and the Dasyures of New Holland, make depredations similar to the preceding. Even Horses are attacked by Wolves in mountainous and woody regions, in preference to other animals, against which enemies they have no other defence than their heels; but by an admirable instinct of self-preservation, they collect together in a circle with their heads towards the centre, and the hinder feet in the circumference. The Oxen of Africa are sometimes surprised by the Lions. After killing them by biting through the hinder part of the neck, the Lions transport their victims to their retreats, with a degree of ease, which serves to exemplify the extraordinary force of these animals. The herds of Paraguay are likewise diminished in number by similar attacks from the Jaguars.

But the Carnassiers are far from inflicting so severe an injury on Man as the herbivorous animals, and especially those belonging to the smallest species, which attack the seed when under ground, the harvest on its surface, or the hoards of the granary and store-house. The wild Deer, Goats, Hares, and Rabbits of Europe, devour the corn while in leaf; Rats, Field-Rats, and Hamsters, devour it while in grain, and the last-mentioned species, not content with destroying its share, amasses a store for future use, which may be estimated, on an average, at about a bushel for each individual. The common and garden Dormouse attack the fruits of our garden trees; the Rats and Mice destroy our provisions of every description; and the Moles, while seeking their food, consisting of Earthworms, Insects, and their larvæ, plough the surface of our meadows. On the continent of Europe, the wild Boars, whose destruction, except by a privileged few, is prohibited in some countries by game-laws of doubtful justice, advance in innumerable troops to attack the stores of potatoes, which perhaps are the only resource of the injured cultivator of the soil. The Otters plunder the fish-ponds of the Continent, and the Water-Rat, by living on the fry of the fishes, prevents their increase. Our own country is happily exempted, by its insulated situation, from many of these depredations.

Each kind of animal, which lays waste our own territory or that of our continental neighbours, finds analogous plunderers in more remote or foreign countries. In Africa the Apes, descending in immense numbers, fill their cheek-pouches with grains of maize, and when molested, take to flight, their hands being filled with as many ears of this plant as they can conveniently carry. In America the Agoutis, Cabiais, and Cobayes, execute the same kind of devastations which, in our country, are inflicted by

the Hares and Rabbits. A herd of forty or fifty Elephants soon causes every vestige of cultivation to disappear from an entire canton of the East Indies. In the North of Europe, thousands of Lemmings, descending in a body from the mountains of Norway and Lapland, direct their route in a straight line towards the south, and may almost be said to destroy every plant in their way. These legions of the north-orn live are soon followed by another plague. Innumerable Foxes, which at first followed the Lemmings, and lived at their expense, are soon obliged to change their prey; and, after the complete annihilation of the Lemmings has been effected, to regale themselves on the fowls of the farm-yard, or some of the smaller quadrupeds.

However great these injuries already enumerated may appear, they are fully compensated by advantages of a more solid kind, derived from the use of that small number of species which Man has succeeded in taming for economical purposes.

The flesh of the herbivorous Mammalia forms a well known article of food. Those animals chiefly used in European countries for this purpose are the Bull, the Hog, the Sheep, the Goat, the Hare, the Rabbit, the Stag or Red Deer, the Fallow Deer, the Roe-buck, the Chamois Antelope, the Ibex, the Squirrel, the Dormouse, and a few others. The Laplanders feed chiefly on the flesh of the Rein Deer; the Canadians upon that of the Wapiti (*Cervus Canadensis*), and of the Elk (*C. alces*). The Negroes eat that of the Elephant, the Rhinoceros, the Hippopotamus, the Manis, and several Apes. The Americans of New Spain do not refuse the flesh of the Armadillos; the inhabitants of Chilo esteem that of the Lama and Vieugna; and the Arabs eat the flesh of the Horse and Dromedary. With the inhabitants of the Indian Archipelago, the flesh of the Roussette Bats forms a daily article of food.

Certain species have been interdicted in some countries by laws dictated either by superstition or convenience. The flesh of the Hog is held in horror by the orthodox Turk and Jew, while the Bull is the object of veneration among the Brahmans.

Particular parts of some of the larger Mammalia are highly esteemed by certain nations. Thus, the foot of the Elephant is generally considered by the Negroes of Africa as a delicious article of food; while the Dutch sailors, who pass half their lives in the midst of the polar ice, look upon the tongue of the Whales as a very delicate morsel.

Seals, Dogs, and Otters, are the only carnivorous animals forming articles of food. The first two are in common use among the inhabitants of Kamtchatska, and the last, from its fishy flavour, is in great request among the monks of Catholic countries during Lent.

A few of those Mammalia which Man has succeeded in taming and subjugating completely to his use, appear to have been distributed, like him, from the more elevated parts of Central Asia, to all other points of the globe. These species are the Horse, the Ass, the Sheep, and the Goat. The Dog and the Rein Deer are proper to the climates of the North; the Buffalo and Elephant to those regions of India situate at the foot of the elevated mountains of Central Asia. The Lama is peculiar to the New Continent. Our race of Bulls, usually considered to be peculiar to Europe, is, with very great probability, identical with the Zebu, or Humped Bull of India; and, according to M. Desmarest, it does not differ specifically from the Yak, or Grunting Bull of Tibet and the frontiers of China.

Two species of Mammalia, in particular, have served to assist in subjugating the remainder; being the Horse and the Dog. Many others are employed in hunting, such as the Chetah or Hunting-Leopard, and the Ferret; or for fishing, as the Otters.

Others have been destined to carry burthens of greater or less weight; of these we may particularize the Bull, the Camel, the Dromedary, the Yak, the Horse, the Elephant, the Ass, and the Lama. Many have been harnessed to carriages of various forms, such as the Dog, the Rein Deer, the Horse, and the Bull; or have served for riding, as the Elephant, the Horse, the Ass, and the Bull.

To some, Man has confided the care of his property. The Dog seems as if were consecrated for this purpose; while the Cat, the Guinea-Pig, and, it is said, also the Ichneumon of Egypt, have been destined to defend his provisions from the attacks of the smaller parasitical species.

The art of medicine has derived many useful materials from this class of animals. Without noticing the ridiculous properties which have been assigned to the excrements of Dogs and Rats (*Album Græcum* and *Album nigrum*), it is generally admitted that the flesh of the Calf possesses relaxing properties; the empyrenmatic oil, procured by the distillation of horns, is used on several occasions, and especially as a vermifuge. The blood of the Ibex, Goat, or Chamois Antelope, was once considered as a useful medicine during attacks of pleurisy.

The organic products of the Mammalia have, from the earliest ages, furnished the materials for a variety of useful arts. The horns and bones are used for combs, boxes, button-moulds, the handles of cutting instruments, and the innumerable products of the toy manufacturer. The longer hairs, such as those of the mane or tail, are used for fishing lines, or coarse stuffs; the shorter or finer hairs, such as wool, the hair of the Goat, the Rabbit, and Cat, when dressed and spun, enter into the fabrication of a multitude of different-tissues; the bristles, or large and stiff hairs, serve for brushes; and the finer hairs of other species for pencils. The skin, prepared in divers manners, furnishes the soles or upper leathers of shoes, the materials for gloves, harnesses, portmanteaus, the roofs of coaches, bottles, &c. &c.; and the Korekis form boat-sails with the skin of the Rein-Deer.

The blood of the Mammalia serves to clarify liquids, and is particularly useful to sugar-refiners, and in the manufacture of Prussian blue. The tendons are used for thread by the Samoiedes, the Laplanders, and the Greenlanders. The fat, more or less liquid, according to the species from which it is taken, may be used under the form of lamp-oil, lard, or suet. The marrow of the bones forms the basis of many kinds of pomatum. The intestines, after having been washed, dried, and twisted, compose the strings of some musical instruments; and the gall serves for extracting grease from stuffs, or for laying on colours over a greasy surface.

The distillation of flesh and bones yields many chemical products of great utility in the arts, such as ammonia, phosphorus, &c. Finally, the manure of the Herbivorous animals may with justice be said to be the *primum mobile* of Agriculture. It restores to the soil those principles which are annually extracted from it, and thus conduces eminently to its fertility. Indeed, it has always been found, that the success of agri-

cultural enterprises depends in general upon the extent to which these animals are multiplied and improved.

The acknowledged importance of the domestic animals, in an economical point of view, has led agriculturists in all ages to pay peculiar attention to them, in order to bring up, feed, dress, treat, and shelter these animals in such a way, as to draw from them the greatest possible amount of benefit in the most economical manner; and, by multiplying and improving the breeds, to render them proper for their several destinations.

Without entering into those details, which belong to Agriculture rather than Zoology, it may be proper here to point out some of the important advantages which result to the cultivator himself, as well as to society at large, by the successful cultivation of the domestic animals.

In respect to the former, unless the cultivator can easily and economically procure a sufficient supply of those manures, of which he is in almost daily want, the produce of the soil will in general be feeble and uncertain. Destitute of these animals, the agriculturist would be deprived of the principal articles of his daily consumption. In fact, rural establishments would want that activity which renders them at once agreeable and useful.

When considered as objects of public utility, the domestic animals possess many claims to our regard. The cultivation of the Cereal plants, which contribute so largely to our maintenance, deservedly occupies the first consideration, and those animals, which are raised for alimentary purposes, possess at least a second claim to our regard, since they tend directly, on the one hand, to increase the former by their manures, and indirectly to economize their consumption. In equal bulks of animal and vegetable food, nearly twice the quantity of nutritive particles is contained in the former as in the latter; and a pound of meat will in general be as nutritious as two pounds of bread.

The numerous and important advantages which Man derives from the domestic animals, have led all nations from their earliest origin to regard them with the most scrupulous attention. On referring back to the first ages of which we have any authentic records, we see the chiefs of tribes, the patriarchs and first sovereigns, paying a special attention to the management of cattle, and founding on this solid basis, not only their own prosperity, but that of their contemporaries and descendants. The sacred books and the most ancient historians furnish repeated examples of these facts, which are too well known to be repeated here. At this remote period, when Man, just formed by the Divine Power, entered upon the dawn of his civilization, the domestic animals were considered not only as the most firm support of Agriculture, but they yielded the most valuable materials for Commerce. As the principal wealth of the times consisted in domestic animals, these naturally became the first medium of exchange between nations. Cattle were therefore the first money that existed, as they were the first article which possessed exchangeable value. We have a confirmation of this fact in the circumstance, that the first acknowledged representatives of mercantile value, the earliest metallic money which passed current, was decorated with an image of these animals, indicating that it maintained an equal value. They were also the earliest offerings presented by most nations to their deities; and the ancient Egyptians worshipped the Bull, *Apis*, with the highest veneration. If we turn to that nation, which has left us the most extensive and important written monuments of its experience in the different branches of rural economy, we shall find the ancient Romans applying themselves with remarkable zeal to the training and management of cattle. We have an evidence of this fact in the term *jumenta*, which they applied generally to all kinds of cattle, derived from *juvare*, to help. There is also the term *pecunia*, money, from which we have derived our English adjective *pecuniary*, and the Latin term *peculium*, from which we have derived our *peculation*, alike derived from *pecus*, which the Romans applied to cattle in general. Cato the elder, the first of their agriculturists who has transmitted his precepts to our times, on being asked by some persons to point out that particular branch of rural speculation which should command their first attention, if they wished to acquire wealth in the quickest possible manner, is said to have replied, "Manage your cattle well;" and on being again asked, what was the next best object of their attention, if they wished to derive only a tolerable return for their labour, he replied, "Manage your cattle tolerably well." In the countries of civilized Europe, we find that a large portion of the wealth of their inhabitants consists in cattle; and we can commonly form a good notion of their respective degrees of agricultural prosperity, as well as of the comforts of the cultivator, by noticing the number and quality of the domestic animals.

Since the proper management of Cattle is thus an undoubted and inexhaustible source of wealth, it may be interesting here to trace the principal rules of conduct, which should form the guide of the Agriculturist and Grazier. These remarks will be equally valuable to the Naturalist, as they are more or less applicable to all terrestrial Mammalia. The chief points to which our remarks are confined are the influence of station, soil, climate, food, exercise, lodging, dressing, as well as the application of these to the several purposes for which the animals are finally intended.

The station in which the domestic animals are maintained may be low or elevated, dry or moist; and these four qualities impart corresponding properties to the animals which receive their influence. Peculiarities of station are often combined together in pairs; thus, an elevated station is often dry, while a low station is usually damp.

When an elevated station is dry, it is generally more healthy than a low one when damp. The air in the former is lighter, keener, and more pure: and communicates its bracing qualities to such animals as are continually exposed to its influence. The vegetable nutriment which it yields is more scanty, but it is, at the same time, more substantial, and rather imparts force and energy to the animals which are fed thereon than volume of body. This kind of soil is best adapted for the Goat, the Sheep, and the greater part of the Ruminantia, which select it naturally when allowed to run at large.

A low soil, when damp, appears to be unfavourable to most constitutions. The air seems overloaded with heterogeneous miasmata; it is, therefore, less healthy, and being of greater specific gravity, communicates a corresponding dulness of motion to those animals which are habitually exposed to its influence. The excessive moisture constantly surrounding them relaxes the fibres of their bodies, elongates their mem-

branes, extends their limbs, and renders the whole animal more massive, ponderous, and slow in its movements. Vegetable food is more abundant in these situations, but it is more watery, and less nutritious; it loses in quality what it gains in quantity, and induces corpulence rather than energy; and while it promotes an increase of size, diminishes strength. Poisonous plants appear to be more abundant in these situations than in stations of an opposite kind, and animals are not only exposed to the prevailing miasmata, but are, as it were, in a continual bath of vapours. This kind of station is best adapted for the Buffalo, the Bull, and the Hog.

The middle point between both extremes, as in many other matters, seems to be the most favorable to a large number of domestic animals. It is best suited, in particular, when accompanied by a proper degree of heat, to the Horse, the Ass, the Dog, the Cat, the Rabbit, and the Hare. Plains are especially adapted for the Solipeda, in which stations they are more at liberty to exercise their limbs.

We may perceive from these general observations, that there necessarily exists a most intimate relation between the nature of the places inhabited by the domestic animals, and the general aspect of those animals. The prevalent character of each race appears greatly to depend upon that of its station. Thus, we see in low and moist districts, that these animals exhibit an aqueous temperament; their flesh appears soft, and the animals themselves acquire a certain degree of apathy and stupidity. Upon an elevated and dry soil, they possess, on the contrary, a certain degree of fineness of structure; their flesh is delicate and muscular; their girth slender; their movements rapid; and they assume an increased sensibility corresponding to their agility and vigour.

The quality of the soil likewise exercises a considerable influence upon the average bulk of animals, and it has been observed, by a law which is equally applicable to Plants, that those frequenting elevated mountains, whether granitic or schistous, and silicious soils when dry and arid, are smaller than those frequenting calcareous plains, luxuriant in herbage, as well as low and moist countries. In the latter case, their fibres are soft and better supplied with nutriment; the meshes of their animal tissues remain more lax, and acquire a greater degree of extension than in the preceding case, where the fibre continues dry and short. On this account, in low and moist soils, and in fertile valleys, the same races of domestic animals exhibit greater bulk and corpulence than upon a dry, elevated, stony, and sterile soil. It is also from this cause that the Horses, Bulls, and Sheep of Holland, Belgium, and the rich pastures of Switzerland and France, become more bulky than animals of the same species brought up in the Alps, the Pyrenees, the Appenines, and all rough and mountainous situations.

It thus appears unquestionable, that the nature of the soil exerts a powerful influence over the constitution of the domestic animals, and that it demands the most scrupulous attention on the part of the rural Economist.

Climate acts in a powerful manner upon the physical constitution of animals, and demands at least an equal share of attention. By the terms difference of climate, we commonly include, in a general manner, all those conditions of the atmosphere which occasion a greater degree of heat and moisture to prevail in one place rather than in another; and it may be easily imagined, that if the nature of the media, in which animals habitually reside, exercises an important influence over them, they will also be influenced by the temperature and moisture of the climate. They are more susceptible than Man to the immediate influence of changes of temperature, from being continually exposed to the inclemency of the air, and seem acutely sensible of great and sudden changes of the atmosphere. We even observe them foretelling and announcing an approaching change of the weather by various premonitory signs.

As the climate may be either hot or cold, dry or moist, each of these conditions induces very different results in respect to their reproduction, constitution, amelioration, and, in general, all the vital functions of the domestic animals.

Heat being one of the most powerful stimuli of the vital reproductive powers, seems conducive both to fertility and growth, especially when accompanied by moisture; cold, on the contrary, is generally injurious. We remark that Nature develops all her treasures of fertility in the ardent climates of the South, while the icy regions of the North are generally less peopled, more uniform and inanimate in their general aspect. Melancholy solitudes replace, in these desolate regions, the most active and well-marked scenes of animation, which, however, are less permanent, and pass more rapidly away.

It thus appears, that the active force of heat, which bears an intimate relation to that of light, exalts the intensity of all the faculties and properties, and gives them the fullest energy which they are capable of acquiring. By the same law which assigns to the plants of the South more exquisite flavours, aromata, essential oils, perfumes, and colours, than to those of the North, we find the animals of warm countries also exhibiting a greater richness and variety in their hues, more vivacity and energy of character, more activity and strength in all their parts. Everything proclaims in Nature the beneficial influence of warmth over reproduction, as well as upon the form and qualities of its productions.

It appears, however, that heat, while it augments the energy of the vital powers, contributes a more diminutive growth to the organs of the different functions, probably because the moisture which contributes much to this development is less abundant, and because the solids of the animal body bear a greater ratio to the fluids, which are more or less dissipated by heat. Climates of dry and warm character render their fibres rigid, slim, moveable, and irritable, and they become deprived of that moisture, which had lessened their sensibility by softening them. Thus, we constantly observe that Horses, Bulls, Sheep, Goats, Dogs, and other domestic animals, are proportionally smaller, but more vivid, ardent, and active in warm countries, than animals of the same species in colder regions, provided always that the cold be not too intense. An excess of cold is, however, still more injurious to growth. The largest races of cattle are found in temperate climates, which are moderately cold and moist. A moderate degree of cold, by giving density and elasticity to the animal fibre, when influenced by an adequate supply of moisture, becomes at once favorable to the growth and multiplication of the species.

We may also remark, that the influence of climate upon the reproduction of animals imported from foreign countries merits a high degree of attention from the Agricultu-

rist. In the same manner that Vegetables, when transplanted from a burning to a cold climate, multiply but seldom and with difficulty in the ordinary way, we remark that animals imported from a very warm to a very cold country often become unfruitful. It has frequently been noticed, that Arabian Mares, when brought to Britain under different circumstances, either become unfruitful, or yield feeble and unprofitable results. The Stallions of many races are sometimes in the same situation, even when transported to a much shorter distance. M. Yvart remarks, that the Asses of Tuscany and Spain are not always productive in France, or in countries lying farther to the northward; and it is well known, that in all the Northern countries of Europe, animals of this species yield products greatly inferior in appearance to those of the South. The other domestic animals present us with results, which may be regarded as equivalent to the preceding, after making due allowances for the differences between the climate of their residence and that of their original country. Thus, we may remark that the Sheep and Bull seem rather to deteriorate on removing from the North to the South of Europe; now these animals appear to have belonged originally to countries where a cold and moist atmosphere was more prevalent, than one of an opposite character. On the contrary, as we have just observed, a different result is obtained in respect to the Horse and Ass, which were originally natives of the South.

That degeneration of individuals, so frequently remarked in animals and plants, results inevitably from their being imperfectly acclimated, and many of the diseases with which they are afflicted proceed from a similar cause. In the Southern countries of Europe, the insensible exhalations which transpire from the surface of the skin are usually considerable, while the contrary takes place in its more Northern regions. Hence, in importing animals from the South to the North, due care should be taken to overcome their constitutional habit in a gradual manner. There is a constant determination of all useless or hurtful matters towards the skin in warm climates; while, in cold countries, transpiration is counteracted, arrested, or suspended, and always modified in a greater or less degree. Hence, unless their change of situation is cautiously effected, animals become predisposed to several cutaneous disorders, to obstructions, enlargement of the liver, and other maladies of this nature. Again, when animals are suddenly transported from the North to the South, and without the necessary precautions, the consequences are not less dangerous than those already enumerated, as the excretory functions of the skin are less energetic in cold than in warm countries, the internal functions possess a greater relative energy; and, on removing them to the South, their constitutional habit becomes modified. The insensible transpiration of the skin necessarily becomes greater, and the active forces of the system tend towards the surface,—a change which may occasion many dangerous maladies, such as putrid fevers. The only effectual way of counteracting these serious inconveniences, is by adopting a system proper to all the circumstances of the locality, according to the principles laid down in our best Medical treatises.

Climate exercises an important influence over many of those characteristics, which commonly serve to distinguish one species from another; and it is highly probable, that many animals, which are commonly considered by Naturalists as belonging to allied species, may in reality be nothing more than permanent races, descended from the same original stock, and preserved distinct solely by the influence of climate. The usual characters of animals, when long exposed to dry and warm climates, may be stated in general terms to be the following:—Their skin is thin, supple, and oily; their hair scanty and fine; their limbs long; the tendinous parts distinct; their horns hard, dry, and brittle; the hoof contracted; the feet narrow and sound; the muscles dry and but slightly fat; and their temperament rather sanguineous than lymphatic. The circulation of the blood becomes accelerated; they possess much ardour, energy, and courage; while the several parts of their bodies seldom acquire very voluminous proportions. On the contrary, animals exposed to a cold and moist climate, along with more strongly marked proportions, have their skin thicker, harder, and dryer; their hair longer, coarser, and more bushy; their extremities shorter, with the tendons less strongly pronounced; the horns softer and more spongy; the feet larger, broader, more flattened, and less compact; the muscles stronger, closer, and well supplied with fat. Their temperament is rather lymphatic than sanguineous; their circulation is slower; they possess less physical and mental energy, and may almost be said to consist wholly of matter, as they are visibly deficient in ardour, energy, and courage. The animals of temperate climates occupy in all respects a mean between these two extremes.

Animals have, as well as vegetables, their natural habitations and stations, to which they should be approximated as much as possible in the state of domestication; and it is always dangerous to separate them from these localities without the greatest caution. Nature often places insurmountable obstacles to their migrations, by depriving them, as we have already seen, of the power of reproducing any where except in their native countries. The study of habitations and stations is therefore of the highest importance in the management of the domestic animals.

By the term *habitation*, we commonly understand the climate which each animal prefers, because it is best adapted to its organization; and by *station*, that particular place which each of them chooses in the same country and under the same climate, from its finding more resources in that locality for living and satisfying all the conditions of its organization.

Thus, the habitation of the Reindeer appears to be irrevocably fixed to the frozen countries adjoining the North Pole, where this animal has long been domesticated, and yields the most important services. After the many unsuccessful trials which have been made, it may be considered as almost impossible to render it acclimated in the temperate plains of Europe. Perhaps it might succeed, with the proper precautions, on the summits of our coldest mountains. Again, the natural station of the Rabbit is on a sandy and dry soil; that of the Sheep and Goat in dry and elevated regions; the Buffalo and Bull delight in low and moist situations. These animals cannot be separated entirely and suddenly from their natural stations, without exposing them to inconveniences more or less serious. In all attempts at acclimating foreign animals it is, therefore, as important to study their natural station as their habitation.

Wherever the same temperature prevails, and in whatever latitude, it is generally

possible to find some spots where animals may be imported with success, where they will multiply like plants in analogous situations. It appears also, that those animals which Nature has placed in the temperate climates, may extend themselves insensibly towards the opposite extremes of heat and cold; for, as Pallas has judiciously observed, all our domestic animals of the North and South are found wild and apparently native, in the temperate regions of Central Asia.

It has long been remarked that those animals, as well as plants, which have their natural station in dry and elevated countries, are analogous to the living productions of cold countries; and that those species which delight most in low and moist grounds approach more nearly in general character to the productions of the South. This serves to indicate that it is commonly more advantageous to attempt the acclimation of animals from warm countries in low localities, whilst those of the North are most easily naturalized in dry and elevated regions, and it is always useful in practice to study these analogies by attending to the natural disposition, whether low or elevated, which a cold or warm country is capable of affording. It seems probable, also, that individuals will be more easily acclimated in places which form the natural stations of congeners species, than of those greatly removed from them, for the same dispositions and qualities are usually found to exist in animals belonging to the different species of the same genus. The chances of a successful acclimation are further increased by the adoption of a similar, or at least a kind of food analogous to that which they would have received in their native country; and, in some instances, this is indispensable to their existence. Thus, we often see Birds, directed by the migratory instinct, resorting to localities where they can find that kind of food which is necessary to their existence, and of which they have been deprived by the severity of the climate.

It follows from the above observations, that whenever animals are imported from a country which is very hot or very cold, very dry or very moist, to one which is less so; and that it becomes desirable to maintain them in a state of health, so that they may continue their species by generation, and in general maintain the healthy exercise of all their functions, it becomes necessary to observe the following precautions:—1st, To approximate them by a convenient and suitable position to their original and natural situation; and, 2dly, To avoid all sudden transitions with the greatest caution, so as to acclimate them gradually. The climate, as we have already remarked, exercises a most direct and powerful influence upon the physical and intelligent powers of all animals as well as upon their offspring; and hence we may readily anticipate alterations more or less sensible and permanent, on transporting them suddenly, and without the suitable precautions, to remote distances, or perhaps to situations of an opposite kind to those whence they were abstracted. The effects become more apparent when their transportation is effected from the warm to the cold climate. It may be added, that it is frequently more advantageous to remove animals which are still young, because, from their being more pliant at this age, they habituate themselves readily to the change, and in the end endure the unfavorable circumstances to which they are exposed. A very sudden and powerful change is, however, better endured by the adult animal, whose frame being more matured, is better capable of resisting the shock.

With the domestic animals, we commonly find that temperate climates, where they are exposed but little to sudden changes of the atmosphere, are in general those which agree best with their natures, and where they are least subject to deformity and disease. In these situations they also become more mild and tractable, as their natures assume the general aspect of the climate, while they seem to acquire a certain degree of rudeness and asperity from the contagious influence of an inhospitable region.

The particular kind of food which animals receive when domesticated, exercises a most marked influence over their physical and intellectual constitutions; and unquestionably forms one of the most important branches of their management.

As the attachment of each species to any particular kind of food is regulated by its internal organization, it will often happen that a description of food which is greedily sought after by one animal is rejected by another, and if taken by the latter may even become poisonous, of which numerous instances are to be found. Animals, when unconfined, have the advantage of removing from place to place, often to very great distances, as well as with great rapidity, and, guided by an unerring instinct, are seldom deceived in the choice of their food. In their domesticated condition, they are, on the contrary, confined within very narrow limits, and, being entirely submitted to the absolute dominion of Man, who is not always guided by the views of an enlightened economy, are reduced to the necessity of appeasing their hunger with the food presented to them by his hand. The contrivances of Art are often at variance with the instincts of Nature, and the most fatal accidents, not always attributed to this cause, are the consequences of a violation of her laws.

The character and habitual dispositions of the domestic animals are influenced, in the most direct and well-marked manner, by the general description, and even the particular variety, of their food. An animal feeding solely upon grass, especially when very watery, is usually dull, slow, and possesses but little activity and vigour, although it may obtain a certain degree of *embonpoint*; another feeding on grass nearly ready for cutting, and deprived of its excess of moisture, acquires more force, and a genuine plumpness. If its nature admit the use of fruit, these qualities become still more apparent, or, if grain be made choice of, its energy is greatly improved. Finally, an animal feeding upon flesh excels the others in its agility, and its animal forces assume the highest degree of energy, or even ferocity. We have frequent instances of the truth of these remarks in all the omnivorous animals, whose characters undergo a considerable metamorphosis, according to the kind of food on which they may happen to be maintained. Let two Dogs be made the subject of an experiment, the one being fed constantly on flesh, and the other on bread, and we shall soon be able to distinguish the former by the superiority of its energy, courage, strength, and ferocity. The carnivorous animals are thus more robust and active than the herbivorous, because flesh is more nutritive and sustaining than a vegetable diet.

It has been correctly remarked by Buffon, that the influence of food is greatest,

and produces the most sensible effects, upon herbivorous animals. Animals feeding exclusively upon flesh are much less liable to be influenced by their food than by climate, and the several other circumstances, whether favorable or unfavorable, of the situation in which they are placed.

It is chiefly by a proper selection of their food, that we can succeed in rendering animals, when domesticated, more fruitful than they would naturally have been. By the same means, their flesh can also be rendered more tender, savoury, and delicate. It is more especially during the early periods of their youth, that an abundant and well chosen food is deserving of the highest attention, for the slightest negligence in this respect may produce unfavorable consequences upon their general health, whilst, by an opposite course, we may even succeed, to a certain extent, in correcting an original and constitutional weakness, accelerate the period of puberty, or promote their growth as well as strength. It is even possible, by taking advantage of accidental conate varieties, to perpetuate new races of great value, and render them capable of transmitting these properties undiminished in utility to their posterity. These facts are not always attended to by rural economists, nor is a sufficient degree of attention paid to the kind of food given to young animals. This exercises an important influence over their physical and intelligent dispositions, and an undue parsimony in the distribution of their food, or an injudicious choice in its quality, may be regarded as the vice of a false economy, which deteriorates the qualities of the most valuable species or races, either by diminishing their fecundity, or preventing the development of their most valuable qualities. It is an admitted fact, that, in early life, the preponderating function is that of nutrition, while in the adult the reproductive function prevails. Considerable differences in the height and proportions of individuals are induced by the abundance, the nature, and the quality of their food; and it is to a superiority in these respects, that the domestic animals are generally larger and more prolific than the same wild species, which are not so well nourished.

It may be useful to practical economists to know, that, in general, small animals eat more in proportion to their size than large ones; and for the same reason their vital energy is greater.

The quantity of food necessary to the maintenance of the domestic animals, is in the direct ratio of the loss of substance which they experience from various causes. For this reason, all those which labour much, and all species naturally exposed to violent exercise, stand in need of food in proportion to the degree in which their muscular strength is exerted. All animals whose movements are slow, and labour light, require but little food, as their loss of force is inconsiderable; and those, again, who pass their winter in a state of torpidity, may remain for a very long time without food, as their loss of strength during this time is still less. An elevated temperature, by diminishing the force of the digestive organs, and by moderating the movements of the body, renders less food necessary than a low temperature. Hence, we may diminish their allowances, with propriety, during the warmest seasons of the year.

It has already been noticed, that the distinction commonly made between herbivorous and carnivorous animals is by no means constant. This fact has been advantageously applied by rural economists in various ways. Thus the young of herbivorous animals, shortly after their birth, are frequently supplied, when very feeble, with fresh eggs. The same nutritious food is likewise given occasionally aux étalons avant la monte, and, it has been stated, with beneficial results; likewise, also, to race-horses, with marked success.

We are assured by M. Yvart that, in Anvergne, fat soups are given to cattle, especially when sick or enfeebled, for the purpose of invigorating them. The same practice is observed in some parts of North America, where the country-people mix, in winter, fat broth with the vegetables given to their cattle, in order to render them more capable of resisting the severity of the weather. Those broths have long been considered efficacious by the veterinary practitioners of our own country, in restoring Horses which had been enfeebled through long illness. It is said by Peall to be a common practice in some parts of India, to mix animal substances with the grain given to feeble horses, and to boil the mixture into a sort of paste, which soon brings them into good condition, and restores their vigour. Pallas tells us that the Russian boors make use of the dried flesh of the Hamster reduced to powder, and mixed with oats; that this occasions their Horses to acquire a sudden and extraordinary degree of *embonpoint*. Anderson relates, in his History of Iceland, that the inhabitants feed their Horses with dried fishes when the cold is very intense; and that these animals are extremely vigorous, although small. We also know that in the Feröe Islands, the Orkneys, the Western Islands, and in Norway, where the climate is still very cold, this practice is also adopted; and it is not uncommon even in some very warm countries, as in the kingdom of Maskat, in Arabia Felix, near the Straits of Ormuz, one of the most fertile parts of Arabia. Fish and other animal substances are there given to Horses in the cold season, as well as in times of scarcity.

The milk of Cows, fed in this manner, has a disagreeable flavour, while the flesh of such animals as are killed for the table is not pleasant. In general it acquires the flavour, whether good or bad, of the substances on which the animals had been nourished, and for this purpose, therefore, vegetable substances are always preferable. Thus, the flesh of the Carnassiers, whether true Carnivora, or merely Insectivora, of Ant-caters, &c., is disgusting; and in the same manner, the flesh of Birds is always agreeable in proportion as they feed more exclusively upon vegetables. Animal substances being easily susceptible of putrefaction, impart to the flesh of those which are fed upon them an alkaline and ammoniacal odour. The corrupt Fish, sometimes given to the domestic animals of the North, contributes greatly to their inferiority; and it is well known that Fish in general imparts less muscular vigour and energy than the flesh of Quadrupeds.

The habitual use of animal food renders the herbivorous animals less docile, more untractable, and even dangerous in some cases, as many facts have demonstrated. Cases are quoted of Horses, fed in this manner, having devoured their own masters. It is not probable that these animals could long exist on such a diet, without inconvenience, from their internal organization being greatly different from that of the

carnivorous animals, especially in respect to the Ruminants. Still it is abundantly demonstrated, that animal substances can be administered with advantage, especially in cases of scarcity of their ordinary food, or of weakness, whilst the carnivorous animals have an indispensable necessity of living upon flesh, in order to derive a sufficient nourishment, and to maintain that kind of life for which Nature has intended them.

The food given to the domestic animals may either be composed of entire and unprepared substances, such as Nature spontaneously presents, or it may be divided and prepared in various manners; while its good qualities are susceptible of being improved in several ways, according to the object which is had in view. It may consist of plants either green or dried, whole or divided, moist or dry, raw or boiled, fermented or the reverse, sweet or sour, plain or seasoned with different substances; and, according as it is given to them in these different states, the results obtained are very different.

The mechanical division of boiled food, whether green or dried, facilitates the several acts of masticating, swallowing, and also of ruminating when it occurs; hence, by a necessary consequence, their digestion being more perfectly performed, an equal weight of food becomes more profitable, and this mode of preparation should always be adopted, except when the food is consumed on the field. For this purpose several useful instruments have been invented, such as turnip-cutting machines, choppers, mills, and many others more or less ingenious, which divide quickly, economically, and completely, the different kinds of food, whether roots, seeds, or forage. Every farmer who feels any interest in the improvement of his domestic animals, should be provided with one or other of these instruments, and he will not fail, sooner or later, to be completely indemnified for the additional expenses they may occasion.

Green food is in general more profitable to these animals, especially when it is intended to fatten them, than such as is either faded or dry; for, independently of the loss of nutritive principles which it experiences more or less while drying, it is digested more easily, rapidly, and completely, in the former than in the latter case.

For the same reasons, food which has been moistened and softened after being dried is usually more profitable than when given under a hard or dry form. Seeds especially, when broken or reduced to flour, or even made into a paste or broth, are more quickly assimilated into the animal substance than when entire. Hence, they are nearly every where reduced to a state of minute division before being given to animals in course of fattening, and numerous experiments have clearly established their comparative superiority over those which have not undergone this process.

The boiling of their food, by performing or facilitating its division, is one of the best means known of promoting digestion, and even of increasing the quantity as well as quality of the alimentary substances which undergo this process.

This advantageous result appears to originate in part from the circumstance that the molecules of the alimentary substance are separated by the coction which they undergo, and thus present a greater surface to the influence of the gastric juice, and partly from the influence of the water wherein they are immersed, as well as of the high temperature to which they are exposed, augmenting their nutritive powers. The water seems actually to become solid as in the making of bread, by entering into union with them, or by imparting its hydrogen, which afterwards becoming united to carbon, may contribute towards the formation of fat. These facts have been established by a great number of experiments made here and elsewhere, with roots, grains, and even with raw and boiled hay or grass, used for fattening the domestic animals. Potatoes and Jerusalem artichokes, which, in their raw state, are either cared for but little by the cattle, or unprofitable, acquire by boiling new properties which render them extremely advantageous after having undergone this operation. Indeed, the general practice of boiling the food cannot be too strongly recommended, especially when the low price of fuel, and the other circumstances of the locality, allow it to be performed conveniently and economically. It is also proper to administer it to the cattle while still warm, if possible, for the reason that it appears to be more agreeable to them when given in that state, and that it invigorates and refreshes them more quickly than when allowed to cool after boiling.

As a confirmation of the correctness of these views, regarding the superiority of boiled over raw food in the fattening of cattle, we have only to consider for a moment what actually takes place every day before our eyes in respect to Man. We here see how greatly substances which have been submitted to the action of heat, such as bread, meat, soups, broths, and other articles, surpass those used in their natural state. A small quantity of wheat, maize, barley, or rice, well boiled and eaten warm with a little milk, gains in nutritive matter an immense superiority over the same quantity of these substances, if eaten without this preparation. The same remark is applicable to all kinds of grain.

It may be noticed here, that the food intended for cattle can be conveniently and economically boiled by steam, by putting it into a common harrel, cased with iron, and having at its base a grating of the same metal, with the bars tolerably close. After filling it with the roots intended to be boiled, it is exposed to the vapour of boiling water arising from a cauldron placed upon an economical furnace. This arrangement permits the food to be boiled cheaply and in a very short time. Care must, however, be taken that the base of the barrel fits accurately into the upper rim of the cauldron, and that it has at its top a moveable cover so as to permit the roots to be easily placed there and withdrawn. There must also be a small hole in the cover to allow a part of the vapour to escape when it has reached the top.

The addition of some coarse provender, such as chopped straw, to boiled roots, is admitted to be advantageous; probably because it renders the mastication of these substances more complete, and serves also as a kind of ballast, which should always bear a certain proportion to the nutriment, properly so called.

Fermentation, which may be regarded as a sort of cooking afforded spontaneously by Nature, adds greatly to the nutritive qualities of the substances which undergo this process. It has long been recommended to allow the barley, intended to fatten cattle, to germinate, and this may be regarded as the first step in the process of fer-

mentation, which the grain undergoes when used for making beer. By this means, the saccharine principle becomes more fully developed, while the food is unquestionably made more digestible and nutritious. Hence cattle-dealers seek with avidity, and employ with great advantage, the residue of breweries, distilleries, and starch manufactories. A part of the grain thus prepared, or its refuse, is used largely for feeding cattle in Belgium, Alsace, and generally in the immediate neighbourhood of all large manufacturing towns. The nutritive properties of the food are further augmented by rendering it sour, or at least, it tends in this state to render the digestive function more energetic. Hence, the farinaceous substances used for food, especially when it is intended to fatten the cattle, are made in a great number of places to undergo the acetous fermentation. Indeed, all the modes of preparation already enumerated are but little useful to animals destined for hard labour. Seasoning renders the food more agreeable to their taste, more digestible, and therefore more profitable. Common salt is probably the most powerful and useful of all substances for this purpose, and hence it is employed almost every where with advantage. It sharpens the appetite, excites to drink, facilitates digestion, renders the flesh of animals intended for the table of a superior quality, and either promotes or supplies the acidity induced by the second stage of fermentation. All Mammalia seek salt with as much avidity in their wild state as in that of domestication, and show a degree of pleasure, which is a sure index of its utility when mixed with their food, and of its power of correcting the hurtful qualities of their aliment when it happens by some accident to have become vitiated.

In addition to those precautions, which are essential to the proper selection and preparation of food for the domestic animals, it is of great importance to regulate the rations or quantity of food distributed to them at intervals, in order that they may be rendered as profitable as possible. The quantity of food ought always to be in proportion to their age, state of health, the violence of their exercise, and final destination, always observing, at the same time, the general principle, that the quantity of the food must be more considerable when it is less substantial, as any diminution of its nutritive qualities can only be compensated by a proportional increase of its quantity. It is always impossible to determine, in a fixed and positive manner, how much of each kind of food an animal should consume in a given time, because this depends upon a great number of circumstances relative to its species, its race or breed, the peculiar constitution of the individual, its employment, as well as its age and state of health. The daily allowances further change with the very variable nature of their food, the different ways in which it is administered, the state of the atmosphere, the season of the year, and several other circumstances, all of which should be taken into consideration before we can determine their proper daily rations with any degree of accuracy. Hence result the various and contradictory opinions emitted on the subject by most writers who have attempted to fix quantities. Some have laid down as a principle, that certain domestic animals will daily consume the third part of their weight of watery food, such as turnips, beet-root, or green clover; while others have fixed for the same animals a fourth part of their weight of cabbages, carrots, and parsnips, and a fifth or a sixth of beet-root, potatoes, and Jerusalem artichokes. There must be, however, a great variation according to the different circumstances just enumerated. It appears to us that all these matters should be regulated by particular and individual trials, and be left wholly to experience. This is of more real use than the futile attempts made in most practical books to fix quantities, and which only serve to demonstrate the real ignorance of the persons attempting to enforce them. Physiologists, and all who have studied this matter properly, know very well, that although there are certain well ascertained general laws which regulate the entire animal economy, each individual possesses a peculiar constitution, or *idiosyncrasy*; which more or less serves to modify these laws. Hence we frequently find a disparity of effects resulting from the same apparent or real cause, and these variations show themselves in the quantity of food which animals consume, as well as on a great many other occasions, the explanation of which can only be obtained on the principles already explained.

Along with the really nutritive food, there must always be mixed a certain quantity of ballast, that is, of some coarse and slightly nutritious food, otherwise the sides of the stomach, as well as the intestines, will not be sufficiently distended and stimulated, so as to perform completely the functions for which Nature intended them. Unless this condition is rigorously attended to, the digestion, elaboration, and assimilation of the nutritive juices, will always be incomplete even in healthy and well constituted animals. It is therefore a very important error to overload the stomachs of these animals with any very nutritious food unmixed, even when it is exclusively intended to fatten them.

In respect to the distribution of their food, it is only necessary to notice one excellent maxim, *Good food, a little at a time, and often*; they should be allowed to eat quietly and slowly in order that they may digest the largest quantity of food in the shortest possible time. Regular intervals of feeding should be observed, with occasional fasting, which serves to appetize them, and give an impulse to their digestive organs. They should not, however, be allowed to grow impatient, which occasions a loss of animal force and nutrition. Digestion never proceeds rapidly as long as the animal continues eating. It is only when sufficiently filled that the circulation becomes accelerated, the temperature of the body more elevated, and digestion proceeds with its greatest activity. All these phenomena succeed in the course of a few hours, after which the temperature of the body falls, the respiration becomes moderate, and hunger returns. It is only at this time that more food should be given, in small rations at a time; and when treated in this manner, the animal consumes less, and derives more benefit from its food.

To alternate and vary the kind of food used is always necessary, because the continual use of the same aliment does not sharpen the appetite so well as a judicious selection and rotation. A variety of food serves to stimulate the digestive organs, and prevent that disgust which the same diet continued too long always occasions by its uniformity. Care should be taken, in respect to these changes of food, to avoid a sudden alteration of diet, especially from green to dry food, or *vice versa*, for these are always more or less prejudicial. It is also very important not to overload the

stomachs of labouring animals, immediately before they set out to their work, as is too frequently done, for this often occasions indigestion, or at least renders it imperfect or laborious. From want of food or other circumstances, these animals are often obliged to submit to a long fast, which they are always better able to endure in proportion as their food has been the more substantial.

There are some domestic animals, such as the Camel and the Ass, which are remarkable for their frugality, as well as their capacity of remaining long without food. There are also some races of other animals which are equally celebrated for these qualities; and when they do not originate in some constitutional defect, or from ill health, and when it is not effected at the expense of their other useful properties, this forms a powerful inducement for propagating some races in preference to others. The Mule is an instance of the above, as well as some of the improved breeds. A quantity of barley, equal to about one feed, is sufficient, according to the report of travellers, for the daily maintenance of an Arabian saddle Horse, after a long journey in the deserts; while a European Horse performing the same service would have consumed, in the same time, a much larger quantity of barley, besides a considerable bulk of hay and straw. The remarkable frugality of the former, although doubtless owing to an original constitution improved by habit, is partly due to a difference in the nutritive qualities of the food, as well as to the climate. If animals of the South consume, in general, a smaller quantity of food than those of the North, this is in part due to the circumstance, that the food is much more nutritious in the former than in the latter case, and also that it possesses a greater specific gravity. It may not be improper in this place to notice a remarkable error almost universally adopted in this country, of giving out corn, which is the most substantial part of their food, by *measure* instead of by *weight*, as it has been ascertained by many trials, that the quantity of really nutritive matter may vary in bulk by nearly one-half, according to the quality of the corn.

As the most useful and important of our domestic animals are herbivorous, it may be advantageous briefly to notice here the general qualities of the several vegetable substances which usually form the basis of their diet.

The substances principally used for this purpose are, 1st, Grass, either fresh, or under the form of Hay. 2d, The Straw of the Cereal plants. 3d, Leaves or Stalks. 4th, Roots or tubers. 5th, Seeds, Grains, or Fruits. Each of these subjects admits of being treated somewhat in detail.

Grass is the most natural food of the herbivorous animals, and is often sufficient to restore feeble animals to a good condition when they have fallen off, upon any other kind of diet. This food is not, however, adapted for hard-working animals.

The best kind of green food is fine, substantial, not very watery or faded, and should not have grown in a shady situation; it is usually found upon natural or artificial meadow-land. The Natural families of the Gramineæ and Leguminosæ are the most abundant in important Plants. In the former we may notice the Meadow-grasses (*Poa*), Fescue-grasses (*Festuca*), Fox-tail-grasses (*Alopecurus*), Oat-grasses (*Avena*), Cat's-tail-grasses (*Phleum*), Bent-grasses (*Agrostis*), Canary-grasses (*Phalaris*), Wheat-grasses (*Triticum*), the Barleys (*Hordeum*), Hair-grasses (*Aira*), Soft-grasses (*Holcus*), Dog's-tail-grasses (*Cynosurus*), Quaking-grasses (*Briza*), Millet-grasses (*Milium*), and a few other genera. Of the Leguminosæ, the following are the most remarkable:—The Medicks or Lucerns (*Medicago*), the Trefoils (*Trifolium*), Saintfoin (*Onobrychis*), the Melilots (*Melilotus*), the Vetches (*Vicia*), the Tares (*Ervum*), the Milk-Vetches (*Astragalus*), and the Bird's-foot Trefoil (*Lotus*). There are some plants, which not only have the property of exciting a more abundant secretion of milk in those females which are fed thereon, but also render it of an excellent quality; such are the roots of the Parsnip or Carrot, and the stalks of the Maize; while others, such as the Garlics (*Allium*), actually impart a disagreeable odour, or other unfavorable qualities. Each domestic animal shows a marked predilection in favor of some plants, and either refuses certain others altogether, or feeds upon them only when compelled by a scarcity of food, as Linnæus and several of his followers have long ago remarked. Not only do they derive pleasure from particular parts of certain plants in preference to the remainder, but the different states of vegetation in which each of them is found, as well as the different situations and nature of the soil on which the plants grow, contribute still more strongly in determining their choice. With a very small number of exceptions, we find in general that when plants are in their flowering state, or one which nearly approaches to it, they are most nutritious. At this time, their nutritive particles are diffused abundantly and equally throughout the whole plant, and they hold a middle state between the aqueous condition which is too relaxing, or not sufficiently nutritious, and the ligneous condition, which renders difficult the functions of mastication, deglutition, and digestion. In general, also, medium qualities of the soil, as well as intermediate stations, should be preferred for pasture grounds.

After numerous comparative trials made at Upsal in Sweden upon the common plants of the meadows, fields, and other pasture lands, it was found, by M. Hesselgreen, that the plants used by each species of domestic animals vary greatly in number. His results are represented in the following table:—

Of 575 Plants, the Goat eats 449, and refuses 126		
528	the Sheep	367, 141
494	the Bull	276, 218
474	the Horse	262, 212
243	the Pig	72, 171

This serves to indicate that the Goat is the least delicate in his taste, and can eat without inconvenience a great number of plants hurtful to other species. The Sheep feeds upon nearly three-fourths of all the plants it encounters; the Oxen and Horses refuse nearly one-half, while the Hog can eat the leaves and roots comparatively of a very small number of species. The above results are, however, very incomplete, and must be considered merely as approximations.

Subsequently to the investigations of M. Hesselgreen, M. Yvert examined nearly seven hundred of the most common plants of France, or those capable of being naturalized there, and as his inquiry appears to have been conducted with much care,

it may be interesting to compare his results with those already given of the Swedish investigator.

	Goat.	Sheep.	Bull.	Horse.	Hog.
Can eat	547	408	311	268	86
Is very fond of	28	81	121	113	36
Sometimes eats	32	33	70	39	23
Takes in all	607	522	502	420	145
Refuses	83	133	183	235	169
Total Plants examined	690	655	685	655	314

Many plants are wholly refused by all animals. Among the principal of these growing in marshy places we may notice the following: The Common Butterwort (*Pinguicula vulgaris*), Common-hooded Milfoil (*Utricularia vulgaris*), Forget-me-Not (*Myosotis palustris*), Perfoliate Pond-Weed (*Potamogeton perfoliatum*), Long-leaved Cowbane (*Cicuta virosa*), the Long-leaved Sun-Dew (*Drosera longifolia*), the Round-leaved Sun-Dew (*D. rotundifolia*), Water-Pepper (*Polygonum Hydropiper*), Sweetflag (*Acorus calamus*), Water Crowfoot (*Ranunculus aquatilis*), Great Spearwort (*R. lingua*), and Water Milfoil (*Myriophyllum spicatum*).

There are several other plants which either grow in somewhat moist pastures or in the shade, and are likewise refused by all cattle. These are the Common Thorn-apple (*Datura Stramonium*), Common Henbane (*Hyoscyamus niger*), Black-berried Nightshade (*Solanum nigrum*), Dwarf-Elder (*Sambucus Ebulus*), Mountain Dryas (*Dryas octopetala*), Black Horehound (*Ballota nigra*), Common White Horehound (*Marrubium vulgare*), Impatient Lady's Smock (*Cardamine impatiens*), Common Celandine (*Chelidonium majus*), and the Blue Erigeron (*Erigeron acer*). It must be noticed, however, that many of these plants, when very young, are sometimes eropped by the cattle without inconvenience, while some even of the most nutritious plants are refused when in grain, from their perfume being too strongly diffused. After the animals have endured a long continued fast, their discrimination in these respects is not so nice; and the climate may occasion some further differences. Thus, the young sprouts of the Wolf's-Bane and Hemlock become esulent even for Man in the North of Europe, where their deleterious properties are not sufficiently developed to become hurtful.

Some plants are often eaten by the cattle while green and fresh, and yet are generally refused by them if offered in a dry or faded state. These are Cook's-Comb (*Rhinanthus crista-galli*), the Horse-Tails (*Equisetum*), the Bedstraws (*Galiun*)—which spoil the Hay, and the Common Buckbean (*Menyanthes trifoliata*); while others, such as the Crowfoots (*Ranunculus*), and Swallow-Worts (*Asclepias*), lose their injurious properties when dried, and in that state are eaten by the cattle without inconvenience. Others serve as seasoning, such as the Garlics (*Allium*), and the Docks (*Rumex*), either of which may be used occasionally as a stimulant or corrective; while the Cotton-Grasses (*Eriophorum*), and some others, become hurtful from their hairs, which serve as a nucleus to those dangerous agagropiles or concretions, sometimes found in the first stomach of the domestic Ruminants.

There are also a great number of plants eaten without inconvenience by the Goat, and even greedily sought after by that animal, while they are refused by all other cattle. The principal are the Common Mare's-tail (*Hippuris vulgaris*), Common Prickly-Seed (*Echinopervum Lappula*), the Greater Water-Plantain (*Alisma Plantago*)—highly detrimental to all other domestic animals, the Wood Anemone (*Anemone nemoralis*), that of the meadows (*A. pratensis*), the Spring Anemone (*A. vernalis*), Celery-leaved Crowfoot (*Ranunculus sceleratus*), the Knotty-rooted Figwort (*Scrophularia nodosa*), and Tamepoison (*Asclepias vincetozicum*), of which it is extremely fond. The last mentioned plant can be eaten by the Horse, only after it has been killed by the frost. To these we may add, the Small Water-Wort (*Elatine Hydropiper*), Box-leaved Andromeda (*Andromeda calyculata*), Biting Stonecrop (*Sedum acre*), Snapdragon (*Antirrhinum linaria*), Stinking Camomile (*Anthemis cotula*), Black-berried Bryony (*Bryonia alba*), Marsh Lousewort (*Pedicularis palustris*), that of the woods (*P. sylvatica*), Hemp Agrimony (*Eupatorium cannabinum*), the Annual Mercury (*Mercurialis annua*), which is poisonous to all other animals, according to Ray and Linnæus, the Corn Horsetail (*Equisetum arvense*), that of the marshes (*E. palustre*), and the Male Polypody (*Polypodium filix mas*).

Some plants are eaten solely by the Hog, and it is often only their roots that are sought after. The chief of these plants are the Common Cyclamen (*C. Europæum*), Common Asarabacca (*Asarum Europæum*), the White Water Lily (*Nymphaea alba*), and the yellow (*N. lutea*), for which the Horse exhibits a marked aversion, the Water Soldier (*Stratiotes aloides*), Sea Wrack-Grass (*Zostera marina*), and Maiden Hair (*Asplenium trichomanes*).

A few plants are very much sought after by all cattle, and almost with equal avidity. These are the Common Millet-Grass (*Milium effusum*), Meadow Soft-Grass (*Holcus lanatus*), Annual Meadow-Grass (*Poa annua*), Oats, Barley, and Wheat, the Carrot and Parsnip, the Great Round-leaved Willow (*Salix caprea*), the Norwegian Cinquefoil (*Potentilla Norvegica*). Also, the Creeping Trefoil, the Common Lucerne, and Sainfoin. But many of these plants must be in different states, in order to be liked equally by the several species of cattle.

On considering the entire vegetable kingdom in a general manner, we find that scarcely any Acotyledonous plants are fitted for the maintenance of cattle. Indeed, if we exclude the Grasses, nearly all of which may be used for this purpose, we find but few even among the Monocotyledonous plants. It is unquestionably in the Dicotyledonous class that the greatest number of useful materials for this purpose are to be found.

The following natural families are arranged according to the order of their utility for food to cattle:—The Gramineæ, Leguminosæ, Cruciferæ, Rosaceæ, Amentaceæ, Umbelliferæ, Cucurbitaceæ, and Polygonæ.

The best Hay is afforded by the more elevated meadows, and its quality depends greatly upon the care with which it has been dried. In this article quality is much

more important than quantity; for a stone of good Hay, well selected, and carefully dried, affords more nutriment than several stones of coarse or ill prepared material,—a matter to which sufficient attention is not always paid. The exposure to the sun or air, during its making into Hay, always occasions grass to lose some portion, more or less considerable, of its nutritive substance, which is evaporated along with the watery matter. New Hay often occasions indigestion, and it should not be given to cattle for several months after being made, at which time it is entirely deprived of its uncombined aqueous substance.

Straw should be considered rather as a useful kind of ballast proper to be mixed with the really nutritive food of the domestic animals, than as a substantial nourishment. The best quality is fine, white, short, and massive. It is often advantageous to have it chopped and even moistened.

Dried leaves, as well as the small branches of a great number of trees, shrubs, and bushes, may sometimes form a useful substitute for straw or hay, when the latter cannot be easily procured. The Elm, the Mulberry tree, the Ash, the Hornbeam (*Carpinus betulus*), the Lime trees (*Tilia*), the Common Maple and Sycamore (*Acer*), the Common Acacia (*Robinia pseudacacia*), the Willows, the Poplars, the Birches, Beeches, Planerces, Chestnuts, Oaks, Dogwood (*Cornus*), Hazel (*Corylus*), Furze (*Ulex*), and the Vine, are frequently used for this purpose on the Continent, in places where they happen to be plentiful. The same substances, if given in their green state, may also replace the newly-mown grass of the meadows; but they should always be administered with caution, and with a due attention to their effects, which vary according to the species, as well as in their several states of vegetation. The green leaves of a tolerably large number of vegetables are annually cultivated on a large scale, either as food for Man or for Cattle; such are the leaves of the Maize, Beet-root, Cabbage, Carrot, Parsnip, Potato, and some others, all of which may be used for this purpose in many cases with advantage.

Roots, or rather their tuberos appendages, which are often very large and voluminous, such as those of the Parsnip, Carrot, Beet-root, Potato, Jerusalem Artichoke, and Turnip, are frequently superior to any of the substances already mentioned as a daily article of food for cattle, and many comparative trials have clearly shown that they are in general much more profitable.

Seeds, grains, or fruits, contain, of all the parts of a plant, the largest quantity of nutritive substance under the smallest bulk. They ought to be given judiciously and sparingly to cattle, from their being in general very costly, and there are some other inconveniences to which their frequent use may give rise. Sometimes they are ground, broken, or prepared in different ways in order to render them more digestible and economical. The principal seeds used for the food of the domestic animals are also, in great part, furnished by the useful families of the Gramineæ and Leguminosæ. Other farinaceous fruits, procured from some of the remaining families, are occasionally added to these; such as the Buckwheat (*Polygonum Fagopyrum*), the Chestnut, Horse-chestnut, and Acorn, as well as the oleaginous seeds of cruciferous plants, especially of some varieties of the Cabbage, and Gold-of-pleasure (*Camelina*). To these may be added, the seeds of Flax, Hemp, some species of Poppy; also Beechnuts and Walnuts, or rather their refuse, and some other fruits less common or important. Most of these, however, have the inconvenience of imparting to the flesh of the animals fed thereon an odour and taste by no means agreeable. In respect to the bran or husk of grains, it is nourishing only when it contains some flour mixed therewith, for the outer rind itself is not only destitute of nutriment, but very indigestible, and often injurious.

Herbivorous animals are wholly overcome by famine, while carnivorous animals are more easily vanquished by an excess of their food. Long-continued hunger exasperates the latter, and renders them furious, while many striking instances are known of the most ferocious animals being wholly tamed by an abundant supply of food, united to other precautions.

Exercise, to which but little attention is commonly paid, is a subject requiring almost an equal degree of consideration with that of their food. By this term we commonly understand the amount of bodily motion necessary to maintain the proper circulation of the fluids, and to impart that degree of activity which the natural condition of their body requires. Exercise is the contrary of repose, and without either of these, the animal machine would soon be destroyed. It greatly assists the insensible transpiration, the most abundant of all the secretions, and keeps off a number of diseases depending upon the superabundance of the fluids, their impurity, or stagnation, enlargements or obstructions of the viscera. Far from diminishing the animal forces, it reanimates them; a languishing appetite is restored, and the consequences of exercise are reflected throughout the entire vital economy.

The influence of exercise upon fecundity and longevity are not less remarkable. Very fat animals are often unfruitful, while a long-continued repose frequently leads to obesity, which again induces impotence, and often death. These are not the only consequences of a continual want of exercise. Their limbs are deprived of that play and spring necessary in preserving all the parts of the body in their state of health.

Exercise should, however, be regular and moderate. Very violent labour may affect all the organs, and render the stature diminutive; hence all excess in this respect should be avoided if possible, especially during the growing period of life.

The domestic animals also require much attention in respect to their lodgings. When in their wild state, they are constantly in the open air; in their domesticated condition they are often abstracted from it. This essential difference necessarily affects the conditions of their existence; and, in proportion as they are brought nearer to their natural state, their health becomes improved, while an opposite course of treatment may be attended with the most fatal consequences.

Our most useful domestic animals are often confined in narrow stables, which are perhaps rather injurious than beneficial, from their vicious construction or pernicious arrangement. A knowledge of these defects has suggested to some rural economists the idea of exposing their cattle continually in the open air; but these persons do not perceive, that in avoiding one error, they fall, as frequently happens, into another not less important. When in their wild state, animals are always in the open air, it is true; but it does not follow that they are continually exposed to the weather,

which is a very different circumstance of their condition. In their native haunts, they always endeavour to withdraw themselves from excesses of every kind, whether of heat or cold, moisture or dryness, as well as from storms, tempests, violent winds, or the attacks of their enemies, while they are free to change, whenever they please, either their place or position. It therefore becomes a serious error, through inattention to these circumstances, to expose domestic animals to the inclemencies of the weather, without the slightest shelter, for the mere purpose of avoiding the common disadvantages of a stable. We have often seen flocks of Sheep shut up in narrow parks, exposed in winter to the frost, in summer to the burning heat of the sun, in spring and autumn to excessive moisture, and in all seasons to the sudden changes of the atmosphere, and consequently to the most sudden alternations of temperature. The natural consequences of this mismanagement have invariably followed, while their undue mortality and impoverished condition fully demonstrated, that animals exposed to all kinds of weather are far from being in that state of nature to which it was intended to reduce them. Their amelioration, their prosperity, and even their existence, are compromised as much by this injudicious treatment, as they would have been by the most confined, uncleanly, and ill-constructed stable.

It is no doubt true, that we should endeavour to bring animals to a real state of nature, and place the enjoyments of liberty and fresh air as much as possible within their reach. Yet this can only be done effectually by giving them the power, whenever circumstances permit of going alternately, under cover or in the field, by having some enclosed space where they may be free to move, and with a sufficient number of retreats or sheltered spots, to which they can resort at those times when there is more real inconvenience and disadvantage in being without than within. This is the only legitimate way in which we can approximate the domestic animals to their natural condition.

To dress their coats occasionally, and clear the entire surface of their bodies from all impurities, by the aid of suitable instruments, are attentions imperatively required by the state of domestication, and are apparently indispensable to the health of the most useful animals which have submitted to the empire of Man. As the skin of these animals is perforated by an infinite number of pores, or orifices of the smaller arteries adjoining the epidermis, there exhales continually during the healthy state of the animals an excremental vapour, which has been considered in Man to surpass in quantity all the other evacuations taken together. This important function, known by the name of *insensible transpiration*, is indispensable to the well-being of all the domestic animals, and it cannot be arrested, or even suspended or modified, without being attended with injury to the system. When this function is performed regularly and suitably, it clears the skin, maintains it in the supple state fitted for the play of all the organs, and smooths as well as nourishes the hair, which then looks sleek and glossy. When, however, by any cause, this passage for the superfluous humours has been intercepted, they either flow back towards the centre, or become fixed in the exterior. In either case the vital functions are disturbed, and a great number of dangerous maladies are the consequence.

These accidental derangements of their natural order may be observed among all animals, but they are more frequent and acquire greater intensity with the domestic quadrupeds, especially such as labour severely or are in course of fattening, from their being more exposed to the causes whence they arise. Being often obliged to remain stationary for a considerable length of time, and most frequently in narrow and confined places, exposed to a continual and abundant dust, with the exhalations arising from their food or other matters, various foreign substances fix themselves upon the skin, and if daily care be not taken to remove all these obstructions to the insensible transpiration, their general health becomes seriously affected, and thus the improvement of the breed may be retarded or their fecundity diminished.

The particular purposes for which each race or species may be intended is one of the points to which the Economist pays special attention. A general distinction, depending on their different adaptations and the variety of their products, is made among all animals intended to be improved artificially. Some, for example, such as the Horse, the Ass, and sometimes the Mules proceeding from them, are chiefly used in Europe for carriage, draught, or speed, while their economical products during life, or afterwards, amount to a small matter, being merely the hide, hoofs, tendons, and the oil abstracted from the marrow of their bones. The Ox and Buffalo again are specially used for draught or the table, while their females chiefly yield milk and its modifications. The Sheep and Goats present us with the three-fold tribute of their fleece, milk, and flesh; and different uses are made of the horns with which

some of the animals are armed, as well as of their skin. The Hog yields little else besides his flesh and bristles, and sometimes his skin. The Rabbit only imparts its flesh and fur; and we esteem the Dog and Cat rather for intellectual than physical qualities.

From the variety of these products, and the different kinds of service which they render, a particular attention is commonly paid to such points as contribute more especially towards the several advantageous results. Thus, their size, weight, volume, tendency to grow fat, smallness of the bones compared with the other parts of the body, the abundance and fineness of their flesh, are qualities which are particularly esteemed in species or races intended to be fattened. The relative volume of the most useful parts compared with those of less value is another point of importance. Intestines of small size are in this case to be desired, as well as small bones, with a fine and supple skin. An abundant cellular tissue, when the accumulation of fat is an object, becomes an essential point; and a broad back with the dorsal and lumbar muscles strongly developed is no uncertain promise of a large quantity of delicate beef-steak. Another and a very different set of qualities are esteemed in animals intended for draught. The size, weight, and massiveness of the body, the breadth of their base, the thickness of the loins, and the force of the bony skeleton, are essential characters in all animals for draught and burthen; while an ordinary Saddle-Horse should be rather active than heavy. Animals specially intended for laborious occupations should have a broad chest, the fore quarters elevated, and the hind quarters neatly made, large, well sloped off and proportioned. For ordinary draught or light work the characters should be less strongly marked, and the general form disposed for agility. The Race-Horse requires much suppleness in all his limbs; and the form best adapted for this purpose consists of a low front, a broad chest, a body rather elongated than shortened, with a great deal of freedom in all his limbs.

In the Ox and Buffalo, muscular force and largeness of the extremities are esteemed, together with suppleness of the skin, and all the qualities for fattening already enumerated.

With the Cow and female Buffalo, as well as in Ewes and she-Goats, the first objects to be considered are the development of the udders, the size of the lacteal vessels and mammary veins, as well as the fineness and suppleness of skin.

In the Sheep, a long and abundant fleece, free from all blemish, united to a suitable height and form, and a great aptitude to fatten quickly, are the most desirable qualities.

The Goat is esteemed for a long, fine, and silky hair, when united to lightness, agility, docility, and other qualities already enumerated, especially in reference to its milk, which is often used.

In the Hog, we esteem an excessive voracity, supple and abundant bristles, with a disposition rather tranquil than wild, and especially a disposition to grow fat quickly.

An abundant and fine fur, large size, powers of reproduction well pronounced, and a tendency to fatten, are valuable qualities with the Rabbit.

In all domestic animals, their liveliness and vigour, with the complete development of all their organs, are the surest guarantees for their strength, energy, and courage, and these qualities ought always to fix the attention of the rural Economist.

The head of young animals, as well as their organs of nutrition and digestion, are usually more voluminous in proportion than the other parts of the body, because the growth of the individual is at this age the principal object of Nature. Their bones are rather cartilaginous than solid. Their skin, whose absorbing power is stronger than at a more advanced age, is a loose and thin tissue. Their blood is not deeply coloured; their fat is white and spongy, with little consistency or flavour, and is most prevalent towards the exterior. Their muscles are softer, and more watery than in mature age, and their flesh is consequently more tender; but, at the same time, more insipid, as well as less nutritious and juicy than in the adult.

With old animals, on the other hand, the solids of the system predominate, and the nutritious parts are lost faster than they are repaired. Not only are the bones very hard, but the cartilages are often ossified; the skin is coriaceous, and adheres forcibly to the subjacent parts; the colour of the flesh is deep; the fat often of a bright yellow, thick, viscid, and more prevalent at the centre than at the circumference; the muscles are shortened and dried up; the flesh is consequently but little nutritious, and difficult of digestion.

It follows from these observations, that the most nutritious, savoury, and substantial meat, without being hard or indigestible, is procured from animals at the medium age, between the two extremities of life.

[We have now considered the Mammalia under most of those general points of view which appear necessary to render the consideration of Species intelligible to the general reader, as well as to impart a sufficient degree of interest to their details. The Geographical distribution of the Mammalia over the surface of the globe, the consideration of the remains of animals now found only in the Fossil state, as well as the causes which have led to their extinction—all subjects of great and general interest, require to be postponed, until we have gone over the numerous species of this Class; for, without a previous knowledge of species and their differences, the importance of these branches of the science cannot be fully appreciated. We also think it advisable fully to develop the system of arrangement adopted in the "Regne-Animal," with the additions and improvements suggested since the publication of the last Edition of that work, before entering upon the History of this branch of the Science, being fully convinced that an intimate acquaintance with some one system, at least, is absolutely necessary for the proper understanding of the several systems which have been proposed from time to time for the arrangement of the objects comprised in this Class of the Animal World. Previous to the consideration of Genera and Species, it will, however, be proper to define some of the most important terms used in describing them.]

GLOSSOLOGY OF THE MAMMALIA,

BEING AN EXPLANATION OF THE PRINCIPAL TECHNICAL WORDS USED IN

MASTOZOLOGY.

ABBREVIATIONS.—LAT. LATIN—GR. GREEK—FR. FRENCH—GERM. GERMAN.

(1.) GLOSSOLOGY, from *γλῶσσα* (*glōssa*), tongue or language, and *λογος* (*logos*), a discourse,—supplies the explanation of the technical terms belonging to any Art or Science. It corresponds with the French “*Terminologie*,” and with the German “*Kunstwörter*.”

(2.) MASTOZOLOGY, from *μαστος* (*mastos*), the breast, *ζῷον* (*zōon*), an animal, and *λογος*,—is the science which treats of the Mammalia or mammiferous animals. The corresponding French word “*Manmalogie*,” being derived partly from the Greek and partly from the Latin, is inadmissible. M. Desmarest has suggested the term “*Mastologie*,” which, however, is more limited in its signification than our term, originally proposed by M. de Blainville.

(3.) THE MAMMALIA, *Lat.* Mammalia, *Fr.* Mammifères, *Germ.* Säugthiere,—corresponds to the English terms “MAN and BEASTS” taken together. These are the MASTOZOA of M. de Blainville, the MAMMALIA of Linnæus, Erxleben, and others. To distinguish them from the four-footed Reptiles which are oviparous, they have been styled “VIVIPAROUS QUADRUPEDS,” with much impropriety, as the Cetacea want the hinder limbs (see page 38). Some recent writers have attempted to introduce the barbarous term MAMMALS.

I.—THE SKELETON IN GENERAL.

(4.) THE SKELETON, *Lat.* Sceleton, *Fr.* Le Squelette, *Germ.* Gcripp, Knochengeriist,—is the bony frame-work of the body, destined to protect the nervous system and other vital parts, and serving as a point of support to the organs of active motion. It is divided into the *head, trunk, and extremities*.

(5.) THE HEAD, *Lat.* Caput, seu Cranium, *Fr.* La tête, *Germ.* Kopf, Schädel,—forms the *anterior* portion of the skeleton [the *superior* in Man], containing the brain and the principal organs of sense.

(6.) THE SKULL, *Lat.* Calvaria, seu Cranium, *Fr.* Le crâne, *Germ.* Hirschädel,—is the upper and hinder part of the Head, especially intended to contain the Brain. Its volume varies relatively to that of the head, and is by some thought to be proportioned to the degree of intelligence. The exceptions are, however, very numerous.

(7.) THE FACE, *Lat.* Facies (*maxillæ*), *Fr.* La face, *Germ.* Gesicht,—forms the anterior part of the Head in Man. It contains the organs of sight, smell, and taste. M. Desmarest is wrong in considering the ear as a part of the face. The length and size of the face are chiefly determined by the dimensions of the organs of the senses, and the degree of intelligence is very often in the inverse ratio of this development. The face is said to be *flat* and *perpendicular* in Man, the Orang-Outang (*Pithecius satyrus*), and the Sloths; sometimes it is *prolonged* into a sort of tube, as in the Echidna, or into a muzzle, as we find in the Dog and most other Mammalia.

(8.) THE JAWS, *Lat.* Maxillæ, Mandibulæ, *Fr.* Les mâchoires, *Germ.* Kiefer, Kinladen,—composing the upper and under parts of the face, are united together by an articulation, and form the mouth.

(9.) THE UPPER JAW, *Lat.* Maxilla, seu Mandibula superior, *Fr.* La mâchoire supérieure, *Germ.* Oberkiefer,—is composed of two maxillary bones, and generally of an incisive bone.

(10.) THE INTERMAXILLARY, or INCISIVE BONE, *Lat.* Os intermaxillare, seu incisivum, *Fr.* Les intermaxillaires, premaxillaires ou incisifs, *Germ.* Zwischenkieferbein,—is a simple or compound bone belonging to the upper jaw, and supporting the incisive or front teeth. It varies in size, being wanting in the adult Man, although found in the human fetus.

(11.) THE PALATE, *Lat.* Palatum, *Fr.* Les palatins, *Germ.* Gaumen,—is the lower surface of the upper jaw, and forms the roof of the mouth.

(12.) THE LOWER JAW, *Lat.* Mandibula, seu Maxilla inferior, *Fr.* La mâchoire inférieure, *Germ.* Unterkiefer,—which chiefly determines the form of the face, is sometimes arched in front, as in Man; or its two branches meet in front at a more or less acute angle, as in most other Mammalia. Sometimes its branches do not form a single bone, but are separated at their point of contact, as in the Rodentia; at other times it presents an inferior point. The sides of the lower jaw terminate behind in two elevated portions called the *ascending rami* or *branches* [*Fr.* les branches

montantes], on which are placed the *condyles*, or articulations with the cranium, in the *glenoid cavity*. The condyles are sometimes *transverse*, as in the Carnassiers, or *longitudinal*, as in the Rodentia, and remarkably so in the Ruminantia. The form of the glenoid cavity corresponds to that of the condyles, though in certain genera, as in the Ant-eaters, they disappear altogether.

(13.) THE CHIN, *Lat.* Mentum, *Fr.* Le Menton, *Germ.* Kinn,—forms the anterior and lower margin of the under jaw. It may be more or less *prominent* or *concealed*.

(14.) THE TEETH, *Lat.* Dentes, *Fr.* Les Dents, *Germ.* Zähne,—are small and very hard bones of the mouth, inserted either in the jaws or the palate, and having a free or projecting extremity. Animals are said to be *edentulous*, *Fr.* Edentiés, *Germ.* Zahnlose, when the teeth are wanting.

(15.) THE TRUNK, *Lat.* Truncus, *Fr.* Le Tronc, *Germ.* Leib,—is composed of the *spinal column*, the *ribs*, and the *sternum*.

(16.) THE SPINAL COLUMN, *Lat.* Spina dorsa, *Gr.* Ραχις (Rhachis), *Fr.* La Colonne vertébrale, *Germ.* Rückgrat, Wirbelsäule,—is formed by the union of the small bones of the back, composing a continuous tube of a triangular or circular form for the protection of the spinal marrow. It is divided into several regions.

(17.) The small bones composing the spinal column are called VERTEBRÆ, *Lat.* Vertebrae, *Gr.* Σπῳδύλοι (Spoudyli), *Fr.* Les Vertèbres, *Germ.* Wirbelbeine, Rückenwirbel.

(18.) THE RIBS, *Lat.* Costæ, *Fr.* Les Côtes, *Germ.* Rippen,—are elongated bones inserted on the sides of the vertebrae, and converging at their other extremities. They are said to be *sternal* or *true ribs* when they extend as far as the sternum, and are articulated to it by means of a cartilage. The *asternal* or *false ribs* are much shorter than the former, and placed further behind [below in Man].

(19.) THE STERNUM or BREASTBONE, *Lat.* Sternum, *Fr.* Le Sternum, *Germ.* Brustbein,—which may be either simple or compound, is placed between the inferior [anterior in Man] summits of the true ribs. It varies in size in different species, being very large in the Cheiroptera and Moles.

(20.) THE CHEST or THORAX, *Lat.* Thorax, *Fr.* La Cavité thoracique, *Germ.* Brustkasten,—is the anterior cavity of the trunk containing the heart and lungs, and bounded above [behind in Man] by the spinal column, on the sides by the ribs, and beneath [before in Man] by the sternum. Man, the Quadrumana, many Cheiroptera, and the Manatus, have their mammae placed on this region.

(21.) THE SACRUM, *Lat.* Os Sacrum, *Fr.* L'Os Sacré, *Germ.* Kreuzbein,—consists of those vertebrae adjacent to the tail and connected with other bones. The spinal marrow most commonly terminates here, and the sacrum may either be simple or composed of several bones.

(22.) THE HAUNCH or PELVIS, *Lat.* Pelvis, *Fr.* Le Bassin, *Germ.* Becken,—serves to protect the hinder part [the lower in Man] of the abdominal cavity. It consists of the sacrum and two ossa innominata, in which are articulations for inserting the bones of the hinder limbs.

(23.) THE OS COCCYGIS or CAUDAL VERTEBRÆ, *Lat.* Os Coccygis seu Vertebrae caudales, *Fr.* L'Os Coccygien ou caudal, *Germ.* Schwanzbein, Steissbein, Schwanzwirbel,—formed of one or more bones annexed to the extremity of the sacrum, serve to support the tail when it happens to be present.

(24.) THE CERVICAL VERTEBRÆ, *Lat.* Vertebrae collares, *Fr.* Les Vertèbres cervicales, *Germ.* Halswirbel,—are the vertebrae placed between the head and the chest.

(25.) THE DORSAL VERTEBRÆ, *Lat.* Vertebrae Pectorales seu dorsales, *Fr.* Les Vertèbres dorsales, *Germ.* Brustwirbel oder Rückenwirbel,—are the vertebrae of the chest supporting the ribs.

(26.) THE LUMBAR VERTEBRÆ, *Lat.* Vertebrae lumbales, *Fr.* Les Vertèbres lombaires, *Germ.* Lendenwirbel,—are the vertebrae between the chest and the sacrum.

(27.) THE LIMBS OF EXTREMITIES, *Lat.* Artus seu Extremitates, *Fr.* Les Membres ou les Extrémités, *Germ.* Gliedmassen,—are articulated

bones on each side, connected in pairs with the thorax and pelvis. In general, they are four in number, as in the greater part of the Mammalia, thence called Quadrupeds. Some Mammalia have only two limbs, as the Cetacea, and then the place of the hinder limbs is occupied by a single bone enveloped in the flesh.

(28.) THE ANTERIOR or PECTORAL LIMBS, *Lat.* Artus pectorales seu antici, *Fr.* Les Membres antérieurs, *Germ.* Brustgliedmassen, Vordergliedmassen,—are the extremities attached to the thorax, each consisting of a shoulder-blade, arm, fore-arm, and a hand, or more commonly a foot. These have no distinct articulations with the trunk, but are wholly isolated, except when the collar-bones happen to be present.

(29.) THE HINDER or POSTERIOR LIMBS, *Lat.* Artus abdominales seu postici, *Fr.* Les Membres postérieurs, *Germ.* Bauchgliedmassen, Hintergliedmassen,—are the extremities articulated to the pelvis, each consisting of a thigh, a leg, and most commonly a foot, or sometimes a hand.

(30.) THE SHOULDER, *Lat.* Humerus, *Fr.* L'Épaule, *Germ.* Schulterglied,—is the first articulation or joint of the anterior limbs, comprehending the shoulder-blade and collar-bone.

(31.) THE SCAPULA or SHOULDER-BLADE, *Lat.* Scapula, *Fr.* L'Omo-plate, *Germ.* Schulter-blatt,—is the broad and flat bone of the shoulder, placed on the chest towards the spinal column.

(32.) THE CLAVICLE or COLLAR-BONE, *Lat.* Clavicula, *Fr.* La Clavicule, *Germ.* Schlüsselbein,—is the other bone of the shoulder, situate between the shoulder-blade and the breast-bone. It is said to be perfect in all animals which can raise their fore-limbs to the mouth. In most of the Carnassiers and Rodentia it is imperfect; while it is wholly wanting in all animals specially intended for walking and running.

(33.) THE HUMERUS or SHOULDER-BONE, *Lat.* Brachium seu Os Humeri, *Fr.* L'Humérus, *Germ.* Ober-Arm,—is the second articulation or joint of the fore-limb inserted upon the shoulder-blade, and bearing the fore-arm at its other end.

(34.) THE FORE-ARM, *Lat.* Anti-Brachium, *Fr.* L'Avant-Bras, *Germ.* Unter-Arm,—is the third joint of the fore-limb, supported by the shoulder-bone, and articulated to the wrist at the other end. Sometimes it is simple, or almost consisting of only one bone, as in the Ruminantia and Solipeda; and sometimes it is double. In the latter case, it consists of the ulna and radius, which may be free, and capable of moving one over the other, as in Man and the Apes; or fixed, as in the greater part of the Carnassiers and Rodentia.

(35.) THE ULNA, *Lat.* Ulna, *Fr.* Le Cubitus, *Germ.* Ellenbogenbein,—is the primary bone of the fore-arm, articulated by a hinge-joint to the shoulder-bone, and having a process or projection at its hinder and upper extremity, forming THE BONE OF THE ELBOW, *Lat.* Olecranon, *Fr.* L'Olécrane, *Germ.* Ellenbogenhöcker.

(36.) THE RADIUS, *Lat.* Radius, *Fr.* Le Radius, *Germ.* Speiche, Spindel,—the remaining bone of the fore-arm, is sometimes reduced to the rudimental state, and forms merely an apophysis of the ulna, as in the Solipeda and Ruminantia.

(37.) THE HAND [in Man], THE FORE HAND [in the Apes], THE FORE PAW, or FORE FOOT [in Quadrupeds], THE FIN [in the Cetacea], *Lat.* Manus seu Pes anticus, *Fr.* La Main, *Germ.* Hand oder Vorderfuss,—consists of all the remaining articulations of the fore-limb taken together, being the carpus, metacarpus, and phalanges.

(38.) THE CARPUS or WRIST-BONES, *Lat.* Carpus, *Fr.* Les Os carpiens, *Germ.* Oberhand,—is the basal joint of the hand, nearest to the Ulna, and consisting of several small bones, usually disposed in two rows. They never exceed nine, nor are less than five in number.

(39.) THE METACARPUS, *Lat.* Metacarpus, *Fr.* Les Métacarpéens, *Germ.* Mittelhand,—is the joint contained between the wrist and the finger-bones. The number of metacarpal bones is variable, as they usually correspond with the fingers, though sometimes they merely represent a rudimentary finger. There are five of these bones in the hands of Man, the Apes, and the greater part of the Carnassiers, and four in the Hippopotamus and Hogs. There are three in the Horse, a principal one called the CANNON or SHANK-BONE (*Fr.* Le canon), and two rudimentary called the SPLENT-BONES (*Fr.* Les péronés). The Ruminantia have two metacarpal bones united into a single Cannon bone.

The total length of the Carpus and Metacarpus varies in an inverse sense to that of the humerus. Thus, animals with a very short humerus have very long cannon bones.

(40.) THE FINGERS or TOES, *Lat.* Digni, *Fr.* Les Doigts ou Orteils, *Germ.* Finger, Zehen,—usually articulated, form the apex of the hand or fore-foot.

(41.) THE PHALANGES, *Lat.* Phalanges, *Fr.* Les phalanges, *Germ.* Fingerglieder,—are the articulations of each finger. Among the quadrupeds, every finger, excepting the thumb, has three phalanges, of which the last supports the nail or hoof. The thumb has only two phalanges, and is often wanting. In the Cetacea, the fingers are formed of a considerable number of flattened phalanges, united together by cartilages, so as to form a kind of fin.

(42.) THE LAST PHALANX, *Lat.* Rhizonychium, *Fr.* Le dernier phalange, *Germ.* Klauenglied, Nagelglied,—bears the nail or hoof, and varies in its form and dimensions, according to the figure and disposition of its horny covering.

(43.) THE FEMUR or THIGH-BONE, *Lat.* Femur, *Fr.* Le fémur, *Germ.* Schenkel (Hüfte)—is united to the pelvis, and forms the first articulation of the hinder limb. It corresponds to the Humerus of an anterior extremity.

(44.) THE SHIN-BONE or TIBIA, *Lat.* Tibia, *Fr.* Le tibia, *Germ.* Schiene (Schenkel)—is the second articulation of a hinder limb. It is supported by the femur, and articulated to a foot or hand at its other extremity.

(45.) THE FIBULA, *Lat.* Fibula, *Fr.* Le péroné, *Germ.* Wadenbein,—is a long bone, sometimes added to the Tibia, though often wanting.

The Tibia and Fibula correspond to the Ulna and Radius of the Fore-arm, and present the same variations. Sometimes these bones are very distinct, and moveable one over the other, as in the Apes and Makis. Sometimes they are distinct, though but slightly moveable. Most commonly the Fibula is the mere rudiment of a bone. In most Mammalia, the Tibia and Fibula together form the LEG. In the Horse and other digitigrade Quadrupeds, this is improperly styled THE THIGH.

(46.) THE FOOT [in Man], THE HINDER-HAND [in the Apes], THE HINDER-PAW or HINDER-FOOT [in Quadrupeds], THE HAND [in the Opossums], *Lat.* Pes, *Fr.* Le pied, *Germ.* Fuss, Hinter-fuss,—includes all the remaining articulations of a hinder-limb, being the Tarsus, Metatarsus, and Phalanges.

(47.) THE TARSUS or INSTEP, *Lat.* Tarsus, *Fr.* Le tarse, *Germ.* Oberfuss, Fusswurzel,—the basal joint of the foot, nearest to the Tibia, consists of several bones, never exceeding seven in number. In the Horse, this is called THE HOCK.

(48.) THE METATARSUS, *Lat.* Metatarsus, *Fr.* Le métatarse, *Germ.* Mittelfuss,—is the second joint of the foot, between the Tarsus and Phalanges. It never consists of more than five bones corresponding to the toes, or of less than two, which, however, may sometimes become united together, so as to form one bone. It consists, in the Horse, of a CANNON or SHANK-BONE, and SPLENT-BONES, as in the Metacarpus.

(49.) THE TOES and PHALANGES may be compared to the corresponding parts of the anterior limb. See (40.) (41.) and (42.)

(50.) THE ELBOW, *Lat.* Cubitus, *Fr.* Le coude, *Germ.* Ellenbogen,—is at the junction of the Humerus and Fore-arm.

(51.) THE WRIST, *Lat.* Flexura, *Fr.* Le poignet, *Germ.* Handbeuge,—is at the junction of the fore-arm and carpus. In the Horse, and other digitigrade quadrupeds, this is very improperly called THE KNEE.

(52.) THE KNEE, *Lat.* Genu, *Fr.* Le genou, *Germ.* Knie.—is at the union of the Femur and Tibia. In the Horse, it receives the name of the STIFLE JOINT.

(53.) THE PATELLA or KNEE-PAN, *Lat.* Patella seu rotula, *Fr.* La rotule, *Germ.* Kniescheibe,—is a small isolated bone in front of the knee.

(54.) THE HAM, *Lat.* Poplites, *Fr.* Le jarret, *Germ.* Kniekehle.—is the hollow part at the back of the knee, in Man and the Apes. This part is concealed in the Horse, and all digitigrade quadrupeds.

(55.) THE ANKLE-JOINT, *Lat.* Suffrago, *Fr.* L'articulation de la cheville, *Germ.* Fussbonge, Hakkengelenk,—is at the union of the Tibia and Tarsus. This is the HOCK-JOINT or HINDER-KNEE of the Horse.

(56.) THE HEEL, *Lat.* Calcaneus, Talus, seu Calx, *Fr.* Le Talon, *Germ.* Hakken, Ferse,—is the hindermost point of the Tarsus. In the Horse, this is called the POINT OF THE HOCK.

(57.) THE ANKLE, *Lat.* Malleolus, *Fr.* La cheville, *Germ.* Knöchel,—is the inner process or projection at the end of the Tibia.

(58.) THE PASTERN or FETLOCK-JOINT, *Fr.* L'articulation du fanon, ou le boulet, *Germ.* Hüfhaaregelenk, in digitigrade quadrupeds,—is the joint at the extremity of the metatarsus in the hinder-leg, or of the metacarpus in the fore-leg.

(59.) THE UPPER PASTERN, *Lat.* Os Suffraginis, *Fr.* Le pâturon, *Germ.* Fessel,—in digitigrade quadrupeds, is the second bone from the hoof, adjoining the fetlock, corresponding to the first phalanx in Man.

(60.) THE LOWER PASTERN or CORONET-BONE, *Lat.* Os coronæ, *Fr.* La couronne, *Germ.* Krone,—in digitigrade quadrupeds, is the bone next to the hoof, corresponding to the second phalanx in Man.

(61.) THE COFFIN-BONE, *Lat.* Os pedis, *Fr.* L'Os du sabot, *Germ.* Hüfbein,—is the bone of the hoof, analogous to the last phalanx of the finger in Man.

II.—THE HEAD IN GENERAL.

(62.) THE VERTEX, or TOP OF THE HEAD, *Lat.* Vertex, *Fr.* Le vertex, *Germ.* Scheitel,—is the highest portion of the skull, in a line drawn between the ears, perpendicularly upwards.

(63.) THE SINCIPUT, or FORE-PART OF THE HEAD, *Lat.* Sinciput, *Fr.* Le sinciput, *Germ.* Vorderkopf,—is that portion of the head reaching from the vertex to the eyes.

(64.) THE OCCIPUT, OR HINDER-PART OF THE HEAD, *Lat.* Occiput, *Fr.* L'occiput, *Germ.* Hinterkopf,—is that portion of the skull extending from the vertex backwards to the cervical vertebrae.

(65.) THE FACE, *Lat.* Vultus, *Fr.* La face, *Germ.* Antlitz,—placed at the anterior part of the skull, contains most of the organs of sense. See (7.)

(66.) THE FOREHEAD, *Lat.* Frons, *Fr.* Le front, *Germ.* Stirn,—is that portion of the Sinciput, extending from the eyes to the anterior margin of the vertex. It is said to be

(67.) PROPORTIONATE, *Lat.* Proportionata, *Fr.* Proportionné, *Germ.* Ebenmässige Stirn,—when it occupies a third-part of the length of the face;

(68.) HIGH, *Lat.* Alta, *Fr.* Haut, *Germ.* Hohe, lange,—when it is longer than the third-part; and

(69.) LOW, *Lat.* Brevis, *Fr.* Bas, *Germ.* Kurze,—when shorter. The Forehead is very open in Man and some Apes.

(70.) THE MUZZLE, *Lat.* Rostrum, *Fr.* Le museau, *Germ.* Schnauze,—is the prolongation of the face.

(71.) THE FACIAL ANGLE, *Lat.* Angulus facialis, *Fr.* L'angle facial, *Germ.* Gesichtswinkel,—is the angle, more or less acute, formed between two imaginary lines, the one drawn from the external hole of the ear to the extreme point of the upper-jaw next to the teeth, and the other from the latter point as a tangent to the most prominent part of the forehead. This angle is seldom measured except in Man and the Apes. In the former it varies from 90° to 70°, and in the latter from 65° to 30°. Of all Mammalia, the Orang-Outang has, next to Man, the most open facial angle, and the Great Ant-eater (*Myrmecophaga jubata*), the most acute.

(72.) THE TEMPLES, *Lat.* Tempora, *Fr.* Les tempes, *Germ.* Schläfen,—are the portions of the head on each side of the forehead, situate above a line drawn from the eye to the ear.

(73.) THE CHEEK, *Lat.* Bucca, *Fr.* La joue, *Germ.* Bakke,—is that portion of the face extending from the corners of the nose and mouth to the ear.

(74.) THE UPPER-CHEEK, *Lat.* Gena, *Fr.* La joue supérieure, *Germ.* Wange,—is that portion of the cheek between the eye and the ear, immediately covering the zygomatic arch.

(75.) THE UNDER-CHIN, *Lat.* Inguvies, *Fr.* La partie inférieure du menton, *Germ.* Unterkinn,—is that portion of the lower jaw between the external margin of its branches and the throat.

(76.) THE UNDER-CHEEK, *Lat.* Mala, *Fr.* La partie inférieure de la joue, *Germ.* Kinnbakke,—is the hinder-part of the lower jaw, extending beneath a line drawn from the corner of the mouth to the ear, and thence downwards to the lower margin of the face.

(77.) THE PAROTID REGION, *Lat.* Regio parotica, *Fr.* La région parotique, *Germ.* Ohrengegend,—is the part of the head round the ears.

(78.) THE OPHTHALMIC REGION, *Lat.* Regio ophthalmica, *Fr.* La région ophthalmique, *Germ.* Augengegend,—is the region around the eyes.

(79.) THE NASAL REGION, *Lat.* Regio nasalis, *Fr.* La région nasale, *Germ.* Nasengegend,—is that portion of the face around the nose.

(80.) THE ORAL REGION, *Lat.* Regio oris, *Fr.* La région orale, *Germ.* Mundgegend,—is the part round the mouth.

(81.) THE SUPERCILIARY RIDGES, *Lat.* Cristæ superciliares, *Fr.* Les crêtes sureilières,—are projections of the frontal bone, placed horizontally over the orbits of the eyes. These are found in certain Apes.

(82.) THE SAGITTAL RIDGES, *Lat.* Cristæ sagittales, *Fr.* Les crêtes sagittales,—are found on the top of the head at the upper part of the parietal bone when single, or at the junction of the parietal bones. They are found particularly among the Carnassiers.

(83.) THE OCCIPITAL RIDGES, *Lat.* Cristæ occipitales, *Fr.* Les crêtes occipitales,—are placed transversely on the occipital bone, and form the point of attachment for the muscles which raise the head, as well as for the cervical ligament in the Apes, Carnassiers, Ruminantia, Solipeda, and others.

In respect to its form and size the HEAD may be

(84.) ROUND, *Lat.* rotundum, *Fr.* arrondie, as in Man and most Apes;

(85.) LENGTHENED, *Lat.* elongatum, *Fr.* alongée, as in the Horse;

(86.) GREATLY LENGTHENED, *Lat.* prælongum, *Fr.* très alongée, as in the Great Ant-eater;

(87.) PYRAMIDAL, as in the Howling Apes;

(88.) VERY LARGE, *Lat.* prægrande, *Fr.* démesurément grosse, as in the Whales, Cachalots, and Elephants;

(89.) MIDDLE-SIZED, *Lat.* medium, *Fr.* moyenne, as in the Dog;

(90.) SMALL, *Lat.* parvum, *Fr.* petite, as in the Ai;

(91.) FLATTENED, *Fr.* aplatie, and

(92.) DUCK-BILLED, *Fr.* En bec de canard, as in the Ornithorhynchus.

(93.) THE ORBITAL FOSSÆ, *Lat.* Fossæ orbitales, *Fr.* Les fosses orbitales,—are the cavities in the skull, for the reception of the eyes. They may be

(94.) ANTERIOR, *Fr.* antérieures, as in Man and the Apes;

(95.) LATERAL, *Fr.* latérales, as in the Rodentia.

(96.) THE TEMPORAL FOSSÆ, *Lat.* Fossæ temporales, *Fr.* Les fosses temporales,—are the depressions of the temples. Sometimes they are

(97.) DISTINCT, *Fr.* distinctes,—when they are separated from the orbital fossæ, as in Man and the Apes;

(98.) COMMUNICATING, *Fr.* communiquans,—when they are united to the orbital fossæ by the bottom of the latter, as in the Horse.

(99.) MARGINED, *Fr.* marginées,—when the orbital and temporal fossæ have a common margin, as in the Carnassiers and Rodentia.

(100.) THE NASAL FOSSÆ, *Lat.* Fossæ nasales, *Fr.* Les fosses nasales,—are the holes in the skull corresponding to the apertures of the nose.

III.—THE ORGAN OF HEARING.

(101.) THE EAR, *Lat.* Auris, *Fr.* L'oreille, *Germ.* Ohr,—is the organ of hearing. See pages 8 and 35.

(102.) THE HOLE OF THE EAR, *Lat.* Meatus auditorius externus, *Fr.* Le conduit auditif externe, *Germ.* Gehörgang,—is the tube of the ear opening externally.

(103.) THE AURICLE OR EXTERNAL EAR, *Lat.* Auricula, seu Concha, *Fr.* La conque externe, *Germ.* Aussenres Ohr, Ohrmuschel,—is a hollow cartilaginous cavity, for conveying the vibrations of the air into the internal ear. It is wholly wanting in the Cetacea, the Seals, the Rat-Moles, Common Moles, and some others.

(104.) THE HELIX, *Lat.* Heligma, seu Helix, *Fr.* L'hélix, *Germ.* Ohrleiste,—is the outer and hinder margin of the Ear, usually convoluted.

(105.) THE ANTHELIX, *Lat.* Anthelix, *Fr.* L'anthelix, *Germ.* Gegenleiste,—is the inner margin of the Ear, running almost parallel with the helix.

(106.) THE TRAGUS, *Lat.* Tragus, *Fr.* L'oreillon ou le tragus, *Germ.* Ohr Ekke,—is the projection at the anterior margin, immediately before the hole of the ear. It assumes an enormous size in some Bats.

(107.) THE ANTITRAGUS, *Lat.* Antitragus, *Fr.* L'anti-tragus, *Germ.* Gegen Ekke,—is the hinder process of the ear, opposite the Tragus.

(108.) THE LOBE, *Lat.* Lobulus, *Fr.* Le lobule, *Germ.* Ohrläppchen,—is the lowest part of the ear below the Tragus.

The AURICLE is said to be

(109.) OPERCULATED, *Lat.* Auricula operculata, *Fr.* L'oreille operculée, *Germ.* Gedekkeltes Ohr,—when the tragus lines the ear, so that it appears to be double;

(110.) MARGINATED, *Lat.* Auricula marginata, *Fr.* L'oreille rebordée, *Germ.* Gerandetes Ohr,—when it is supplied with a convoluted helix;

(111.) RUDIMENTARY, *Lat.* Auricula abseondita, *Fr.* L'oreille rudimentaire, *Germ.* Versteckte Ohren,—when it is almost concealed, as in the Marmot.

(112.) ROUNDED, *Fr.* arrondie, and

(113.) APPLIED TO THE HEAD, *Fr.* appliquée contre la tête,—as in Man, and such of the Apes as most resemble him;

(114.) ANGULAR, *Fr.* anguleuse,—as in the Macacos and Baboons;

(115.) HORN-SHAPED, *Fr.* En cornet,—with the opening in front, and the base enlarged, as in Cats, Dogs, and Weasels;

(116.) PEDUNCULATED, *Fr.* pedonculée,—in the form of an elongated horn, with a kind of branch, which gives it great mobility, as in the Ruminantia, the Horse, and Rhinoceroses.

(117.) THE AURICULAR OPERCULUM, *Lat.* Opereulum auriculare, *Fr.* L'oreillon, *Germ.* Ohrdekkel. This term is applied to the tragus, when it is elongated so as almost to cover the auricular cavity.

IV.—THE ORGAN OF VISION.

(118.) THE EYE, *Lat.* Oculus, *Fr.* L'œil, pl. les yeux, *Germ.* Auge,—is the organ of vision.

(119.) THE EYE-BALL, *Lat.* Bulbus oculi, *Fr.* Le globe de l'œil, *Germ.* Aug Apfel,—is the body of the eye, more or less globular, composed of membranes and humours.

(120.) THE CONJUNCTIVE MEMBRANE, *Lat.* Tunica conjunctiva seu adnata, *Fr.* La conjonctive, *Germ.* Verbindende Augenhaut,—is the anterior membrane of the eye-ball, being a continuation of the skin of the eye-lids.

(121.) THE EYE-LIDS, *Lat.* Palpebræ, *Fr.* Les paupières, *Germ.* Augenlieder,—are moveable cutaneous coverings, enveloping the whole or a part only of the eye.

(122.) THE SCLEROTICA, OR WHITE OF THE EYE, *Lat.* Tunica sclerotica, *Fr.* La sclérotique, *Germ.* Weisse Augenhaut,—is a firm and white membrane, covering the Eye-ball, and seen partially on its external surface.

(123.) THE CORNEA, *Lat.* Tunica cornea, *Fr.* La cornée, *Germ.* Hornhaut,—is that transparent anterior membrane or coat of the eye filling the circular aperture of the sclerotica.

(124.) THE IRIS, *Lat.* Iris, seu Tunica iridea, *Fr.* L'iris, *Germ.*

Regenbogenhaut,—is the coloured circle of the eye, seen through the Cornea. It varies in colour, from light-blue to yellow, or deep orange, and is most commonly of a deep yellow or brown colour.

(125.) THE PUPIL, *Lat.* Pupilla, *Fr.* La pupille, *Germ.* Sehe,—is the dark central disc of the eye, surrounded by the iris. When fully dilated it is most commonly round.

(126.) THE ORBIT, *Lat.* Orbita, *Fr.* L'orbite, *Germ.* Augenhöhle,—is the external margin of the cavity of the skull, destined to contain and protect the eye-ball.

(127.) THE APERTURE OF THE EYE, *Lat.* Apertura oculi, *Fr.* L'ouverture de l'œil, *Germ.* Augenöffnung,—is the space occupied by the eye-ball, and appearing externally when the eye-lids are drawn back.

(128.) THE ANGLES OF THE EYES, *Lat.* Canthi oculorum, *Fr.* Les angles des yeux, *Germ.* Augenwinkel,—are the corners formed on each side by the joining of the eyelids.

(129.) THE INTERNAL OR NASAL ANGLE, *Lat.* Canthus nasalis, *Fr.* L'angle intérieur ou nasal, *Germ.* Nasenwinkel,—is the inner corner of the eye nearest to the nose.

(130.) THE EXTERNAL OR TEMPORAL ANGLE, *Lat.* Canthus temporalis, *Fr.* L'angle extérieur, *Germ.* Schläfenwinkel,—is the outer corner of the eye nearest to the ear.

(131.) THE NICTITATING MEMBRANE, *Lat.* Membrana nictitans, *Fr.* La troisième paupière, *Germ.* Blinzhaut,—is a cutaneous covering of the eye placed at the nasal angle, and capable of covering it like a curtain.

(132.) THE LACHRYMAL FOSSA, *Lat.* Fossa lacrymalis, *Fr.* La fosse lacrymale, *Germ.* Thränengrube,—is the dilated upper extremity of a duct, in the nasal angle of the eye, for conveying the tears from the eye to the nose.

(133.) THE SUB-ORBITAL SINUS, *Lat.* Sinus suborbitalis, *Fr.* Le Larmier,—is a naked furrow beneath the eye, secreting a peculiar humour, as in the Antelopes.

The EYES are said to be

(134.) RUDIMENTARY, *Fr.* Rudimentaires,—when they are not visible externally, and some minute traces alone can be discovered beneath the skin, as in the Blind-rat (*Spalax typhlus*);

(135.) APPARENT, *Fr.* Apparens,—when they are visible externally, as most commonly happens in the other Mammalia.

In respect to their size, the EYES may be

(136.) VERY LARGE, *Fr.* Très-grands,—in many nocturnal animals, and several aquatic species, as the Galagos, Hares, Flying-Squirrels, Seals, and Otters;

(137.) MEDIUM SIZE, *Fr.* mediocres ou moyens,—as in most terrestrial quadrupeds; or

(138.) SMALL OR VERY SMALL, *Fr.* Petits ou très-petits,—as in subterraneous species, such as the Moles, and Cape-Moles (*Bathyergus*), or in some nocturnal species, as the Bats.

The EYES may vary in their relative position, and are said to be

(139.) ANTERIOR, *Fr.* Antérieurs,—when they are directed in front, and more or less approaching to each other, so that their visual axes are nearly parallel, as in Man and the Apes; or

(140.) LATERAL, *Fr.* Latéraux,—when they are widely separate, and placed on the sides of the head, as in the Hares and other Rodentia, and generally in most herbivorous animals, where the eyes have nearly the same visual axis.

The CORNEA may have different degrees of projection. It is

(141.) VERY CONVEX, *Fr.* Très bombé,—in the nocturnal species, as the Galagos, also in the Tapir and Hare;

(142.) ORDINARY, *Fr.* Ordinaire,—as in most diurnal Mammalia; and

(143.) FLAT, *Fr.* Plat,—as in species which are habitually immersed in water, such as the Seals and Cetacea.

(144.) THE CARPET OF THE EYE, *Lat.* Tapetum lucidum, *Fr.* Le tapis,—is a portion of the choroid coat, situate at the bottom of the eye, opposite to the point where the optic nerve enters. It is variously coloured in different Mammalia. See page 35.

V.—THE ORGAN OF SMELLING.

(145.) THE NOSE, *Lat.* Nasus, *Fr.* Le nez, *Germ.* Nase,—is the organ of smelling. See pages 8^a and 36.

(146.) THE NOSTRILS, *Lat.* Nares, *Fr.* Les narines, *Germ.* Nasenlöcher,—are the two external orifices of the nose for admitting the air. These are said to be

(147.) CLOSE, *Fr.* Peu ouvertes,—when they consist of simple clefts but slightly open, as in the Apes, some Carnassiers, and Rodentia;

(148.) CAVERNOUS, *Fr.* Caverneuses,—when they open into large cavities, as in the Horse, the Ass, and Hippopotamus;

(149.) SPIRAL, *Fr.* En spirale,—when they are convoluted, as in the Makis;

(150.) OPERCULATED, *Fr.* Operculées,—when they are closed by a lid, as in some Bats, especially of the genus *Nycteris*;

(151.) OBLERATE, *Lat.* Obserata,—when the nostrils can be closed by muscles at the will of the animal, as in the Seals.

(152.) THE SPIRACLES, *Lat.* Spiracula, *Fr.* Les événements, *Germ.* Luftlöcher, in *Dutch* Lugtstippen,—are nostrils united together, and placed at the top of the head, as in the Whales, through which these animals discharge the enormous quantity of water swallowed while pursuing their prey.

(153.) THE PARTITION OF THE NOSTRILS, *Lat.* Dissepimentum seu septum narium, *Fr.* La division des narines, *Germ.* Nasenscheidewand,—is found in most Mammalia.

(154.) THE EXTERNAL NOSE, *Lat.* Nasus externus, *Fr.* Le nez extérieur, *Germ.* Aussere Nase,—is the external part of the face containing the nostrils.

(155.) THE BULB OF THE NOSTRIL, *Lat.* Pterygium, Rima, *Fr.* La bulbe du nez, *Germ.* Nasenflügel,—is the expanded part on each side of the external wall of the nose.

(156.) THE SNOUT, *Lat.* Rhinarium, *Fr.* Le museau, *Germ.* Nasenkuppe,—is the extreme part of the nose, distinguished by a smooth granular and moistened surface, on the sides of which the nostrils are commonly placed.

(157.) THE CHILOMA, *Lat.* Chiloma, *Fr.* Le muse, *Germ.* Maul,—forms the projecting muzzle of some Ruminants. It is wanting in the Sheep, Goats, Camels, some Stags, the Musk-Ox, and a few others; in most of the remainder it swells outwards, and comprises the upper lip and the part of the nose immediately adjoining.

The NOSE, which is usually placed in the middle of the face, may be

(158.) PROMINENT, *Lat.* Prominulus, *Fr.* Proéminent, *Germ.* vorragende,—when it projects beyond the upper lip, as in Man, and the Proboscis Monkey (*Nasalis larvatus*), in which cases the nostrils are inferior;

(159.) FLATTENED, *Lat.* Inpressus, *Fr.* Camus, *Germ.* Gepletsehte,—when it is depressed within the upper lip, and begins to resemble a muzzle, as in most of the Apes;

(160.) SPREADING, *Lat.* Repandus, *Fr.* Repandu, *Germ.* Verbreitete,—when its extremity is broader than the rest of the nose;

(161.) POINTED, *Fr.* Pointu,—when the head is narrowed in front, so as to make the nose entirely terminal, as in the Makis, Moles, and Ant-eaters;

(162.) SHORT, *Lat.* Abbreviatus, *Fr.* Court, *Germ.* Kurze,—when the head is not prolonged, so that the nose scarcely projects, as in the Cats, and most Rodentia;

(163.) TUBULAR, *Lat.* Tubulosus, *Germ.* Röhrlige,—when the nose terminates in a tube inclosed on every side, and having no perceptible bulb;

(164.) HOOKED, *Lat.* Resimus, *Fr.* Crochu, *Germ.* Ramsnase, Umgebogne Nase,—when it is curved downwards, so that the ridge of the nose forms an arch;

(165.) TURNED-UP, *Lat.* Simus, *Germ.* Stülpnase, Aufgebogne Nase,—when it is curved upwards, so that the upper ridge appears hollow;

(166.) SIMPLE, *Lat.* Simplex, *Fr.* Simple, *Germ.* Einfache,—when the nose is destitute of any remarkable appendage or sinuosity, as in most Mammalia; and

(167.) COMPLICATED, *Lat.* Complex, *Fr.* Conpliqué,—when it is ornamented with naked membranes, more or less developed.

(168.) THE NASAL APPENDAGE, *Lat.* Prosthemium, *Fr.* La feuille membraneuse, *Germ.* Nasen-Ansatz,—this term is applied to the leaf-like membrane superadded to the nose, found in many Genera of Bats. The nasal appendage is said to be

(169.) FOLIATED, *Lat.* Foliatum, *Fr.* Folliculé, *Germ.* Geblättert,—when it is shaped like a simple leaf;

(170.) CORDATE, *Lat.* Cordatum, *Fr.* En forme de cœur, *Germ.* Geherzte,—when in the form of a heart;

(171.) FUNNEL-SHAPED, *Lat.* Infundibuliforme, *Fr.* Infundibulifère, *Germ.* Trichterförmige,—when it resembles the funnel of a chimney;

(172.) HASTATE, *Lat.* Hastatum, *Fr.* En forme de fer-de-lance, *Germ.* Spiessförmige,—when it assumes the form of a lance;

(173.) LYRATE, *Fr.* En forme de lyre,—when it is shaped like a lyre;

(174.) CRISTATE, *Lat.* Cristatum, *Germ.* Kammandige,—when the margins of the nostrils are surrounded with small folds or crests; and

(175.) STELLATED, *Fr.* En forme d'étoile,—when the nostrils are surmounted with a membrane in the form of a star.

The NOSE is said to be

(176.) PROBOSCIDEAL, *Lat.* Proboscideus, *Fr.* En forme de trompe, *Germ.* Rüsselförmige,—when it extends slightly beyond the point of the jaw and is moveable, as in the Coatis (*Nasua*).

(177.) THE PROBOSCIS, *Lat.* Proboscis, *Fr.* La trompe, *Germ.* Rüssel,—is a very long and moveable muzzle, as in the Elephants and Tapirs.

(178.) THE CHANFRIN, *Fr.* Le chanfrein,—is the upper part of the nose, comprised between the forehead and the nostrils. It is observed to be arched upwards in the Sheep; curved in an opposite direction in

the Goats; armed with one or two horns in the Rhinoceros, and furrowed longitudinally, as in the Bats of the Genus *Nycteris*.

VI.—THE MOUTH AND ORGANS OF TASTE.

(179.) THE CAVITY OF THE MOUTH, *Lat.* Cavum oris, *Fr.* La cavité de la bouche, *Germ.* Mundhöhle,—is the hollow place formed by the jaws and cheeks, commonly divided into three portions; the *superior*, between the tongue and the palate; the *inferior*, between the tongue and the lower jaw; and the *anterior*, between the tongue and the teeth or lips.

(180.) THE LIPS, *Lat.* Labia, *Fr.* Les lèvres, *Germ.* Lippen,—are the extremities of the skin, upon the external margins of the jaws, distinguished into the *upper* and *lower lip*.

(181.) THE CORNERS OF THE MOUTH, *Lat.* Anguli oris, *Fr.* Les angles de la bouche, *Germ.* Mundwinkel,—are the angles, formed at the points of union of the lips.

(182.) THE OPENING OF THE JAWS, *Lat.* Rictus, *Fr.* La gueule, *Germ.* Mundöffnung,—is the distance of one jaw from the other when the mouth is distended.

(183.) THE CHEEK-POUCHES, *Lat.* Sacculi buccales, *Buccæ saccatæ*, seu *Thesauri*, *Fr.* Les abajoues, *Germ.* Bakkentaschen,—are cutaneous sacs in each cheek within the cavity of the mouth, and fitted for holding food.

(184.) THE GUMS, *Lat.* Tomia, *Fr.* Les Gencives, *Germ.* Lachnrand, —are the margins of the jaws within the mouth, adapted for mastication, and on which the teeth are most commonly placed.

(185.) THE ALVEOLAR CAVITIES, *Lat.* Alveoli, *Fr.* Les fosses alvéolaires, *Germ.* Zahnhöhle,—are the depressions of the jaws, into which the teeth are inserted.

(186.) THE TONGUE, *Lat.* Lingua, *Fr.* La langue, *Germ.* Zunge,—the principal organ of taste, supplied with nervous papillæ (see p. 36), is most commonly fleshy and flexible. It may be

(187.) MEDIUM-SIZED, OVAL, AND FLAT, *Fr.* Médiocre, ovale, et aplatic,—as in Man, the Apes, and many other Mammalia;

(188.) LONG, AND VERY THIN, *Fr.* Lougue et très mince,—as in most Carnassiers, especially the Dogs and Cats;

(189.) LONG AND THICK, *Fr.* Longue et épaisse,—as in the Horse and Ruminantia, in which animals it serves to pluck the herbage;

(190.) VERY LONG AND VERMIFORM, *Fr.* Très-longue et vermiforme,—as in the Ant-eaters, Armadilloes, and Orycteropus.

In respect to its movements, the TONGUE may be

(191.) EXTENSIBLE, *Fr.* Extensible,—in a greater or less degree, as in Man, the Apes, the Carnassiers, Rodentia, Pachydermata, and Ruminantia;

(192.) VERY EXTENSIBLE, OR PROTRACTILE, *Fr.* Très extensible, ou protractile,—as in the Ant-eaters, Orycteropus, Armadilloes, and the Bats of the Genus *Glossophaga*;

(193.) FIXED, *Fr.* fixée,—by the entire of its lower surface, as in the Cetacea.

The surface of the TONGUE may be

(194.) SMOOTH, *Fr.* Douce,—when the papillæ, with which it is covered, are fine and soft, as in Man, the Apes, Dogs, Ant-eaters, Cetacea, and many others;

(195.) ROUGH, *Fr.* Rude,—when the papillæ are horny, and have their points directed backwards, as in the Cats, Civets, Opossums, and the Bats of the Genera *Phyllostoma* and *Pteropus*;

(196.) SCALY, *Fr.* Ecaillée,—when its sides are protected with large scales, having two or three points terminating in an angle, as in the Porcupines;

(197.) FUNNEL-SHAPED,—when its point terminates in a disc, shaped like a cupping-glass, as in the Bats of the Genus *Glossophaga*; and

(198.) FURROWED, *Fr.* Sillonée,—when its upper surface is marked with a longitudinal furrow.

VII.—THE TEETH,

IN RESPECT TO THEIR TEXTURE, PARTS, AND FORM.

(199.) THE IVORY, *Lat.* Substantia ossea, *Fr.* L'ivoire, *Germ.* Knochenmass,—is the central or bony part of the teeth, usually constituting the principal part of its substance.

(200.) THE PROPER IVORY, *Lat.* Ebur, *Fr.* L'ivoire proprement dit, *Germ.* Elfenbein,—is the same bony substance, when composed of conical layers, as in the Tusks of the Elephant.

(201.) THE ENAMEL, *Lat.* Substantia vitrea, *Fr.* L'émail, *Germ.* Schmelz,—is the white, hard, and dense substance covering the teeth externally, or intersecting them internally.

(202.) THE CORTEX, *Lat.* Indumentum corticale, seu *Cementum*, *Fr.* Le Cortical, *Germ.* Zahnkütt,—is a substance of less density, covering the enamel, or connecting its interstices in compound teeth.

(203.) THE WHALE-BONE, *Lat.* Elasmia, *Fr.* Les fanons ou barbes, *Germ.* Barten,—horny laminae in place of teeth, hanging transversely from the sides of the palate.

(204.) THE ROOT OF A TOOTH, *Lat.* Radix, *Fr.* La racine, *Germ.* Zahnwurzel,—is the lower part of a tooth placed within the alveolar cavity and the gum, and most commonly destitute of enamel.

In respect to its ROOT, a TOOTH may be

(205.) MONO-RHIZAL, DI-RHIZAL, TRI-RHIZAL, OR POLY-RHIZAL,—according as it has one, two, three, or many roots;

(206.) CÆLORHIZAL,—when its root is hollow; or

(207.) STEREOHIZAL,—when its root is solid.

(208.) THE CROWN OF A TOOTH, *Lat.* Corona dentis, *Fr.* La couronne, *Germ.* Zahnkrone,—is the part of the tooth beyond the alveolar cavity and gum, serving for mastication.

(209.) THE NECK OF A TOOTH, *Lat.* Collum dentis, *Fr.* Le Collet, *Germ.* Zahnkranz,—is the interval more or less distinct, separating the crown from the root of a tooth.

(210.) A SIMPLE TOOTH, *Lat.* Dens obductus, *Fr.* Dent simple, *Germ.* Ueberlegter Zahn, Einfacher Zahn,—has its ivory entirely covered with enamel, but only on the exterior. It consists of a Root, a Neck, and a Crown, and being always of a determinate form, ceases to grow after having left the bulb whence it originated.

(211.) A COMPOUND TOOTH, *Lat.* Dens lancllosus, *Fr.* Dent composée, *Germ.* Blättriger Zahn,—has its ivory intersected with folds of enamel in every direction, so that it appears to be formed of perpendicular laminae.

(212.) A COMPLICATED TOOTH, *Lat.* Dens complicatus, *Fr.* Dent demi-composée, *Germ.* Schmelzfaltiger Zahn,—along with a simple root, has its crown more or less intersected with folds of enamel, but not so far as to separate the tooth into laminae.

(213.) THE RIDGE OF A TOOTH, *Lat.* Machæris, *Fr.* Le bord tranchant, *Germ.* Schmelzleiste,—is the sharp external line of a fold of enamel, emerging from the crowns of a compound or complicated tooth.

(214.) A FIBROUS TOOTH, *Lat.* Dens fibrosus, *Fr.* Dent fibreuse, *Germ.* Fasriger Zahn,—is composed of fibres or longitudinal tubes, resembling the stalk of a reed.

(215.) THE CUSPS OR POINTS, *Lat.* Cuspis, *Fr.* Les points, *Germ.* Zäkke,—are the sharp points on the crown of a tooth.

(216.) THE TUBERCLES, *Lat.* Tuberculum, *Fr.* Les tubercules, *Germ.* Zahnhöcker,—are the small blunt planes on the crown of a tooth.

A TOOTH is said to be

(217.) TEARING, *Lat.* Sectorius, *Fr.* Déchirante, *Germ.* Reiss Zahn,—when it terminates in a sharp point cutting unequally;

(218.) CONICAL, *Fr.* Conique,—when it varies in form from the Cylinder to the Oval or Ellipse (see page 88);

(219.) TRENCHANT, *Lat.* Incisorius, *Fr.* Tranchante, *Germ.* Schneide Zahn,—when it terminates in a sharp edge cutting equally (see page 88);

(220.) CHISEL-SHAPED, *Lat.* Cestriiformis, *Fr.* En ciseau-à-tailler, *Germ.* Meisselförmiger Zahn,—when a long and narrow trenchant tooth terminates in a thin edge, hollowed or scooped out on one side;

(221.) WEDGE-SHAPED, *Lat.* Acutatus, *Fr.* En biseau, *Germ.* Zugschärfter,—when a trenchant tooth is cut obliquely off at its extremity, as in the upper Incisors of most Rodentia, and the lower Incisors of some.

(222.) THE APEX, *Lat.* Scalprum, *Fr.* Le coin, *Germ.* Schneide,—is the point of the crown in a tearing, trenchant, chisel-shaped, or wedge-shaped tooth.

A TOOTH is said to be

(223.) UNICUSPIDATE, BICUSPIDATE, TRICUSPIDATE, OR MULTICUSPIDATE,—according as its crown ends in one, two, three, or many cusps;

(224.) TUBERCULOUS, *Lat.* Tuberculatus, *Fr.* Tuberculeuse, *Germ.* Höckriger,—when it is furnished with Tubercles or small blunt planes on its crown (see page 88);

(225.) CUSPIDATE, *Lat.* Cuspidatus, *Germ.* Zäkkiger,—when its crown is supplied with many cusps;

(226.) RIDGED, *Lat.* Rugosus, *Fr.* à collines transverses, *Germ.* Runziger,—when its crown is armed with several elevated ridges;

(227.) PLANE, *Lat.* Lævis, inermis, *Fr.* Plane, *Germ.* Glatte,—when its crown is smooth, and without cusps, tubercles, or ridges;

(228.) GROWING INDEFINITELY, *Lat.* Auctus, *Fr.* Poussant, *Germ.* Erweiterter,—when the crown continues to be pushed outwards on the sides, before, or behind, from its interior part, during the entire life of the animal, as in the Incisors of the Rodentia.

TEETH are said to be

(229.) HOMOGENEOUS, *Lat.* Homogenei, *Germ.* Gleichartige Zähne,—when they all resemble each other in form and texture; and

(230.) HETEROGENEOUS, *Lat.* Heterogenei, *Germ.* Ungleichartige Zähne,—when they differ in form and texture.

VIII.—THE TEETH,

IN RESPECT TO THEIR INSERTION AND POSITION.

A TOOTH is said to be

(231.) SEPARABLE, *Lat.* Injunctus, *Fr.* Séparable, *Germ.* Eingekelter Zahn,—when it has a distinct root inserted into an alveolar cavity of the jaw, and capable of being separated from it, as in the teeth of most Mammalia;

(232.) INSEPARABLE OR INNATE, *Lat.* Innatus, *Fr.* Inséparable, *Germ.* Eingewachsener Zahn,—when the tooth is inserted in its alveolar cavity, in such a way that it appears to be a continuous process or excrescence of the jaw-bone, so that it cannot be separated from it without fracture, as in the Molars of the Orycteropus or Cape Ant-eater;

(233.) IMPOSED, *Lat.* Impositus, *Fr.* Imposée, *Germ.* Eingefleischter Zahn,—when the tooth is merely attached to the gum, and has no alveolar cavity of its own;

(234.) ADHERENT, *Lat.* Agglutinator, *Fr.* Attachée, *Germ.* Angehefteter Zahn,—when a tooth is attached to the jaw or palate, without any distinct root, and solely by an intermediate membrane, as in the Ornithorhynchus.

(235.) MAXILLARY TEETH, *Lat.* Dentes maxillares, *Fr.* Les dents maxillaires, *Germ.* Ladenzähne,—are inserted on the jaws.

(236.) PALATINE TEETH, *Lat.* Dentes palatini, *Fr.* Les dents palatines, *Germ.* Gaumenzähne,—are inserted on the palate.

(237.) THE INCISORS OR FORE-TEETH, *Lat.* Dentes primores, *Fr.* Les incisives, *Germ.* Vorderzähne,—are maxillary teeth in the front of the mouth. These are distinguished into the *Upper Incisors*, placed, except in Man, upon the intermaxillary bone, and the *Lower Incisors* opposite to the former. (See page 86.)

(238.) THE MOLAR TEETH OR MOLARS, *Lat.* Dentes molares, *Fr.* Les dents molaires, *Germ.* Backenzähne,—are maxillary teeth placed far within the mouth, upon the hinder margins of the jaws. (See page 86.)

(239.) THE CANINE TEETH OR CANINES, *Lat.* Dentes canini, *Fr.* Les dents canines, *Germ.* Eckzähne,—are simple maxillary teeth, placed at the sides of the front teeth and near the corners of the mouth, whence they are sometimes called *corner teeth*. They are always pointed, and of a conical form. When the jaws are closed, the canine teeth of the upper jaw always fall behind those of the lower. (See page 86.)

The MOLAR TEETH are said to be

(240.) CONTINUOUS, *Lat.* Molares continui, *Fr.* Les Molaires complètes, *Germ.* Anschliessende Backenzähne,—when they immediately adjoin the Canines, or, when these are wanting, the Incisors;

(241.) ABRUPT, *Lat.* Molares abrupti, *Fr.* Les Molaires incomplètes, *Germ.* Abgesetzte Backenzähne,—when they are separated from the Canines or Incisors by a broad space, although continuous to each other.

(242.) THE INTERVAL, *Lat.* Diastema, *Fr.* L'espace vide, *Germ.* Zahnlucke,—is the large vacant space between the Incisors or the Canines, and the Molars, as in the Horse and Bull.

The TEETH, in respect to each other, are further said to be

(243.) APPROXIMATED, *Lat.* Approximati, *Germ.* Gedrängtstehende,—when they stand close together;

(244.) DIVIDED, *Lat.* Discreti, *Germ.* Vereinzelt,—when there are interstices between them; and a Tooth is

(245.) REMOTE, *Lat.* Dimotus, *Germ.* Weggerückt,—when separated by a broad interstice from the others of its own kind.

The TEETH of the one jaw, in respect to those of the other jaw, are said to be

(246.) OPPOSITE, *Lat.* Oppositi, *Germ.* Entgegengesetzt,—when the crowns of the upper teeth are opposite those of the lower;

(247.) CONGRUENT, *Lat.* Congrui, *Germ.* Deckende,—when each crown of every individual tooth in the upper or under jaw is opposite to the corresponding crowns of the opposite teeth;

(248.) OBLVERSE, *Lat.* Obversi, *Germ.* Abgeschrägte,—when the oblique crowns of the one jaw are fitted into the corresponding oblique crowns of the other;

(249.) ALTERNATE, *Lat.* Alternantes, *Germ.* Wechselständige,—when the crown of a tooth in either jaw occupies the space between two teeth of the opposite jaw;

(250.) INCLINED, *Lat.* Aeclinati, *Germ.* Ubergreifende,—when the sides of the teeth in the one jaw cover the sides of the teeth in the opposite jaw, and this they may do either *externally* or *internally*.

The TEETH, in respect to the Jaws and Lips, may be

(251.) ERECT, *Lat.* Erecti, *Germ.* Aufrechte,—when they are placed vertically in the gum;

(252.) PROCUMBENT, *Lat.* Procumbentes, *Fr.* Proclives, *Germ.* Liegende,—when they lie more or less horizontally upon the gum, as in the lower Incisors of the Makis and Kangaroos;

(253.) OBLIQUE, *Lat.* Obliqui, *Germ.* Schräge,—when they are joined to the gum, so as to form an obtuse angle with it;

(254.) TRANSVERSE, *Lat.* Transversi, *Germ.* Queerzähne,—when they are so placed in the gums as to stand inwards beyond the remaining teeth of the same series;

(255.) INCLOSED, *Lat.* Inclusi, *Germ.* Bedeckte,—when they are completely covered by the jaws and lips on the mouth being shut;

(256.) PROJECTING, *Lat.* Exserti, *Germ.* Freie, vortragende Zähne,—when they appear externally although the mouth be closed.

IX.—THE TEETH,

IN RESPECT TO THEIR POSITION AND FORM JOINTLY.

The TEETH are said to be

(257.) ANOMALOUS, *Fr.* Anomales,—when the forms of the three kinds of Teeth, Incisors, Canines, and Molars, are not very distinctly pronounced, as in Man and the Orangs;

(258.) NORMAL, *Fr.* Normales,—when the differences among the Incisors, Canines, and Molars, are strongly marked, as in the Carnassiers and Hogs.

The MOLAR TEETH have received the names of

(259.) GRINDERS, *Lat.* Dentes tritores, *Fr.* Les Machelières, *Germ.* Mahlzähne,—when they have broad crowns, which may be tuberculous, cuspidate, ridged, or plane;

(260.) CARNASSIERS, *Lat.* Lanarii ambigu, *Fr.* Les Carnassières, *Germ.* Zweideutige Eckzähne,—when they are strong and lobed, compressed and cutting on their margins, so that, excepting from their position, it would remain doubtful whether they should be set down as Molars, Canines, or Incisors;

(261.) FALSE MOLARS, *Lat.* Molares incurrentes, *Fr.* Les Fausses Molaires, *Germ.* Ubergelende Backenzähne,—when they are placed anteriorly, and are somewhat conical, like the canine teeth;

(262.) TUBERCULOUS MOLARS, *Lat.* Molares tuberculati, *Fr.* Les Molaires tuberculeuses, *Germ.* Höckeriger Backenzähne,—when they present tubercles or blunt excrescences, and belong to an animal which also has Carnassier Molars.

The CANINE TEETH assume the name of

(263.) TUSKS, *Lat.* Dentes falcati, *Fr.* Les défenses, *Germ.* Fangzähne,—when they project strongly from the mouth. The Tusks are *curved downwards*, as in the Morse; *directed laterally*, as in the Boar and Ethiopian Hog; or *curved upwards*, as in the Indian Hog.

The INCISIVE TEETH are said to be

(264.) CLEFT, *Lat.* Pectinati, *Fr.* Pectinées,—when their margins exhibit deep scissures, as in the Flying-Cats;

(265.) BILOBED OR TRILOBED, *Fr.* Bilobées ou Trilobées,—when they have one or two furrows upon their edge, as in some Bats and young Dogs;

(266.) BIFURCATED, *Fr.* Bifurquées,—when they are in the form of a fork with two prongs, as in some Sea-Lions (*Otaria*);

(267.) SPOON-SHAPED, *Lat.* Cochleari-formes, *Fr.* En cuiller,—when they are flattened, rounded, and slightly hollowed at their internal surface, as in the lower jaws of the Genus *Condylura*;

(268.) AWL-SHAPED, *Lat.* Subulati, *Fr.* En alène,—when they end gradually in a sharp point, as in the lower Incisors of most Rodentia;

(269.) CYLINDRICAL AND TRUNCATED, *Fr.* Cylindriques et tronquées,—as in the Wombat (*Phascotomys*).

The Incisive Teeth sometimes become TUSKS, see (263), when they may be

(270.) STRAIGHT, *Fr.* Droites,—as in the Narwhal; or

(271.) CURVED UPWARDS, *Fr.* Arquées en en-haut,—as in the Elephant.

(272.) A SUPERNUMERARY TOOTH, *Lat.* Dens accessorius, *Germ.* Nebenzahn,—is a minute homogeneous Molar, superadded either before or behind the other Molars.

(273.) RUDIMENTARY TEETH, *Lat.* Dentes spurii, *Fr.* Dents rudimentaires, *Germ.* Unächt Zähne,—are small deciduous teeth placed before the Molars.

X.—THE NECK.

(274.) THE NECK, *Lat.* Collum, *Fr.* Le cou, *Germ.* Hals,—is the intermediate portion between the Head and Trunk, and covering the Cervical Vertebrae. (See page 32.)

(275.) THE CERVIX OR BACK OF THE NECK, *Lat.* Cervix, *Fr.* Le cou supérieur, *Germ.* Hinterhals,—is the upper side of the Neck (the hinder in Man), extending from the Occiput to the first Dorsal Vertebra.

(276.) THE NUCHA OR NAPE OF THE NECK, *Lat.* Nucha, *Fr.* La nuque, *Germ.* Genick,—is that part of the Cervix next to the Occiput.

(277.) THE AUCHENIUM OR LOWER PART OF THE NECK, *Lat.* Auchenium, *Fr.* Le cou postérieur, *Germ.* Nacken,—is the region of the Cervix below the Nucha.

(278.) THE THROAT, *Lat.* Guttur, *Fr.* La gorge, *Germ.* Vorderhals,—is the lower region of the Neck (the fore in Man), extending from the Under-clin (75) downwards to the Breast.

(279.) THE GULLET, *Lat.* Gula, *Fr.* L'œnecure, *Germ.* Kehle,—is the region of the Throat next to the Under-chin.

(280.) THE JUGULUM OR LOWER PART OF THE THROAT, *Lat.* Jugulum, *Fr.* La gorge inférieure, *Germ.* Gurgel,—is the region of the Throat between the Gullet and the Breast.

(281.) THE SIDE OF THE THROAT, *Lat.* Parauchenium, *Fr.* Le cou latéral, *Germ.* Halsseite,—is the part of the Neck on each side between the Cervix and Throat.

(282.) THE PIT OF THE THROAT, *Lat.* Fossa jugularis, *Fr.* La fosse jugulaire, *Germ.* Gurgelgrube,—is the hollow part before the breast-bone at the base of the Jugulum.

(283.) THE HYOID BONE, *Lat.* Os hyoides, *Fr.* L'os hyoïde, *Germ.* Zungenbeine,—which serves to support the tongue, sometimes appears externally, when it assumes the form of a drum, as in the Howling Apes.

(284.) THE COLLAR, *Lat.* Torques, *Fr.* Le Collet, *Germ.* Ringkra-gen,—is a coloured ring surrounding the neck.

XI.—THE TRUNK.

(285.) THE TRUNK, *Lat.* Truncus, *Fr.* Le tronc, *Germ.* Rumpf,—is the primary part of the body containing the viscera and alimentary canal, and bearing the head and neck, the limbs, and frequently the tail.

(286.) THE UPPER REGION OF THE TRUNK [the hinder region in Man], *Lat.* Notæum seu Pars supina, *Fr.* Le dos, ou la partie supérieure du tronc, *Germ.* Rückenseite,—is the entire upper part of the body, extending along the spinal column from the Nuchæ to the Anus.

(287.) THE GASTRIC OR LOWER REGION OF THE TRUNK [the fore region in Man], *Lat.* Gastræum, seu Pars prona, *Fr.* La partie inférieure, *Germ.* Bauchseite,—is the entire lower or sternal part of the body, extending from the Gullet to the Anus.

(288.) THE FRONT REGION OF THE BONY [the superior in Man], *Lat.* Stethiæum, *Fr.* La partie antérieure, *Germ.* Vordertheil, Vordergeschlepp,—is the entire of the front or thoracical portion of the body.

(289.) THE HINDER REGION OF THE BODY [the inferior in Man], *Lat.* Uræum, *Fr.* La partie postérieure, *Germ.* Hintertheil, Hintergeschlepp,—is the entire posterior or inferior portion between the Thorax and the Anus, including the abdominal cavity.

(290.) THE DORSAL REGION, *Lat.* Dorsum, *Fr.* La région dorsale, *Germ.* Rücken,—is the middle part of the Upper Region, resting upon the spinal column.

(291.) THE INTERSCAPULAR REGION, *Lat.* Interscapulium, *Fr.* La région inter-scapulaire, *Germ.* Vorderrücken,—is the fore-part of the dorsal region, situate between the Scapulæ, and opposite to the breast. In the Horse, it receives the name of THE WITHERS, *Fr.* Le garrot.

(292.) THE SMALL OF THE BACK, *Lat.* Tergum, *Fr.* Défaut des côtes, *Germ.* Hinterücken,—is the hinder part of the dorsal region, next to the interscapular region.

(293.) THE CRUPPER, *Lat.* Prymna, *Fr.* La Croupe, *Germ.* Kreuz,—is the hindermost part of the dorsal region, opposite to the insertion of the thighs.

(294.) THE UROPYGIUM, OR ROOT OF THE TAIL, *Lat.* Uropygium, *Fr.* L'uropygium, *Germ.* Steiss, Schwanzgegend,—is the hindermost part of the trunk, immediately above the anus.

(295.) THE PECTORAL REGION, *Lat.* Pectus, Præcordia, *Fr.* La poitrine, *Germ.* Brust,—is the anterior part of the thorax [the superior in Man], immediately covering the sternum and ribs, and having its STERNAL REGION longitudinally in the centre.

(296.) THE ABDOMEN, *Lat.* Abdomen, *Fr.* L'abdomen, *Germ.* Bauch,—is the hinder part of the belly [the lower in Man], between the thorax and the anus.

(297.) THE NAVEL, *Lat.* Umbilicus, *Fr.* Le nombril, *Germ.* Nabel,—is the external vestige of the umbilical cord, placed usually near the middle of the abdomen.

(298.) THE UMBILICAL REGION, *Lat.* Regio umbilicalis, *Germ.* Nabelgegend,—is the region around the navel.

(299.) THE EPIGASTRIC REGION, *Lat.* Epigastrium, Serobiculus cordis, *Germ.* Oberbauch, Vorderbauch,—is that portion of the belly next to the breast.

(300.) THE GROIN, OR INGUINAL REGION, *Lat.* Inguina, Sumen, *Fr.* L'aîne, *Germ.* Unterbauch, Hinterbauch,—is the extreme hinder part of the belly [the lower in Man], next to the anus, and between the lower extremities.

(301.) THE PERINÆUM, *Lat.* Perinæum, *Germ.* Damm,—is the narrow isthmus between the organs of generation and the anus.

(302.) THE HUMERAL REGION, OR SIDE, *Lat.* Armus, *Fr.* La région humérale, *Germ.* Schultergegend,—is the region of the shoulder on the lateral part of the thorax.

(303.) THE HYPOCHONDRIC REGION, *Lat.* Hypochondria, *Germ.* Weichen,—is the lateral region of the trunk, between the thorax and the loins,

(304.) THE LOINS, OR LUMBAR REGION, *Lat.* Lumbi, Coxa, Regio lumbaris, *Fr.* Les reins, *Germ.* Hüftengegend,—consist of the hindermost part of the hypochondriac region, around the insertion of the thighs.

XII.—THE TAIL.

(305.) THE TAIL, *Lat.* Cauda, *Fr.* La queue, *Germ.* Schwanz,—formed by the vertebræ of the os coccygis projecting beyond the trunk, is not found in all Mammalia. It is wanting in the Orangs, some Bats, the Rats, Moles, Cabiais, &c., or its place is occupied by a mere tubercle, as in the Magot.

THE TAIL is said to be

(306.) VERY LONG, *Lat.* Cauda longissima seu elongata, *Fr.* La queue extrêmement longue, *Germ.* Sehr langer Schwanz,—when it is longer than the body, as in the Guenons and Makis;

(307.) MEDIUM LENGTH, *Lat.* Mediocris, *Fr.* Médiocre, *Germ.* Mittellanger,—when it is scarcely shorter than the trunk;

(308.) SHORT, VERY SHORT, AND ABRUPT, *Lat.* Brevis, brevissima, abrupta, *Germ.* Kurzer, sehr kurzer, abgekürzter,—when it is shorter than the thigh, and most commonly only the stump of a tail;

(309.) ANNULAR, *Lat.* Annulata, *Fr.* Annulaire, *Germ.* Geringeltes,—when the skin of the tail is divided by rings;

(310.) LORICATE OR SHIELDED, *Lat.* Loricata, *Fr.* Plaquée, *Germ.* Gepanzerter, when it is covered with a bony case;

(311.) VOLUBLE OR ROLLING, *Lat.* Volubilis, *Fr.* S'enroulante, *Germ.* Wickelschwanz, when the tail is very long, capable of being rolled around the animal, and of continuing in that position;

(312.) PREHENSILE, *Lat.* Prehensilis, *Fr.* Prénante, *Germ.* Greifschwanz,—is a rolling tail, with the under part of its apex usually smooth, and supplied with a soft skin fitted for touching and holding;

(313.) LOOSE, *Lat.* Laxa, *Fr.* Libre, *Germ.* Schlaffer,—when it is neither voluble nor prehensile;

(314.) BUSHY, *Lat.* Comosa, Jubata, *Fr.* Tonffue, *Germ.* Buschiger,—when it is ornamented to its base with long and pendulous hair;

(315.) TUFTED, *Lat.* Floccosa, *Fr.* Floconneuse, *Germ.* Gekunasteter,—when its apex is ornamented with a tuft of long hair;

(316.) DISTICHIOUS, *Lat.* Disticha, *Fr.* Distique, *Germ.* Zweizeiliger,—when the tail is covered with long hair, arranged in two series diverging from the centre.

THE TAIL may be

(317.) THICK, OVAL, and FLAT, *Fr.* Epaisse, Ovale, et Aplatie, as in the Beavers and Ornithorhynchus;

(318.) SQUARE, *Fr.* Carrée,—as in some Shrews;

(319.) TRIANGULAR and ROBUST, *Fr.* Triangulaire et Robuste,—as in the Kangaroos.

(320.) THE STUMP OF THE TAIL, *Lat.* Stirps caudæ, *Fr.* Le tronc de la queue, *Germ.* Schwanzrube,—is the body of the tail when considered without the hair.

(321.) THE SWITCH-HAIR OF THE TAIL, *Lat.* Coma, *Fr.* Les longues poils de la queue, *Germ.* Schweif,—are the longer tail-hairs considered by themselves.

XIII.—THE MAMMÆ, &c. &c.

(322.) THE MAMMÆ, *Lat.* Mamme, *Fr.* Les Mamelles, *Germ.* Euter, Brüste,—consist of a number of glands secreting milk, and placed symmetrically in a more or less considerable number on each side of the lower part of the body.

(323.) THE TEATS OR NIPPLES, *Lat.* Papillæ, *Fr.* Les trayons, *Germ.* Säugwarzen,—the excretory ducts of the milk, are placed upon the Mamme.

(324.) THE AREOLA, *Lat.* Areola, *Fr.* L'aréole, *Germ.* Hofe,—is the circle surrounding the nipple, and frequently coloured.

THE MAMMÆ are said to be

(325.) PECTORAL, *Lat.* Pectorales, *Fr.* Pectorales, *Germ.* Brust-Euter,—when they are placed upon the breast;

(326.) ABDOMINAL, *Lat.* Abdominales, *Fr.* Abdominales, *Germ.* Bauch-Euter,—when they are placed upon the belly;

(327.) INGUINAL, *Lat.* Inguinales, *Fr.* Inguinales, *Germ.* Schaam-Euter,—when they are placed upon the groin between the thighs.

(328.) THE ABDOMINAL OR MARSUPIAL POUCH, *Lat.* Mastotheca seu Marsupium abdominale, *Fr.* La Poche marsupiale, *Germ.* Zitzensack,—is a large fold of skin, placed in front of the belly, and capable of being closed, so as to form a bag or pouch, containing the mammæ, and some times also several young in the embryo state.

THE MAMMÆ are said to be

(329.) EXPOSED, *Lat.* Apertæ, *Fr.* Ouvertes, *Germ.* Unbedeckt,—when they are not covered by an abdominal pouch.

(330.) THE ANUS, *Lat.* Anus, *Fr.* L'anus, *Germ.* After,—is the ex-

ternal opening of the rectum, placed under the tail for excretory purposes.

(331.) THE ANAL POUCH, *Lat.* Rima odorifera, *Saccus analis*, *Fr.* Les follicules anales, *Germ.* Riechende Hautfalte, Aftertasche,—is a sac placed between the tail and the anus, or between the latter and the organs of generation, and emitting an odoriferous secretion.

(332.) THE PENIS, *Lat.* Penis, *Fr.* La verge, *Germ.* Ruthe,—is the male organ of generation placed upon the groin. It is said to be

(333.) ADNATE, *Lat.* Adnatus, *Germ.* Angewachsne,—when the basal part is concealed by the skin of the abdomen, and its apex alone is free towards the umbilical region.

ANIMALS are said to be

(334.) RETROMINGENT, *Lat.* Animalia retromingentia, *Germ.* Rückwärtsharnende Thiere,—when the penis is directed backwards.

(335.) THE VULVA, *Lat.* Vulva, *Fr.* La vulve, *Germ.* Wurf,—is the female organ of generation, placed upon the perinæum.

(336.) THE CLOACA, *Lat.* Cloaca, *Fr.* Le cloaque, *Germ.* Kloake,—is the common outlet for the intestinal canal and the organs of generation, found in the Monotremata.

XIV.—THE LIMBS.

(337.) THE LIMBS, *Lat.* Artus, *Fr.* Les membres, *Germ.* Gliedmassen,—are the articulated extremities, fitted for walking, and usually having their apices furnished with fingers or toes, and nails, claws, or hoofs. In general the limbs are of equal length; sometimes, however, the fore-limbs are the longer, as in the Gibbons and Sloths; and sometimes the hinder limbs exceed the former, as in the Kangaroos, and most Rodentia.

THE LIMBS are said to be

(338.) RETRACTILE, *Lat.* Retracti, *Obyoluti*, *Germ.* Eingezogne,—when their articulations are very short, so that the basal joints are buried in the flesh, and the terminal almost hidden in the fur.

(339.) PINNIFORM, *Lat.* Artus pinniformes, *Fr.* En forme de nageoires, *Germ.* Flossenartige Gliedmassen,—when the pectoral limbs are so immersed in the trunk, and covered with skin, that their articulations are only discoverable by anatomization. They are then called

(340.) THE PECTORAL FINS, *Lat.* Pinnæ pectorales, *Fr.* Les Nageoires pectorales, *Germ.* Brustfinnen,—from their resembling the fins of a fish, both in general form and use.

(341.) THE CAUDAL LIMBS, *Lat.* Pedes compedes, *Fr.* Les Nageoires caudales, *Germ.* Verwachsne Beine,—are hinder-limbs placed horizontally like a tail, so that their articulations can only be perceived anatomically.

(342.) THE FOOT,—is the extreme part of a limb, adapted for walking. See (37.) and (46.)

(343.) THE SOLE, *Lat.* Planta, *Fr.* La plante du pied, *Germ.* Sohle,—is the inferior side of the foot from the wrist or ankle-joint to the extremities of the fingers or toes.

(344.) THE FINGERS OR TOES,—form the apex of a limb. See (40.) Their number varies from one to five on the several extremities.

Thus, there are on each limb in

Man.....	5	Above and 5 Below.
The Bears, Elephant.....	5	Before and 5 Behind.
Most RODENTIA	4 5
Pecaris, Cabiais, Agoutis.....	4 3
Hippopotamus, Suricate.....	4 4
Two-toed Ant-eater.....	2 4
Sloths	2 or 3 4
Rhinoceroses.....	3 3
RUMINANTIA.....	2 2
SOLIPEDA.....	1 1

A FOOT is said to be

(345.) MONO-DACTYLOUS, DI-DACTYLOUS, TRI-DACTYLOUS, TETRA-DACTYLOUS, or PENTA-DACTYLOUS,—when it has one, two, three, four, or five toes or fingers;

(346.) ADACTYLOUS, *Lat.* Adactylus, *Mutilatus*, *Fr.* Adactyle, *Germ.* Ohnzehiges,—when the toes or fingers are wanting.

(347.) THE AXILLA OR ARM-PIT, *Lat.* Axilla, *Fr.* L'aisselle, *Germ.* Achsel,—is the hollow under the fore-limb at its insertion with the thorax.

(348.) THE THIGH, *Lat.* Clunus, *Fr.* La jambe, *Germ.* Keule,—is the femur, together with its fleshy covering.

(349.) THE BUTTOCKS, *Lat.* Nates, *Fr.* Les fesses, *Germ.* Gesäss,—are the hinder [or lower] sides of the thighs, and frequently prominent.

(350.) THE CALLOSITIES OF THE BUTTOCKS, *Lat.* Tylia, *Natis calvæ*, *Fr.* Les callosités, *Germ.* Gesäss-schwiele,—are hard and smooth portions of the buttocks, frequently coloured, found in some Apes.

(351.) THE CALF, *Lat.* Sura, *Fr.* Gras de la jambe, *Germ.* Wade,—is the swelling muscle behind the upper part of the tibia.

XV.—THE FEET OR HANDS,

IN RESPECT TO THEIR PARTS AND APPENDAGES.

(352.) THE THUMB OR GREAT-TOE, *Lat.* Pollex, *Hallux*, *Digitus primus*, *Fr.* Le pouce, *Germ.* Daumen, *Innenzehe*,—is the innermost finger or toe, usually distinguished from the others by its situation, and by being always the shortest and thickest.

(353.) THE INDEX OR FIRST FINGER, *Lat.* *Digitus index seu secundus*, *Fr.* Le doigt indicateur, *Germ.* Zeigefinger, *Die zweite zehe*,—is the finger next to the thumb.

(354.) THE SECOND OR MIDDLE FINGER, *Lat.* *Digitus tertius*, *Fr.* Le medius, *Germ.* Die dritte zehe,—is the finger next to the index.

(355.) THE THIRD OR RING FINGER, *Lat.* *Digitus quartus*, *Fr.* L'annulaire, *Germ.* Die vierte zehe,—is the third finger from the thumb.

(356.) THE FOURTH OR LITTLE FINGER, *Lat.* *Digitus quintus*, *Fr.* Le petit doigt, *Germ.* Die funfte zehe,—is the fourth finger from the thumb. The same phraseology is applied to the Toes.

THE THUMB is said to be

(357.) RUDIMENTARY, *Lat.* *Verruca hallucaris*, *Fr.* Le pouce rudimentaire, *Germ.* Daumenspur,—when it scarcely emerges from the skin;

(358.) OPPOSABLE,—when it is capable of being applied to the fingers. This may be upon the fore-limbs only, as in Man, or on all the limbs, as in the Apes, or only on the hinder limbs, as in the Opossums.

THE FINGER OR TOE is said to be

(359.) INSISTENT, *Lat.* *Insistens*, *Germ.* Auftretend,—when it touches the earth while the animal rests upon its feet;

(360.) ELEVATED, *Lat.* *Amotus*, *Germ.* Hinaufgerückte,—when it is inserted so high, that it does not touch the ground while the animal is walking.

(361.) THE GLOVE, *Lat.* *Podotheca*, *Germ.* Fuss-scheide,—is the fur covering the entire foot or hand.

(362.) THE FINGER-GLOVE, *Lat.* *Dactylotheca*, *Germ.* Zehenscheide,—is the part of the glove covering each separate finger.

(363.) THE FINGER-BALLS, and HEEL-BALLS, *Lat.* *Tylari*, *Germ.* Zehenballen, *Hakkenballen*,—are the naked and callous parts under the fingers and the heels.

(364.) THE NAIL, *Lat.* *Lamna*, *Unguis*, *Fr.* L'ongle, *Germ.* Nagel,—is the broad and flat horny surface, covering in a greater or less degree the upper side of the last phalanx.

(365.) THE CLAW, *Lat.* *Falcula*, *Unguis falcularis*, *Fr.* Griffe, *Germ.* Kralle,—is an elongated, compressed, and rounded nail.

A CLAW is said to be

(366.) RETRACTILE, *Lat.* *Falcula vaginata*, *Fr.* Rétractile, *Germ.* Gescheidete Kralle,—when it can be drawn within a proper sheath upon the last phalanx;

(367.) TEGULAR, *Lat.* *Tegularis*, *Germ.* Kuppennagel,—when it approaches to a Nail in form.

(368.) THE HOOF, *Lat.* *Ungula*, *Fr.* Le sabot, *Germ.* Huf,—is a horny covering, enveloping the point of the phalanx on every side.

(369.) THE SOLE OF THE HOOF, *Lat.* *Solea*, *Fr.* La sole, *Germ.* Hufsohle,—is its entire under surface, including the hollow part.

(370.) THE CORONET, *Lat.* *Coronamen*, *Fr.* La couronne, *Germ.* Hufkranz,—is the upper margin of the hoof, where it presses the finger or foot.

(371.) THE FROG, *Fr.* La fourchette,—is an elevated portion in the form of a V, sometimes found behind the middle of the sole of a hoof.

(372.) THE HAND, *Lat.* *Manus*, *Fr.* La main, *Germ.* Hand,—is the extreme part of a limb, having its thumb free and opposable, and covered with a flat nail. Sometimes this term is applied to a foot, when its toes are very long and much separated from each other.

(373.) THE PAW, *Lat.* *Palma*, *Fr.* La patte, *Germ.* Tatze,—is the broad part, consisting of the carpus and metacarpus in the fore-limb, or the tarsus and metatarsus in the hinder.

(374.) THE PALM, *Lat.* *Vola*, *Fr.* La paume, *Germ.* Handhöhlung,—is the flat inner surface of a hand.

XVI.—THE FEET OR HANDS,

IN RESPECT TO THEIR FORM AND USE.

THEIR FINGERS OR TOES may be

(375.) DIVIDED, *Lat.* *Fissi*, *Fr.* Séparés, *Germ.* Gespaltne,—when they are not connected by any intermediate membrane; or

(376.) HALF-DIVIDED, *Lat.* *Semi-fissi*, *Fr.* Demi-séparés, *Germ.* Halbspaltne,—when they are only partially connected.

ANIMALS are said to be

(377.) FISSIPEDE, *Lat.* *Animalia Fissipeda*, *Fr.* Les fissipèdes, *Germ.* Spaltfüssige Thiere,—when their fingers or toes are unconnected by a membrane.

THE FINGERS OR TOES are said to be

(378.) UNITED, *Lat.* Coadunati, *Fr.* Réunis, *Germ.* Verwachsne,—when they are connected by no membrane, and yet adhere so closely together that they are contained in the same finger-glove (362).

THE FEET are said to be

(379.) PALMATED, *Lat.* Palmati, *Fr.* Palmés, *Germ.* Schwimmfüsse,—when the fingers or toes are connected together by a membrane reaching nearly to their extremities, so as to be fitted for swimming;

(380.) SEMI-PALMATED, *Lat.* Semipalmati, *Fr.* Demipalmés, *Germ.* Halbe Schwimmfüsse,—when the membrane between the fingers extends to about one half of their length;

(381.) PINNATED, *Lat.* Lomatini, *Fr.* Pinnés, *Germ.* Gesäumte Füsse,—when the fingers are supplied with membranes only on their sides.

(382.) THE WEB, *Lat.* Palama, *Fr.* La membrane pour la natation, *Germ.* Schwimmhaut,—is the membrane belonging to a palmated or semi-palmated foot.

THE FEET are said to be

(383.) CHEIROPTEROUS, *Lat.* Chiropteri, *Volatiles*, *Fr.* Cheiroptères, *Germ.* Flugbeine,—when the fingers of the fore-feet are excessively elongated and supplied with a light membrane, so as to adapt them for flight.

(384.) DERMOPTEROUS, *Lat.* Dermopteri, *Fr.* Dermoptères, *Germ.* Flatterbeine,—when the fore and hinder feet are connected together by a membrane, which is merely an expansion of the skin of the trunk, and often extending before and behind the limbs.

(385.) THE EXTENSIBLE MEMBRANE OF WING, *Lat.* Patagium, *Fr.* La membrane extensible, ou L'aile, *Germ.* Flughaut,—is the membranous appendage of a dermopterous or cheiropterous foot.

It is said to be

(386.) DIGITAL, *Lat.* Digitale, *Germ.* Zehen-Flughaut,—when the membrane extends between the elongated fingers of the fore-limb;

(387.) CERVICAL, *Lat.* Collare, *Germ.* Halsfittig,—when it extends between the neck and the expanded fore-limb;

(388.) LUMBAR, *Lat.* Lumbare, *Germ.* Seitenfittig,—when the membrane between the fore and hinder limb proceeds from the sides of the trunk;

(389.) INTERFEMORAL, *Lat.* Interfemorale, *Anale*, *Germ.* Steissfittig,—when the membrane extends behind the thighs;

(390.) HAIRY, *Lat.* Pellicum, *Fr.* Pileuse, *Germ.* Flugfell,—when the membrane is thickly covered with hair;

(391.) NAKED, *Lat.* Membranaceum, *Fr.* Nue, *Germ.* Flughaut,—when it is light and destitute of hair.

THE HINDER FEET are said to be

(392.) SALTATORIAL OR LEAPING, *Lat.* Saltatorii, *Fr.* Propres à sauter, *Germ.* Springbeine,—when they are nearly twice as long and strong as the fore-feet, and fitted for leaping;

(393.) AMBULATORIAL FEET, *Lat.* Pedes ambulatorii, *Fr.* Les pieds propres à marcher, *Germ.* Gangbeine,—fitted for walking, are such as are not palmated, cheiropterous, dermopterous, or saltatorial, but may be either fissipede or united;

(394.) FOSSORIAL FEET, *Lat.* Pedes fossorii, *Fr.* Les pieds propres à fouiller la terre, *Germ.* Grabfüsse,—are very broad, and armed with strong FOSSORIAL NAILS, *Lat.* Ungues fossorii, *Germ.* Grabklauen,—so as to be fitted for digging.

THE FEET are said to be

(395.) PLANTIGRADE, *Lat.* Plantigradi, *Fr.* Plantigrades, *Germ.* Solhenschreitende Beine,—when they are destitute of hair as far as the heel, from the animal placing the entire sole of the foot upon the ground when walking;

(396.) DIGITIGRADE, *Lat.* Digitigradi, *Fr.* Digitigrades, *Germ.* Zehenschreitende Beine,—when they are covered with hair almost to the apices of the toes, which alone touch the ground when the animal is walking;

(397.) BISULCATE OR CLOVEN, *Lat.* Bisulci, *Fr.* Pieds fourchus, *Germ.* Spalthufge,—when the toes are only two in number, insistent (359), and unguled or hoofed;

(398.) SUB-BISULCATE, *Lat.* Subbisulci, *Fr.* Pieds demi-fourchus, *Germ.* Kerbhufge,—when the two toes are almost united, and their apices alone are free and covered with hoofs;

(399.) SOLIDUNGULATE, *Lat.* Solidunguli, *Fr.* Solipèdes, *Germ.* Einhufige,—when the foot consists of a single finger, covered by a single hoof;

(400.) UNGUICULATE,—when the toes are furnished with nails;

(401.) UNGULATE,—when they are protected by hoofs;

(402.) TRJUNGULATE, QUADRIUNGULATE, OR MULTUNGULATE,—when they are protected by three, four, or more hoofs.

(403.) THE SIDE-HOOF, *Lat.* Ungulae succenturiatæ, *Fr.* Onglons surnuméraires, *Germ.* Nebenhuße,—are the hoofs of elevated toes (360), found in bisulcate and multungulate feet.

XVII.—THE SKIN.

(404.) THE SKIN, *Lat.* Cutis, *Fr.* La peau, *Germ.* Haut.—is the

general integument of the entire body, composed of several layers. See page 89.

It is said to be

(405.) LOOSE, *Lat.* Laxa, *Fr.* Lâche, *Germ.* Schlotternde,—when it hangs down and forms folds.

(406.) THE DEW-LAP, *Lat.* Palcaria, *Fr.* Le fanon, *Germ.* Wamme,—is a loose skin hanging from the neck and fore-part of the breast, as in the Bull.

(407.) THE HUMP, *Lat.* Tophus, *Gibber*, *Fr.* La bosse, *Germ.* Höcker,—is a broad and swelling projection, formed of fat under the skin, as in the Indian Bull.

(408.) THE CALLOSITY, *Lat.* Callus, *Fr.* Le callosité, *Germ.* Schwiele,—is a naked skin protected by a hard and horny epidermis, upon which some animals rest upon the ground, as the Camels and Dromedaries. It is also found on the palms of the hands, the soles of the feet, and the thighs of some Apes.

(409.) A WART, *Lat.* Verruca, *Fr.* Une Verrue, *Germ.* Warze,—is a small, hard, and round tumour.

(410.) THE SCALES, *Lat.* Squamae, *Fr.* Ecailles, *Germ.* Schuppen,—are flat, horny, or bony parts, inserted on the skin, and frequently imbricated, or arranged one over the other, like the tiles of a house.

(411.) THE SHIELD, SHELL, OR COAT OF MAIL, *Lat.* Lorica, Clypeus, Testa, *Fr.* Le bouclier, ou la plaque, *Germ.* Panzer, Schild, Schale,—is a horny or bony case covering the trunk and tail, or the most part of them, as in the Armadilloes.

It is said to be

(412.) AREOLATED, *Lat.* Scutulata, *Fr.* Plaqué, *Germ.* Getäfelter,—when the surface of the shield is covered by regular partitions, and a shining epidermis.

(413.) THE AREOLA OF A SHIELD, *Lat.* Scutulum, Assula, *Fr.* Le compartiment d'un bouclier, *Germ.* Feld, Schildchen,—is each partition of an areolated shield.

(414.) THE BANDS, *Lat.* Cingula, *Zonæ*, *Fr.* Les bandes transversales, *Germ.* Gürtel,—are the distinct divisions of a transverse shield, and movable by means of the skin.

(415.) THE TAIL-RINGS, *Lat.* Gyri, annuli, *Fr.* Les anneaux d'écailles, *Germ.* Schwanz-ringel,—are the separate divisions of a shielded tail.

(416.) THE DORSAL FIN, *Lat.* Pinna dorsalis, *Fr.* La nageoire dorsale, *Germ.* Rückenfinne,—is a fin-like cutaneous process placed on the back, and sustained by small bones.

(417.) THE CAUDAL FIN, *Lat.* Pedalium, Pinna analis, *Fr.* La nageoire caudale, *Germ.* Schwanzfinne,—is a cutaneous process placed horizontally in the shape of a fin upon the apex of the tail.

THE SKIN is said to be

(418.) APPLIED, *Lat.* Applicata, *Fr.* Appliquée,—when it exactly fits upon the body, as in the Deer and Antelopes;

(419.) VERRUCOSE, *Lat.* Verrucosa, *Fr.* Verruqueuse,—when it is covered with small naked eminences, or warts;

(420.) SCALY, *Lat.* Squamosa, *Fr.* Ecailleuse,—when the epidermis is folded over in such a way as to resemble the scales of a fish, as on the tail of the Beaver;

(421.) NAKED, *Lat.* Nuda, *Fr.* Nue,—when it is destitute of hair or any other integument;

(422.) THICK, *Lat.* Densa, *Fr.* Epaisse,—as in the Elephant, Rhinoceros, and others; for which reason these animals are said to be PACHYDERMATOUS, OR THICK-SKINNED, *Lat.* Pachyderma;

(423.) ROUGH, *Lat.* Asperata, *Fr.* Rugeuse,—as in the animals already mentioned; and

(424.) CALLOUS, *Lat.* Callosa, *Fr.* Calleuse,—when it is hard to the touch.

XVIII.—THE HAIRS.

(425.) THE HAIRS, *Lat.* Pili, *Fr.* Les poils, *Germ.* Haare,—are horny filaments of various shapes (see page 89), covering the body externally in various degrees. They may be fine like silk, as in the Chinchilla, or coarse like hay, as in some Ruminantia.

(426.) THE BRISTLES, *Lat.* Setæ, *Fr.* Les soies, *Germ.* Borsten,—are hard and rigid hairs frequently divided at the points, as in the Hog.

(427.) THE PRICKLES OR SPINES, *Lat.* Aculei, Spinæ, *Fr.* Les piquans ou les épines, *Germ.* Stacheln,—are very strong, hard, and rigid hairs, frequently ending in a sharp point. Sometimes they are nearly conical and of medium length, as in the Echidnas; very long and bulging in the middle, as in the Porcupine; flattened like the blade of a sword, as in the Echinos and some spiny Rats; alone, as in the Hedgehogs, Coendou, and Spiny Echidna; or mixed with hair, as in the Silky Echidna and Canada Porcupine.

THE BODY is said to be

(428.) HAIRY OR COVERED, *Lat.* Pilosum, Vestitum, *Fr.* Pileuse, *Germ.* Behaart,—when it is furnished with Hair;

(429.) HAIRLESS, *Lat.* Depilis, *Fr.* Nue, *Germ.* Haarlos,—when it is destitute of hair; as upon all callosities; on most part of the face in Man and some Apes; on the Chiloma (157) of most Ruminants; and on the snout of all Carnassiers and Rodentia.

(430.) THE FUR, *Lat.* Vellus, *Fr.* La fourrure, *Germ.* Pelz,—consists of the hairs of the entire body or a part, considered together.

(431.) THE FELT, *Lat.* Pellis, *Fr.* Le feutre, *Germ.* Fell,—is the hairy skin and fur, considered together.

(432.) THE WOOLLY FUR, *Lat.* Codarium, *Germ.* Wollpelz.—consists of the finer and softer hairs of the fur, amongst which the longer hairs are usually intermixed.

(433.) THE WOOL, *Lat.* Lana, *Fr.* La laine, *Germ.* Wolle,—consists of long, fine, frizzled, and curly hair, as in the Sheep.

(434.) THE HAIR OF THE HEAD, *Lat.* Capilli, Crines, Coma, *Fr.* Les Cheveux, *Germ.* Haupthaare,—are the long hairs proceeding from the skin of the skull.

(435.) THE CREST, *Lat.* Caprona, Antia, Crista, *Fr.* L'aigrette, *Germ.* Stirnschopf,—consists of long hairs, proceeding upwards and backwards from the top of the head, and it may either be *Stellated* (455) or *Vorticillated* (456).

(436.) THE BEARD, *Lat.* Barba, aruncus, *Fr.* La barbe, *Germ.* Bart,—consists of long hairs hanging from the chin, as in the Goat and Bison.

(437.) THE WHISKER, *Lat.* Mystax, barba malaris, *Fr.* La moustache, *Germ.* Bakkenbart,—is the long hair covering the under-cheek (76).

(438.) THE MOUSTACHIO, *Lat.* Mastax, *Fr.* La moustache, *Germ.* Knebelbart,—is the beard of the upper lip. It is very long in the nocturnal or aquatic Carnassiers, as the Cats and Seals. It can scarcely be observed in the Kangaroos and Ruminantia, and is wholly wanting in the Whales and Dolphins.

(439.) THE STIFF HAIRS, *Lat.* Vibrissae, *Fr.* Les faisceaux de poils, *Germ.* Schnurrhaare,—are long elongated bristles of great strength upon the nose, and some other parts of the face, and sometimes also upon the inner sides of the fore-limbs. These gigantic moustachios serve as weapons of defence to the Manatus.

(440.) THE EYE-BROWS, *Lat.* Supercilia, *Fr.* Les sourcils, *Germ.* Augenbraune,—are transverse series of hairs placed at the lower part of the forehead and above the eyes.

(441.) THE EYE-LASHES, *Lat.* Cilia, *Fr.* Les cils, *Germ.* Wimpern.—are long hairs proceeding from the eyelids.

(442.) THE MANE, *Lat.* Juba, *Fr.* La crinière, *Germ.* Mähne,—consists of long hairs adorning the ridge of the back, sometimes extending from the occiput to the end of the tail, as in the Civet and Zibet; sometimes it extends no lower than the shoulders, where it becomes mixed with the long hairs of the withers, as in the Lion; and sometimes its hairs have their points turned towards the head, as in the *Antelope leucoryx*.

(443.) THE TAIL-TUFT, *Lat.* Ploccus, *Fr.* Le Flocon, *Germ.* Quaste,—consists of long loose hair covering the extremity of the tail, as in the Lion, the Ass, and some Apes.

(444.) THE HAIR-BUNCH, *Lat.* Scopa, *Fr.* La brosse, *Germ.* Haarbüschel,—is a bunch of long and loose hair hanging from the wrist (51), as in some Antelopes, or from any other part of the body.

(445.) THE PENCIL, *Lat.* Penicillus, *Fr.* Le pinceau, *Germ.* Pinsel,—is a very small bundle of rigid hair placed on the top of any part.

(446.) A LOCK, *Lat.* Cincinnus, *Fr.* Une touffe, *Germ.* Lokke,—is each small bundle of hair involved at its apex.

(447.) THE PUBES, *Lat.* Pubes, *Fr.* Le pubis, *Germ.* Schaamhaar,—is the hairs placed upon the groin.

(448.) THE DOWN OR MILK HAIR, *Lat.* Lanugo, *Fr.* Le duvet, *Germ.* Milch-haar,—is the soft and fine hair of young animals, not yet changed, and frequently variegated with different colours.

(449.) THE HAIR-SEAM OR SUTURE, *Lat.* Sutura, *Germ.* Haarnaht,—is the line formed by the points of the hairs of the fur converging together.

THE HAIRS are said to be

(450.) SMOOTH, *Lat.* Pili incumbentes, *Fr.* Les poils couchés ou lisses, *Germ.* Anliegende haare,—when they are pressed close to the skin along their entire length;

(451.) ERECT, *Lat.* Erecti, *Fr.* Droits, *Germ.* Aufrechte,—when they are placed almost vertically upon the skin;

(452.) KNOTTED, *Lat.* Tomentosi, *Fr.* Noueux, *Germ.* Filzige,—when they are entangled together and interwoven, so that they can be extricated only with difficulty;

(453.) SILKY, *Lat.* Sericei, *Fr.* La bourre, *Germ.* Seidenhaare,—when they are soft, short, and shining, as in the Makis;

(454.) VILLOUS, *Lat.* Villosi, *Germ.* Zottige,—when they are long, thin, and straight;

(455.) STELLATED, *Lat.* Stella, *Germ.* Haarstern—when the hair proceeds from a centre like the radii of a circle, as on the head of the Hair-lipped Macaco (*Macacus cynomolgus*);

(456.) VORTICILLATED, *Lat.* Vortex, *Germ.* Haarwirbel,—when the hairs run from the circumference to the centre in bent radii, as on the head of the Chinese-capped Macaco (*M. Sinicus*);

(457.) DISTICHOUS, *Lat.* Varicula, *Germ.* Scheitelung,—when the hair of the fur is arranged in two series, diverging in opposite directions;

(458.) FISTULOUS, *Fr.* Fistuleux, *Germ.* Fistelartig,—when it is shaped like a reed or quill, as in the hairs beneath the body of the Porcupine.

XIX.—THE HORNS.

(459.) THE HORNS, *Lat.* Cornua, *Fr.* Les cornes, *Germ.* Hörner,—are hard processes, composed either of horn or bone. These may proceed either from the nose, when they are said to be *nasal*, or from the forehead, when they are termed *frontal*. According to the substance of which they are composed and their form, they may be either *ossaceous* or *cornaceous*, *solid* or *hollow*.

(460.) THE PROPER HORNS, *Lat.* Cornua vaginantia, *Fr.* Les cornes creuses, *Germ.* Scheidenhörner,—are hollow bodies or sheaths covering ossaceous processes of the frontal or nasal bones, found in several Ruminants, such as the Bulls, Goats, Sheep, and Antelopes.

(461.) THE HORN-BASE OR CORE, *Lat.* Embolus, *Germ.* Hornzapfen,—is the bony process of the frontal or nasal bone, covered by a proper horn.

(462.) THE ANTLERS, *Lat.* Ceras, cornu, *Fr.* Les bois, *Germ.* Geweihe,—consist of two solid, frontal, and cornaceous horns, which fall and are renewed every year, as in the Deer. They are called the *ATTIRE* by hunters, and are said to be

(463.) BRANCHING, *Lat.* Cerata ramosa, *Fr.* Les bois branchus, *Germ.* Astige Geweihe,—when they emit branches.

(464.) THE BEAM OR MAIN-STEM, *Lat.* Caulis, *Fr.* Merrain, *Germ.* Stange,—is the principal trunk of a branching antler.

(465.) THE BURR, *Lat.* Stephanium, *Fr.* Le Noyau, *Germ.* Krone,—is a granulated prominence at the base of the beam, and covering the horn-base (461).

(466.) THE BRANCHES OR SNAGS, *Lat.* Rami, *Fr.* Les andouillers, *Germ.* Zinken, Enden,—are the processes of the beam.

(467.) THE BROW ANTLER, *Lat.* Propugnaculum, Amynter, *Germ.* Augensprosse,—is the foremost and lowest branch of a beam.

THE ANTLERS may be

(468.) PALMATED, *Lat.* Cerata palmata, *Germ.* Schaufelförmige Geweihe,—when the branching antlers are dilated at their extremity like a shovel;

(469.) DECIDUOUS OR ANNUAL, *Lat.* Decidua, annua, *Fr.* Caducs, *Germ.* Wechselnde, Abfallende,—when they fall and are renewed every year.

THE HORNS AND ANTLERS may be

(470.) PENDANT, *Lat.* Prona, *Germ.* Vorgelegte,—when they hang downwards above the muzzle;

(471.) REFLECTED, *Lat.* Reclinata, *Fr.* Recourbées, *Germ.* Rückgelegte,—when they are turned backwards, as in the *Capra Mambria*;

(472.) INCURVATED, *Lat.* Camura, *Fr.* Courbés en dedans, *Germ.* Eingebogene,—when they are bent inwards;

(473.) DIVERGENT, *Lat.* Vara, *Fr.* Divergens, *Germ.* Auswärtsgebogene,—when they are bent outwards, as in the *Cervus Dama*;

(474.) REDUNCATE, *Lat.* Redunca, *Fr.* Courbés en avant, *Germ.* Hakige,—when they are curved forwards, as in the *Antelope Tragocampus*;

(475.) LYRATE, *Lat.* Lyrata, *Fr.* En lyre ou lyroides, *Germ.* Leierförmige,—when they are so bent as to exhibit the form of an ancient lyre, when viewed behind, before, or on the side;

(476.) ROUND, *Lat.* Teretia, *Fr.* Arrondies,—as in the Stags;

(477.) ANNULATED, *Lat.* Annulata, *Fr.* Annelées,—covered with rings, as in the Gazelles.

(478.) BIFID, *Fr.* Bifourqués,—divided into two prongs at the point, as in the Roebuck;

(479.) TRIFID, *Fr.* Trifourqués,—divided into three prongs, as in the *Cervus pygargus*;

(480.) UNCINATE, *Fr.* Recourbés à leur extrémité,—bent at the points;

(481.) SPIRAL, *Fr.* En spirale,—as in the *Ovis sterspiceros*;

(482.) TRIANGULAR,—as in the *Capra depressa*;

(483.) CARINATED, *Fr.* Garnies de petites cannelures,—with furrows, as in the *Capra Agagrus*;

(484.) KNOTTED, *Fr.* Moniliforme,—as in the *Capra Iba*.

(485.) THE PANNICLE, *Lat.* Pannicula, *Germ.* Bast,—is the rough skin covering deciduous horns when they have just begun to appear.

(486.) THE PRICKET OR DAG, *Lat.* Patalus, *Fr.* Dague, *Germ.* Spiess,—is the simple antler of a young animal, before it begins to have branches.

(487.) A SPITTER, *Lat.* Subulo, *Fr.* Daguët, *Germ.* Spiessern,—is a young animal, having only prickets or dags upon its forehead.

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ORDER I.—BIMANA.

MAMMALIA WITH FOUR DISTINCT UNGUICULATED LIMBS; WITH THREE KINDS OF TEETH; AND OPPOSABLE THUMBS ON THE PECTORAL LIMBS ALONE.

SYNONYMS.

PRIMATES (in part).—Linnæus and others.
 BIMANES.—Duméril, Cuvier, and others.
 BIMANA.—Hamilton Smith and others.
 ERECTA (Aufrechte Säugthiere).—Illiger.

Man forms but a single Genus, and this Genus is the only one of its Order.

GENUS.—HOMO. MAN.

SYNONYMS.

HOMO.—Erxleben, Illiger, Fischer, and others.
 HOMO SAPIENS.—Linnæus and others.
 L'HOMME.—Cuvier, Buffon, Duméril, Desmarest, and others.
 MENSCH.—Tiedemann and others.
 MAN is excluded from the Zoological systems of Pennant, Brisson, and others.

GENERIC CHARACTERS.

THE TEETH continuous, approximated, erect, and nearly of equal length; the FORE-TEETH eight, trenehant, the upper not inserted in an intermaxillary bone; the CANINES four, pointed, unicuspidate; the MOLARS twenty, grinders, tuberculous; eight being FALSE MOLARS, bicuspidate; the remaining twelve, TRUE MOLARS, and quadri-cuspidate. The DENTAL FORMULA for the Adult is therefore

$$2 \left| \begin{array}{l} 2 + C + (2 F + 3) M = 16 \\ 2 + C + (2 F + 3) M = 16 \end{array} \right. = 32$$

For the Infant it is

$$2 \left| \begin{array}{l} 2 + C + 2 M = 10 \\ 2 + C + 2 M = 10 \end{array} \right. = 20$$

THE PECTORAL LIMBS, with pentadactylous HANDS, eminently disposed for prehension.

THE LOWER LIMBS, with pentadactylous and plantigrade FEET,
 THE NAILS flat and feeble, on all the fingers and toes.
 THE HEAD, with its FACIAL ANGLE from 70° to 90°. THE CHIN prominent. THE ORBITAL and TEMPORAL FOSSÆ distinct.
 THE CLAVICLES perfect.
 THE MAMMÆ two, and pectoral. THE PENIS free.
 THE SKIN naked except on the skull, also on the chin, axillæ, and pubes of adults.
 THE TAIL wanting.
 WALKS erect.
 FEEDS on many animal and vegetable substances (Polyphagous).
 INHABITS all parts of the globe, except the regions immediately surrounding the Poles (Cosmopolite).

As the physical history of Man is directly interesting to ourselves, and ought to form the standard of comparison to which that of other animals is to be referred, it will be proper to consider the subject more in detail.

The several points in which the organic arrangements of Man are peculiar to himself will be briefly contrasted with those possessed by him in common with the other Mammalia. We shall point out the advantages which these peculiarities give him above the other species, and indicate the natural order in which his individual and social faculties have developed themselves. Finally, we shall enumerate the several races of Man and their distinguishing characteristics.

THE PECULIAR CONFORMATION OF MAN.

THE foot of Man is very different from the hinder-hand of an Ape. It is broad, the leg bears vertically upon it, and the heel expands beneath. Its toes are short, and can scarcely bend; the great-toe, longer and thicker than any of the others, is placed on the same plane, and cannot be opposed to them. This kind of foot is therefore proper for supporting the body in an erect position, but can be of no use either for seizing or climbing. Further, the hands of Man are not adapted for walking, and he is therefore truly Bipedal and Bimanous—qualities which are possessed by no other animal.

In fact, the entire frame of Man is disposed for an upright posture. His feet, as we have just seen, supply him with a broader base than those of any other Mammiferous animal. The *extensors* or muscles which maintain the leg and thigh in a state of extension are extremely vigorous, whence result the projections of the calf and buttock. The *flexors* of the leg are attached very high, so as to permit the knee to be completely extended, and thus occasion the calf to appear more prominent. The pelvis is broad, and serves to separate the thighs and feet, giving to the body a pyramidal form highly

favorable to equilibrium. The necks of the thigh-bones form, with the bodies of these bones, an angle, which increases the separation of the feet, and enlarges the base of the entire body. Finally, the head, by this upright posture, is balanced upon the trunk, from its articulation being placed above the centre of gravity of the entire mass.

When a Man makes the attempt, he cannot walk conveniently on all-fours. His feet being short and inflexible, and his thigh too long, the knees are thrown against the ground. His broad shoulders and arms, placed far apart from the medial line, are but ill adapted for sustaining the fore part of the body. The rhomboid muscle which, like a girth in quadrupeds, suspends the trunk between the shoulder-blades, is smaller in Man than among any of them. His head is heavier on account of the size of the brain, and the smallness of the sinuses or cavities in the bones of the skull, yet the means of supporting it are most feeble; for Man has not the cervical ligament of quadrupeds, and the vertebræ of his neck are not disposed so as to prevent it from bending forwards. At the very most, he can but sustain his head on a level with the spine, and then his eyes and mouth are directed downwards to the earth, so that he cannot see before him. On the contrary, the arrangement of these organs is perfect when he returns to the upright posture.

The arteries which serve to convey the blood to the brain are not subdivided, as in many quadrupeds, and the blood necessary for so large an organ would be poured into it with too great a velocity, so that frequent apoplexies would be the consequence of his persisting in a horizontal position.

Man is, therefore, formed for resting on his feet only in an upright posture. He thus preserves the entire freedom of his hands for the arts and occupations of life, and his organs of sense are placed in the most favorable position for receiving external impressions.

His hands, which derive so many advantages from their freedom of movement, are not less favored in respect to their structure. The thumbs, which are longer in proportion than those of the Apes, impart in consequence a greater facility for holding small objects; while every finger, excepting the third or ring-finger, is capable of moving separately—a peculiarity which cannot be found in any other animal, not even in the Apes. As the nails protect one side only of the extremity of each finger, they supply a point of attachment to the organs of touch, without depriving them of any portion of their delicacy. Again, the arms which support these hands possess a solid point of attachment in their broad shoulder-blades, their strong clavicles, and the general disposition of the shoulder-joint.

Man is thus highly favored in respect to his fitness for dexterous or skilful movements, but these qualities have been assigned at the expense of his strength. His speed in running is much less than that of other animals of the same size. He is likewise without offensive arms; his jaws are flat, his canine teeth do not project, and his nails are not crooked; while his body, destitute of hair on the back and sides, is absolutely unprotected from the inclemencies of the atmosphere. Finally, he is a longer period of time than any other animal in acquiring that degree of strength necessary to enable him to provide for his own maintenance and defence.

This natural feebleness has, however, one important advantage, that of compelling him to resort to the resources within himself, and particularly to that intelligence which has been assigned to him in a supereminent degree.

No quadruped approaches to Man, in respect to the size and the number of convolutions in the hemispheres of his brain, that is to say, in that portion of the organ which serves as the principal instrument to his intellectual operations, and the hinder part of that organ even extends backwards so as to cover the cerebellum. The very shape of the skull proclaims the magnitude of the brain, while the smallness of his face announces how little that part of the nervous system, influenced by the external senses, is predominant in the human species.

The external senses of Man are all of medium power, yet they are at the same time of great delicacy, and in due proportion to each other. His eyes are directed forwards, and he cannot see on both sides at once like many quadrupeds, yet their position imparts more unity to the results of his vision, and serves to direct his attention more especially to sensations of this kind. The eye-ball and iris

can vary their dimensions but slightly, and this confines the sphere of his vision to a limited distance and a determinate intensity of light. His external ear cannot move to any great extent, and its small size scarcely augments the intensity of sounds; yet he is better able than any other animal to appreciate minute differences of tone. His nostrils, more complicated than those of the Apes, are less so than in any other genus, yet he appears to be the only animal whose sense of smell is sufficiently delicate to be affected by disagreeable odours. This delicacy of smell would lead us to expect a corresponding delicacy in his organs of taste, and Man must possess considerable advantages in this respect at least over those animals having the tongue covered with scales. Finally, the fineness of his touch results from the thinness of the skin, the absence of all insensible parts, as well as the form of a hand, better adapted than that of any other animal for accommodating itself to the minute inequalities of surfaces.

Man enjoys a peculiar pre-eminence in respect to his organs of voice. He alone of all Mammalia can produce articulate sounds, to which the form of his mouth, and the great flexibility of his lips, alike contribute. This means of communicating his ideas is to him of the greatest value, the various modifications of sound being employed most conveniently for this purpose, as they may be perceived at greater distances and in more directions at the same time than any other signs.

It would appear that even the position of the heart and the larger vessels is suited to the upright posture. The heart is placed obliquely upon the diaphragm, and its point directed to the left side, which arrangement requires a disposition of the aorta different from that in most quadrupeds.

Man seems formed for feeding chiefly upon fruits, roots, and other succulent parts of plants. His hands enable him to gather them with ease; while his short and comparatively weak jaws, his canine teeth not projecting beyond the line of the remaining teeth, and his tuberculous molars would permit him neither to pasture upon grass, nor to devour flesh, did he not prepare his food by a culinary process. Once, however, in possession of fire, and a knowledge of those arts which have enabled him to seize or kill at a distance the other animals, all living beings can be made to contribute towards his maintenance. This circumstance has further enabled him to increase the numbers of his species without any apparent limit.

The digestive organs of Man correspond with those of mastication. His stomach is simple; the intestinal canal of medium length; the larger intestines well defined; the cæcum short, thick, and augmented with a narrow appendage; the liver is divided only into two lobes and a lobule; and the epiploon hangs before the intestines even as far as the pelvis.

To render this abridged statement of the anatomical structure of Man more complete, it may be sufficient to add, that he has thirty-two vertebræ, seven of which are cervical, twelve dorsal, five lumbar, five sacral, and three coccygeal. Seven pairs of ribs are united to the sternum by cartilaginous appendages, and are termed *true ribs*, the five following pairs are called *false ribs*. The cranium of the adult has eight bones, namely, one occipital, forming the base of the skull, two temporal, two parietal, one frontal, the æthmoid, and the sphenoid. The bones of the face are fourteen in number; two maxillary; two jugal, each of which serves to connect the temporal and maxillary bones by a kind of bridge, called the zygomatic arch; two nasal; two palatine behind the palate; a vomer between the nostrils; two turbinated bones within the nostrils; two lachrymal at the nasal angles of the eyes; and the single bone of the lower jaw. Each jaw contains sixteen teeth, four trenchant incisors in front, one pointed canine at each corner, and ten molars with tuberculous crowns, five on each side, making in all thirty-two teeth. His shoulder-blade has at the end of its spine or projecting crest, a process called the *acromion*, to which the clavicle is attached, and, below its articulation, there is a point called the coracoid process, for the attachment of several muscles. The radius turns completely upon the ulna, on account of its peculiar mode of articulation with the humerus. The carpus has eight bones, four being in each row. The tarsus has seven; the remaining bones of the hands and feet may be easily counted according to the number of the fingers.

By means of his industry, Man commonly enjoys the advantages of a regular diet. With him a uniform attachment to the other sex supplies the place of that periodical rut observed in many other animals. The male organ of generation is not sustained by a bony axis; the prepuce is not attached to the abdomen; and the penis is therefore pendulous. Numerous large veins serve to lead the blood of the testicles back into the general circulation, and contribute towards the moderation of his desires. The matrix of the female is a simple and oval cavity; her mammae, two in number, are placed upon the breast, and correspond to that facility with which she holds the infant upon her arms.

On comparing the purely corporeal properties of Man with those of the other Mammiferous animals, we thus find that he presents only a few slight differences, insufficient to separate him from their class. Among these, his upright posture is at once the most remarkable and important; for while the quadruped carries the trunk of his body nearly parallel to the ground on four supports, Man rears an upright column erected upon a narrow yet firm basis.

Those who are disposed to consider the anatomical structure of Man with attention, will readily appreciate the doubtful veracity of the accounts of savages found wandering on all-fours in the woods of Europe. Linnæus erroneously considered these as forming a distinct variety of the human race, under the name of *Homo ferus tetrapus* (Linn. Syst. Nat. ed. Gmel. p. 21), of which he enumerates several examples. They were probably only the descendants of some unfortunate outcasts of civilized society, abandoned by their parents during the early years of infancy. Indeed, the property of walking upon four feet appears to be so incompatible with the human organization, that we may safely consider the narrations of Tulpius, Connor, and Camerarius, to be erroneous in this particular. All the more modern and best authenticated accounts of these savages represent them in every ease as walking erect. Among these narrations we shall select, as being most entitled to credit, that of the young boy of Aveyron, who resided for a long time in Paris, at the Asylum for the Deaf and Dumb, under the care of the celebrated Sicard. His history has been detailed by MM. Bonnaterre and Virey, from the latter of whom we have obtained the following particulars.

During the year 1795, a naked child was observed searching for acorns and roots in the woods of La Caune, Department of Tarn. He fled at the approach of strangers, but was taken, and afterwards escaped. Fifteen months afterwards he was retaken by three hunters, although he had climbed a tree, and was conducted to La Caune. He again escaped, and lived at large for six months, exposed to the cold of one of the most rigorous of winters, until at length he was compelled by hunger to enter one of the houses in the outskirts of the town of Saint-Sernin, with only a slight remnant of his former garments. He was offered some potatoes, which he devoured raw, as well as chestnuts and acorns. He refused every other kind of food, such as flesh, raw or boiled, bread, apples, pears, grapes, nuts, or oranges, smelling them carefully before tasting them. As he uttered no articulate sound, he was supposed to be naturally dumb. He seemed terrified, and had apparently no other design than that of eating and then fleeing again to the woods. He could scarcely endure clothes, refused to sleep in bed, and seemed devoid of every feeling of decency or cleanliness, qualities which appear to be peculiar to the highly-civilized Man.

This lad was seen by M. Virey at Paris, at the age of eleven or twelve years. He was then strong and well formed for his age, and though his new mode of life had rendered him rather fat and unwieldy, he was still able to run very fast. He walked erect, balancing himself with his arms, and remained nearly all day upon the ground in a sitting posture, eating continually while awake, and sleeping immediately afterwards. His skin, which appeared brown and dirty when he was first taken, became white after being washed. His nails were very long, and his face almost concealed by long flaxen ringlets. On being taken to Paris, he was attacked with the small-pox in a mild form, from which he soon recovered, having refused to take anything during the entire course of the malady. He appeared at times to have spasmodic movements, as if he had been very much frightened. His teeth were nearly bare to their alveola, and, being of a careless temper, liking nothing but eating and sleeping, he had grown rattler corpulent. All his movements were hasty but sure. He could not swim, and did not usually climb trees, unless compelled by the approach of danger. Once he leaped from the second story of a house in order to flee to the woods. His hands were by no means callous or hard; and his fingers were surprisingly flexible. Although he appeared not to dread the most extreme cold or heat, yet he seemed to prefer the

cool shade in summer and the fire in winter. His skin was covered with many scars and marks of burns. When he perspired, he strewed dust upon his skin, not liking the moisture. Though fond of sleeping, his slumbers were never profound; and when at rest, he gathered himself up like a ball, rocking himself by way of assisting his slumbers. He hated children of his own age, yet he was not ill-natured, and never attempted any mischief. Though innocent and foolish, he could not be considered as imbecile; his character was very mild, but he would not endure contradiction. He was frank in his manners, and excessively selfish, though simple and confined in his notions.

This savage continued always upon his guard, and showed his fondness for solitude by seeming annoyed at the presence of strangers. He had not learned to throw stones; and, without being actually timorous, did not exhibit courage superior to other children of his own age. When enraged, he raised a blustering cry, or a murmur in the throat, and had, when first taken, some natural signs of resentment, fear, and other passions. He had no defect in his organs of speech, but his excessive want of attention, and ignorance of the vernacular language, rendered him careless on the subject: at length he became able to comprehend many things, but without attempting to speak himself. This young Aveyronese was very much disposed to steal fruit and other articles of food, but attached no value to anything except it contributed towards his immediate natural wants. He continued in a half-savage state, without ever learning to speak, although much trouble had been taken to instruct him.

Many other stories are quoted in the foreign journals of savages found in Hungary and elsewhere, but they offer nothing remarkable. The authentic instances of girls found in the wild state are perfectly analogous to that of the boy of Aveyron, with the exception that these females exhibited some marks of modesty, in which he was wholly deficient.

It is therefore absurd to maintain, with Moseati and other writers, that Man is formed for walking on all-fours, a position to which the objections already stated are insurmountable obstacles. This supposition must be classed with that equally probable one of Adrian Spigel, who attributed the habits of reflection peculiar to Man to the size of the muscles upon which he usually sits, and the consequent ease of that posture.

The form of the pelvis is one of the most important consequences of our upright position. Its direction is oblique in the Apes and quadrupeds, and the os coccygis, which turns inwards, and is wholly concealed with us, usually appears externally with them in the form of a tail. This obliquity of the os coccygis is one of the chief causes of the difficulty in human parturition. "Aussi la direction du vagin, chez les femelles d'animaux, est parallèle à l'axe des vertèbres sacrées; ces femelles accouchent et urinent en arrière; les mâles s'accouplent aussi à elles par derrière (Venus præpostera); il n'en est pas ainsi des singes, et surtout de la femme, dont la station, plus ou moins rapprochée de la perpendiculaire, ramène en devant l'ouverture du vagin. La direction du canal utéro-vaginal est, en ce cas, oblique de devant en arrière, d'où il suit que l'écoulement des urines, des menstrues, a lieu en devant, de même que l'accouplement (Venus antica), et le part est plus laborieux." This inconvenience would not occur, had the human species been supplied with a tail and went on all-fours, as certain credulous travellers have related. The other animals are never afflicted with inguinal hernia, which is the occasional consequence of the downward pressure of the intestines, and the upright position of Man.

The suspensory muscle of the eye-lid is not found in the human species, as it was not the intention of Nature that Man should keep his eyes directed towards the earth, like the Ruminating animals. He is also destitute of the *panniculus carnosus*, or sub-cutaneous muscle, the *pancreas Asellii*, the *corpus Highmorii*, the hepato-cystic ducts, the nictitating membrane, and the incisive fossa behind the upper teeth. The cervical ligament also has not been assigned to us, as our upright position would render it useless.

The great size of the human head and the weakness of the arms are obstacles which prevent Man from swimming naturally like the quadrupeds. The infant, different from the young of other animals, sinks with its head foremost, and even the adult will swim more easily with his back downwards. It is evident, therefore, that our species was never intended for an aquatic or amphibious life, as some have supposed. The accounts of Mermeu and Mermaids found in various places, either resolve themselves into absolute imposture, or the objects erroneously described were merely Seals or Lamantines. They are generally described with palmated hands, like a duck, short arms, flat noses, the figure of a beast, a body terminated with two paws or a forked tail, the skin covered with scattered hairs of a gray or brown colour,—characters which agree sufficiently with those of a Seal, to warrant the above conjecture.

THE PHYSICAL DEVELOPMENT OF MAN.

BIRTH AND INFANCY.

THE number of offspring in the human species is usually one at each parturition, and twins do not occur more frequently than once in five hundred accouchements. Births, in which a greater number is produced, occur still more rarely. Gestation continues for nine months. A fœtus of one month old is usually an inch in length; of two months, two inches and a quarter; of three months, five inches; of five months, six or seven inches; of seven months, eleven inches; of eight months, fourteen inches; of nine months, eighteen inches. Infants born at a less period than seven months very seldom survive.

The milk-teeth begin to appear some months after birth, commencing by those in front. There are twenty at the age of two years (see the Dentary Formula), all of which fall successively towards the seventh year, to be replaced by others. Of the twelve back molars which do not fall, four appear at the age of four and a half, four at nine years, and the last four do not sometimes appear until near the twentieth year.

The fœtus grows more and more in proportion as it approaches the period of birth;—the infant, on the contrary, grows at a less rapid rate as it advances in years. At the period of birth, it is more than a quarter of its ultimate height; it has reached the half at the age of two years and a half; and the three quarters at nine or ten years.

The first cries of the newly-born infant indicate the uneasiness of its change from the one mode of existence to the other. On its first appearance it is washed in tepid water, and dried; its umbilical cord is tied, and cut above the ligature. The women in savage countries bite this cord through with their teeth, and do not always tie it, yet hæmorrhage is not always the consequence of this neglect, and the Hottentot women do not even remove the slight mucous fluid left upon the skin. Among several nations of the North, it is customary to plunge the newly-born infants into cold water, or even to roll them in the snow. This practice was anciently adopted by the Scotch, Irish, Helvetians, and Germans. In our own times, it is still practised by the Morlachs, Icelanders, Siberians, and several others; and, though it sometimes hardens the cellular tissue, renders it violet-coloured, and causes them to perish, yet it has the effect of accustoming the survivors to the cold at an early age, and induces a more robust habit of body. At the moment of birth an important change is effected in the circulation of the blood. The air rushes into the lungs, and the blood which fills these viscera returns to the heart by the *vena portæ*, and is distributed throughout the body by the aorta and its branches. Before this period the blood passed immediately from the right to the left ventricle of the heart. The infant at birth is still cartilaginous. Its limbs are small; its flesh soft, gelatinous, and moist. Its vessels are large and wide; the brain considerable; the belly distended; the cellular tissue surrounding its organs loose, spongy, and filled with lymph; its glands swollen and filled with watery fluid. A milky fluid can sometimes be squeezed from its breasts during the first days after birth. Its eyes are dull, wrinkled, and covered with a slight membrane (*tunica Halleri*), which prevents the too violent action of the light upon these still delicate organs. The ears are closed by a mucous fluid, which prevents the admission of loud sounds. The pituitary sinuses of the nose are obstructed by a viscous humour, so as to be incapable of smell; the skin is too soft to convey any sensations of touch; and the tongue can scarcely taste anything. The use of the senses is acquired gradually; and instinct alone directs the infant mechanically towards its mother's breast, and instructs it to suck.

At birth, the infant is about twenty inches in length, and weighs from six to ten pounds. The first milk of the mother, or *colostrum*, is serous and laxative, and serves to clear the intestines of the *meconium*, or blackish fluid, which is discharged during the first day after birth; yet the infant is commonly delayed for twelve hours before it is permitted to be fed. Nature has wisely adapted the qualities of the mother's first milk to the wants of the infant. The milk of nurses is much less suitable, being too old and substantial, for it is more serous in the mother in proportion as it approaches the period of birth. At all times, the milk of a stranger is not so well adapted to the temperament of the infant as that of its own mother, and the milk of any other animal is still more objectionable. There is nothing so judicious in these matters as a scrupulous attention to the suggestions of Nature.

The newly-born infant sleeps almost continually, and requires the breast every time it wakes. The Negro infant clings to the long breast of its mother, and holds itself so firmly to her back, that she can attend to her other labours without the trouble of supporting it upon her arms. Towards the fourteenth day the infant begins to smile and recognize those

who approach it; but it does not attempt to speak until about the tenth or twelfth month. The words most easily pronounced are composed of labial consonants, such as *papa*, *mamma*, *baba*, and these have, therefore, served in most languages to denote the same objects.

For the first three months after birth, no other food should be given to the infant than the milk of its mother; afterwards, several nutritious substances, easy of digestion, may also be employed. The natural period for discontinuing the milk is commonly on the appearance of the first teeth. The incisive teeth, eight in number, being four in the front of each jaw, appear at the age of eight or ten months. Their growth is painful, and is announced by fever and inflammation. At this critical period, very little food should be given to the infant. The order in which the teeth exhibit themselves has already been explained (See pages 86, 87). Infants are sometimes born with their front teeth; but these examples are very rare.

The hair of newly-born infants is always more or less fair in the European variety, but in other races of Man it is already quite black. The same remark applies to the iris; and the colour both of the hair and eyes becomes deeper as they advance in years. The infants of Negroes, and persons of dark complexions are born rather of a lighter tint, but they become gradually darker and darker, although they are not exposed to the rays of the sun. The growth of girls is usually more rapid than that of boys.

PUBERTY.

IN our climates, the human species exhibits the first signs of puberty from the ages of twelve to fourteen in girls, and from fifteen to seventeen in boys; but these periods vary all over the globe. They seem to depend upon the temperature of the climate, the quantity and quality of the food, the general purity of morals, the temperament of the individuals, their employments, as well as the peculiar constitution of the races to which they belong.

Heat, as is well known, tends to increase the activity of the vital power in all organized bodies; and ought, consequently, by hastening their growth, to bring the period of puberty nearer to that of birth. An inhabitant of Finland or Iceland is scarcely marriageable at eighteen years of age, and some are even as old as twenty-two before they become so, from their exposure to the excessive cold of their climate; the women also are not marriageable until seventeen or even nineteen. On the other hand, in Hindoostan, Persia, and Arabia, the males are capable of marrying at the age of thirteen or fourteen, while girls are often mothers at ten or twelve. Intermediate climates may accelerate or retard the puberty of the people exposed to their influence.

Among the white races of Europe, these variations are very considerable, especially in respect to the females. Thus, in Saxony, Thuringia, and Upper Germany, the women are not marriageable before fifteen even in the towns, and they are still slower in countries lying farther to the north, or in elevated places, where they are sometimes delayed until the ages of twenty to twenty-four. For this reason, the females in the islands of the North, the Orkneys, and the Western Islands, preserve their fecundity to an advanced age. In Ireland, sixteen appears to be the usual period; in France, it is fourteen or even thirteen in the southern departments or the large towns, where various causes combine, and induce a greater degree of precociousness. In Italy, the women are formed at twelve years of age; and it is the same in Spain; while at Cadiz, marriages frequently take place at that age. In Minorca, eleven is the period of puberty; and at Smyrna, mothers have been seen at eleven or twelve. The Persian women are marriageable at nine or ten; and nearly the same thing takes place at Cairo. The Berber women are often mothers at eleven, according to Shaw; also the Agows of Abyssinia, according to Bruce. From nine to ten, they appear to be marriageable at Senegal, according to Adansson. The age of ten years is the usual marriageable period, not only in Arabia, but also in most parts of Africa.

Many instances are quoted of an equally great precociousness being observed on the Malabar Coast, where the females are married at eight to ten years, and become mothers soon afterwards. In the Deccan, according to Thévenot, women have been known to have children at eight years of age. Paxman has seen married children from four to six years of age; but it is impossible to believe that these could have reached the period of puberty. In fact, a common custom prevails in India, for the inhabitants to betroth and even to marry their children together, for which reason, girls have been known in Java and Hindoostan to be mothers at ten years of age.

These instances are not, however, very general, and remarkable exceptions of the same kind are often observed in the temperate regions of Europe. Thus, Haller saw Swiss girls of twelve years, and Smellie, English girls of the same age, exhibiting the usual signs of puberty. In Belgium and Switzerland, girls have produced at nine years of age; but nothing general should be inferred from these solitary cases.

When individuals of the Negro races are removed to more temperate climates than Africa, such as Europe or North America, they arrive at puberty sooner than the White races, the difference in this respect commonly amounting to a year. This serves to indicate that their races are naturally more precocious than ours. The same remark is also applicable to the Mogul races. On the authority of several travellers, the females of Siam, Golconda, China, and Japan, are marriageable at eleven or twelve years; but even in climates much colder than our own, individuals of the same races still continue to be more precocious. A Calmuck, or a Mogul woman of Siberia, in a climate as cold as that of Sweden, is marriageable at thirteen, while a Swedish woman would not be so under fifteen or sixteen. The Samoiede and Lapland women present the usual appearances of puberty at the age of eleven or twelve, and the males at twelve or thirteen, while the English, German, and French, become marriageable only at a much later period. We thus see that each human race possesses a peculiar aptitude in this respect, that the individuals of one race naturally become formed at an earlier period than those of another, and this they do notwithstanding the various differences of climate, food, and temperament.

Females who become marriageable at an early age soon lose their powers of conception. From the ages of thirty to thirty-five years, the women of India are accounted old, according to Paxinan. The Javanese women do not conceive beyond thirty years, and even in Persia, according to Chardin, many women do not produce after twenty-seven years. The Sianese women are apparent exceptions to this observation, for they are said to have children at the age of forty, although they attain to puberty at a very early period. Upon the whole, it may be stated generally, that the usual period for the commencement of puberty in females varies, under the burning sun of the Tropics, from nine to twelve years, and terminates about thirty, though sometimes extending as late as forty years. On the other hand, the Samoiede women, though marriageable at an early age, continue their powers unimpaired to forty-one. In our own country, its termination may be stated at the ages of forty to forty-five years.

Puberty is represented by external signs. These appear (in France) from the ages of ten to twelve in girls, and from twelve to sixteen in boys. In warm countries they are sooner observable; and either sex is rarely capable of procreation before that period.

Among other well-known signs of puberty, the deepening of the voice in the male, and the expansion of the breast in the female, are the most obvious and constant.

MATURITY.

After attaining the age of puberty, the body soon acquires its maximum of height. Some young men do not grow after fourteen or fifteen years of age; while others continue as long as twenty-two or twenty-three years. Nearly all of them, during this time, are of a slender make, their thighs and legs small, with the muscular parts not so perfectly developed as they ultimately become.

At the age of eighteen years the youth usually ceases to grow. The adult man rarely exceeds the height of six feet, and is seldom found below five feet. Women are usually some inches less.

The stature of individuals is subject to great variations. Dwarfs have been known scarcely more than two feet high, while we are not without authentic accounts of giants nearly nine feet in height. Contrary to what is observed among the domestic animals, the medium height of one human race is but little different from that of another. The height of women is less variable than that of men. Among all nations of great stature, they are very considerably smaller than the men, while the difference in the relative height of the sexes varies but slightly among the races of diminutive stature. The height of the smallest dwarf bears to that of the largest giant the ratio of 1 to 4 very nearly; and, supposing them to be equally well-proportioned, their ratio of bulk will therefore be as 1 to 64. On the other hand, the medium height of the smallest races is to that of the largest only as 1 to 1½; consequently, their ratio of bulk will be very nearly as 1 to 3½.

The following tables, deduced by M. Isidore Geoffroy-St-Hilaire, from a number of scattered observations, published by different authors, serve to exhibit the average amount of the hereditary variations of height.

NATIONS REMARKABLE FOR THEIR GREAT STATURE.

	INHABITING	CLIMATE.	HEIGHT.		AUTHORITIES.
			FEET.	IN.	
Patagonians,	45° to 50° S. lat.	Rather cold.	6	4.7	La Girandais, Malaspina.
Do.	do.	do.	6	2.6	Commerson, De Gennes.
Inhabitants of the Navigators' Islands,	14° S. lat.	Warm.	6	2.6	La Pérouse.
Carribees,	8° to 10° S. lat.	Very warm.	6	1.5	Humboldt.
Patagonians,	45° to 50° S. lat.	Rather cold.	6	0.5	Bougainville.
Mbayas,	20° to 21° S. lat.	Warm.	6	0.5	Azara.
New Zealanders,	35° to 45° S. lat.	Rather warm.	5	11.4	Garnot & Lesson.
Otaheitan Chiefs,	17° S. lat.	Very warm.	5	10.3	do.
Marquesas,	10° S. lat.	do.	5	10.3	Marchaud.
Patagonians,	45° to 50° S. lat.	Rather cold.	5	9.	Cook, Wallis.

NATIONS REMARKABLE FOR THEIR SMALL STATURE.

	INHABITING	CLIMATE.	HEIGHT.		AUTHORITIES.
			FEET.	IN.	
New Holland,	35° S. lat.	Warm.	5	2.9	Quoy & Gaimard.
Inhabitants of Vanikoro,	12° S. lat.	do.	5	2.3	do.
Orotchys Tartars,	51° N. lat.	do.	5	1.8	La Pérouse.
Kamtschatskadales,	50° to 60° N. lat.	Very cold.	5	1.8	do.
Papous of Offack,	0° to 1° S. lat.	Very warm.	4	10.6	Garnot & Lesson.
Different European and Asiatic Nations near the Arctic Circle,	60° to 75° N. lat.	Very cold.	5	1.8	{ Krusenstern, La Pérouse, Regnard, Depaw.
			4	9.6	
Esquimaux,	70° N. lat.	do.	4	3.2	Hearn, Depaw.
Boschismans,	30° S. lat.	Rather warm.	4	3.	Barrow, Péron.

The differences in the statements regarding the average height of the Patagonians may partly be explained by the circumstance, that these tribes are of migratory habits, and partly through the observers paying too much attention to the individual variations of stature.

It has long been remarked, that the nations of smallest stature abound more especially in the northern hemisphere, and towards its most northern extremity. The second of the preceding tables shows this fact clearly; but it also exhibits some exceptions. On the other hand, the tallest nations are almost confined to the Southern Hemisphere, where they form two series, the one continental, from the Carribees to the Straits of Magellan, and the other insular, extending from the Marquesas to New Zealand, throughout the islands of the Southern Ocean. This peculiarity, though often interrupted, commences about 8° 10' of S. latitude, and terminates towards the 50th degree. In the Southern Hemisphere we meet, however, with many nations, whose medium height, without being very

small, is still above the average; and reciprocally, there are many in the Northern Hemisphere of very considerable height.

Upon comparing the geographical position of nations, whose stature is very great, with that of the very diminutive races, we are led to notice a very curious, and apparently paradoxical result. Nations of very small stature are always found in the immediate vicinity of the very tallest inhabitants of the whole globe; and, reciprocally, there are nations of considerable stature dwelling in the neighbourhood of the very smallest. Thus, in the Southern Hemisphere, the island of Terra del Fuego, though separated from Patagonia merely by the Straits of Magellan, and only at a short distance from the Navigators' Islands, is inhabited by a very diminutive and ill-made race of men. It is the same in the Northern Hemisphere, where the inhabitants of Sweden and Finland, though bordering upon Lapland, are rather above the middle stature. Thus the influence of climate upon the height of the human races appears unquestionable, al-

though often modified and even wholly counteracted by other causes. Excessive cold tends to arrest the development of the human frame; while, on the contrary, a moderate degree of cold is favorable to it. We find that the nations of the coldest climates in Europe, Asia, and America, such as the Laplanders, Samoiedes, and Esquimaux, are of small stature, and likewise the people of Terra del Fuego in the Southern Hemisphere.

Again, we see that the inhabitants of all countries, which, in reference to the temperate parts of Europe, we should term *rather cold*, are of very considerable dimensions. The Swedes, Finlanders, Saxons, the inhabitants of the Ukraine, and many other nations of Europe, Asia, and North America, are instances in the Northern Hemisphere, and we have the Patagonians in the Southern. Again, in our own island, while the people of the south and centre of England are of ordinary stature, the inhabitants of the Border counties and of several districts in the Lowlands of Scotland are in general of very considerable stature. Further, in the Highlands of Scotland, where the cold is severe, the stature falls rather below the average. The comparative moisture of the several localities may be another cause of these variations, and when united with those of temperature, serve to account for some of the most remarkable differences.

The elevation of a country is another cause of these variations. In tropical climates, the inhabitants of the several regions of elevated mountains present an epitome of those differences of stature which we trace throughout the several climates of the globe. Nations dwelling upon slightly elevated plateaux are in general tall and robust; while men only of small stature are found in the neighbourhood of mountain fastnesses, which are as desert as the Polar regions, and covered, like them, with eternal snows. In the mountains of temperate, and especially of cold climates, the height of the people dwelling on plateaux, even but slightly elevated, diminishes considerably, in consequence of the more marked differences of temperature. These relations are not, however, invariable; the mountaineers of Puy-de-Dome, and especially the Swiss, are, in some rich cantons, according to M. Villermé, not only of middle stature, but rather above the average standard.

From the various circumstances already noticed, it follows that under every isothermal line, except in the immediate neighbourhood of the poles, nations are to be found of very great stature, others very small, and others again of medium size. Even in the same regions, or in countries apparently identical in physical character, we find races of very different degrees of stature. Thus, the Hottentots, in the immediate neighbourhood of the Caffres, but unquestionably belonging to another race, are much smaller; and, what is still more remarkable, we may find in several islands, such as the Friendly, the Society, and Sandwich Islands, two classes of men very unequal in height. "In the Sandwich Islands," observes M. Gaimard, "the population is divided into two very distinct classes, being the chiefs and the populace. The first enjoy a more abundant diet, consume more animal food, are never compelled to labour excessively, and intermarry together; they are consequently tall, strong, and well made. The others possess no land, and cannot always obtain good food; they are generally of inferior height and strength."

The causes which M. Gaimard assigns for these variations are fully confirmed by the recent observations of M. Villermé upon the average height of the population in France. He found, as Haller and other physiologists had previously conjectured, that the human stature is always greater, other circumstances remaining the same, when the country is rich and fertile; that, where there are good clothing, lodging, and especially wholesome food, it improves, and diminishes where difficulties, fatigue, and privations are experienced during infancy and in early youth. From these facts M. Villermé concludes, that the hardships experienced by most mountaineers form one of the causes which have hitherto retarded their growth, and this observation may further be extended to the inhabitants of the arctic regions, where they receive the two-fold influence of cold and want.

The differences found in the heights of the several nations of Africa cannot be explained by any of the above causes. They serve to show that there must have been some original difference of stature in the primitive types of the several races; as well as to demonstrate the tendency of the human species, in common with the domestic animals, to transmit the connate varieties of races to their posterity.

It is, at the least, very improbable, that the average stature of the human species could have sensibly diminished through the lapse of ages. Antiquity believed in the existence of whole nations of Giants; but it also credited the existence of Pygmies, Troglodytes, or Myrmidons. Many travellers, and especially Péron, show, that savages, far from being stronger than individuals of the more civilized races, are usually feebler. Man, on becoming civilized, has, therefore, lost nothing of his original strength.

A man is longer in arriving at his full growth than a woman, the latter being usually as completely formed at twenty years as a man at thirty. Every part of the form in either sex, to use the words of Buffon, announces the superiority of the human species over all living creatures. Man

maintains his body erect and elevated; his attitude is that of command; his countenance is directed towards the heavens; and presents an august face on which is impressed the character of dignity; the image of his soul is painted in his physiognomy, and the excellence of his nature penetrates through the material organs which surround it, animating the features of his face with a divine expression. His majestic carriage, his firm and resolute step, announce the nobleness of his rank. He touches the earth solely by his most remote extremities, and seems to regard it at a disdainful distance. His arms are not given to him merely as pillars to support the mass of his body; his hand is not permitted to tread on the ground, or to lose, by a continuous friction, that fineness of touch, of which it is the chief organ. His arm and hand are reserved for nobler purposes,—to execute the suggestions of his will, and be subservient to the various circumstances of life.

All the features of the face remain in a state of calm repose while the mind is tranquil;—their proportion, connexion, and harmony, serve to indicate the tranquillity which reigns within. When the mind is agitated, the human face becomes a living tablet, upon which the passions are transcribed with delicacy and energy; where every expression of the mind is represented by a corresponding trait, every mental process by a characteristic, the vivid impression of which often serves to betray the intended action, and represent externally the image of our secret thoughts.

The body of a well-made man, according to Buffon, ought to be rather square, the muscles well-expressed, the form of the limbs well-defined and the features strongly marked. When contrasted with the female, we find him of a taller stature, larger and firmer muscles, a browner skin, a larger brain, the bones more robust, the voice deeper, the chest broader, the hairs more numerous and of a deeper tint.

In woman, every thing is more rounded, the lines are softer, and the features more delicate. "To man," says Buffon, "belong strength and majesty, while grace and beauty form the embellishments of the other sex." The hair of her head is longer, finer, and more flexible; her skin lighter and more delicate, her limbs more graceful, the pelvis broader; the thighs thicker, and the limbs smaller. In the man, the upper parts of the body, such as the chest, the shoulders, and the head, indicate strength and power; the capacity of his cranium is considerable, and contains three or four ounces of brain more than the skull of the female, according to the experiments of M. Virey; but his haunches, his pelvis generally, and thighs, are narrower and thinner than hers. The upper part of a man is, therefore, broader than the lower, so that he somewhat resembles a reversed pyramid. In the woman, on the contrary, the head, shoulders, and chest, are small and narrow, while the pelvis and adjacent parts are broad and large, for which reason her body appears to converge upwards towards a point, like an erect pyramid. This difference in their form corresponds to the appropriate functions of either sex. The man being destined by nature for labour, is formed rather for the employment of his physical energies, in making provision for the maintenance of that family of which he is the chief; while the other sex, to whom the business of reproduction more especially belongs, requires a more capacious pelvis to fulfil the conditions of parturition. The trunk of the female is longer in proportion than that of the man; her lumbar region is more extended, her neck thinner and longer; while her legs, thighs, and arms, are shorter. From these circumstances result her more slender form, as well as the elegance, lightness, and ease, of all her motions.

There are many circumstances in the constitution of woman analogous to the characteristics of infancy in both sexes, and serving to indicate that her organization is not so highly matured as that of Man. Her bones are smaller and thinner; her cellular tissue more spongy and humid, imparting a roundness and plumpness to her form, and increasing the flexibility of her whole frame. Her pulse is weaker and more rapid; her skin is smooth, and almost deprived of scattered hairs, as well as of a beard, excepting after the age of parturition has passed, when the hair begins to grow plentifully upon the chin. It often happens that women have a smaller number of molar teeth than men, so that it may be said, with truth, that the wisdom teeth of many women never appear at all. They in general eat less than the other sex, preferring soft and saccharine food; while the man, being more energetic and vigorous, is instinctively led to prefer the more substantial and stimulating qualities of animal substances.

The beauty of the fair sex varies greatly all over the globe. In the north of Europe, the women are found more frequently than the men with light hair and eyes, and their dazzling whiteness often degenerates into insipidity. All the southern women are brown, and more or less striking; but the most beautiful of the sex, according to our notions of beauty, are found in the temperate parts of Europe and Asia. The centre of Spanish beauty seems to lie towards Cadiz or Andalusia, while the most agreeable Portuguese abound in the neighbourhood of Guimaraens. Women of great beauty are also seen in many parts of Italy and the adjacent islands; in particular, the Sicilian and Neapolitan ladies, descended from ancient Greek colonies, are accounted exceedingly beautiful. The Albanian women are well made; the females of the island of Chio appear charming.

Those of the Ægean Archipelago are very white, lively, and agreeable; like all Greeks, their eyes are very large and of great beauty.

But the most enchanting models formed by the hand of Nature are allowed to be the Circassians, the Cashmerians, the Georgians, the Mingrelians, and in general all those from Gurgistan, Imerita, and the neighbourhood of the Caucasian chain of mountains. All travellers agree upon this point; and the beauties of these nations being largely exported for slaves, are exclusively reserved, by the laws of Mahomedan countries, for the Faithful alone, while Jews and Christians are not permitted to purchase them in the markets of the Turkish empire. According to the most recent observations, the Lesghian women surpass all the others in beauty. Their manners are not, however, the most unobjectionable. In the regions inhabited by this beautiful race, scarcely an ugly countenance can be seen in either sex. Constancy is there as rarely to be found among the women as jealousy among the men. It is a remarkable fact, that this handsome race is immediately surrounded by the ugliest inhabitants of the earth, the hideous Calmucks and Nogais Tartars, with flat noses, high cheek-bones, their eyes far apart, their skins deeply sun-burnt, and of a dark brown colour. Yet the climate, the soil, the habits and mode of life in both, are the same; but the races are very different. The Calmuck women are not less frightful than their husbands. Imagine a mouth almost reaching to the ears; a skin of the colour of soot; oblique eyes, not very dissimilar to those of a goat; a nose so flat that the holes of the nostrils are alone visible; the lips and cheeks projecting and elevated; the hair stiff, black, and coarse as a horse's mane; a small stature and meagre limbs; flaccid mammae hanging down like sacks of tanned leather, surmounted with a jet black nipple,—and we have the picture of a Calmuck beauty. The young Circassian female is a complete contrast in every particular. With a skin of the utmost delicacy and whiteness, she possesses fair and flowing tresses, blue eyes, a gently-swelling bosom, a slender and flexible figure,—qualities which are combined with a lightness of step, a softness of voice, and an expression of the eye, which renders her the most charming of women, in respect at least to her external form. We must not, however, expect to find in her either the polished education, or that propriety of conduct which belongs exclusively to the most civilized nations. It is indeed chiefly from intermarrying with the females of Cashmere, Circassia, and other nations inhabiting the ancient Colchis, that the higher classes among the Persians are more handsome than the lower. The descendants of the ancient Guebres, or Parsees, of the sect of Zoroaster, who were forbidden, like the Jews, to marry out of their own caste, still continue brown and very ugly.

The expressive physiognomy and brilliant complexions of the English ladies are admired by foreigners. The general elegance of the bust, probably derived from their Norman ancestors, finds an exact counterpart at the present day in Belgium, Normandy, and Switzerland. Their hair and eyes are most commonly light, sometimes the former is even red, especially towards the northern part of the island. In Scotland, the bones of the cheeks and ancles appear rather too prominently, and the general complexion is paler, approaching more nearly to that of the Dutch ladies. The latter are remarkable for an excessive *embonpoint*.

Among the Germans, the Saxon ladies bear the palm of beauty. Scarcely an ugly face can be seen in the territory of Hildesheim, and the charming complexions of its inhabitants have given rise to the German proverb, that "The pretty women spring from the earth like flowers." Although the Austrian ladies are not in general ugly, the Hungarians far exceed them in beauty; but among all the German nations, a tendency towards *embonpoint* is rather common.

The Polish women are said to possess all the whiteness, as well as the coldness, of their native snows. This observation must, however, be considered as rather hyperbolic, for nearly all the females of Slavonian origin are lively and ardent, though doubtless their countenances want expression. The Russian ladies were recently in the habit of daubing their faces with a thick paint, while the abuse of the vapour-bath soon deprived them of their attractions. Their forms are masculine, and like most Slavonian women, their dispositions are energetic and passionate. The Albanian females are more agreeable than the Morlachians. The skins of the latter are very much sun-burnt, while long, pendant mammae, surmounted by black nipples, are often exhibited to the traveller's eye. In the extreme North of Europe, in Denmark, and Sweden, the women are almost always of a pale blonde, with blue eyes, and complexions often fading into a deadly whiteness. They usually have very large families, especially on the borders of the Baltic Sea.

The most beautiful French women are found towards Avignon, Marseilles, and the ancient Provence, which was formerly peopled by a Greek colony of Phocians. Further to the north, the Cauchoises, the Picardes, and the Belgians, are the prettiest, their skins being of a dazzling whiteness. There is, however, less elegance in their motions, as well as delicacy in their forms. The Parisian ladies are more distinguished for the finished elegance of their manners than for beauty. In Brittany, the ancient Armorica, the women are generally too thick in the limbs. The

prettiest Portuguese ladies have rather long necks; those of the Castilians are excessively short. The more attractive beauties of Italy are found in Tuscany, about Florence, Sienna, or even Venice; but in Lombardy and the neighbourhood of the Alps, their forms, being more voluminous and massive, are less attractive.

In those regions of Asia situate on this side of the Ganges, and peopled, like Europe, by the same white race, we still observe some beautiful features in the females. The Persian women, born under a fertile and temperate climate, are generally very agreeable. The women of Turkey are pretty, for the most part. "Even among the lower classes in the East, every woman," says Belon, "has a fresh and blooming countenance, with a white skin as soft as velvet," probably owing to the frequent use of the hot-bath. They destroy the hair on every part, excepting the eyebrows and head, with the *Rusma*, a depilatory substance made of lime and orpiment; while they tinge their nails and fingers red with *Henna* (*Lawsonia inermis*, Linn.) From the excessive inactivity of their harems, their countenances acquire, according to the Turkish expression, the roundness of the full moon. An unusual rotundity of form is here considered as the highest beauty; so that, according to Volney, beauty is estimated by the quintal. As in Egypt, their mammae are of enormous size. Yet nothing can be more monotonous than the physiognomy of all Turkish women, owing to their faces being always covered. Indeed, so much are they attached to this practice, that some of the poorer women, who can afford only a partial clothing, prefer exposing any part of their body rather than the face. Their countenances thence become wholly destitute of every expression.

The Arab women, although tolerably agreeable in their extreme youth, and remarkable at all times for large black and brilliant eyes, which their poets compare to those of the Gazelle, disfigure themselves by passing a large ring through the cartilage of the nostril; also by designs engraved upon the skin with the point of a needle, and dyed of various colours. The Hindoo women place a similar ring in the left nostril. The heat of the sun dries up and browns the Bedouin and Hindoo females. They sometimes paint the forehead and cheeks blue, and the nails always red.

Nearly the same observations are applicable to the Moorish and Berber women of the white races; their features are considered tolerably regular. Those who never leave the harems and towns preserve a very white appearance, according to Bruce and Poiret. They are even etiolated or blanched like plants which vegetate in obscurity.

In Malabar, Bengal, Lahore, Benares, all Hindoostan, and Mongolia, the women seem agreeable in general, but small, yellow, and slender; partly from the heat of the climate, which enervates them, and partly from marrying excessively young, at ten or twelve years of age, before their constitutions can be completely formed. The continual transpiration which they experience from the surface of the skin renders its appearance always fresh, and this is increased by the use of perfumed oil of cocoa. The latter is also copiously applied to the hair; and they make frequent application of some depilatory substance. It is stated that the jaws of the women of Malabar are very narrow, that their legs are long in proportion to the body, and their ears placed very high. All the women of the East, according to many travellers, have the pelvis very broad, a defect which the Armenian and Jewish dealers in female beauty endeavour to remedy by tight bandages.

The females of the White races, according to the notions prevalent in our climates, engross the whole beauty of the sex. We must, however, add a few words regarding the Yellow and Black beauties,—such, at least, as they appear in the eyes of those who have learned by habit to get rid of the prejudices of colour.

In Asia, the yellow ladies of Golconda and Visapour are much prized; their features are lively and attractive. Those of Guzerat are olive-coloured; but paler than the men, who are more tanned by the heat of the sun. It is said that the prettiest Chinese beauties come from the province of Nan-king, and Nan-chou its capital.

Even the Negresses are not without their degrees of beauty. In the markets of the East, they bear their proportionate prices, especially the younger females. According to the reports of the slave-merchants, no black beauty is ever imported from countries where the waters are bad, or the soil steril. The black women from the shores of the Red Sea are much esteemed by the Persians, who import a great number annually. The East Indians are also partial to the Caffre girls, who are entirely black, and exported in large numbers from Mozambique. "Les femmes Kamtehadales et Samôïèdes ont, dit-on, les parties de la génération très-larges. On sait que plusieurs Hottentotes ont les grandes lèvres du vagin longues et pendantes comme le fanon du bœuf, et quelquefois découpées en festons; mais elles n'ont point ce prétendu tablier de peau qu'on leur attribuoit; les femmes des Houzonanas portent vers la croupe un coussin de graisse qui ressemble à un cul postiche."

Many attempts have been made to estimate the total number of human beings on the surface of our globe; but relative to this subject nothing has hitherto appeared but conjectures of great vagueness. While some

would consider them as amounting to a thousand millions, others, with greater probability, estimate their number as low as six hundred millions. This principally arises from our ignorance regarding the amount of the population in the great empires of Asia, the innumerable states of the interior of Africa, the vast territories of America, and in New Holland. M. Malte-Brun makes the following approximations, which are probably very far from the truth—

Europe,.....	170 millions.
Asia,.....	320 to 340.
Africa,.....	70
America,.....	45 to 46.
South Sea Islands.....	20

Total, 625 to 646 millions.

The population of China by some accounts is said to amount to 333 millions, while others make it as low as 19½ millions.

In respect to the proportion which the number of the one sex bears to that of the other, our information is more precise. More males than females are always born in the civilized countries of Europe; yet the number of females exceeds that of the males. In England and Wales, and in Sweden and Finland, the male births are to the female as 100 to 96; in France as 100 to 95. The ratio of 25: 24 is approached very nearly in all other places where observations have hitherto been made. Thus, at Petersburg, 100 male infants appear to 95 females; at Paris, 100 males to 96 females. By one enumeration made in France, during the ministry of M. Chaptal, the returns were 100 males to 95 females; and once for Paris they were 100 males to 97 females. Süsmileh assures us, that 100 males are born for 93 females in North America. In New Spain, according to Humboldt, 100 males to 97 females.

This law of Nature will be more satisfactorily illustrated by the following Table, showing

THE PROPORTION OF THE SEXES AT BIRTH,

In	During the	Preceding	Males.	Females.	Authorities.
England and Wales,	29 years	1800	3,285,188	3,150,922	Population Abstracts.
Sweden and Finland,	20	1795	1,006,420	965,000	Wargentin.
France,	3	1802	110,312	105,287	La Place.
Scotland,	29	1800	67,353	62,636	Population Abstracts.
Carlisle,	18	1796	2,400	2,271	Heysham.
Montpellier,	21	1792	12,919	12,145	Mourgue.
Stockholm,	9	1763	12,015	11,706	Wargentin.

The mortality among male infants is, however, greater than that of females; hence it results that their numbers become equal about the 15th year. Men are always exposed to greater dangers than women, owing to various circumstances peculiar to their sex, such as their removal to the colonies, military and naval service, unhealthy arts and dangerous trades, accidents, and the temptations to excesses of all kinds. The women, even in our climates, are therefore always more numerous than the men. From the observations of Kerseboom, Deparcieux, and others, it further appears, that women live longer than men in the ratio of 18 to 17, when once they have passed the more critical ages. More boys die than girls, and more men than women, nearly in the ratio of 10 to 9, at Paris, London, and elsewhere. In 1778, the female population of France exceeded the male by one-sixteenth part; in 1763, Wargentin remarked one-fifteenth in Sweden. In Venice, during the year 1811, there were 10 women to 9 men; and, by more recent observations, 9 women to 8 men in Paris.

In warm countries, notwithstanding the misrepresentations of prejudice, we find the number of females very considerably greater than that of men. Kempfer relates that at Meaco, a large city of Japan, there are 6 women to every 5 men, and the same proportion was noticed at Quito by Ulloa. M. Labillardière found nearly 11 women to 10 men in the south of New Holland. Among the Guaranis, in America, there are about 14 women to 13 men, according to Azara. Major Pike found a much greater proportion of women in several of the savage tribes of New Mexico; there being in some of them 7 women to 6 men, or even 3 women to 2 men; and among the Sioux, the surprising proportion of 2 women to 1 man. In the large towns of Mexico, according to Humboldt, there are 5 women to 4 men.

This numerical excess of women is more especially remarkable on the Coast of Guinea, and in the different Islands of the East Indies, such as Java; likewise on the Malabar Coast, in Bengal, and at Bantam. It may arise partly from the traffic of Negroes, which exists in Africa, and partly from the commerce and navigation of the East removing a large portion of the male population. It is still, however, very probable that their number is considerably greater, as the accounts of nearly all travellers agree, although their statements are not in general founded upon any precise enumeration. It is asserted that there are at Cairo 7 women to 6 men, 6 to 5 in the East Indies, 5 to 4, or even 4 to 3, in the different regions of Southern Asia.

According to the estimates of some eminent Statisticians, in a district of country where 10,000 infants are born annually, we must expect to find 295,022 inhabitants of both sexes. Of these 93,003 are children below the age of 15, and 202,019 above that age. Of the latter individuals, in the most civilized country of Europe, there will not be more than 23,250 marriages, the average duration of which may be estimated at 21 years, 5812 widows, and 4359 widowers.

The number of births always exceeds that of deaths among the most civilized nations, but the proportion varies according to local circumstances.

OLD AGE AND DEATH.

Scarcely has the body attained its full height, than it begins to increase in thickness, and the fat accumulates in its cellular tissue. The different vessels gradually become obstructed; the solids grow rigid; and, after a life of greater or less duration, more or less agitated, more or less painful, old age follows, bringing in its train decay, decrepitude, and death. Those who live beyond one hundred years are rare exceptions; by far the greater number perish before that term, by disease, by accidents, or merely by old age itself.

The systematic order in which the human race are snatched away by death, is one of the most remarkable phenomena of Nature. Nothing appears, at first sight, to be more uncertain than the life of a single individual, because the estimate is derived from a limited experience of the mortality among a few private acquaintances. Yet the Tables of observation obtained by recording the numbers of individuals who die at every period of life from infancy to extreme old age, indicate that a remarkable regularity actually exists. Once in possession of a knowledge of the law of mortality prevalent in a given country, or among a given class of individuals, we are not only able to form general estimations, but to calculate the nicest shades of risk or adventure.

All tables of observation exhibit the precarious life of the infant in a striking point of view. The expectation of human life increases gradually until the ages of six, seven, or eight, which may therefore be considered as the safest period of life, while it diminishes to the most advanced ages.

The following Table exhibits the mortality experienced among the inhabitants of our crowded metropolises.

THE MORTALITY IN LONDON,
OBSERVED AMONG 190,565 INHABITANTS, FROM 1811 TO 1820.

Ages.	No. Living.	Deaths.	Ages.	No. Living.	Deaths.	Ages.	No. Living.	Deaths.
From 0 to 2	190,565	52,970	From 60 to 70	35,589	15,888	From 103 to 104	13	4
2 5	137,595	18,772	70 80	19,701	12,247	104 105	9	1
5 10	118,823	7,848	80 90	7,454	6,210	105 108	8	2
10 20	110,975	6,363	90 100	1,244	1,205	108 109	6	2
20 30	104,612	13,600	100 101	39	16	109 111	4	2
30 40	91,012	17,916	101 102	23	5	111 113	2	1
40 50	73,096	19,668	102 103	18	5	113 114	1	1
50 60	53,428	17,839						

On comparing this Table with Dr Heysham's, showing the mortality at Carlisle, or with the returns of the Registry Commission for the kingdom of Sweden, we find that the inhabitants of London are, with the sole exception of the centenaries, subject to a greater mortality than the residents in small towns, villages, or the open country. This arises chiefly from the vices, unhealthy occupations, sedentary habits, and the want of cleanliness, so remarkable among the lower classes of the people, who in all large cities form the great mass of the population.

The apparent difference is, however, greatly diminished, if we make allowance for the circumstance, that the hospitals are almost always established in towns, and many of the sick brought to them from the

country. Out of 21,000 deaths recorded in Paris, nearly 7000 took place at the hospitals. Although the inhabitants of the country enjoy a purer air, a more sober and regular life, it cannot be denied that rural employments subject them to many hardships, so that it may be fairly questioned whether the real disadvantages of cities are so great as a comparison of Tables of Mortality would indicate.

From the Returns obtained in the whole kingdom of Sweden and Finland, by the Tabell-verket, or Registry Commission, during the 50 years preceding 1805, the expectation of human life was found to vary as in the following Table:—

THE EXPECTATION OF HUMAN LIFE,
Deduced from the Observed Mortality in Sweden and Finland, during the 50 years from 1755 to 1805.

At Birth,	36.64 years.	Age 25	35.46 years.	Age 50	18.71 years.	Age 75	5.95 years.
Age 5	48.24 .	30	32.00 .	55	15.66 .	80	4.43 .
10	46.28 .	35	28.64 .	60	12.69 .	85	3.43 .
15	42.69 .	40	25.20 .	65	10.07 .	90	2.48 .
20	38.98 .	45	21.98 .	70	7.74 .		

These investigations were commenced under the direction of M. Wargentin, and continued by MM. Nicander and Leyonmarck.

We here see that the probable expectation of the life of an Infant just born, is rather more than that of a person aged 25 years; that the best period of life is midway between the ages of 5 and 10, and that the value of life does not diminish in the direct ratio of the years which gradually roll away, a circumstance not usually attended to by ordinary calculators. Although the expectation of human life diminishes with increasing years, it always decreases in a smaller ratio. Thus, at 65 years of age, the expectation of life is 10 years, while at 75 it is still 6 years. The probabilities of death during these 10 years being already decided and converted into certainty, the remaining probabilities after 75 can alone affect the result.

We are still in want of accurate returns of the Mortality prevalent at the several ages over the entire Kingdom of Great Britain and Ireland. In this respect, the government of Sweden has set an example to the rest of Europe, well worthy of imitation.

In the absence of more accurate Observations, Dr Thomas Young formed a hypothetical Table of all the observations made in Great Britain previous to the year 1824; but, from the influence of the London Bills of Mortality, and the want of returns from other parts of the kingdom, the mortality of this country would appear by his Table to be very considerably greater than that of Sweden and Finland. However, until some system of observations, embracing the entire kingdom, is set on foot by our government, we must remain in comparative ignorance of the probabilities of life at the several ages as far as regards our own country.

THE EXPECTATION OF HUMAN LIFE,
According to the Mean of all the Observations in Great Britain, previous to the year 1824.

Age. At Birth.	Years.	Age.	Years.												
30	0	15	37.6	30	27.8	44	20.1	58	13.1	72	7.2	86	3.2	100	2.4
1	36.8	16	36.8	31	27.3	45	19.5	59	12.6	73	6.8	87	3.0	101	2.1
2	40.6	17	36.0	32	26.7	46	19.0	60	12.1	74	6.5	88	2.8	102	1.8
3	42.5	18	35.3	33	26.1	47	18.5	61	11.7	75	6.1	89	2.6	103	1.8
4	43.5	19	34.6	34	25.6	48	18.0	62	11.2	76	5.8	90	2.5	104	2.4
5	43.9	20	33.9	35	25.0	49	17.5	63	10.8	77	5.5	91	2.4	105	3.0
6	43.8	21	33.2	36	24.4	50	16.9	64	10.3	78	5.2	92	2.5	106	3.5
7	43.6	22	32.5	37	23.9	51	16.4	65	9.9	79	4.9	93	2.5	107	2.8
8	43.1	23	31.9	38	23.3	52	15.9	66	9.5	80	4.6	94	2.5	108	2.5
9	42.6	24	31.3	39	22.8	53	15.4	67	9.1	81	4.3	95	2.7	109	2.0
10	41.9	25	30.7	40	22.2	54	15.0	68	8.7	82	4.1	96	2.9	110	1.5
11	41.2	26	30.2	41	21.7	55	14.5	69	8.3	83	3.9	97	2.9	111	1.0
12	40.5	27	29.6	42	21.2	56	14.0	70	7.9	84	3.6	98	2.9	112	0.5
13	39.8	28	29.0	43	20.6	57	13.5	71	7.5	85	3.4	99	3.1	113	0.0
14	38.3	29	28.4												

From the limited number of survivors who attained the age of 90, the results in the above table above that age cannot be relied on.

The Tables of Observation made at Carlisle by Dr Heysham approach very nearly to those procured from the whole kingdom of Sweden, and probably represent the average Mortality among the upper and middle classes of society more correctly than any other in this country. We there find, out of 10,000 infants at birth, that one-fourth die before they attain the age of 3 years, and one-third before the age of 6 years. Further, that only one arrives at

The age of 41	out of	2 Infants.
... 62	...	3 ...
... 69	...	4 ...
... 73	...	5 ...
... 75	...	6 ...
... 80	...	10 ...
... 85	...	22 ...
... 90	...	70 ...
... 95	...	333 ...
... 100	...	1,111 ...
... 104	...	10,000 ..

cially in respect to their state of peace or war, plenty or scarcity. In Sweden and Finland, one male out of 35½, and one female out of 39, died annually, during the 20 years preceding 1795. In the whole population of England, there died annually in the 10 years preceding 1810

One out of 43½ males,
and One out of 48 females.

Owing to the sudden changes of temperature, the beginnings of spring and autumn, about the time of the equinoxes, are the most unfavorable periods of the year; and in tropical climates, where there are only two seasons, the most dangerous periods are about the times when these seasons change.

By Dr Heysham's Observations at Carlisle, it appeared that the intensity of mortality there was least in the month of August for both sexes, and at its maximum for females in the month of May; and for males, as well as the whole population without distinction of sex, in October. Dr Short's Observations, collected at Derby, Chester, York, Lancaster, and other parts of England, indicate that the maximum mortality occurs in April, and its minimum in August; so as fully to confirm the popular opinion that settled weather is healthy, and frequent transitions unhealthy, especially sudden changes from heat to cold, and the contrary.—[Milne's Treatise on the Valuation of Annuities and Assurances.]

According to the London Bills of Mortality, during the ten years preceding 1810, the numbers cut off by certain well-known diseases were as follows:—Consumption, 43,905; Fevers of all kinds, 16,204; Old Age,

sin, Buckwheat, or Black corn (*Polygonum Fagopyrum*), on which the poorer inhabitants of Sologne, in the Orleansois, are almost wholly maintained, occasion pains in the joints and other diseases. In like manner, the glutinous dishes of polenta, macaroni, millet-broth, and new chestnuts, produce different glandular enlargements and other endemic maladies, in every place where the populace feed too exclusively upon these substances. The abuse of acid wines on the Rhine, and other districts of Germany, as well as the constant use of cider, dispose towards gout and colic.

According to Forster and other observers, we can only attribute the sloughing ulcers found among the inhabitants of several Islands in the South Seas to the acrid drinks, which they prepare from the roots of a species of Pepper. Several other diseases must be considered rather as resulting from a particular kind of diet prevalent in one particular place, than from any other cause. Of this kind are the flabby and leucophlegmatic condition of those nations which subsist chiefly on milk, butter, and cheese, as in Friesland, in the Alps, and all places where much cattle are maintained. The dysentery and diarrhoeas, so fatal in very warm or tropical climates, proceed rather from indigestible substances, the abuse of fruits and spirituous liquors; for we find that these diseases can often be avoided by abstaining from the excesses which led to their prevalence.

Hippocrates has long ago remarked, in his Treatise on Air, Water, and Soils, that the local circumstances of each territory predispose the human constitution to particular maladies, or relieve it from diseases of an opposite kind. At the present day, we find the dull inhabitants of the banks of the Phasis equally subject to disorders of the lymphatic system with the Sauromates of the Palus Mæotis; we may contrast, with equal justice, the mild and timid Asiatic with the robust and courageous European, or the corpulent inhabitant of a fertile valley, with the energetic and nervous mountaineer. We likewise find that in low and humid grounds, where the air is stagnant, or exposed to the influence of warm and moist winds from the south and west, as in Holland, putrid and eruptive diseases become very prevalent. Broken-down constitutions are often affected by vertigo, deafness, catarrhal ophthalmias, difficulty of breathing, coughs, lethargy, apoplexy, catarrhs, &c.

On the other hand, in dry and northern exposures in elevated regions, agitated by winds from the north and east, such as the upper Auvergne, the Vivarais, or at Marseilles, Montpellier, or Grenoble, the inhabitants are much exposed to inflammatory consumption, active hæmorrhages, a strong disposition to acute maladies, to inflammations, pneumonia, rheumatism, and acute ophthalmias. Diseases of the chest are common among the inhabitants of cold and mountainous countries.

The two characters of a locality just enumerated, give rise to endemic affections of an opposite kind. In low, moist, and tolerably warm places, the constant humidity habitually relaxes the frame. Diseases here assume a chronic character, with imperfect crises, and humoral degenerations, inducing a precocious old age, among the most of the inhabitants. Elevated regions, on the other hand, bring the body into a state of vigour and energy.

From these endemic dispositions, it follows that strangers often remain exempt from the diseases prevalent among the natives of a country, or, on the contrary, the same circumstances, which have become, through habit, essential to the health of the inhabitants of a district, occasion the illness of a stranger. The water of the Seine often causes Diarrhoea to every one, except the Parisians, who are accustomed to drink it. The Cretin of the Valois loses his stupid appearance in the arid and stimulating heights of the surrounding mountains, while the mountaineer is less affected with hæmorrhages and acute affections by descending into the denser and moister air of the neighbouring valleys.

Hence it follows, that maladies, like plants, do not disseminate themselves equally in all regions. The miliary fever, frequent in Normandy, is almost unknown in the other provinces of France. Aphthæ, common in Holland, are scarcely ever to be found in Vicenne. The carbuncle, common in the south of France, can scarcely be encountered in the north. For analogous reasons, it may be said that the peculiar nature of each country serves to modify the types of the several diseases of the human race. A pleurisy, for example, will be different in intensity in a mountainous locality and in deep valleys. On this account, however exact the descriptions of diseases may be made by physicians, they always exhibit varieties in different climates, which have not been elsewhere remarked.

The Laplanders, according to Schœffer and Linnæus, are subject to inflammations of the head and lungs, and especially of the eyes, in consequence of their being exposed to smoke and dust, as well as to the glare of the sun upon the snow; also to mortification of the extremities from the cold. The frequent use of the milk of the Rein-deer and smoked flesh often occasions pyrosis, and violent colics, followed by pyalism. They are also disposed to vermes, and are singularly liable to spasmodic affections. They are never affected with plague, acute fever, or agues.

In Norway and Sweden, in some parts of Finland, of Russia and Den-

mark, however, agues, paralysis, gout, dropsy, and rheumatism, are prevalent, according as the country is more or less moist or cold. But the dryer and elevated regions of Iceland, Norway, and Sweden, are salubrious, and the inhabitants attain a remarkable degree of longevity.

The Muscovites, Cossacks, and Tartars of Kasan, inhabit more healthy countries: with the exception of affections of the chest, caused by cold, they experience few maladies, and have good appetites. Sometimes they experience a morbid hunger during severe frosts. Intermittent fevers prevail on the banks of the Volga, the Don, and other large rivers.

We know that the peculiar affection of the hair, termed the *Plica Polonica*, is endemic in Poland, Lithuania, Transylvania, and Silesia, and sometimes is found in Alsace, Switzerland, and the Low Countries. It is said to prevail more especially among Jews and Christians, of uncleanly and intemperate habits, but especially among the former. This disease, according to many writers, was introduced originally from Tartary in the Ukraine. It is often accompanied by a general affection of the lymphatic system, and other diseases. Some instances are not wanting among the uncleanly Fakirs of Hindoostan.

In Hungary, the inhabitants are sometimes affected with pestilential fevers, accompanied by purple or miliary eruptions. In Thrace, Macedonia, and Turkey in Europe, we find many acute fevers, affections of the brain, and dysenteries. It is well known that the plague often prevails in Constantinople, and extends its ravages among the Turks. From the frequent use of the hot bath and opiates, their constitutions assume less energy than those of Europeans in other climates.

In Germany, purple and miliary fevers are very prevalent towards Leipsic; in Misnia, these affections are frequently complicated with small-pox and measles.

We find a great number of endemic affections in Britain. Tuberculous consumption and catarrh are very frequent maladies in this country. The counties of Essex, Cambridge, and Lincolnshire, were once very subject to intermittent fevers, owing to their marshes, though latterly they have greatly diminished from the general drainage of these districts. Common continued fever is very prevalent, especially towards autumn, and in our large manufacturing districts, hooping-cough, measles, and scarlatina, occur almost universally among children.

In France, calculous disorders prevail in the Barrois and the wine country, which some would attribute to the nature of the waters, but are more probably owing to the wine. In the moist territory of Languedoc, children become subject to the disease called *la sarrette*, a kind of locked-jaw, and *crinons*, *masclous*, or sub-cutaneous vermes, found likewise in the north of Europe.

The Swiss are often troubled with nostalgia, or an excessive longing for their native land, when in foreign countries. The districts of Vaud, Fancigny, Maurienne, and especially the Valais, are subject to cretinism, bronchocele, glandular swellings, accompanied by cachexia, dropsy, and idiocy. During the greatest heats of summer, the inhabitants of these deep valleys are also afflicted with inflammations of the brain and coups-de-soleil.

In Italy, diseases vary according to the localities. The maladies endemic in marshy countries increase towards Mantua, the lagunes of Venice, the marshes of Pisa, and especially during autumn, in the *aria cattiva* of the Pontine marshes, near Rome. Towards Naples, there are often to be seen red spots upon the skin, being a kind of urticaria or nettle-rash. The Greeks are often afflicted with ordinary leprosy, attended with alopecia, or a falling away of the hair from the entire body.

In the moist gorges of the mountains in the Asturias, there prevails a peculiar scorbutic leprosy, called *mal de la rosa*, described by M. Thierry in the Journal Medicale.

The elevated plains of Tartary in Central Asia maintain a great number of wandering nations, whose disorders can scarcely be termed endemic, as these people continually change their place of residence. Some Siberians are subject at birth to an occasional relaxation of the muscles of the upper eye-lid, occasioning a temporary blindness, like the young of many quadrupeds. Southern Asia exhibits most of the endemics peculiar to tropical climates; the hepatic and nervous systems become highly excited, and lead to corresponding diseases. In Asia Minor, besides the plague and many affections of the lymphatic system, such as leprosy and elephantiasis, there prevail spasmodic affections, and especially the *cholera morbus*, which is also frequent in Batavia. At Ceylon, ascites and tympanites are very prevalent, especially during the rainy season. Among all these nations, the nervous system is excited by a kind of habitual irritation from the heat, which gives rise to a corresponding debility in the muscular system, and feebleness of the digestive organs, the vital energy being determined towards the surface of the body. According to Duhalde, there prevails a peculiar kind of erysipelas among those Chinese who work in varnish, and the Asiatics generally are often afflicted with a kind of eruptive disease or *penphigus*, from being exposed to the heat of the sun.

Many of the diseases found in Asia prevail also in Africa, but modified

by the peculiar conditions of the climate and the races of men. The plague appears to be endemic in Egypt; it ceases at the period of the greatest heat, when the Nile rises, and the Northern or Etesian winds blow. When, however, the winds blow from the deserts, during the fifty days following Easter, they raise whirlwinds of a hot and fine sand, which occasion frequent ophthalmias. In Cairo, there are an immense number of blind individuals, and at least one half of the inhabitants are afflicted with diseases of the eye. While the plague prevails, other diseases cease, and particularly intermittent fevers. Diseases of the skin are very common in this country.

Mungo Park found numerous goitres and frequent swellings of the sub-maxillary glands, in different regions of Bambarra, along the river Niger. In the island of St Thomas, the inhabitants are affected with a species of elephantiasis, to such a degree, that Buffon mistook them for a new variety of the human species. There is a dry and burning wind, called *Harmattan*, blowing from the north-east, which traverses the Sahara, loaded with a reddish vapour, or rather a fine and hot sand, which dries up the vegetation, chops the lips, occasions ophthalmias, but at the same time produces very salutary effects upon the system, so that, when it arrives at the marshy districts of Africa, it immediately drives off fevers, dropsy, and other diseases.

Some disorders are confined to the Negro race. The yaws, a disease in which elevated red blotches appear upon the skin, are so peculiar to this race, that they do not attack the Europeans in the colonies of America, although apparently under the same circumstances. The inhabitants of the African deserts, who feed upon locusts, are subject, according to Drake, to the *morbus pediculosus*, of which disease numbers die before the age of forty. The western coasts of Africa are more unhealthy than the eastern, from the trade-winds blowing from the east, and becoming heated as they traverse the continent.

The extensive hemisphere of America comprises a vast number of different climates, and is liable to an immense number of endemic affections. At its northern extremity, such as Labrador and Hudson's Bay, and on the western coasts at Nootka Sound, few diseases are to be found except such as arise from the excessive cold. The descendants of the French and English, who have settled in Canada, have acquired the same hardy constitution as the Swedes.

Intermittent fevers prevail greatly in the United States, from the marshy nature of the country. The frequent changes, as well as the humidity of the atmosphere, occasion catarrhal affections, inflammations of the pleura and lungs, with phthisis. Connecticut is more healthy. Louisiana is much subject to spasmodic affections and opisthotonos, a form of tetanus.

Mexico, and indeed all equinoxial America, is moister, and covered more densely with forests than Africa. It is chiefly towards Vera Cruz, and its fatal coasts, that the yellow fever has long been known. According to M. Humboldt, the ancient Mexicans, or Toltecs, had experienced this malady before the arrival of the Spaniards. It has spread rapidly throughout all the Spanish colonies and elsewhere, as at New York, St Domingo, Porto-Bello, where it bears the name of the black vomit, or *vomito prieto*. This fatal disease is chiefly endemic on the marshy banks of rivers, and towards the end of autumn. It principally attacks Europeans, and seems to spare the Negroes. Some parts of Spain and Italy are not exempt from this malady. Dropsy is very common on the coast of Mexico. In all these warm climates, tetanic affections very frequently follow ordinary wounds, causing sudden death, which has often been erroneously ascribed to the poison of the woorara and upas.

During the rainy seasons in Jamaica, acute fevers and colics are the most common maladies, followed by paralysis. Many African maladies prevail here, especially among the Negroes, with whom they are imported. Most Europeans, on passing under the Tropics, experience a kind of feverish delirium called *calenture*, the effect of the heat, and which goes off by vomiting. On arriving at the colonies, they fall into a state of extreme debility and languor. Afterwards, the abuse of strong liquors, fruit, and other habits unsuited to the climate, occasion them to become afflicted with dysenteries, diarrhœas, and boils. The Brazilians are exposed to frequent ulcerations of the feet, called *bichos*, produced by a species of Flea (*Pulex penetrans*, Linn.), which penetrates into the flesh. A red insect (*Izodes nigri*, Latr.) occurring in the Savannahs of Martinique, occasions much inconvenience to the Negroes.

Most writers consider Syphilis as imported from the New Continent, and it cannot be denied that it was found in Peru; but the warm climate and the vegetable diet of the inhabitants render it less dangerous than in our own climate. In some of the South Sea Islands, this disease, introduced by Europeans, cures itself without medical treatment. The elevated plateaux of the Andes are very healthy, and contain many centenaries.

The influence of the various occupations of civilized life upon the human frame is a subject of equal interest with that of the prevalence of diseases in particular localities. Under this head we may include seden-

tary habits; want of ventilation; insufficient exercise of particular parts of the body; exposure to cold; over-exertion; the excessive use of particular parts; unnatural or constrained positions; exposure to heat, moisture, and the noxious fumes or minute particles of animal, vegetable, or mineral substances.

Sedentary habits, when continued for a long time, and without those occasional relaxations necessary to the health of the system, are certain to shorten life. Persons of these habits soon become afflicted with stomach complaints, and various organic diseases, in many cases arising from the pressure on the sternum and lower part of the stomach. Want of exercise is peculiarly fatal to the young, among whom it is as necessary as food to the development of the several structures of the body. The effect of confinement is strikingly observable on comparing the crowded inhabitants of a manufacturing town with a body of active agriculturists. It not only stunts the growth but produces deformity, and depresses the mental powers. Mr Owen states that, in his factory at New Lanark, the children were frequently deformed in their limbs, their growth was stunted, and they were incapable of making any progress in the first rudiments of education. The evil effects of confinement are greatly increased by excesses of any kind, such as too much food, or the use of ardent spirits. On the other hand, too limited a supply of food is almost equally prejudicial. Literary men in general suffer in an especial manner from the want of bodily exercise, on account of the disproportionate manner in which their mental powers are over-strained. In various classes of artizans, such as tailors, weavers, jewellers, engravers, and watchmakers, the effects of long confinement are especially observable, and in the several classes of writing-clerks. Tailors are particularly subject to curvatures of the spine, to inflammations of the stomach, bowels, and liver. In all the instances just enumerated, the muscular and nervous systems acquire an unnatural degree of subserviency to the lymphatic system.

Want of ventilation is especially prejudicial in factories, where children and adults are congregated together in vast numbers and in over-heated apartments. The air becomes tainted with an excess of carbonic acid and animal effluvia, while oxygen is supplied in quantities too small to purify the blood during respiration. When the rooms are not heated in the usual manner by a common fire-place, but by pipes of warm air or by steam, the ill effects of a want of ventilation become greatly increased.

Exposure to cold is one chief cause of many diseases. Indeed, it may almost be said, that one-half of the deaths and two-thirds of the diseases that occur among the children of the poor, are more or less caused by cold. Numbers fall victims, during the winter and spring, to their want of sufficient clothing. A brief or moderate exposure to cold, during perfect health, acts as a useful stimulus to the vital action; but a very intense or long continued abstraction of heat acts as a direct impediment to its exertion.

Exposure to heat is chiefly injurious from the subsequent transition to cold. The perspiration is suddenly checked, and the consequences often become fatal. Rheumatism, asthma, catarrhs, and inflammation of the lungs, are the results of sudden exposure to cold, without the precaution of warm clothing. Bakers, brewers, sugar-refiners, forgers, and glass-blowers, are particularly liable from their occupations to be affected with these diseases.

Moisture, in itself, does not appear to be positively injurious, except in so far as it lowers the temperature of the body by evaporation. As the sea is usually warmer than the air during winter, it happens that, in cases of shipwreck at this season, an almost total immersion in the water is less injurious than sitting in wet clothes exposed to the cold air, and the rapid reduction of temperature during the time they are drying. Cullen records an instance of shipwreck, where the persons who lived longest were almost totally immersed in salt water; while the consequences were fatal to those who were exposed to the freezing influence of the wind only, or to the wind, assisted by the evaporation from wet clothes. Immersion for a long period in salt water is not so injurious as in fresh, from the former being more stimulating. The use of spirituous liquors during shipwreck increases the danger, as it raises the temperature of the body for a short time, only to render it more sensibly affected by the subsequent cold. It is not unfrequently followed by apoplexy. Inattention to change wet clothes, whether from rain or perspiration merely after severe labour, is very injurious. This is the exciting cause of most of the diseases found among fishermen, water-carriers, fullers, and washerwomen.

The animal effluvia of candle-manufactories, slaughter-houses, and dissecting-rooms, are generally unhealthy, although no positive diseases can be assigned to them. In most of these occupations, where persons are much exposed to animal effluvia, there are certain causes serving to counteract the ill effects that would otherwise follow. Tanners are preserved, by the tan and lime, from the injurious consequence of exposure to animal matter and moisture. M. Patissier observes, that butchers and catgut manufacturers are free from phthisis, while glue and size boilers are comparatively healthy.

The particles of vegetable matter in a minute state of division, found floating in the atmosphere of corn-mills, when inhaled by the work-people, bring on asthma, indigestion, and frequently consumption. Millers are consequently pale and sickly in their appearance, and their lives usually short. The heated and sulphureous vapours arising from kilns render maltsters liable to many diseases. Snuff-makers, from being exposed to the dust of the tobacco, are often affected with diseases of the lungs and head, partly from its mechanical effects, and partly from its narcotic influence.

Mineral particles in general are peculiarly noxious. The fumes of mercury become speedily fatal to the workmen in quicksilver mines, to gilders, and glass-platers. M. Jussieu states (*Mémoires de l'Académie des Sciences*, 1719), that by proper precautions, by care in changing the dress, and by minute attention to cleanliness, the free workmen in the mines of Almaden escaped disease for a long time; while the slaves who could not afford a change of clothing, and took their food in the mines without ablution, speedily became diseased in the throat and lungs. Lead occasions paralysis and colic. M. Merat (*Traité de la Colique Métallique*, Paris, 1812) states, that out of 279 cases of colic in the hospital of La Charité, at Paris, in the years 1776 and 1811, the numbers were—Painters 148; Plumbers 28; Potters 16; Porcelain-makers 15; Lapidaries 12; Colour-grinders 9; Glass-blowers 3; Glaziers 2; Toy-men 2; Shoemakers 2; Printer 1; Lead-miner 1; Shot-manufacturer 1. Of the remainder (39) there were 17 belonging to trades connected with copper. The same writer recommends the artisans never to take their meals in the workshop, or without ablution, and in general to preserve great cleanliness. The acid vapours of chemical works frequently occasion inflammation of the throat, and the most corpulent person is speedily reduced to a small size. Chlorine is similarly injurious, but at the same time acts as a disinfectant. The chemical manufactory of Belfast was preserved by the Chlorine fumes from the effects of the epidemic that ravaged Ireland for the three years preceding 1819.

Particles of matter acting mechanically on the lungs are perhaps of all others the most certainly fatal to the artisan. By irritating the bronchial surface, pulmonary diseases are speedily induced. These causes act principally among needle and steel-fork pointers, dry grinders, and sandstone cutters. These unfortunate victims of their industry seldom live above the age of 40, while the greater number die at the ages of 30 and 35. Philanthropists of every description have long attempted, by various contrivances, to remove these evils; but the ignorance, perverse habits, and blind fatuity of the workmen themselves, are the principal obstacles to their success. Mr Abrahams of Sheffield proposed magnetic masks to intercept the minute particles of steel; M. D'Arcet invented the *fourneau d'appel*; Dr Johnstone the damp crape, and Dr Gosse the sponge. But the carelessness of the workman mars the good intentions of the philosopher; so strong is the influence of habit and the recklessness consequent on the certainty of a short career.

TEMPERAMENTS.

Besides the marked differences observable among Mankind in respect to age and sex, there are others arising from the relative energy of the different functions of the human body, while in a state of health, and occasioning that peculiar aspect and physiognomy termed the *temperament*, which strikes an observer at the first glance. This word, *temperament*, must not be confounded in its signification with *constitution*; for one individual may be of a robust constitution, and another frail in the extreme, although both are of the same temperament.

Some modern writers enumerate as many as seven temperaments; the more ancient authors admit only four. We shall describe the sanguineous, the bilious, the lymphatic, and the nervous; to which may be added the subordinate temperaments, called the athletic and melancholic, making six in number.

1. THE SANGUINEOUS TEMPERAMENT is characterized by the predominant activity of the heart and blood vessels. Externally, it is marked by rosy cheeks, an animated countenance, and all those physical characters which are so accurately represented in the superb statues of Antinous and the Apollo Belvidere. Its moral character is exhibited in the lives of Alcibiades and Marcus Antonius. The Duc de Richelieu is a striking instance of the sanguineous temperament among the moderns.

These peculiarities constitute the *Muscular* or *Athletic*, when men of a sanguineous temperament devote themselves to the habitual exercise of their physical strength, and the entire frame undergoes a corresponding modification. The head becomes small, the shoulders broad, the chest large, the haunches solid, and the intervals of the muscles deeply marked. Of this acquired temperament, we find an excellent model in the statue of the Farnese Hercules.

2. THE BILIOUS TEMPERAMENT is characterized by a brown skin, inclining towards yellow; moderate fulness and firmness of body; the muscles well-defined; and the forms harshly expressed. It is chiefly among men of this temperament that we find those splendid virtues and enormous crimes, which have been at once the admiration and terror of the

world. Alexander the Great, Julius Cæsar, Marcus Brutus, Mahomet, Charles XII. of Sweden, the Czar Peter the Great, Oliver Cromwell, Sixtus V., and Cardinal Richelieu, are commonly cited as examples.

Whenever the bilious temperament is attended by a morbid obstruction of the abdominal viscera, or derangement in the nervous functions, the skin acquires a deeper hue, the aspect becomes uneasy and gloomy, and it assumes the characters of the *atrabilious* or *melancholic* temperament of the ancients. Louis XI., Tiberius, Rousseau, Tasso, Pascal, Gilbert, and Zimmerman, are its models.

3. THE LYMPHATIC TEMPERAMENT arises from the undue proportion of the fluids over the solids, and is chiefly marked by the form becoming rounded and without expression, all the vital actions more or less languid, the countenance pale, the memory treacherous, the attention interrupted, the pulse weak and slow. Snel Men are but little fitted for business, and never produce any of those great characters, which occupy an eminent place in the moral history of the human race.

4. THE NERVOUS TEMPERAMENT is marked by the predominance of the nervous or sensitive system, over the muscular or motive. This excessive sensibility of the organs is rarely natural or primitive, but is most commonly the acquired result of a life too sedentary and inactive, in which the mental powers have attained a great development. Voltaire and Frederick the Great of Prussia are illustrious instances of the nervous temperament. (See Richerand, *Elémens de Physiologie*, 10^e Edit. 1833.)

It is seldom that we find all the particulars of any temperament united in the same individual, and every person is born with peculiarities of his own, which constitute the *idiosyncrasy* of that individual. The sanguine temperament is, however, directly opposed to the melancholic, bilious, and lymphatic; although it may happen, that an individual, sanguineous in early youth, becomes melancholic with advancing years.

According to M. Thomas (*Physiologie des Tempéramens et des Constitutions*, 1826), the human temperaments depend upon the relative proportions in the cavities of the cranium, the thorax, and the abdomen. He enumerates,

1. THE MIXED, or just proportion of these cavities, constituting the Apollo Belvidere, or complete physical Man. This corresponds with the sanguineous temperament.

2. THE CRANIAN, or relative predominance of the cranium over the thorax and abdomen. This is the bilious temperament of other writers.

3. THE THORACIC, or relative predominance of the thorax over the cranium and abdomen, forming the athletic or muscular temperament.

4. THE ABDOMINAL, or predominance of the abdomen over the cranium and thorax. Here the pelvis is broad, the cellular tissue widely distributed, as in the Venus de Medicis; accordingly, this temperament is usually found in the female sex.

5. THE CRANIO-THORACIC, or predominance of the cranium and thorax over the abdomen. It is directly opposed to the abdominal. When this temperament is highly developed, the muscles are hard and well pronounced, the cellular tissue is rare in all parts of the body. This temperament seems merely to be a modification of the nervous already described.

6. THE CRANIO-ABDOMINAL, or relative preponderance of the cranium and abdomen over the thorax. This form of the nervous temperament, most commonly found in females, is directly opposed to the thoracic.

7. THE THORACO-ABDOMINAL, easily recognised by the predominance of the face over the cranium, and directly opposed to the cranian, is more widely distributed over Asia, Africa, and America, producing, when excessive, imbecility of mind and idiocy.

It can scarcely be denied, that the temperaments exercise a considerable influence over the moral character of the individual. Although we admit that every virtue and every vice in all its degrees may be distinctly exhibited in the several temperaments; yet there are certain general facts which mark the natural tendency of the moral sentiments to follow corresponding states of the body.

If, for instance, we find the lungs of great extent, the chest spacious, and the heart of considerable size, attended by a high degree of animal heat, and a very active state of the vital functions; with a muscular fibre and a cellular tissue of medium consistency; we shall also find the moral character mild and amiable, generally amorous, light, inconstant, and volatile.

Again, if we find in addition to these a large hepatic system, and copious secretions of bile, with corresponding powers of procreation, the animal heat becomes higher, the circulation obtains greater rapidity, and the vessels acquire a size still larger than in the former instance. Violent dispositions of mind are the result, with a character of great energy, ambition, magnanimity, intrigue, or cruelty.

On the other hand, if we remark a high degree of softness in the muscular fibre, a feebleness in the nervous system, attended with slight activity of the abdominal and thoracic viscera, the prevalent states of mind may be safely predicted to be mildness, want of energy, indolence, idleness, and an almost total inactivity of the mental powers.

Those states of mind, which habitually belong to an individual of high

intellectual and moral attainments, of intense habits of application, whether in business or study, are the usual consequences of a nervous temperament, when attended by a considerable firmness of the muscular fibre. Persons of delicate constitution, whose nervous system is highly developed, never acquire this moral character. A morbid sentimentalism occupies the place of energy of thought and action, the individual becomes timorous, undecided, and often excessively prone to superstitious observances.

THE INTELLECTUAL AND MORAL DEVELOPMENT OF MAN.

THE infant requires the assistance of its mother for a much longer time than the nourishment of her breast, and its nature being at the same time susceptible of an intellectual as well as of a physical education, a durable attachment arises between them. From the circumstance that the sexes are not very unequal in number, and, from the difficulty of supporting more than one wife, where wealth does not supply the means, we may infer that monogamy is the natural bond of union for our species. The father consequently assumes a share in the education of his offspring, a circumstance not peculiar to the human race, but common to all other species where this kind of union is observed to prevail. The length of this education permits him to have other children during the interval, and hence the perpetuity of the matrimonial union seems to have a real foundation in Nature. Thus, the great length of the period of infancy gives rise to the paternal influence, and, indirectly, to all the subordination of society, as the young people who form new families will preserve for their parents the same relative feelings of respect, which have so long been experienced under their mild sway.

The natural disposition of Man to social labour has multiplied, without any apparent limit, those advantages which he would otherwise have obtained from his personal skill and intelligence. It has enabled him to tame or repel the other animals, to preserve himself from the inclemencies of the most rigorous climates, and to extend his species over the face of the entire globe.

Man does not appear to be swayed by any principle, which can be compared [in intensity] to the instinct of the lower animals, to that constant industry produced by an internal irresistible impulse. His knowledge is the entire result of his sensations and observations, or of those of his predecessors. The accumulated experience of ages, transmitted by word of mouth, improved by meditation, and applied to the various purposes of necessity, or the enjoyments of life, has given rise to the Useful Arts. Speech and writing, by preserving the knowledge already acquired, seem to be sources of an indefinite improvement of the species. It is thus that he obtains all his science, and becomes entitled to occupy an important place in the economy of Nature.

The Intellectual and Moral Development of the human species has proceeded, however, by very distinct gradations.

The first hordes, reduced to live by the chase, by fishing, or on wild fruits, compelled to devote their whole time in obtaining a scanty subsistence, could not multiply to any great extent without exhausting their resources, and consequently were incapable of making any important progress. Their arts were confined to the construction of huts and canoes; to covering themselves with skins, or to the fabrication of arrows and nets. They made no physical observations, excepting, perhaps, on those more obvious stars which served to guide them in their wanderings, or on a few natural objects whose properties were immediately useful. They domesticated no animal excepting the Dog, because it seemed to be disposed by Nature to the same predatory mode of life.

As soon, however, as Man succeeded in taming the larger herbivorous animals, he found a more secure means of subsistence in the possession of numerous herds, and a certain degree of leisure, which enabled him to extend his knowledge. Some degree of industry was bestowed upon the fabrication of dwellings and clothes, the value of property became known, and consequently commerce, wealth, and the inequality of conditions,—at once the incentives to the noblest emulation as well as to the basest passions. Yet the necessity of seeking new pasturage, and of migrating according to the seasons, still retained his civilization within narrow limits.

It was only since the invention of Agriculture, and the conse-

The athletic temperament is most frequently accompanied by a want of sensibility, of intellectual capacity, and even of real vital energy, requiring some great stimulating cause, before it will exert its enormous physical power. The melancholic temperament seems to belong to a kind of mental pathology. (See the Table Analytique of M. Le Comte De Tracy, prefixed, in some editions, to Cabanis, sur les Rapports du Physique et du Moral de l'Homme.)

quent division of the soil among hereditary proprietors, that Man has really succeeded in multiplying the numbers of his species to a high degree, and carried to a great extent his Science and the Useful Arts. By means of Agriculture, the manual labour of a part only of the members of society can produce a sufficient quantity of food to maintain the whole. A sufficient degree of leisure is thus left for other pursuits which are less necessary; while, at the same time, the hope of securing, by industry, a comfortable subsistence for each individual and his posterity, has given a new stimulus to emulation. The invention of a circulating medium for representing exchangeable values, raises this emulation to the highest degree. By facilitating the means of intercourse, it has at once rendered capital more independent and susceptible of a greater increase; while, by a necessary consequence, it has augmented the vices of luxury and the fury of ambition.

In all stages of social progress, the natural propensity of Mankind to reduce every thing to general laws, and to find out the causes of phenomena, has given rise to men of philosophical minds, who have added new ideas to the mass of the previously-acquired knowledge. As long as the great body of the people continued unenlightened, they have sought, by exaggerating their merit, and disguising their limited knowledge under the propagation of superstitious notions, to make their personal abilities the means of ruling over others.

A more incurable evil is the abuse of physical force. At the present day, Man is the only species capable of contesting with Man; and he is almost the only species which is continually at war with his fellows. Savages dispute the possession of their forests, the wandering shepherds their pastures, and both classes make irruptions as often as they are able, in the territories of the neighbouring Agriculturists, to carry off without trouble the fruits of a labour not their own. Civilized nations themselves, far from being satisfied with their share of the enjoyments of life, fight for mere objects of national vanity, or for the monopoly of commerce. From these circumstances arise the necessity of Governments to direct the national wars, and to suppress, or reduce to regular forms of law, the quarrels of private individuals.

Circumstances, more or less favorable, have retarded the social progress of Mankind within certain limits, or have served to promote its development.

The frozen climates in the North of both continents, and the impenetrable forests of America, are still inhabited by savage hunters or fishermen.

The immense plains of sand or salt in the centres of Asia and Africa are covered by pastoral tribes and innumerable herds of cattle. These half civilized hordes assemble together at intervals, on the call of some enthusiastic chieftain, and fall upon the cultivated countries which surround them, where they establish themselves, and eventually become civilized, only to be subdued by other shepherds in their turn. This is the cause of that despotism which, in all ages, has served to crush the rising germs of industry and science in the delightful climates of Persia, India, and China.

Mild climates, soils naturally well-watered, and rich in vegetation, are the appropriate cradles of Agriculture and Civilization. Wherever their geographical situation shelters them from the irruptions of barbarians, all kinds of talent are naturally excited. Such were Greece and Italy, in the early days of Europe, and such at the present day is all this happy portion of the globe.

There seem, however, to be other intrinsic obstacles which serve to arrest the progress of some races of Mankind, even in the midst of circumstances, apparently the most favorable to their improvement.

VARIETIES OF THE HUMAN SPECIES.

ALTHOUGH Mankind appear to compose a single species, [partly] from the circumstance that individuals of all the races are capable of producing a fertile progeny, [and partly from other considerations], they present certain hereditary peculiarities which constitute what are termed *Races*.

THREE of these appear to be eminently distinct from each other; namely, the White, or CAUCASIANS; the Yellow, or MONGOLIANS; and the Black, or NEGROES.

We shall distinguish by the term NORMAL, those varieties of Mankind which admit of being readily referred to one or other of the preceding types. The remainder, or ANOMALOUS RACES, will be arranged under SIX divisions. These may be termed the MALAYANS, the POLYNESIANS, the AUSTRALASIANS, the TASMANIANS, the HYPERBOREANS, and the AMERICANS.

Though obviously distinct from each other, the characters of the Anomalous races approach more or less nearly to those of some or all of the Normal races.

NORMAL RACES.

Syn. LES RACES ÉMINEMMENT DISTINCTES.—Cuv.¹ Reg. Anim. I. 80.
VARIÉTÉS DE RACES BIEN CARACTÉRISÉES.—Desm.² Mam. 47.

I. CAUCASIANS.

Syn. RACE CAUCASIQUE.—Cuv. Reg. Anim. I. 80.—Desm. Mam. 47.
HOMO SAPIENS, EUROPEUS, VAR. β. Lin.³ Gmel. I. 22.—VAR. δ. Erxl.⁴
2.—VAR. α. Albin Tab. Oss. Hum. (fide Fischer).—VAR. CAUCASICA.
Blumenb.⁵ Handb. et Abbild.⁶
HOMO JAPETICUS.—Fisch.⁷ Syn. Mam. 2.
CELTO-SCYTH-ARABES.—Desmoul.⁸ Tab.
EUROPAER.—Camp.⁹ Gesichtsz.

LA CAUCASIQUE, OU ARABE-EUROPEENNE.—Dum.¹⁰ Zool. Anal. 6.
RACE BLANCHE, OU CAUCASIENNE (in part)—Less.¹¹ Mam. 24.
PREMIÈRE RACE, BLANCHE.—Virey,¹² Hist. Nat. du Gen. Hum. I. 438,
et Nouv. Dict. d'Hist. Nat. art. Homme.¹³
RACE EUROPEENNE, OU CAUCASIQUE.—De Lacepède, in Dict. des Sc. Nat.
art. Homme.¹⁴

The Caucasian variety, to which we belong, may readily be distinguished by the beauty of the oval form of the head. Some of the groups belonging to this division have constituted nations of the highest comparative civilization, and which have most frequently exercised dominion over the remainder. They may vary in the tint of the skin and colour of the hair, and have been [rather improperly] termed *Caucasians*, from the circumstance that the early traditions of nations would refer [some of] their tribes to the group of mountains between the Black and Caspian Seas, from which they [are conjectured by several writers to have] emigrated in all directions. The inhabitants of the Caucasus itself, such as the Circassians and Georgians, are still accounted at the present day among the most beautiful people of the globe.

The leading branches of these races may be distinguished by the analogy [and affinity] of their languages.

Whenever two languages have a general resemblance in their grammatical structure, and when a great number of the roots or elements are common to both, they are said to be *allied* to each other. Thus, the Hebrew, the Chaldee, the Syriac, and the Geoz or Ethiopic, have a natural affinity. Again, there are others which are wholly distinct in their vocabularies, with few words in common, yet they bear a striking resemblance to each other in their grammatical structure, such as the monosyllabic languages of the Chinese, Tibetans, Siamese, &c. These may be termed *analogous* languages.¹⁵

By combining a philological inquiry into the affinity or analogy of languages, with a careful examination into the physical diversities of nations, we are enabled to classify the several tribes of Men under appropriate subdivisions.

All the Caucasian races may be reduced to five principal sub-varieties, (A.) *Homo Caucasicus*, or Caucasians Proper; (B.) *H. Iapeticus*, or

Iapetans; (C.) *H. Celticus*, or Celts; (D.) *H. Semiticus*, or Aramcans; (E.) *H. Scythicus*, or Scythians. Minor differences of form and language give rise to further subdivisions into groups or families of nations.

(A.) HOMO CAUCASICUS.—CAUCASIANS PROPER.

Syn. HOMO JAPETICUS, α a CAUCASICUS.—Fisch. Syn. Mam. 2.
CAUCASIENNE.—Desmoul. Tab.
RACE CAUCASIQUE (ORIENTALE).—Bory.¹⁶ Ess. Zool. I. 110.
1° SOUCHE EUROPEENNE, 1° TIGE CAUCASIQUE.—Broc.¹⁷ Ess. 28.
RACES GREQUES ET PÉLAGIQUES (in part).—Malte-Brun,¹⁸ Géog. Univ.
Icon. Blumenb.¹⁹ Dec. Cran. III. t. 21. (Skull of a Georgian female.)

The various tribes known by the names of Georgians, Imeritians, Mingrelians, Abassians, Tscherkessians or Circassians, and Lesghians, have long been celebrated for the extreme regularity and general beauty of their features. They inhabit the mountain chains of the Caucasus and the adjacent valleys, situate in the immediate neighbourhood of the Black and Caspian Seas, between the 41° and 45° of N. latitude. From the earliest ages, these regions have been the abode of numerous tribes, all of whom, excepting the Ossetes, according to M. Julius Klaproth, speak languages, the idioms of which are wholly distinct from those of all other known tongues.

These circumstances, combined with the characteristic physiognomy of the Caucasians Proper, entitle them to be regarded as indigenous and primitive tribes of great antiquity.

The Georgian races, as we are informed by Chardin,²⁰ are the most beautiful in the East, and we may even say, in the world. During the twelfth century, numerous poetical and historical works were composed in their own peculiar language.²¹ Their women are not so white as the Circassians, nor are their figures quite so graceful, yet they possess great beauty, and scarcely an ugly countenance can be found in all the country. They are tall, well made, extremely slight round the waist, and of a most

¹ CUV. REG. ANIM.—Le Règne Animal distribué d'après son organisation. Par M. Le Baron Cuvier, Paris, 1829. Nouvelle Edition.

² DESM. MAM.—Mammalogie, ou Description des Espèces de Mammifères. Par M. A. G. Desmarest, Paris, 1820.

³ LIN. GMEL.—Caroli A. Linné, Systema Naturæ per Regna Tria Naturæ. Curâ Io. Frid. Gmelin, Lugduni, 1769.

⁴ ERXL.—Io. Christ. Polyc. Erxleben, Systema Regni Animalis. Classis I. Mammalia. Lipsiæ, 1777.

⁵ BLUMENB. HANDB.—Handbuch der Naturgeschichte, von J. F. Blumenbach, Gött. 1821.

⁶ BLUMENB. ABBILD.—Abbildungen Naturhistorischer Gegenstände, von J. F. Blumenbach, Gött. 1797.

⁷ FISCH. SYN. MAM.—Synopsis Mammalium. Auctore J. B. Fischer, Stuttgartiæ, 1829.

⁸ DESMOUL. TAB.—Tableau Général, Physique, et Géographique des Espèces et des Races du Genre Humain. Par A. Desmoulins.

⁹ CAMP. GESICHTSZ.—Ueber die Verschiedenheit der Gesichtszüge von P. Camper, Berl. 1792 (fide Fischer).

¹⁰ DUM. ZOO. ANAL.—Zoologie Analytique, ou Méthode Naturelle de Classification des Animaux. Par A. M. Constant Duméril, Paris, 1806.

¹¹ LESS. MAM.—Manuel de Mammalogie. Par René-Primeverre Lesson, Paris, 1827.

¹² VIREY, HIST. NAT. DU GEN. HUM.—Histoire Naturelle du Genre Humain. Par J. J. Virey, Paris, 1824.

¹³ NOUV. DICT. D'HIST. NAT.—Nouveau Dictionnaire d'Histoire Naturelle appliquée aux arts. Par une Société de Naturalistes et d'Agriculteurs, Paris, Deterville, 1817.

¹⁴ DICT. DES SC. NAT.—Dictionnaire des Sciences Naturelles. Par plusieurs Professeurs du Jardin du Roi, et des principales Ecoles de Paris, Strasbourg, et Paris, 1821.

¹⁵ Abstract of a Comparative Review of Philological and Physical Researches. By J. C. Pritchard, M.D., in Reports of the British Association for 1832.

¹⁶ BORY ESS. ZOO.—L'Homme, Essai Zoologique sur le Genre Humain. Par M. Bory de Saint-Vincent, Paris, 1836, 3d Edit.

¹⁷ Broc, Ess.—Essai sur les Races Humaines. Par P. P. Broc, Paris, 1836.

¹⁸ MALTE-BRUN, GEOG. UNIV.—Géographie Universelle. Par M. Malte-Brun, Paris, 1816.

¹⁹ BLUMB. DEC. CRAN.—Decas Craniorum. Ed. J. F. Blumenbach, Gött. 1790-1820.

²⁰ Les Voyages de Jo. Chardin, vol. I. p. 171, Amsterdam, 1735.

²¹ Eugene, Annales des Voyages, XII. p. 86, 90 (fide Malte-Brun).

pleasing expression of countenance. The Men are likewise very handsome, have good abilities, and might excel in the sciences and useful arts, did not a defective education render them very ignorant and vicious.¹ There is perhaps no country where libertinism and dissipation prevail to a greater extent than in Georgia. The skull of a Georgian female, who died at Moscow, after having been taken by the Russians in one of their wars with Turkey, is figured by Blumenbach in his *Decades of Skulls*, and would strike the most careless observer by the noble expansion of its frontal region, and the general symmetry and elegance of its proportions. The Imeritians speak a Georgian dialect.

In Mingrelia, the women are equally beautiful, but perfidious. When love or hatred happens to be the ruling passion, a Mingrelian female is equal to any action, however atrocious. The men are as remarkable for their immorality, and theft and assassination are common occurrences. They exchange wives without the slightest scruple, and are not particular as to the degrees of their consanguinity to spouses, which are commonly two or three in number, or to concubines, in general as numerous as their means will allow. Husbands have here but little jealousy, and a gallant Lothario, when convicted, is compelled to atone for his offence, according to Chardin, by paying a pig to the injured husband; and it is not uncommon, he adds, for the pig to be caught together by the three parties interested in the affair. Large families are anxiously desired in this country, for the sordid purpose of selling the miserable progeny as slaves. The master disposes of his servants, the brother of his sister, and the father of his children, without the slightest compunction. On this account slaves are very cheap. Their prices average as follows:—

Handsome girls, aged from 13 to 18 years.....	20 crowns.
Men from 25 to 40 years of age.....	15 ..
Married women.....	12 ..
Men above 40 years of age.....	8 to 10
Children.....	3 or 4

The physiognomy of the Abassians is very remarkable,—an oval face, a head very much compressed on the sides, a short chin, large nose, and hair of a deep chestnut colour, form its usual traits.

The Circassian nobles speak a language peculiar to themselves, and different from the vernacular language of their country. They are of a robust make, with a small foot, and strong wrist. The females are delicate, pleasing, and graceful in their forms; their skins white, with black or brown hair. It is chiefly the remarkable cleanliness of their persons which renders them so attractive to Europeans, for they are often surpassed in regularity of form and features by some of the neighbouring tribes. The Lesghian women, in particular, rival them in respect to personal attractions, as well as in courage. The dialects of the latter tribes are very numerous, and have some affinity to the language spoken by the inhabitants of Finland.

To this sketch of the more important tribes, belonging to the Proper Caucasian races, we may add, that the medium height of the men is about 5 feet 8 inches, their temperament usually sanguineous and bilious.² Their hair is most commonly black, fine, shining, and very much curled; the nose straight; the shape of the face perfectly oval, and the facial angle varying from 85° to 90°. The women are occasionally subject to an excessive rotundity of form. Their mouth is small, their bust most graceful, and skin perfectly white. Their eyebrows, excessively narrow, have been compared to the gently-curved filaments of silk. Such are the peculiarities of the Caucasian females, whose beauty is so celebrated in the East. They serve to ornament the harems of the Mahometans from the centre of Asia to the kingdom of Morocco.³

(B.) HOMO IAPETICUS.—IAPETANS.

Syn. LE RAMEAU INDIEN, GERMAIN, ET PÉLASGIQUE.—Cuv. Reg. Anim. I. 81.—Less. Mam. 24 (in part).

THE Indian, German, and Pelasgian branch is much more widely distributed than the remainder, and became subdivided at an earlier age. We are still able, however, to recognise innumerable affinities among its four principal languages,—the Sanscrit, at present the sacred language of the Hindoos, and the parent of most of the dialects of Hindoostan; the ancient language of the Pelasgi, the common mother of the Greek, the Latin, and several others now extinct, also of all our languages in the South of Europe; the Gothic, Teutonic, or Tudesque, from which are derived the languages of the North and North-west of Europe, such as the German, the Dutch, the English, the Danish, the Swedish, and their dialects; finally, the languages called the Slavonian, from which are derived the Russian,

the Polish, the Bohemian, the Wend, and other dialects of the North-East of Europe.

The nations of this powerful and important branch of the Caucasian race have raised philosophy, the sciences, and the arts, to their present advanced state, and for more than thirty centuries have been the depositors and guardians of human knowledge.

The ancient Persians have the same origin as the Hindoos, and their descendants at the present day bear the most striking marks of their affinity with the nations of Europe.

All these nations may be termed *Iapetans*, not from any fancied descent from Japhet, son of Noah, but rather from Iapetus, the father of Prometheus, whose daring exploits are celebrated in the legendary history of remote antiquity.

Audax Iapeti genus,
Ignem fraude mala gentibus intulit.
Hor. lib. I. Od. 3.

This illustrious branch of the Human Race would be justly entitled, from moral and political considerations alone, to occupy the first place in our classification. Some of its subdivisions emulate the Proper Caucasians in personal beauty, and the facial angle approaches nearly to 90°. As in them the face is oval, the forehead open, the nose straight, or nearly so; the eye-brows more or less arched; the eye-lashes of medium length; the mouth middle-sized; the beard long; and the ears closely applied to the head. Their hair, generally fine, and even silky, varies from black and deep chestnut to a blonde, approaching to white. A complexion more or less vivid relieves the excessive paleness of the face, and betrays the passions of the moment by the changes of its colour. This ruddiness may, on the one hand, become degenerate in individuals, who are etiolated by confinement, or, on the other, it may merge into a deep brown when exposed to the excessive heats of a tropical sun. In every part of the globe, the skin of the Iapetans preserves its primitive whiteness, when protected from the direct solar rays.

With the exception of the Indo-Persians, all the nations of this sub-variety are essentially monogamous. Polytheism was their primitive religion, with some vague notions regarding the immortality of the soul. Christianity and its numerous modifications are now professed by nearly all of them excepting the Indo-Persians, who conform themselves to other creeds more congenial to the prejudices of a degraded people.

Industrious, patriotic, and brave, with a taste for the Sciences, the Fine and Useful Arts—in a word, endowed with talents of the highest order, the Iapetan races have produced, without exception, all those great geniuses who have astonished and enlightened the world.

I. PELAGIUS.—PELASGIANS.

Syn. HOMO IAPETICUS b. PELAGIUS.—Fisch. Syn. Mam. 2.
LES PÉLAGES.—Cuv. Reg. Anim. I. 81.
RACE PÉLAGE (MÉRIDIIONALE).—Bory Ess. Zool. I. 114.
RACES GREQUES ET PÉLAGIQUES (in part).—Malte-Brun, Geog. Univ.
ETRUSCO-PÉLASGE.—Desmoul. Tab. IIum.
Icon. Blumenb. Dec. Cran. IV. t. 32. (Skull of a Roman Prætorian Soldier): VI. t. 51. (Skull of an ancient Greek).

From the earliest ages, the Pelasgi were divided into two distinct branches, the Proper Pelasgi and the Etruscans. Among the former were included the Phrygians, Lydians, Carians, Trojans, Thracians, Illyrians, and the aborigines of Greece. Among the latter we find the native Italian nations.

Next to the Proper Caucasians in the beauty of their features, we may observe their models at the present day in the statues of the Jupiter Olympian, the Apollo Belvidere, and the Venus de Medicis. The characters are the following; medium height about five feet seven inches; the hair fine, brown or chestnut, rarely blonde, and often of surprising length. The foot is larger and the leg thicker at its base than agrees with our ideas of beauty; the nose is perfectly straight, and in the same line with the forehead, without the slightest depression at the point of junction. The eyes, remarkable for their size, have often been compared to those of an Ox (*βουπίης*.) Their temperament is most commonly sanguineous and bilious.

Though nearly extinct, or lost among their numerous alliances with the neighbouring races, the traits of the pure Pelasgian race may still be found in a few Roman and Grecian Ladies. They have, however, entirely disappeared among the great mass of the people who now inhabit the Ægean Archipelago, Turkey in Europe, Italy, and Sicily,—regions once the exclusive abodes of this interesting race. To them we owe the

¹ BUFF. HIST. NAT.—Histoire Naturelle générale et particulière, Paris, 1750, tome III. p. 433, 434. Par M. De Buffon.

² Bory Ess. Zool. I. 110.

³ Bory Ess. Zool.—Also, Sir R. K. Porter's Travels in Georgia, Persia, &c.

introduction of the Cereal plants, the cultivation of the Olive, and they appear to have first domesticated the Bull. Having received the knowledge of letters and the art of writing from the Phœnicians, belonging to the Aramean race, their first poets became their historians, and philosophy, born on the banks of the Nile, was developed by the genius of a Socrates, an Aristotle, or a Cicero. Attached to their native soil, the Pelasgians seldom ventured upon maritime expeditions, except when impelled by views of ambition or self-defence. The mighty empires of Greece and Rome were the results of their genius and enterprise.

Among their descendants at the present day we may include the modern Greeks, who speak the Rounaika language; the Albanians or Schyptars, whose dialect exhibits some traces of a Celtic origin; the Wnllachians or Rounouni, partly blended with the Slavonians; and perhaps also the great Celto-Latin nations, whose languages, such as the Italian, French, Spanish, and Provengal, though partly of Celtic origin, are now the principal vernacular languages of the south of Europe.

2. GERMANICUS.—GERMANS.

Syn. RACE GOTHICO-GERMANIQUE.—Malte-Brun, Geog. Univ.
RACE GERMANIQUE (BORÉALE).—Bory Ess. Zool. I. 129.

This is the tallest of all the Iapetan races, its medium height being from five feet ten inches to five feet eleven inches, and men are sometimes found of six feet and a half in height. Their temperament is usually lymphatic; the complexion often animated; the skin of a dazzling whiteness, sometimes approaching to albinism; the eyes usually blue; the hair very fine, straight, of a golden blonde, and becoming grey only at a very advanced age. Their frames are well-proportioned, the tissues soft, and overloaded with fat. The men are robust, brave, accustomed to fatigue, but often passionately fond of fermented liquors. The women are tall, of strong make, fine complexion, and of remarkable *embonpoint*. "La plupart," says Col. Bory de Saint-Vincent, "répandent une odeur qu'il est difficile de qualifier, mais qui rappelle celle de la chair des animaux fraîchement dépecés; elles sont rarement nubiles avant seize à dix sept ans, passent pour avoir certaines voies fort larges, accouchent conséquemment avec plus de facilité que les femmes de la race Celtique, et n'ont en général que peu de ce qui, chez ces dernières, garnit en abondance certaines parties du corps que doivent cacher les ajustemens."

Two great branches of Germans, the *Teutonic* and *Slavonian*, became distinguished at a remote age.

α. TEUTONICUS.—TEUTONIC RACES.

Syn. VAR. TEUTONE.—Bory Ess. Zool. I. 132.
H. JAPETICUS d. GERMANICUS.—Fisch. Syn. Mam. 3.

The Teutonic races exhibit the German physical characters already enumerated in their greatest purity. Naturally gay, and of a jovial temper, they are fond of good cheer and spiritous liquors. With much frankness and loyalty, they are brave, warlike, capable of executing the most daring enterprises, determined enemies to slavery, and very punctilious as to points of honour. To them we owe the practice of duelling; and their females have always enjoyed the highest degree of influence and consideration.

Under the name of Cimbri, the Teutonic race penetrated into Scandinavia; and the Suenones, afterwards the Goths, who descended towards the south of Europe, upon the feeble remnants of the Roman empire, have left in Gaul, Italy, and Spain, numerous traces of their invasions. Other tribes under the names of Saxons, Danes, and Normans, ravaged the coasts of the British Isles and Gaul, then inhabited by Celts and Romans, and even extended their incursions to the territories of Italy and Greece, where they formed permanent settlements. Further to the north they became the Borucsi, and under the name of Norwegians and Swedes, extended their domains to Iceland, Norway, and the regions of the Arctic circle. Of their modern languages, we need only particularize the English, the German, the Dutch, the Flemish, the Swensk or Swedish, Dansk or Danish, the Frieslandic, Icelandic, Norse, Dalska, and the innumerable Germanic dialects of central Europe.

The love of liberty has always been a ruling passion among the Teutonic races, and this feeling has extended alike to their political and religious institutions. "Their opinions were not blindly received from priests, nor was their liberty of action fettered by chiefs."² Nearly all the

nations of Teutonic origin profess the doctrines of the Reformed Church as being more congenial to the freedom of their opinions. The Anglo-American colonists, and their descendants, preserve undiminished the haughty and unyielding spirit of their Saxon ancestors.

β. SLAVONICUS.—SLAVONIAN RACES.

Syn. VAR. SCLAVONE.—Bory Ess. Zool. I. 135.
H. JAPETICUS e SLAVONICUS.—Fisch. Syn. Mam. 3.
RACE SCLAVONNE.—Malte-Brun, Geog. Univ.
Icon. Blumenb. Dec. Cran. III. t. 22. (Skull of a Lithuanian.)

The traits and manners of the genuine Slavonian are still forcibly impressed upon the Muscovite Russians, the Polanders, Lithuanians, and Bohemians. With eyes commonly brown, and the colour of the hair rather dark, their cheek-bones are somewhat prominent, the nose often slightly turned upwards, their eyes piercing, their voice strong and coarse. They are in general of an elevated stature, sometimes middle-sized; their step is masculine, and their temperament usually bilious or lymphatic. Capable of enduring the greatest fatigue, hospitable, and brave, they are, at the same time, ignorant, idle, and cunning. The women do not receive the same high consideration and respect as among the Teutonic races, and they have still preserved that habit of sitting with crossed legs, indicative of an Asiatic origin. Indeed, to use the words of Gibbon, "they seem to unite the manners of the Asiatic barbarians with the figure and complexion of the ancient inhabitants of Europe."³

Some of their tribes, such as the Cossacks, maintain at the present day the same habits of plunder as the Scythians their neighbours, with whom they are daily becoming more and more blended. For a long time the wandering Bohemians of Western Europe have preserved the predatory habits as well as the language of their Slavonian ancestors. A branch of the same race, emigrating into the regions occupied almost exclusively by the Teutonic tribes, has established itself on the Elbe, where it still maintains unaltered the characteristics of the genuine Slavonian, in the little state of Bohemia.

The two great branches of Germans, with a few tribes of genuine Scythians, though really of *Oriental* origin, are celebrated in the history of the middle ages as the *Northern* nations, and as such, became the scourge of the Roman Empire. Scandinavia, so long censured as the great "Northern hive,"⁴ has been fully "vindicated" of the charge by a modern writer.

3. INDO-PERSICUS.—INDO-PERSIANS.

LES ANCIENS PERSES ET LES INDIENS.—Cuv. Reg. Anim. I. 82.

A certain degree of resemblance in the physical traits of the Persians and Indians, the vicinity of their geographical stations, and, above all, the remarkable affinity, which the Sanscrit and the Zend bear to each other, and to the Greek, the Latin, the Teutonic, the Gothic, and the Icelandic, both in their roots and inflexions,⁵ have led us to place the Hindoos and Medo-Persians as subordinate branches of the Iapetan races.

α. INDICUS.—HINDOO RACES.

Syn. H. INNIEUS.—Fisch. Syn. Mam. 3.—Bory Ess. Zool. I. 225.
INDOUES.—Desmoul. Tab.—Cuv. Reg. Anim. I. 81.
Icon. Blumenb. Dec. Cran. VI. 53. (Skull of a young Bengalese Indian.)

The Hindoos, or descendants of the ancient Indians,⁶ though now mingled with many foreign races, occupy the finest and most extensive regions of the vast peninsula extending to the south of the Himalayan mountains. In respect to stature, they are very considerably below the average, being about five feet six inches. The traits of their physiognomy most forcibly resemble those of the other Iapetans, and we should almost be led to place them in the same subdivision as the Germans, were it not for their colour, which is a very dark yellow, tending towards a bronze, and always with a slight olive tinge. The nose is aquiline, and never flat; the mouth of middle size, with the teeth placed vertically in the gum; the lips thin and coloured; the chin round, and usually marked with a slight dimple; while the skin betrays, by its sudden paleness, the emotions of the individual. The eyes are large and round, with a yellowish cornea; the eye-lashes very long; the eye-brows narrow and arched; the hair straight, long, and very black; the ears well made, and of medium length; the beard scanty. Their legs and feet are extremely elegant, especially among the women. The latter are very short in the body, and elongated in the

¹ Tacitus (De Moribus Germanorum, Sec. 4.) notices the strong family likeness of the Ancient Germans.

² Sir James Mackintosh's History of England, vol. 1, c. 1, in Dr Lardner's Cabinet Cyclopædia.

³ Gibbon's Decline and Fall of the Roman Empire, c. 42.

⁴ The "*Officina Gentium*," and "*Vagina Nationum*," of Jornandes, c. 4. The opinion that the Goths were of Scandinavian origin has been too hastily adopted by Gibbon and Montesquieu.

⁵ Adelung's Mithridates, and Klaproth's Asia Polyglotta, passim. Also, Paul de St Bartholomé Dissert. de Antiq. et Affin. Linguarum Zend., Sanscr., et German. (fide Malte-Brun).

⁶ M. Broc arranges the Hindoos, with great impropriety, among the Mongolians, with whom they have little affinity, excepting in colour.

limbs, without being thin; their shoulders in just proportion, and the bust nearly hemispherical—"Elles n'ont presque pas de poil au pubis, mais il y est ordinairement très-dur; elles accouchent avec une prodigieuse facilité, passent pour très-lascives, et font connaître leur penchant à la volupté par la variété de mouvemens et d'attitudes qu'elles savent prendre avec tant de souplesse dans ces dances qui les ont rendues des Bayadères célèbres." (Dict. Class. d'Hist. Nat. art. Homme.)¹ The puberty of the females is very precocious, as they often become mothers at the age of nine or ten years, but lose this power of production at thirty. Few instances of longevity occur among the Hindoos.

The Sanscrit, or dead language in which their sacred books were composed, is written with fifty-two letters, and many thousands of abbreviating syllables. The Pracrit or common dialects of the country are very numerous. From the earliest ages the Hindoo nation has been subdivided into four *Tchadi* or castes, consisting of the Brahmins, or sacred order; the Kshatriyas or soldiers, sometimes called the Rajas or Rajepootras, princes or sovereigns; the Vaisjas, or shepherds and agriculturists; and the Sudras or labourers. This division, and the reputed dishonour of a marriage out of each caste, have tended greatly to preserve the primitive traits of the genuine Hindoo from foreign intermixture. Every thing serves to prove the extreme antiquity of their civilization; yet so strong is the influence of their religious and political prejudices, that they have preserved themselves almost stationary like the Chinese, though exposed to a constant intercourse with Europeans. The simplicity, mildness, and docility of their character, with their ignorance of the art of war, have led them to submit to a handful of Europeans, allured to their coasts merely by views of commercial advantage. Industrious and sedentary in their habits, they leave the neil commerce of their country to Arabs, Jews, Malays, Chinese, and especially to Europeans. Rice, seasoned with pepper and other stimulants, forms their habitual food. The use of Elephants in war, as well as for domestic purposes, was first introduced by the Hindoos, and adopted afterwards by the Carthaginians in Northern Africa, Spain, and Italy.

The Hindoos believe in the transmigration of human souls into the bodies of other animals, and consequently never embalm their dead. All animals are more or less the objects of veneration. The extravagant mythology of the Hindoos would almost defy all powers of analysis; and the existence of a Trimurti or Indian Trinity, consisting of Brahma, the Creator,—Vishnou, the Preserver,—and Siva, the Destroyer, bears a prominent place among Oriental dogmas. They practise no barbarous mutilations of the body; but from the earliest ages, purification in the Ganges has been considered a sacred duty. The self-immolation of widows on the funeral piles of their husbands is now discouraged; and an enlightened government endeavours by humane regulations to lighten the terrors of that superstition, which once led thousands to sacrifice themselves under the ear-wheels of Juggernaut.²

β. PERSICUS.—MEDO-PERSIAN RACES.

Syn. LES ANCIENS PERSES.—Cuv. Reg. Anim. I. 82.

Icon. Blumenb. Dec. Cran. V. t. 35. (Skull of a Persian;) V. t. 41. (Skull of an Armenian.)

From the earliest ages, until the subjugation of Persia by the Arabs, that country has been the abode of a distinct indigenous race, composed of different nations, and speaking languages in many respects allied to the Germanic dialects. As might be expected from their frequent alliances with the females of other nations, and especially with those of the Proper Caucasians, their physical traits approach more nearly to the European nations, than to the Hindoo branch of the Indo-Persians. Like them, however, the Persians and Armenians have a tinge of yellow and even of olive, but not so dark a skin. The hair is black, the nose aquiline, and the countenance oval, with an elevated forehead. The females are of middle stature, with long black hair, large and dark eyes; the nose small, and the feet narrow. To these we may add small feet and hands, slender shape, a soft skin, the neck long, and the breast of moderate proportion, long eye-lashes, arched eye-brows, a slight rosy complexion, and we have a portrait of the Persian beauty of the present day. The man of rank and wealth is often distinguished by a portly rotundity of form.

A most extraordinary resemblance may be traced between the Persian and German languages, in their roots, their inflexions, and the forms of their syntax. This affinity may be traced likewise in many Gothic words belonging to the English, Danish, or Icelandic languages, and especially in the latter.³ Thus the English word *door*, corresponds with the German *thür*, the Danish *dor*, and the Persian *dar*. The most ancient dialect of the Persians is the Zend, in which the sacred books called the Zend-Avesta, of great antiquity, are written. The ancient Parsee has been preserved in the Shah-Naameh, or Historical Work of Ferdosi, and in the Ayer-Akbeir. The modern Parsee, the Deri, and the Pehlevi, are now the prevailing dialects of the race. The ancient philosophy of Zerdusht or Zoroaster, once the prevailing religion, and tenaciously held by the persecuted Guebres or Fire-worshippers, has now given place to the Mahometanism of the sect of Ali. The Persians are said to possess that politeness, and versatility of mind, which characterizes a neighbouring nation, and they have been not unaptly termed the Frenchmen of Asia. Many of the arts have made great progress, but their science is almost nominal.

The Armenians must be placed in the same division as the Persians. Their language, according to Adelung, possesses much analogy to others of the Iapetan races.

C. HOMO CELTICUS.—CELTS.

Syn. RACE CELTIQUE.—Bory Ess. Zool. I. 120.—Desmoul. Tab. Hum.—Bosc. Ess. 30.

H. JAPETICUS c. CELTICUS.—Fisch. Syn. Mam. 2.

RACES OCCIDENTALES DE L'EUROPE.—Malte-Brun, Geog. Univ.

The Iapetan races were preceded in Europe by the Celtic tribes, who came originally from the North [or more probably from the East],⁴ and were once widely distributed; and by the Cantabrians, who emigrated from Africa to Spain. The former were soon confined to the most western extremities of Europe, and the latter have now become blended among the numerous nations whose posterity inhabits the Spanish Peninsula at the present day.

The languages spoken by the Celts, in so far as they have reached our times, appear to bear some affinity to those of the Iapetans, an affinity which, according to some writers, amounts almost to an absolute identity. The Celtic dialects may be arranged under two distinct divisions, each of which is unintelligible to men of the other division. The Gaelic dialects are spoken in the Highlands of Scotland, in Ireland, and the Isle of Man; and the Cymric dialects in Wales, Cornwall, and Lower Brittany. Both branches unquestionably belong to the same family of nations. The dialects spoken in the Basque provinces of Spain are commonly referred to this sub-division.

The Celts, Kelts, or Gauls, were the aborigines or primitive inhabitants of Western Europe, and once extended from Ireland as far as the Danube. Before they adopted an agricultural mode of life, they threatened Spain, Greece, and Italy, with their migratory bands, and succeeded in forming permanent settlements in many places, even as far as Asia Minor, where they gave their name to the province of Galatia.

They differed from the Germans in obeying an order of Druids, who united the sacerdotal and political functions, and practised human sacrifices, with other barbarous rites. Their skulls are of an unusual thickness;⁵ the forehead rather protuberant on the sides; the nose is not rectilinear, but more or less marked by a depression between the eyes. Their hair is of no great length, but thickly furnished, of a deep chestnut or brown colour, and of tolerable fineness. Their eyes are not so large and prominent as in the Proper Caucasians and Pelasgians, and generally black or brown, sometimes grey. In respect to stature, they are rather taller than the two races just mentioned, their medium height being about five feet nine inches. Their body is well proportioned, robust, and more plentifully covered with hair than that of almost any other race.

All the nations on the left bank of the Rhine were anciently⁶ of Celtic origin, and at the present day, nearly three-fourths of the French population exhibit at least some considerable proportion of Celtic characters, though greatly mixed with those of the Pelasgians and Germans, and occasionally with the traits of some Aramean races.

¹ DICT. CLASS. D'HIST. NAT.—Dictionnaire Classique d'Histoire Naturelle. Paris, 1825. The article "Homme," by M. Bory de St Vincent, forms the basis of his "Essai Zoologique," already quoted.

² Malte-Brun, Geog. Univ., tom. III., lib. 50, consists of an excellent chapter on the Moral and Political State of the Hindoos.

³ See M. Balbi, Atlas Ethnographique du Globe, Paris, 1827, wherein the several nations of the world are arranged according to the analogy of the idioms and roots of their languages, as well as their manners and customs.

⁴ Pritchard, on the Eastern Origin of the Celtic Nations.

⁵ M. Latour d'Auvergne (Origines Gauloises, Hamburg, 1801) considers the thickness of the skull as a special distinction of the Celtic races, and to be found at the present day among the Lower Bretons. We have examined the skulls of several ancient Druids from the Hebrides, deposited in the Museum of the Phrenological Society of Edinburgh, and found them to be in general of very considerable thickness. One skull, in particular, from the Monastery of Iona, and apparently of great antiquity, was remarkable in this respect.

⁶ Cæsar de Bello Gallico, lib. 1.

D. HOMO SEMITICUS.—ARAMEANS.

Syn. HOMO ARABICUS.—Bory, Ess. Zool. I. 162.—Fisch. Syn. Mam. 3.
LE RAMEAU ARAMÉEN, OU DE SYRIE.—Cuv. Reg. Anim. I. 81.—Less.
Mam. 24.

The Aramean or Syrian branch of the Human Species is stationed to the south of the regions inhabited by the Proper Caucasi-ans. It has produced the Assyrians; the Chaldeans; the ever-unconquerable Arabs, who attempted under Mahomet to render themselves masters of the world; the Phœnicians, the Jews, the Abyssinians, and other Arabian colonies; and probably also the Egyptians. It is from this branch, ever prone to the dissemination of mystical doctrines, that the most widely-prevalent systems of religion have derived their origin. Science and literature have sometimes flourished among them, but always under a repulsive form or a figurative style.

1. ARABICUS.—ARABIANS.

Syn. H. ARABICUS, (b.) ADAMICUS.—Fisch. Syn. Mam. 3.
RACE ADAMIQUE (ORIENTALE).—Bory, Ess. Zool. I. 179.
RACE ARABE.—Malte-Brun, Geog. Univ.—Desmoul. Tab.
Icon. Blumenb. Dec. Cran. I. t. 1; IV. t. 31, and VI. t. 52. (Skulls of Ægyptian Mummies.) IV. t. 31, and III. t. 28. (Skulls of Jews.)

In the primary division of the Arameans, we include all nations and tribes who speak dialects nearly resembling the Hebrew. Of these, we may enumerate the Old Syriac, spoken by the tribes in the neighbourhood of Damascus and Mount Libanus; the Hamyarite and Koreishite dialects of the Arabic, the latter of which is consecrated by being the language of the Koran; and the Coptic, a relic of the ancient Ægyptian, with its dialects, the Memphitic, Saidic, and perhaps also the Bashmooric.¹ The Hebrew and its dialect the Chaldee are well known as the original language of the more ancient division of our Sacred Scriptures.

The Arab race, which the conquests of Mahomet have distributed over an extensive territory, is distinguished by an oval but elongated face, elevated forehead and prominent chin; the nose well marked, and in general aquiline; the eyes black or deep brown, of large size, and of a peculiar expression in the females, which has often led to their being compared to those of the Gazelle. Their eye-brows are tolerably thick and arched, their lips narrow, and the mouth agreeable. Their hair, which is black, smooth, seldom curly, and rather coarse, usually grows to an extraordinary length; and the women wear it in plaits, which commonly hang as low as the ancles. The Arab is rather of an elevated stature; while on the contrary the Arab female is diminutive—a disparity between the sexes which seems to be one of the characteristics of their race. The Arab women being exceedingly precocious soon lose their powers of procreation, while the men preserve their youthful vigour to an advanced age. This physical peculiarity has rendered polygamy from the earliest ages² the prevailing custom of the Arabic races. Circumcision—a rite once sanctioned by Religion—appears to have tended greatly to preserve these races from alliances with foreign nations. The modern Jews, dispersed in all parts where a lucrative commerce prevails, have maintained to the present day many of the sacred institutions of their ancestors, and the same abhorrence of swine's flesh,³ with other branches of the Aramean race. By a kind of over-refinement, the Arabian devotee, according to Sonnini, occasionally extends the practice of circumcision further than antiquity would have authorised.⁴

The modern Arab has been not improperly termed the *brown* variety of the White races. On the burning sands of Abyssinia his skin acquires a deep tint, but becomes almost etiolated in the cool mountain valleys of the same territory, while the females of rank, confined to their tents, are of a dazzling, and often an insipid whiteness. The brown tint of their skin seems, therefore, to be rather an accidental result of climate than a peculiarity of race.⁵

The Bedouin Arab of the desert preserves the same predatory habits as in the days of Jacob or Moses; and by the assistance of the Dromedary and the Horse, with some cattle, he is enabled to maintain the nomadic life in a country of peculiar sterility. All his senses acquire from habit an extraordinary acuteness, in detecting the traces of an enemy in the sand, or the footsteps of a lost Camel among thousands of other impressions. A

stranger is usually received as an enemy; yet some instances of a romantic hospitality are not unknown.⁶ The genuine Arab possesses a poetical imagination, which often degenerates into extravagance. Religious enthusiasm and fanaticism seem in all ages to have been congenial to his disposition.

Many tribes, devoting themselves to agriculture, and especially to commerce, exhibit a peculiar tact and penetration in matters relating to their own pecuniary advantage.

The splendid monuments of ancient Ægypt attest the early period at which the arts were cultivated by these races, but the writings of the Arabian physicians in the middle ages exhibit the extreme limit of their scientific attainments.

We may recognise the Arabian features in the inhabitants of a large portion of the east coast of Africa, in the Comora Islands, Socotora, and the north of Madagascar, though often blended with the traits of the genuine Moor, the Ethiopian, and the Caffre.

2. ATLANTICUS.—ATLANTIC RACES.

Syn. H. ARABICUS (a.) ATLANTICUS.—Fisch. Syn. Mam. 3.
RACE ATLANTIQUE (OCCIDENTALE).—Bory, Ess. Zool. I. 174.
Icon. Blumenb. Dec. Cran. V. t. 42. (Head of the Mummy of an ancient Guanche from Teneriffe.)

The caverns of the Peak of Teneriffe have preserved the remains of an ancient branch of the Aramean race, which the philological researches of MM. Hornemann and Marsden have proved to be allied to that of the Berbers or Shillocks, who inhabit a large portion of the north of Africa. To this race, whose early civilization appears undoubted, we must refer the ancient Phœnicians, the Numidians, and Carthaginians, and probably also the Getulians and Garamantes. From the invasions of Greeks and Romans, Goths and Vandals, Turks and Arabs, the Atlantic races of the north of Africa exhibit many characteristics of the other white races, such as fine hair, tending towards chestnut, and even blonde, and in the mountain districts some families are almost white. In general, their nose is less aquiline than among the other Arameans, and they are not usually of so dark a colour, but approaching towards an olive tint.

The modern Moors inherit the maritime genius of their Phœnician ancestors, and have long been celebrated for their piracies; in which respect they differ remarkably from some nations of the Arabian branch, and especially from the Ægyptians, whose aversion to the sea is of great antiquity. The Moorish females would be accounted beautiful in any country. Those of the kingdom of Tripoli, though next to the Ægyptians, differ considerably from them, and are much taller. Like many of the Arab females, they tattoo their faces, especially upon the cheeks and chin. Red hair, as in Turkey, is much esteemed, and the locks of their children are often dyed with vermilion. The practice of rubbing the hair of the eyelids with plumbago is very general.⁷

E. HOMO SCYTHICUS.—SCYTHIANS.

Syn. LE RAMEAU SCYTHE ET TARTARE.—Cuv. Reg. Anim. I. 82.
HOMO SCYTHICUS (in part).—Bory, Ess. Zool. I. 236.

The Scythian and Tartar branch of the human race, established from the earliest ages towards the north and north-east of the ancient continent, has preserved its nomadic life in the immense plains of those regions, from whence it has never descended upon the more favoured regions of the other branches, but with views of plunder and devastation. The Turks, who overthrew the empire of the Arabs, and subverted in Europe the miserable remnant of the Greek empire, belonged to this populous race. The Finns and Hungarians are Tartar nations, who may be almost said to have lost their way among the Slavonian and Tentonic Races. The North and East of the Caspian Sea, apparently their original country, contains other nations of the same origin, and who speak similar languages, although intermixed with a considerable number of small tribes, differing from each other in descent as well as language. The Tartar nations have remained for a greater period unblended in all the regions which extend from the mouths of the Danube as far as the banks of the Irtisch, whence they have long threatened the

¹ Professor Vater in Adelung's Mithridates.

² Genesis, and the Books of Samuel, *passim*.

³ Pliny (Nat. Hist., lib. VIII.) imagines that the Hog cannot live in Arabia.

⁴ Un développement excessif des nymphes a rendu presque nécessaire une opération analogue à la circoncision chez les hommes. Consult on this subject Sonnini, Voyage en Egypte; also Virey, Hist. Nat. du Gen. Hum., tome I.

⁵ Niebuhr's Description de l'Arabie, and Burckhardt's Travels in Arabia, *passim*.

⁶ Volney (Voyage en Syrie), Niebuhr, and Burckhardt (Notes on the Bedouins and Wahabys), give many interesting details regarding the manners and customs of the wandering Arab.

⁷ Buff. Hist. Nat., tome III. 430.

Russian Empire, though ultimately subdued by its power. In this subdivision we may place those Ancient Scythians, who at a remote period made irruptions into Upper Asia; and the Parthians, who subverted the Asiatic dominion of the Greeks and Romans. Owing to the conquests of the Mongolians, numerous alliances have been contracted with that race, and many evident traces of Mongolian blood may be recognised, especially among the inhabitants of Lesser Tartary.

1. OTTOMANICUS.—OTTOMAN TURKS.

Syn. LES TURCS.—Cuv. Reg. Anim. 1. 82.

RACE TURQUE (in part).—Desmoul. Tab.

Icon. Blumenb. Dec. Cran. 1. t. 2 (Skull of a Turk).

The origin of that tribe of Scythians, who, in modern times, have obtained so much celebrity under Othman and his successors, is involved in considerable obscurity. From time immemorial they appear to have wandered in the plains near the Southern bank of the Oxus, until the feebleness of their neighbours induced them to desolate with their inroads the fertile territories of Greece, Asia Minor, Syria, and Egypt.¹ Their language bears at the present day no inconsiderable affinity to the dialects of Tartary, though mixed with many Persian and Arabic words, derived from an intercourse with the nations whom their valour had subdued.

Possessed of a noble but harsh physiognomy, the features of the Ottoman Turks nearly approximate to those of a European. Being rather tall, robust, and well-made, with tawny complexions, and black or dark-brown hair, it is with some difficulty that we can trace any resemblance to those Mongolian races, with whom their own historians, and some other continental writers, would confound them. A large and flowing dress, thick rolls of turban upon the head, and long mustachios, impart an imposing aspect to a deportment of no ordinary gravity.² Polygamy forms the luxury of the wealthy, but the poorer Mussulman is glad to escape from the trouble and extravagance of an extensive Haram. Inolent, proud, and ignorant, the Turks are averse to business, and passionately devoted to the immoderate use of coffee, opium, and tobacco. Their customs and manners, their religious bigotry, the feebleness of their political institutions, and the steadiness with which they have opposed all attempts to improve their condition, mark them out as Scythians in the strictest sense of the term.

2. FINNICUS.—FINNS.

Syn. RACE FINNOISE.—Malte-Brun, Geog. Univ.—Desmoul. Tab.

The Finnic or Tchoude nations, surrounded by races of different extraction, may be recognised by their language, customs, and physiognomy. The Finlanders, Biarmians, Ehstes, Livonians, Wotiaks, Woguls, Tchouveshes, Teheremisses, and Ostiaks, tribes of the Russian Empire; the Magyars, Ungres, Ungers, or Hungarians, who form a large portion of the population of modern Hungary; and the Laplanders, may be included with propriety in this subdivision.

The Finnic races, widely dispersed throughout the provinces of Russia, are marked by a sallow complexion, prominent cheek bones, red or yellow hair, a large occipital region, and scanty beard. In the Russian language they are termed *Tchoudes*, which signifies *strangers*. A few relics of the mythology and history of these obscure nations are preserved in the Saga of Saint Olaf, and in some Scandinavian and Russian monuments.

The Finns are possessed of a literature and mythology peculiar to themselves. The Finnic language is understood by their neighbours the Ehstes or Esthonians, who still retain under all the degradation of slavery the yellow hair and other characteristic features of their race. Their poetry is metrical and full of alliteration. The Wotiaks are a weak and ugly race, mostly with red or yellow hair and scanty beard. The religious notions of these tribes are peculiar; and the wicked, after death, are placed for ever in cauldrons of burning pitch, while the Tchouveshes change them into skeletons, which roam eternally in a frozen desert. The Ostiaks pay a peculiar veneration to the Great Bear, and swear allegi-

ance to every new Russian Czar upon a skia of that animal, or upon an axe with which a bear has been killed.

The Hunns or Magyars, though of Finnic origin, are connected with those tribes of Tartars, who, under the name of Turks, devastated Europe during the middle ages. The Hungarian peasant in general is of a robust and energetic constitution, but of moderate stature, and still retains many of his Tartar habits. The modern traveller may recognise in his peculiar costume many points of resemblance to that of most nomadic Scythians of Central Asia.

The remarkable affinity of the Hungarian language to that of the Laplanders led Sainovicz to consider them as identical;³ and M. Klaproth has proved the intimate relation of the former to that of the Ostiaks.⁴

The Laplanders belong unquestionably to the Finnic or Tchoude race. They are of small stature, with dark brown complexion, black hair, high cheek bones, broad face, and pointed chins. The men are thickly set and active, their beards scanty; the women are robust, and produce with slight inconvenience. Naturally of a roaming disposition, the Laplanders reside in tents made of cloth or the skin of the Rein-deer; and seldom remain for any considerable time in the same locality. From time immemorial they have been maintained by numerous herds of Rein-deer, which almost compose their entire means of sustenance. Polytheism, wherein every object in Nature is changed into a Deity, and a universal idolatry, in which the elements are typified, form the bases of their religious opinions. Their superstition is extreme, and many tribes, who even profess Christianity, still preserve their ancient idols, their magical drums, and certain knots with which they allay the frequent storms of those desolate regions.

3. TARTARUS.—TARTARS.

Syn. LES PEUPLES TARTARES.—Cuv. Reg. Anim. 1. 82.

RACE TURQUE (in part).—Desmoul. Tab.

Icon. Blumenb. Dec. Cran. 11. t. 12. (Skull of a Tartar of Kasan.)

The Tartar, Tatar, or Turkish nations of Central Asia, who are probably identical with the Asiatic Scythians of the Ancient Greeks, must be carefully distinguished from the Mongolians. Their European cast of countenance, though tending slightly towards a yellow, their long beards, curly hair, and slender figures, mark them out as belonging to the White races. The Moor is not more different from the Negro, than the real Tartar from the genuine Mongolian.

The pastoral life has been in all ages the favorite mode of existence of the Tartar races, who roam undisturbed, over the extensive plains between the Beloor mountains, and the basins of Lake Aral and the Caspian Seas. With extensive herds of cattle, with a numerous body of horse, which the Tartar can manage with skill, and those habits of continual motion which are essential to the practice of successful war, the tribes of the Scythians have always been prepared to advance upon unknown countries, wherever they expected to find a powerless enemy or a plentiful subsistence. Led by their Khans, the Tartars are well known at various periods of history as having acted an important part in several mixed emigrations of Tartar and Mongolian nations. On these occasions, both were included under one common appellation, and they may be recognised at one period as the Euthalites, Nephthalites, or White Hunns; at another, as the Turks of Transoxiana; again as the Hunns of Attila; as the Abares in the sixth century; and finally, under Chingis Khan and Timoorlane they assisted in devastating Persia, India, and Western Asia, for more than two centuries; while the most fertile countries of Europe have been struck with terror at the approach of these martial shepherds.⁵

Their invincible courage, overwhelming numbers, and rapid conquests, have given a military aspect to the pastoral mode of life, which our poets are in the habit of adorning with the attributes of peace and innocence. The flocks and herds which accompany the Tartar during his inroads supply him with milk and flesh, and he feeds indiscriminately on animals which have died by accident or disease. Horse-flesh is particularly esteemed as an article of food, but the animals themselves are in general too valuable to be used for this purpose except on an emergency. The ignorance of these nations is extreme, and it is seldom that even a Tartar Khan can either read or write.

At the conclusion of this enumeration of the Caucasian races, but without referring them to any particular section, we shall place the Zigeunes, Zingani, Tchinganés, Atchingans or Gypsies, who appear to have wandered from time immemorial in most parts of Europe, but especially in Turkey;

¹ Von Hammer, Geschichte des Osmanischen Reiches, II. Band.

² Lady Mary Montague's Letters, Volney's Voyage en Syrie, Olivier's Voyages, and Malte-Brun, Geog. Univ.

³ Sainovicz, Demonstratio Idioma Hungarorum et Laponum idem esse, Copenhagen, 1770.

⁴ Klaproth, Asia Polyglotta.

⁵ Gibbon (Decline and Fall of the Roman Empire, chap. 26, 34, and 64) describes with elegance and fidelity the manners of the pastoral nations, the conquests of Attila and his Hunns, and the devastations of the united bands of Mongolians and Tartars in the thirteenth and fourteenth centuries.

Wallachia, Moldavia, Hungary, and Transylvania. "They have wandered through the world, in every region, and among every people they have continued equally unchanged by the lapse of time, the variation of climate, and the force of example. In the neighbourhood of civilized life, they continue barbarous, and near cities and settled inhabitants, they live in tents and holes in the earth, or wander from place to place like fugitives or vagabonds." The skull of a genuine Gypsy is figured in Blumenb. Dec. Cran. II. 11.

II. MONGOLIANS.

Syn. RACE MONGOLIQUE.—Cuv. Reg. Anim. I. 82.—Desm. Mam. 47.
 LA MONGOLE (in part).—Dum. Zool. Anal. 7.
 H. SEYTHIENS (in part).—Fisch. Syn. Mam. 4.
 RACE JAUNE, ou OLIVATRE.—Virey, Hist. Nat. du G. Hum. I. 457.

RACE JAUNE, ou MONGOLIENNE (in part).—Less. Mam. 25.
 HOMO SAPIENS, VADIUS, VAR. β .—Lin. Gmel. I. 23.—TATARUS, β
 Exrl. 1.—VAR. MONGOLICA, Blumenb. Hand. et Abbild.

The Mongolians may be recognised by their prominent cheek-bones, a flat face, narrow and oblique eyes, straight and black hair, a scanty beard [if we except the Ainoos, or hairy-men of the Kurile Islands], and an olive complexion. They have formed empires in China and Japan, and sometimes extended their conquests beyond the Great Desert; but their civilization has always remained stationary.

The geographical station of the Mongolian races commences at the east of the Tartar branch of the Caucasians, and extends to the Pacific Ocean. Some of their branches, still nomadic, roam over the Great Desert, under the names of Calmucks or Kalkas. Three times their ancestors, under Attila, Chingis, and Timoorlane, spread far and wide the terror of their name. The Chinese appear to have been civilized at an earlier period than any other of these races, and indeed we may almost say, than any nation in the world. The Mantchoos, forming a third branch, have recently conquered China, which they still continue to govern. The Japanese, the Coreans, and nearly all the hordes which extend to the north-east of Siberia, under the dominion of the Russians, may be referred to this division, as well as the natives of the Marianne Islands, the Carolinas, and the adjacent islands of that Archipelago. If we except some of the Chinese literati, the Mongolian nations are generally devoted to the different sects of Buddhism, or the religion of Fo.

The origin of these races appears [according to the conjectures of some writers] to have been in the mountains of Altai, in the same manner as our White races have been assigned to the Caucasian mountains; but it has not been found possible to follow out with equal ease the [supposed] affiliation of their several branches. The history of these nomadic races is as fugitive as their settlements; and the records of the Chinese, confined within the limits of their empire, give but a few short and unconnected notices of the neighbouring nations.

The affinities of their languages are also too little known to guide us through the labyrinth. The dialects used to the north of the peninsula beyond the Ganges, as well as in Thibet, bear some relations to the Chinese language, at least in their nature, being in some respects monosyllabic, while the nations who speak them are not without some traits of personal resemblance to the other Mongolians.

A. HOMO CALMUCCUS.—CALMUCCS, & MONGOLIANS PROPER.

Syn. LES CALMOUQUES.—Cuv. Reg. Anim. I. 83.
Icon. Blumenb. Dec. Cran. I. t. 5. (Skull of a Calmuck); also II. t. 14.

The languages of the Calmucks or Kalkas, the true Mongolians, and the Booriaits of Lake Baikal, bear a considerable degree of resemblance to each other, but are wholly distinct from those of the Tartar races, in their vocabularies as well as in the forms of their syntax.¹ One important circumstance proves them to be allied in some degree to the dialects of China and Thibet, being the frequent recurrence of monosyllabic words. The Calmuck language is highly poetical, abounding in romances and epic compositions of considerable beauty.

The Calmuck is of a middle stature, with the internal angles of the eye

directed downwards towards the nose, the eye-brows black and narrow, the interior ends of the arches low, the nose flat and broad at the point, the cheek-bones prominent, the head and face very round. Their complexion is a brownish-yellow, differing in intensity according to the sexes and individuals. The acuteness of their senses is much celebrated, but not more so than their ugliness, which is described by travellers as being something terrible. The men shave their heads, with the exception of a small tuft, which is allowed to grow sufficiently long to form a lock of considerable length on either side of the face. The women allow their hair to hang in two braids over the shoulders, but without shaving any part of the head.

The proper Mongolians have thick lips, short chins, scanty beards, large and prominent ears, flat noses, and oblique eyes, nearly resembling those of the true Calmucks. Their language is but little known. Polygamy, though permitted by law, is among them, as in other places, rather uncommon. The religion of all these benighted tribes is that of the Dalai Lama, in which the people are held under the entire subjection of priests and jugglers.

B. HOMO SINICUS.—CHINESE.

Syn. LES CHINOIS.—Cuv. Reg. Anim. I. 83.
 H. SEYTHIENS β . SINICUS.—Fisch. Syn. Mam. 5.
 H. SINICUS.—Bory, Ess. Zool. I. 249.
 INDO-SINIQUE.—Desmoul. Tab.
Icon. Blumenb. Dec. Cran. III. t. 23 V. t. 44. (Skulls of Chinese).
 CHINESE.—Griff.² Anim. King. (Head of a fur-dealer).

Under the general term Chinese we shall include the inhabitants of China Proper, Corea, Tonquin, Thibet, Cochín-China, Siam, and the natives of the Birmese Empire. The Japanese, also, may probably be referred to this head, until a more minute acquaintance with their language and history shall fully establish their claim to a distinct subdivision.

Of these nations, the Birmese and Siamese are the tallest, being commonly from five feet six inches to about five feet nine inches in height. They strikingly exhibit the ordinary features common to all the Mongolian races, such as prominent cheek-bones, with oblique and narrow eyes; they also have scanty beards. Their ears are very broad, and project outwards, so as to be entirely visible in front. On the beautiful porcelain wares of China and Japan, their physical traits are often depicted with precision. The intensity of their complexions varies in the several races, being darker among the Cochín-Chinese and Siamese, and brown-olive among the Tonquinese. Their hair, which has nearly the coarseness of horse-hair, grows within an inch of the eyebrows. The Chinese ladies of rank, confined to their abodes by the barbarous treatment which their feet undergo in early youth, as well as by the forms of etiquette, often exhibit an etiolated appearance corresponding to that of our European ladies; yet there is always something about them, to use the words of M. Bory, which forcibly recalls the idea of *suet*. In general, the Chinese races have an oily skin, a yellowish-green complexion, passing towards a brown, according to climate, and even becoming dark below the 20th parallel of north latitude, from their alliances with the Malay races. It is however remarkable, that the most northern Chinese have the darkest complexions of the whole.

The greater number of the races of Chinese descent have the utmost horror of intermarrying with strangers, whom indeed they generally regard with aversion. To preserve themselves from the aggressions of foreigners, they constructed their celebrated wall, which serves to protect the northern frontier of their empire. Agriculture forms their chief

¹ Bergmann, Nomadische Streifereinen unter den Kalmuken, I. p. 125. (Fide Malte-Brun).

² GRIFF. ANIM. KING.—The Animal Kingdom. By Edward Griffith, and others. London, 1827.

means of sustenance. "The staff of life in China," observes Sir John Barrow,¹ "is rice, and it is the chief article of produce in the middle and southern provinces. The grain requires little or no manure; age after age the same piece of ground yields its annual crop, and some of them two crops a year. In the culture of rice, water answers every purpose." All the details of agriculture are prescribed by the laws; national festivals are consecrated in honour of the art, and the Emperor of China ostensibly professes to be the first agricultural labourer of this vast territory. A sea-faring life is held in abhorrence by the greater number of the natives, and those Chinese who leave their country for purposes of trade, only do so in defiance of the laws, for, if recognised, they are not permitted to return without molestation.

Silk is the material most commonly used for their larger garments, and cotton dresses are by no means so common as among the Hindoos. Being scarcely ever addicted to the abuse of spirituous liquors, tea forms the favorite beverage of the Chinese; and perfumes are highly esteemed. Their soldiers have little courage; and their dress and appearance are said to be "most unmilitary, better suited for the stage than the field of battle; their paper helmets, wadded gowns, quilted petticoats, and clumsy satin boots, being but ill adapted for the purposes of war." The people, however, are very industrious and skilful in business. Clever artisans in nearly all the useful and elegant articles of life were common in China, at a time when Europe was sunk in profound barbarism. Their history, and the peculiarities of their monosyllabic language, may be traced to a remote period of antiquity; yet their civilization has long remained stationary, and the most trivial actions of individuals are here regulated by the forms of law.

The Emperor and his court have long adhered to the ancient religion as originally taught by Kong-fu-tse, commonly called Confucius, but the present Mantchoo dynasty exhibits a very marked leaning towards Buddhism, or the religion of Fo.

The traditions of the Japanese tend to show that they were originally a Chinese colony, yet their language is wholly different; few Chinese terms can be recognised; the words are not monosyllabic; while the syntax and conjugations possess a distinct and original character. There is a peculiarity in the eye of a Japanese, which indicates a slight resemblance to the Mantchoo; it is oblong, sunken, and narrow, so as to appear as if constantly winking; the eyelids form a deep furrow, and the eyebrows appear higher than we find generally in other nations of this race. The head of a Japanese is commonly large; the hair thick, black, and glossy; the neck short, and the nose broad.

The native inhabitants of Pegu, Ava, and Aracan, do not differ greatly from the proper Chinese in their physical traits, but are merely a little darker in their complexions. It is said that the Aracanese admire a broad and flat forehead, and with this view continue to flatten the foreheads of their infants soon after birth. Their nostrils are broad and open, their eyes small and lively, and their ears hang down to the shoulders. The females are not very dark, and their ears are fully as long as those of the male population.

C. HOMO SERICUS.—MANTCHOOS.

Syn. LES MANTCHOUX.—Cuv. Reg. Anim. l. 83.—Lesson, Mam. 25.
Icon. Blumenb. Dec. Cran. II. t. 16. (Skull of a Tongoos), and III. t. 23. (Skull of a Daourian).

According to M. Langlès,² the language of the Mantchoos is wholly different to that of the true Mongolians, the Chinese, or any of the Tartar tribes, and bears some remote affinities to the languages of Europe.

Most of the leading families of Mantchoo extraction have settled in China, where they have adopted the common dress of the country. For these reasons they are gradually becoming incorporated with the Chinese, whom their arms have subdued. Their religion has some affinity with Shamanism. They are more robust in their figure than the Chinese, but their countenances have less expression. The feet of the genuine Mantchoo women are not cramped and rendered useless by bandages.

The several wandering tribes of hunters, known by the name of Tongooses or *Qevans*,³ who roam over the barren wastes situate to the eastward of the Sea of Baikal, may be placed in this subdivision.

D. HOMO KURILIANUS.—AINOOS.

Syn. KOURILLENNE.—Desmoul. Tab.
Icon. Desmoul. Hist. Nat. des R. Hum. pl. 5 and 6.

The islands extending in a chain from Japan to Kamtchatska are inhabited by a race of men peculiar in language and appearance, called by the Japanese *Mo-sins*, or Hairy men, though they style themselves *Ainoos*, according to Krusenstern.⁵ They are taller than the Japanese, and of a more robust frame, with very thick and black beards, and the hair of the head also black and somewhat frizzled. The forehead rises rather squarely upwards, the nose is straight, and nearly on a level with the forehead, as in the Celtic, Iapetan, or Aramean races, only shorter and thicker. Their complexion is deep brown, approaching towards black; the beard and eyebrows so thick as almost to conceal the face; the whole body covered with hair; and, if we may credit the accounts of the Russians, a child of five years old, found, in 1806, at the bay of Mordwinoff, had his body already covered in this remarkable manner.

Their height is about five feet seven inches in the neighbourhood of Jesso; their limbs well proportioned. The women appear to European eyes far uglier than the men; their complexion is equally dark, their lips painted blue, and their hands tattooed. M. Desmoulins (Hist. Nat. des R. Hum. pl. 6) represents an Ainoos family, from a singular Japanese design, which, though rude, is executed with some spirit. The mother of the family appears to be suckling a young pig, a common practice in the island of Jesso, where the females rear young bears, dogs, or pigs, in this manner, and confine them when old enough in cages until they are sufficiently fat for killing.

The language of the Ainoos is said to bear no affinity to the Japanese, the Kamtchatskadale, or the Mantchoo, and, as far as hitherto known, seems to be very different from any other.

III. NEGROES.

Syn. RACE NÈGRE.—Cuv. Reg. Anim. I. 80.
RACE NOIRE OU MÉLANIENNE (in part).—Less. Mam. 26.
RACE ETHIOPIENNE OU NÈGRE.—Desm. Mam. 47.—Dum. Zool. Anal.

The Negro races are confined to the region south of Mount Atlas. Their complexions are black, their hair woolly, the cranium compressed, and the nose flattened, while their projecting muzzle and thick lips indicate a near approach to the characters of the Monkey tribes. The hordes composing this division have always remained in a barbarous state.

A. HOMO ÆTHIOPICUS.—ETHIOPIANS.

Syn. ETHIOPIEN.—Less. Mam. 26.—Desmoul. Tab.
H. ÆTHIOPICUS.—Bory, Ess. Zool. II. 29.
Icon. Blumenb. Dec. Cran. I. t. 6, 7, and 8. II. t. 17, 18, 19.

The traits of the genuine Ethiopian are so very different from those of

any of the races already described, as to strike an observer at the first glance. But independently of the nature of his woolly hair, the excessive darkness of his entire skin, and the clear tones of his voice, there are some striking anatomical differences, which, according to some writers, would be accounted specific, if recognised in any other animal than Man. The cranium is narrowed in front, flattened on the top, and becomes rounded in the occipital region; the sutures are very close, the bones of the nose considerably flattened; the incisive teeth inserted obliquely; while the skeleton of the entire body surpasses that of all other races in whiteness.⁶ The bones of the pelvis are larger, especially in the females, and the thighs and legs possess a certain degree of curvature, so as to impart a bow-legged appearance to the best made Negro.

The following may be briefly stated as the characters of the true Ethiopian:—The skin of the entire body black, excepting the palms of the

¹ Encyclopædia Britannica. Art. China. By Sir John Barrow. Also, Barrow's Travels in China; and Narrative of a Journey in the Interior of China. By Dr Clarke Abel, London, 1818.

² Langlès, Alphabet Mantchoo. (Fide Malte-Brun.)

³ See Malte-Brun. Geog. Univ. And the Synoptical Table at the end of the XLth division.

⁴ DESMOUL. HIST. NAT. DES R. HUM.—Histoire Naturelle des Races Humaines. Par A. Desmoulins. Paris, 1826.

⁵ Krusenstern's Voyage, II. p. 7.

⁶ This remark has been made by M. Bory Saint-Vincent; we have not had an opportunity of verifying his observation.

hands and the soles of the feet; the forehead depressed; the hair woolly and curly, forming a true cap on the top of the head, and leaving the inferior margin almost regular; the eyes large and prominent; the sclerotic tinged with yellow; the nose flattened; the cheek-bones projecting; the lips very thick and protruding forward; the chin depressed; the ears long and directed laterally; the occiput thrown far behind. The shoulder-blades are longer and more pointed than those of any of the Caucasian races; the anterior limbs are singularly elongated; the lower limbs are thin, the thighs flattened, especially in the internal parts; the calf of the leg is very small, and placed at a short distance from the cavity at the back of the knee, the heel projects far behind, and the sole is excessively flattened.

It has been shown by M. Soemmering, that the brain of the Ethiopian is comparatively more confined than ours, the cranium being always smaller in proportion as the face projects forward; while, on the other hand, the nerves which issue from it are larger. The colour of his blood is evidently deeper, as well as that of the muscles, the bile, and generally of all the humours of his body. His perspiration is also more ammoniacal, and taints linen with a very disagreeable odour. The breasts of the females hang very low, and from the earliest marriageable age assume a long, pendant, and pear-like form, which permits them to suckle their infants over the shoulder. "Elles ont aussi le vagin en tout temps large et proportionné au membre viril du mâle, souvent énorme, mais à-peu-près incapable d'une érection complète. La grande facilité avec laquelle conséquemment les Nègresses accouchent dès l'âge de onze à douze ans où elles sont définitivement réglées, dégénère en inconvénient, et nulles femmes ne sont plus sujettes à l'avortement. Dans le fœtus, la tête n'est pas aussi grosse proportionnellement qu'elle l'est dans les autres espèces; aussi la fontanelle du nouveau-né est très peu considérable et presque fermée dès la naissance, les os du crâne ne devant pas jouer les uns vers les autres, quand il est question de la délivrance."

Every thing in the constitution of the proper Negro denotes an approximation towards the animal, where the mere physical impressions predominate over, and often almost extinguish, the moral or intellectual. His sight is piercing, his sense of smelling extremely subtle, and his hearing very sensitive to musical impressions. The Ethiopian is sensual in his tastes, gluttonous, and excessively amorous. Every other variety of the human species is excelled by his race in agility, dexterity, and indeed in all those imitative qualities which more or less depend upon the animal frame. He is an adept in dancing and swimming, but seldom rides. He performs the most striking feats of address, climbs, and leaps with an agility surpassed only by the Apes. While dancing, the Negro agitates every part of the body, and seems indefatigable. He can distinguish a remote object, which the gaze of a European could only reach by the aid of a telescope; and can detect the presence of a serpent, or hunt an animal by the scent. The slightest noise does not escape his ears; and the fugitive Negro slave frequently evades the pursuit of his master through the superior delicacy of his organs of sense. His touch is surprisingly acute; but being thus keenly attentive to the impressions of mere sense, his reflecting powers are but little exercised. The dread of the most cruel punishments, and even of death itself, does not prevent the Ethiopian from abandoning himself to the passion of the moment; and even when writhing under the lash of the overseer, the sound of the tam-tam, or some other execrable music, will inspire him with fortitude, or bind up the feelings of the past in forgetfulness. The monotonous notes of some dull chant, picked up by chance, are sufficient to support him under the most violent fatigues. A moment of pleasure is sufficient to obliterate the remembrance of a year of pain. Ever devoted to the affections and feelings of the moment, the past and the future are nothing in his eyes; his griefs are fugitive, and as he follows the suggestions of sense rather than the dictates of reason, he is extreme in all things,—like a lamb when oppressed,—like a tiger when power is placed in his own hands. In a moment of vengeance, he does not hesitate to massacre one of his wives, or dash his infants upon the earth. Nothing is more terrible than his despair, or more sublime than the devotedness of his attachments.¹

The genuine Negroes are subject to certain disorders, such as the yaws, which they do not communicate to the other varieties. The small-pox is very dangerous in them, and commonly appears before the age of fourteen; but after that period, we are assured that the Negroes are comparatively free from it. Though exceedingly muscular, the prevalent temperament is lymphatic; the pulse appears to be more accelerated than among the White races.²

Whatever opinion may be adopted regarding the cause of the intellectual and social inferiority which the Ethiopians exhibit, when contrasted with the Caucasian races, or even with several of the Mongolians; whether we consider it as proceeding from their original constitution, or from the uncultivated state in which their faculties have always been suffered to remain,—the fact cannot be denied. In general, the Ethiopian is lazy, without the least foresight, deriving no knowledge from the experience of the past, with few wants but such as Nature can readily satisfy in a tropical climate; and thus he vegetates in a condition which cannot be termed absolutely savage, although without the smallest pretensions to be accounted as a genuine civilization.

The true Negroes are generally divided into petty tribes or small nations, despotically governed by chiefs of the most sanguinary dispositions, nearly always at war with each other, for the purpose of making prisoners, to satisfy the avidity of the execrable slave-dealer. Some of these tribes, according to their geographical position, live on fish; others devote themselves to trade; and others, again, cultivate some kinds of pulse or grain, or lead the nomadic life of shepherds. Without any established form of religious belief, they attribute supernatural powers to any remarkable object which strikes their attention. Some adore a Serpent, or any other animal, some a Baobab, or any large tree, according to the peculiar form of Fetishism, which happens to be countenanced in the locality.³

Polygamy, in the widest sense of the word, seems to be practised throughout the entire races; and seldom do sentiments either of modesty or humanity penetrate into their savage breasts. Blood flows unheeded, and the most inhuman torments and mutilations are inflicted on their vanquished enemies; such as tearing off the lower jaw, or some of the limbs, as a trophy. Whole tribes wander entirely naked, armed with bows and arrows, or wooden javelins pointed with iron; and it is only in the European colonies that they consent to wear the *langouti*, or blue girdle. Some of the tribes, who have become more civilized or degraded by their commerce with Europeans, adopt the cotton cloths or stuffs of foreign manufacture. The beautiful natural productions of the vast and almost unknown continent of Africa are exchanged for ardent spirits, gunpowder, iron, or trinkets. "Les Ethiopiennes passent pour très lascives ou plutôt elles paraissent ignorer qu'on puisse repousser les sollicitations d'un homme, surtout lorsqu'il est blanc. Cependant il est quelques nations Nègres où une sorte d'état social ordonne la fidélité des femmes envers les maris, et où l'on punit l'adultère, en enterrant tout vifs les deux coupables."

The Negroes do not appear to be equally long-lived with the individuals belonging to the other races of mankind; they become decrepid at sixty years of age, even when they enjoy, in a free country, the utmost extent of that domestic liberty which they seem to be capable of enjoying. Their woolly hair is observed to become grey sooner than among the White races.

Before the avarice of Europeans had transported the Ethiopian races to the New World, Africa was their exclusive abode; here they continue to occupy a vast tract of coast, extending along the Gulf of Guinea, from the river Senegal, and the 16th or 17th degree of north latitude, as far south as the parallel of Saint Helena, that is to say, to about the 16th or 17th degree of south latitude. The Ethiopian races scarcely appear beyond the Tropics, but probably extend far into the interior of the continent. They are rarely to be met with on the eastern coast, which is inhabited by races of Men differing from them in many respects. Towards the west, we find the Foulahs, on the banks of the River Gambia, already slightly mingled with the Moors; the Ghiolofs or Yalofs, a very black, tall, and robust race; the Sousous of Sierra Leone; the Mandings of the Grain Coast; the Ashantees of the Gold Coast, whose warlike and dangerous character is much celebrated; the Negroes of the Coast of Ardra and Benin, where the greater number of slaves are at present procured; the inhabitants of the Coast of Gabon, which are slurred by Europeans; and the nations of Loango, Congo, Angola, and Benguela, more or less civilized from their intercourse with the Portuguese for several centuries.

B. HOMO CAFFRARIUS.—CAFFRES.

Syn. H. CAFER.—Bory, Ess. Zool. 11. 86.

CAFER.—Less. Mam. 27.

KAFFERN.—Lichtenst.⁴ Reise. 11.

EURO- AFRICAINE.—Desmoul. Tab.

Icon. Péron, Voy.⁵ pl. 5b. (A native of the Mosambique Coast.)

The term Caffre, or *Infidel*, originally applied by the Mussulmans to designate all Negroes who refused to submit to the rite of circumcision.

¹ Virey, Hist. Nat. du G. Hum. tome 11.

² Bory, Ess. Zool. 11. p. 33.

³ Journal of an Expedition to explore the Course and Termination of the Niger. By Richard and John Lander. London, 1832.—Also Annales des Voyages, passim.

⁴ LICHTENST. REISE.—Reise nach dem südlichen Afrika von H. Lichtenstein. Berlin, 1811.

⁵ PÉRON, VOY.—Voyage de découvertes aux Terres Australes, fait par ordre du gouvernement sur les Corvettes le Géographe, le Naturaliste, et la Gôelette le Casuarina, pendant les années 1800 à 1804. Rédigé par François Péron, et continué par M. Louis de Freycinet.—Atlas par MM. Lesueur et Pett. Paris, 1824.

has been latterly confined to a race of Negroes, occupying the country to the south-east of Africa, called Caffraria, which extends from the Cape of Good Hope to Monomotapa.

The races inhabiting this extensive district differ alike from the Ethiopians, the Hottentots, and the Aramean races, which adjoin them. The skull of the Caffre exhibits an elevated arch, like that of the European; the nose, far from being flattened, approaches to the aquiline form. He has the thick lips of the Ethiopian, and the high cheek-bones of the Hottentot; his curly hair is less woolly than that of the Negro, and his beard stronger than that of the Hottentot. In general he is tall and well-made; with the skin not quite so black as in the Negro, and is usually in the habit of painting his face and entire body with a red ochre. The height of the females contrasts forcibly with that of the males, for scarcely do they attain the stature of a European female, though in other respects they are equally well-formed. The limbs of a well-made Caffre present that rounded and graceful contour which we admire in the antique statues of the Pelasgian races; his countenance is mild and lively. The Caffre girls are highly esteemed for their beauty, and form an important branch of a disgraceful export trade. The clothes of the Caffres are made of skins, and their ornaments consist of ivory or copper rings, which they carry on the left arm or in the ears. Cattle form their principal wealth, although the cultivation of the soil, performed exclusively by the females, yields no inconsiderable portion of their sustenance.¹

All the Caffres are very warlike and active, fond of long journeys, either to visit their friends, or merely from the restless desire of change.

The Bejouanas have already exhibited some rude approaches towards civilization. Their countenances are intelligent; their memory retentive; and they exhibit no small degree of inquisitiveness during their intercourse with strangers. Their priests, the chief of whom is second only to the king, preside over certain religious ceremonies, such as the circumcision of the male infants, the consecration of cattle, and predictions of the future. They are unacquainted with the art of writing; their arithmetic is confined to addition; they count on their fingers, and have no signs of a decimal notation. The form of their houses distinguishes them most advantageously from the other nations of Southern Africa, and some considerable towns are occasionally to be found, with a population of several thousands.

The Koussas have a decided attachment for a pastoral life; yet they do not hesitate to take up arms in defence of their country, and have successfully resisted the attacks of Europeans. The Maroutzas and Makinis manufacture the dresses, ornaments, arms, and domestic implements of the other tribes. Hence the Caffre races would appear to have advanced further in civilization than any of the Ethiopian races, though none of them have yielded their faith to the exertions of the Christian missionaries. Some Caffre families have emigrated to the southern extremity of the Island of Madagascar.

The language of the Caffres is sonorous, rich in vowels and aspirations, with very few of those harsh guttural sounds which render the Hottentot dialect so disagreeable to foreigners.

C. HOMO CAPENSIS.—HOTTENTOTS & BUSHMEN.

Syn. HOTTENTOT.—Less. Mam. 27.

II. HOTTENTOTUS.—Bory, Ess. Zool. II. 113.

AUSTRO-AFRICAINE.—Desmoul. Tab.

Icon. Blumenb. Dec. Cran. V. t. 55. (Skull of a Bushman Hottentot.)

Geoff. et F. Cuv.² Hist. Mam. (Femme Boschesmanne); and Péron, Voy. pl. 57.

The Hottentots of Southern Africa present the widest divergence in their physical traits, as well as in their anatomical characters, from the White races of Europe; and in many respects assume the characteristics of the Orangs, and larger Apes. As we find in the Genus *Macacus*, the bones of the nose are united, according to Lichtenstein, into a single scaly lamina, flattened, and much broader than in any other human skull. The olecranon cavity of the humerus is also pierced with a hole; and the front teeth with their alveolæ are oblique.

The complexion of the Hottentot is more or less brown or yellowish-brown, but never black. His head is small, the cheek-bones very prominent, the eyes sunk, and the sclerotica pure white; the face, very broad above, ends in a point, the nose is flat, the lips thick, and the teeth very white. He is well made and tall, with small hands and feet in proportion to the rest of his body. The hair is black, curly, or woolly; but in many tribes, instead of covering the surface of the scalp, it is collected

into small tufts, at certain distances from each other, resembling the pencils of a stiff shoe-brush, only curled and twisted into hard and round lumps. When allowed to grow it forms small tassels like the fringe of a curtain. The Hottentot is almost destitute of beard, his ears are directed backwards, and the concha is so small that no part of that organ is visible in front. The form of the foot is very different from that of an Ethiopian or Caffre, and the impression of a Hottentot foot on the sand in consequence is readily recognised.

The Boschismans, or Bushmen, called Saabs by some of the native tribes, seem to have been separated from the proper Hottentots at a very remote era. These races having been hunted like wild beasts by the colonists, and driven to the deserts, exist only by hunting or plunder. They live in caverns, and clothe themselves with the skins of animals killed in the chase, while their industry is confined to the fabrication of poisoned arrows and fishing-nets. They exist in the extreme of wretchedness; their meagre limbs and famished appearances betray the privations to which they are reduced. They remain without leaders, without property, or even a social tie, excepting the transient passion of the moment.³

We must here notice the existence of two singular anomalies in the organization of the female Boschismans; these are the extraordinary size of their haunches, and that remarkable prolongation of the sexual organ, vulgarly called the *apron*.

In respect to the first of these peculiarities, Le Vaillant assures us that he saw it in a girl of three years old.⁴ The large projection of her haunches consisted in a fleshy and adipose tissue, oscillating at every movement of the body like a tremulous jelly. The mother while walking occasionally places her infant upon this protuberance, and Le Vaillant observed one female running while her child stood upon the haunch, like the groom behind a cabriolet.

The female Boschisman, exhibited in Paris during the year 1815, measured about nineteen inches across the haunches, while the hips projected full seven inches, a peculiarity which was afterwards found to proceed from a large mass of fat placed immediately under the skin.⁵

According to Péron, the apron of the Boschisman female has nothing in common with the ordinary sexual organs as observed in the females of other nations; while, according to the Parisian anatomists, the peculiarity of the female already alluded to consisted merely in an unusual development of the nymphæ. The labia were slightly pronounced, and intercepted an oval of 4.26 inches in length. From the upper angle there descended between them a half-cylindrical eminence about 1.6 inches in length, and .53 in thickness, the lower extremity of which enlarging became forked, and was prolonged into two fleshy petals, about 2.66 inches in length, and 1.06 inches in breadth; each of them rounded on the summit; their bases enlarging and descending along the internal margin of the great labium, on its side, and changing into a fleshy crest which terminated at the lower angle of the labium. On raising these two appendages, they formed together the figure of a heart, with long and narrow lobes, the centre of which was occupied by the vulva. It may be readily seen on comparing this description with the analogous parts in the European female, that the two fleshy lobes which form the apron are formed at the upper part by the clitoris and the summits of the nymphæ, while in all the remainder of their extent they consist merely in an excessive growth of the nymphæ. This view of the subject is confirmed by the fact that the length of the nymphæ varies greatly even in Europe, and in general becomes more considerable in warm climates, and that the Negro and Abyssinian females are sometimes incommoded to such a degree as to be compelled to extirpate them by fire or amputation. The amount of this development observes no constant law among the Boschismans. Blumenbach states that he is in possession of drawings of the organs which were 8.5 inches in length, and they vary frequently in respect to their form.

This excrescence is evidently not the result of art, as all the Boschisman females possess it in their earliest youth; and the female already mentioned concealed it, so carefully, and as though it were a deformity, that its existence was not even suspected until after her death.

The countenance of this Boschisman female presented an odious combination of the Mongolian and Negro features. Her muzzle projected still more than in the Negro, and the face was more flattened than in the Calmuck; while the bones of her nose were smaller than in either. Her breasts hung downwards in large masses, obliquely terminated by a blackish areola, about 4.3 inches in diameter, furrowed with radiated striæ, in the centre of which appeared a flat and almost obliterated nipple. The

¹ Lichtenst. Reise II.

² GEOFF. ET F. CUV. HIST. MAM.—Histoire Naturelle des Mammifères. Par M. Geoffroy-Sainte-Hilaire; et par M. Frederic Cuvier. Paris, V. Y.

³ Barrow's Narrative of a Journey amongst the Boushouanas; and Campbell's Second Journey.

⁴ LE VAILL. VOY.—Voyage dans l'Intérieur de l'Afrique, par le Cap de Bonne-Espérance.—1^o Voyage, Paris, 1790.—2^o Voyage, 1795.

⁵ Geoff. et F. Cuv. Hist. Mam. Femme Bosch. p. 5.

general colour of her skin was a brownish yellow, almost as deep as that of her face. Her movements had something hasty and capricious in them, like those of an Apc. She had the same habit of pushing out her lips, as may be observed in the Orang-Outang. Her height was about four feet nine inches, which appears, according to the report of her countrymen, to be much above the usual size.

The tribe of Boschismans, which is probably identical with that of the Houzouanas, described by M. Le Vaillant, has its facial angle no greater than 75°, and approaches nearer to the brute in this respect as it does in many others, than most other branches of the human species.

The Hottentots and Boschismans occupy the extreme Southern point of Africa, but do not extend within the tropics; they are spread around the basin of the Orange River under the names of Gonaquois, Namaquois, Coranas, Boschismans, and Houzouanas.

The Caffres, as well as the Colonists of the Cape, wage a war of extermination against the unfortunate Hottentots, who wander about clothed in skins, besmeared with black or red grease, in the midst of their cattle, which form their whole possessions.

ANOMALOUS RACES.

Syn. VARIÉTÉS DE RACES MOINS DISTINCTES.—Desm. Mam. 47.

The southern portion of the peninsula, situate immediately beyond the Ganges, is inhabited by the Malays (*H. Malayensis*), who approximate more nearly to the Hindoos in their physical characters than to the Mongolians. Their race and language are widely dispersed throughout the coasts of nearly all the islands of the Indian Archipelago.

The innumerable small islands of the Southern Ocean are also peopled by a handsome race (*H. Polynesiensis*), apparently resembling the Hindoos, while their language bears many [remote] analogies to the Malayan.

But the interior districts of the larger islands, and more especially their wildest territories, are inhabited by another race (*H. Australasicus*), with dark complexions, and approaching more nearly to the Negro in form. These islanders, who live in a state of extreme barbarity, are commonly termed Alfooroos [and may be subdivided into two branches, the Proper Australians (*H. Australius*) and the Oceanic Negroes (*H. Melaninus*)].

Again, we find upon the coasts of New Guinea and the neighbouring islands, a race commonly termed Papoos (*H. Papuensis*), and nearly resembling the Caffres of the Eastern Coast of Africa. The inhabitants of New Holland (*H. Australius*) are regarded as Alfooroos, while those of Van Diemen's land should rather be considered as Papoos [or Tasmanians].¹

It is not very easy to refer either the Malays or Papoos to any of the three Normal Races, for the former merge by insensible gradations, on the one hand, into the Hindoos of the Caucasian races, and on the other, into the Chinese of the Mongolian race, so that we can scarcely point out any characteristics sufficiently marked to distinguish them. We are not yet in possession either of figures or descriptions sufficiently exact to decide whether the Papoos [as some have conjectured] are not merely Negroes, who have anciently lost their way upon the Indian Seas.

The tribes (*H. Hyperboreus*) who inhabit the northern extremity of both continents, such as the Samoids² and the Esquimaux, belong, according to some writers, to the Mongolian race; according to others, they are merely some degenerate off-sets of the Scythian or Tartar branch of the Caucasian races. The Americans themselves (*H. Americanus*) have not hitherto been clearly referred to any one of the races found in the Ancient Continent, yet they have not those precise and constant characters which would permit us to elevate them to the rank of a Normal race. Their reddish copper-coloured complexion is not a sufficient one, while their hair, generally black, and their scanty beards, would lead us to include them among the Mongolian races, if their harshly-defined countenances, their nose as prominent as ours, their large and projecting eyes, did not oppose this arrangement, and assimilate them more nearly to the European forms of countenance. Their languages

are as innumerable as their tribes, and all attempts to demonstrate a satisfactory analogy between the latter and the dialects of the Old World have hitherto failed.³

A. HOMO MALAYENSIS—MALAYS.

Syn. LES MALAIS.—Cuv. Reg. Anim. I. 83. — Less. Mam. I. 24.

RACE MALAIE.—Desm. Mam. 47 (in part).

H. NEPTUNIANUS, RACE MALAISE (ORIENTALE).—Bory, Ess. Zool. I. 281.

MALAISE ou OCEANIQUE.—Desmoul. Tab.

H. SAPIENS, VAR. MALAYANA (in part).—Blumenb. Hand.

Icon. Blumenb. Dec. Cran. IV. t. 39. (Skull of a Javanese.)

Péron Voy. pl. 38 to 43.

The Malays were first recognised as a distinct race during the twelfth century, when some of their tribes, emigrating from Menaug-Kabou in Sumatra, founded Singhapoura, and established the principal seat of their power at Johor, in the peninsula of Malacca. This warlike and commercial people have rendered themselves masters of the sea coast of most of the islands in the Indian Archipelago, and have either extirpated the original inhabitants, or driven them to the mountains of the interior, where the Alfooroos long existed, unknown to European navigators.

From a continual intercourse with the Moors of the Red Sea they have acquired the Mahometan Religion, with many Arabian customs, while other traditions and customs are evidently derived from their neighbours the Hindoos. The inhabitants of Java, mixed with Arabic blood, have long composed several powerful and populous states. In the neighbouring Islands of Borneo, Celebes, Tidore, Ternati, Sumatra, and Sooloo, we find the same race established, though often modified in some degree from an extensive intercourse with Europeans and Chinese. But the Malayan race may be found in its greatest purity in the Islands of Gnebay, Oby, Gilolo, Floris, Lombok, and Bali.

In all the governments of the Malays, we find the despotic form of the Hindoos universally adopted, where the person of the Rajah is held in the profoundest veneration. Capable of the blackest perfidy and duplicity, and with an ardent thirst for revenge, the Malays are as celebrated in the East for their treachery, as some Atlantic nations once were for their "Punic faith." The annals of Malayan history are one continued record of assassination and treason, while in all ages piracy has been, with a large portion of the population, one favourite mode of acquiring a livelihood. Professing the tenets of Islamism, the Malays adopt polygamy, and other precepts of the Koran, but modified by several Hindoo dogmas. Their chiefs are richly clad according to the Hindoo manner, while the lower orders go about entirely naked, with the exception of a narrow piece of cloth round the waist. In general, the Malay is sensual and dissolute in the extreme, passionately devoted to intoxicating liquors and opium; and, above all, to the practice of chewing the betel-nut. This drug appears almost peculiar to the Malayan race, in whose territory the materials are plentifully to be found. The Pinang (*Areca*), the Pepper, and occasionally also the Cashew, with some calcareous earth, form its ingredients.

¹ For a further knowledge of the different races who people the Islands of India and the Pacific Ocean, consult the Dissertation of MM. Lesson and Garnot, in the "Zoologie du Voyage de la Coquille," p. 1-113; and for the languages of the Asiatic nations and their mutual relations, see the "Asia Polyglotta" of M. Klaproth.—*Note of the Baron Cuvier.*

² M. Cuvier includes the Laplanders in this enumeration (Reg. Anim. p. 84); and M. Garnot (Voyage de la Coquille, tome I. p. 512) is disposed to consider a part only as Hyperboreans. We have been induced (see before, p. 132), from the affinity of their language to the Finnic or Tchoude dialects, to place them in the Scythian branch of the Caucasians.

³ On the subject of the Americans, besides the Voyage of M. Von Humboldt, so rich in important documents, consult the Dissertations of Vater and Mitchell.—*Note of the Baron Cuvier.*

The Malayan race, resident in the immediate vicinity of the equator, is seldom found beyond the 92d and 132d meridian of Eastern longitude; yet they can be traced to the eastern coast of the Island of Madagascar, though sometimes partially mingled with the Moors. They may be said to form the entire population of the shores of the Indian Archipelago, the Sonda and Molucca Islands; from whence they have been distributed to some of the Philippine Islands, and as far as the Island of New Guinea, on the north of which they have formed some permanent settlements. The Malays are even to be found at Wajoo, at the Isles of Aroo, and in Dampier's Straits.

The physical traits of the Malays are as characteristic as their manners and customs. In general they are of medium size, robust and well proportioned, their complexions of a yellowish copper-colour, slightly mixed with orange. M. Bory remarks that their mucous membranes have a deep violet tinge. The females, every where subjected to a jealous *surveillance*, are in general of diminutive stature, well rounded, their breasts voluminous, their hair very coarse and black, their mouth wide, and their teeth might be accounted beautiful, if they were not blackened and corroded by the immoderate use of the betel. Both sexes are violent in their passions, irritable, treacherous, capable of the grossest deceit, submissive and crouching to the yoke of the strongest, barbarous and merciless to their enemies or their slaves.¹

The Malayan language is spoken throughout all the islands, with slight local variations. It is mild, harmonious, and simple in its rules; full of oriental terms of expression, and abounding in figures of speech.² Their religion and knowledge being derived from the Arabs, the inhabitants of Malacca have adopted the characters of the Arabic, with the practice of writing from right to left, while those of Java and Sumatra write like the Europeans, from left to right.³

B. HOMO POLYNESIUS.—POLYNESIANS.

- Syn.* RAMEAU Océanien.—Less. Mam. 25.
H. NEPTUNIANUS Océanique (Occidentale).—Bory, Ess. Zool. I. 298.
RACE JAUNE DU GRAND Océan.—Quoy et Gaim. Zool. de l'Astr. 4 I. 18 (in part).
Icon. Blumenb. Dec. Cran. III. t. 26. (Skull of an Otaheitan); V. t. 50. (Skull of a Marquesan).
Cook and King, Voy.⁵ Pl. XI. XVIII. XXIII. LXIII. and LXIV.
Langsd. Reise.⁶ I. t. 7 and 8.
Kotzeb. Voy.⁷ II. fig. and III. fig. tit.
Quoy et Gaim. Zool. de l'Astr. pl. I. and fig. 4 and 5 of pl. 2.

The Polynesian or Oceanic variety of the human race is far superior to the remaining population of the Southern Ocean in the beauty and symmetry of its proportions. In general, the South Sea Islanders are of an elevated stature, with their muscles well defined, a well formed and elevated cranium, and an expressive physiognomy, varying from placid timidity to warlike ferocity. Their eyes are large and protected by dense eyelashes. The colour of their complexion is a clear yellow, deeper in those natives who are compelled to seek for subsistence among the coral reefs, and much fainter among the females. Their noses are broad and flat, the nostrils widely-dilated, the mouth large, the lips thick, the teeth very white and beautiful, and the external ears remarkably small. The beauty of the women, though somewhat exaggerated by the earlier navigators, is not inconsiderable. Their eyes are large, their teeth of the purest enamel, their skins soft and smooth, their hair long and black, and tastefully arranged over breasts of the most perfectly hemispherical form. In other respects they may be termed ugly, having, like the men, large mouths and flat noses. The colour of their complexions is almost white, their stature short, their forms corpulent. The inhabitants of Mendocia and Rotooma, according to Krusenstern,⁸ are the most comely; next to these we may place the Otaheitan, the Sandwich Islanders, and those of Tonga. At New Zealand, the beauty of the females declines, while the males are more robust and athletic than any others of the same race.

The greatest analogy may be traced in the manners and customs of these islanders, though separated from each other by an immense expanse of ocean, and the identity of the race has been demonstrated upon the greater portion of the islands situate to the south-east of the Indian Archipelago and Australia. In fact, all the volcanic and coral islands of this ocean within the Southern Temperate Zone are peopled by the Polynesians, while they appear to have sent only a single colony to the northward, which occupies the Sandwich Islands. The entire Archipelago of the Carolinas, on the contrary, with the Philippine and Marianne Islands, is peopled by a totally different race. The Polynesians are thus widely distributed in the Friendly and Society Islands. A branch has extended to the Isles of Mandana, Washington, Mangaia, Rotooma, Lady Penryn, Sauvage, Tonga, and New Zealand. About one half of the population of the Fidjee and Navigators' Islands belongs to this race, which does not extend, according to MM. Lesson and Garnot, beyond the Island of Rotooma in that direction.

Both sexes of the Polynesian variety clothe themselves in the most graceful manner with long flowing robes, wherever the variations of temperature require this covering. The chiefs alone possess the prerogative of wearing the *tipouta*, a garment which bears much resemblance to the *poncho* of the Araucanos in South America. The New Zealanders, placed beyond the tropics, have adopted garments suited to their climate, consisting in an ingenious fabric, formed of the silky fibres of the Phormium. All these islanders agree in possessing a singular taste for head dresses. Those of Otaheite and Sandwich crown themselves with flowers, while those of the Marquesas and Washington, Rotooma and the Fidjee, attach a superstitious value to the teeth of the Cachalot. These ornaments are replaced in New Zealand by plumes of feathers. Throughout the entire islands, the practice of tattooing the skin is widely practised, either to distinguish the different ranks of the people, or merely for ornamental or superstitious purposes. The inhabitants of the Pomotoo Islands cover their entire bodies with these designs; in Otaheite and Tonga, they are more limited and simple; while in the Sandwich Isles and New Zealand, the entire countenance is covered with devices, arranged in a symmetrical and highly expressive form. The women of New Zealand and the Marquesas tattoo the internal angle of the eyes, the angles of the mouth, and often also the chin. In general, the tattooing of the South Sea Islands is composed of circles and semicircles, opposed or bordered by notches somewhat resembling the never-ending circle of the Hindoo mythology.

The same domestic habits may be traced throughout the entire race. Their food is cooked in subterranean ovens by means of heated stones; the leaves of plants are used for culinary purposes; the Bread-fruit (*Artocarpus incisa*), the Cocoa, and the Taro, are boiled for food. They all drink the Kava or Ava, the juice of a species of Pepper, which intoxicates or refreshes. Before the arrival of Europeans, the women were excluded from all entertainments. Their dwellings are adapted to the circumstances of the locality. In some places, such as the Society Islands, Tonga, Mangaia, the Marquesas, and Rotooma, the houses are large and capacious, serving for several families, without closed walls, and built nearly on the same plan. In other places, such as New Zealand, where each tribe is continually at war with its neighbours, and where the tempests are violent and prolonged, their *hippahs* are almost inaccessible, surrounded with palisades; while the narrow buildings, sunk in pits almost level with the ground, and sufficient to contain only two or three persons, are entered on all-fours.

The language of the Polynesians, though apparently simple, and rich in Oriental figures, is directly opposed to the genius of the pure Malayan. All navigators agree in remarking the singular affinity which prevails throughout the dialects of the great Southern Ocean. An Otaheitan can be understood in the Marquesas, the latter at Sandwich, and the native of these last islands in New Zealand.⁹

Our limits do not permit us to notice at present the religious opinions prevalent among these tribes, their human sacrifices, their Morais, or the occasional cannibalism of some nations.¹⁰

¹ Sir Thomas Stamford Raffles' History of Java. London, 1817.

² Wm. Marsden's History of Sumatra. London, 1811. Also Grammar and Dictionary of the Malayan Language. London, 1812.

³ Crawford and Leyden's Memoirs, in the Asiatic Society's Transactions.

⁴ QUOY ET GAIM. ZOOL. DE L'ASTR.—Voyage de la Corvette l'Astrolabe, exécuté par ordre du Roi, pendant les années 1826 à 1829, sous le commandement de M. Jules Dumont D'Urville—Zoologie, par MM. Quoy et Gaimard. Paris, 1830, et suiv.

⁵ COOK AND KING, VOY.—A Voyage to the Pacific Ocean, undertaken by the command of his Majesty, for making discoveries in the Northern hemisphere, performed under the direction of Captains Cook, Clerke, and Gore, in his Majesty's ships the Resolution and Discovery, in the years 1776 to 1780. Vols. I. and II. by Captain James Cook; III. by Captain James King. London, 1785.

⁶ LANGSD. REISE.—Bemerkungen auf einer Reise um die Welt, von G. H. von Langsdorff. Frankfort, 1812.

⁷ KOTZEB. VOY.—Otto Von Kotzebue. A Voyage of Discovery into the South Seas and Behring's Straits, undertaken in the years 1815–1818, in the ship Kurick, (in German.) Translated by H. E. Lloyd. London, 1821. Also, a new Voyage round the World in 1823 to 1826. London, 1830.

⁸ KRUSENST. VOY.—A. J. Krusenstern—Voyage round the World, (in Russ.) Peters-burg, 1809, and atlas in fol. 1813. (Translated into English by R. B. Hoppner. London, 1813.)

⁹ Otaheitan Grammar, published by the Missionaries at Otaheite, 1823. A Grammar and Vocabulary of the Language of New Zealand, 1820.

¹⁰ See the Voyages of Cook, Bougainville, Vancouver, Carteret, Turnbull, Mariner, Wallis, Krusenstern, La Pérouse, Langsdorff, Lisianskoi, &c. &c.—Also Forster, in the 2d Voyage of Cook.

To this subdivision of the Human race, some writers would refer the Dayaks of Borneo,¹ as well as the Ancient Peruvians and Mexicans.²

C. HOMO AUSTRALASICUS.—AUSTRALASIANS.

Syn. ALFOUROUS.—Cuv. Reg. Anim. I. 84.

These barbarous races, known by the name of Alfooroo, may be subdivided into two branches, the Proper Australians or New Hollanders (*H. Australis*), and the Oceanic Negroes (*H. Melaninus*).

I. AUSTRALIUS.—AUSTRALIANS.

Syn. II. POLYNESEUS —Fisch. Syn. Mam. 8.

H. AUSTRALASICUS.—Bory, Ess. Zool. I. 318.

AUSTRALIENS.—Less. et Garn. Zool. de la Coq. I. 106.

AUSTRALASIENNE.—Desmoul. Tab.

ALFOUROUS—AUSTRALIEN.—Less. Mam. 28.

Icon. Blumenb. Dec. Cran. III. t. 27, and IV. t. 40. (Skulls of New Hollanders.)

Péron Voy. pl. 20 to 28.

Griff. Anim. King. (New Hollander.)

Quoy et Gaim. Zool. de l'Astr. pl. 5.

The indigenous tribes of New Holland, who exhibit a marked resemblance to each other, according to the statements of navigators,³ have already been noticed for their ignorance, their wretchedness, as well as their moral and intellectual debasement. Their tribes are not numerous, have little communication with each other, and are sunk into a state of almost hopeless barbarism.

The natives of New South Wales live in the rocks and thickets surrounding the European settlements, without adopting any of the manners of civilized life, excepting, perhaps, the taste for intoxicating liquors. Modesty seems wholly foreign to the race, and even in the midst of a populous European colony, they are not particular in adopting any kind of covering. The most unrestrained liberty appears indispensable to the existence of the genuine Australian, who preserves his independence in the rocky fastnesses of the neighbourhood, reclining near a wood fire, and protected from the wind merely by a few branches, or a large piece of bark torn from the Eucalyptus.

The stature of the Australians is commonly below the average. Many tribes have meagre limbs, apparently of disproportionate length; while a few individuals, on the contrary, have the same parts long and well proportioned. Their hair is not woolly, but coarse, very black, and plentiful, usually worn loose and disordered, but most commonly short and collected into curly masses.

The face is flat; the nose very broad, with the nostrils almost transverse; the lips thick; the mouth widely cleft; the teeth slightly inclined outwards, but of the purest enamel; and the external ears very large. Their eyes are half-closed through the laxity of the upper eye-lids, a circumstance which imparts to their savage countenances a physiognomy peculiarly repulsive. The colour of their skins commonly assumes a darkish tint, varying in intensity, but never becoming absolutely black. The Australian females are still more ugly than the men, so that the interval which appears to separate their forms from that of the Pelasgian races appears immense to our eyes.

Marriages are concluded by force. At a certain period of life an incisive tooth is extracted from every man, and a phalanx amputated from the finger of every female. Their head and breast are usually covered with some red colouring matter, and this ornament is of the highest importance in all their *coroboris*, or great ceremonies. The habit of painting the nose and cheeks by the same rude means is also common, with the addition of white rays along the forehead and temples. On the arms and the sides of the thorax they raise the same conical tubercles, which are practised largely by the Negro race. Numerous families insert rounded sticks, from four to six inches in length, into the partition of the nostrils, a practice which imparts a savage aspect to their physiognomy. Finally, the garments of this race never extend beyond a rude coat of Kangaroo skin thrown over the shoulders, or a front robe of filaments weaved into a coarse kind of net work.

These tribes are superstitious to an excessive degree; jugglers are encouraged, and witchcraft punished. Their differences are decided by a kind of duel, consisting of equal numbers, or equal arms; and the judges

of the field decide the rules of the combat. Their offensive arms consist of a kind of javelin, a wooden sabre, a club or woodah, while the shield alone is used for defence. The bow and arrows are wholly unknown in the entire continent of Australia.

The inhabitants of King George's Sound are subject to an intense cold during winter, and cover themselves with large mantles made of Kangaroo skins. Those in the neighbourhood of Sydney and Bathurst prepare the skins of the Petaurista, while the New Hollanders within the tropics live in a state of absolute nudity. Their ornaments consist of small collars made of stubble. Their dwellings around Port Jackson are made of the branches or bark of trees; elsewhere they seem to consist in a sort of nests formed of interwoven branches, and covered with bark.

The care which they bestow upon their tombs serves to indicate their belief in a future state. In general, it has been observed that they burn their dead, and inter the ashes with a religious veneration. Their industry is confined to the construction of lines for hunting and fishing, the product of which is devoured on the spot, after being roasted over a wood fire, which they always carry along with them. The women are treated with contempt, compelled to the most laborious occupations, such as carrying their utensils and children, while the man walks about leisurely with nothing but a javelin in his hand. They also prepare the food, of which they are only permitted to eat the fragments rejected by their masters. The pungent root called *dingona* is gathered and prepared by the women for their own use, and only eaten by the men in times of scarcity, when the chase is unsuccessful. Their canoes vary with the tribes; near Port Jackson these are formed of a solid piece of the bark of the Eucalyptus joined tightly together at each extremity. They have some rude ideas of drawing and music, and their dancing consists in an awkward imitation of the leaps of the Kangaroo.

Their languages, differing in every tribe, are nearly unknown to Europeans.⁴

2. MELANINUS.—OCEANIC NEGROES.

Syn. H. MELANINUS.—Bory, Ess. Zool. II. 104.

ALFOUROUS-ENIAMÈNES.—Less. et Garn. Zool. de la Coq. I. 102.

NÈGRE OcéANIQUE.—Desmoul. Tab.

Icon. Less. et Garn.⁵ Zool. de la Coq. t. I. (Crânes d'Alfoorous-Endamènes).

Labillardière, Voy.⁶ pl. VII. and VIII.

Quoy et Gaim. Zool. de l'Astr. pl. 3.

The indigenous population in the Islands of the Indian Archipelago appears to have consisted of a black race, which has been extirpated in some islands, and in other places driven to the mountains of the interior, as the ancient history of Malacca confirms. This nation, with black skins, coarse, black, and straight hair, live in places inaccessible to the other races, and are known by various appellations. The central plateau of the Molucca islands is now occupied by the Alfooroo or Haratoras, and of the Philippines by *los Indios* of the Spaniards. At Mindanao, they are styled *los Negros del monte*; at Madagascar they are the *Vinzimbers*, or native inhabitants of that island, and at New Guinea, they are styled *Endamènes*.

The Oceanic Negroes live in the most savage and miserable manner. Always at war with their neighbours, they are wholly occupied in avoiding the ambuscades and pit-falls laid for their destruction. It is therefore with difficulty that they can be examined by Europeans, who visit only the coasts. The Papoos represent their enemies of the mountains as ferocious, cruel, and vindictive, without the knowledge of any art, while their entire lives are occupied in obtaining a scanty subsistence in the forests. M. Lesson considers this description as exaggerated by the hatred of the Papoos. Those seen by him had a repulsive expression of countenance, their nose flattened, their cheek-bones prominent, their eyes large, their teeth inclining outwards, their limbs long and meagre, their hair black, thick, coarse, and straight, but of no great length, and their beards very coarse and thick. An expression of extreme stupidity was impressed upon their features, perhaps owing to the individuals examined being in slavery. These Oceanic Negroes, whose complexions were of a dirty brown nearly approaching to black, went entirely naked. They had incisions upon the arms and chest, and carried a small stick about six inches long in the partition of the nose. Their countenances were ferocious, and their movements capricious. The Southern Coast of New Guinea is probably inhabited by the Endamènes of the interior.

¹ Less. et Garn. Zool. de la Coq. tome I. p. 46.

² Fisch. Syn. Mam. p. 4.

³ See the Voyages of Phillips, Collins, White, D'Entrecasteaux, Péron, Finders, Grant, King, &c. &c.

⁴ Journal of two Expeditions into the Interior of New South Wales, undertaken by order of the British Government, in the years 1817-18. By John Oxley. London, 1820.

⁵ LESS. ET GARN.—ZOOLOGIE DE LA COQUE.—Voyage autour du monde, exécuté par ordre du Roi. Sur la corvette de sa Majesté la Coquille, pendant les années 1822 à 1825, par M. L. I. Duperrey. Zoologie, par MM. Lesson et Garnot. Paris, 1826, et suiv.

⁶ Labillardière, Voyage à la recherche de La Pérouse. Paris, an. VIII.

D. HOMO PAPUENSIS.—PAPOOS & TASMANIANS.

- Syn.* H. NEPTUNIANUS, PAPOUE (intermédiaire).—Pory, Ess. Zool. I. 303.
 PAPOUS et PAPOUS.—Quoy et Gaim.¹ Zool. de l'Uran. p. 1.—Less. et
 Garn. Zool. de la Coq. I. 84.
 PAPOUE.—Desmoul. Tab.
Icon. Quoy et Gaim. Voy. de l'Astr. pl. 4, fig. 4 and 5. (Natives of New
 Guinea), and Voy. de l'Uran. pl. I. and II.
 Péron, Voy. pl. 4 to 8. (Natives of Van Diemen's Land.)

The races who inhabit the shores of the islands of Waijoo, Salwatty, Gammen, and Balenta, and all the northern coast of New Guinea, from Point Sabelo to Cape Dory, are known by the name of Papoos. Their hair and the general colour of the skin hold medium characters between those of the Malays and Oceanic Negroes, from the intermixture of whom they have in all probability originated. Their existence as a distinct race, though noticed by Dampier in 1699, was not fully recognised until the first voyage of MM. Quoy and Gaimard.

The Papoos are in general of medium stature, and tolerably well-made, though some individuals are seen with feeble and meagre limbs. The colour of the skin is not black, but rather a deep brown, midway between the tints of the Malay and Oceanic Negro. Their hair is very black, neither straight nor curled, but woolly, tolerably fine, and frizzled, which gives to their head an extraordinary voluminous appearance, especially when they neglect turning it up behind. The beard is scanty, but very black on the upper lip; the pupil of the eye is of the same colour. Although the nose is slightly flattened, the lips thick, and the cheek-bones prominent, their physiognomy is not disagreeable. Hated by the other races, as being a kind of hybrids, they live with the adjoining tribes in a continuous and permanent state of distrust, and wander about armed with a bow and two or three large quivers filled with arrows. Suspicion, hatred, and all the passions which naturally arise from their situation, are forcibly depicted on their countenances; and, as with all the other black races, the instinctive faculties exhibit a marked prevalence over the moral or intellectual. The women, with a few exceptions, are unusually ugly, and compelled by their despotic masters to perform all the offices of slavery.

The Papoos of the Bouka Islands, New Britain, and Port Praslin, wear no garments of any kind. The natives of Dorey and the north of New Guinea are exceptions to this custom, and procure cotton fabrics, dyed blue or red by the Malays, in exchange for birds of paradise, tortoise-shell, or slaves. These nations are in the habit of covering the chest and shoulders with elevated and papillated cicatrices, arranged in curved or straight lines, according to some regular pattern.

Some tribes of New Guinea, Waijoo and Booka, give their hair that singular frizzled appearance, which has been regarded by some as characteristic of the Papoo race. Other tribes, however, such as those of Rony in New Guinea, of New Britain, and New Ireland, permit their hair to fall upon the shoulders in tangled and flowing masses.

In general, the Papoos are fond of daubing the hair and face with a composition of red ochre and grease, variegating the breast and face with transverse bands of earth or coral. Different from the Polynesians, the practice of tattooing is but sparingly adopted, and they confine themselves to tracing a few scattered lines upon the arms or the lips of their females. Ornaments of every kind are anxiously sought, and worn indiscriminately on the head, breasts, and arms. Bracelets of a dazzling whiteness, made with great skill and beautifully polished, are frequently to be seen; but these are probably procured merely from the larger extremity of those enormous Cones which are plentifully found in the surrounding seas. They pierce the nostril occasionally for inserting some small ornament. The custom of chewing the betel, with areca and lime, has been partially introduced from their intercourse with the Malays.

The Papoos of Dorey and Waijoo have a peculiar taste for carving idols, which they place on their tombs, in particular parts of their cabins, as well as on the prows of their canoes. Their religion is a pure Fetishism, though a few traces of the Mahometan rites may be noticed.

Their barbarous and guttural dialects wholly differing from tribe to tribe, are as unintelligible to each other as they are to foreigners.

To this division once belonged the aborigines of Van Diemen's Land, now said to be exterminated by the colonists. Their contrast to the New Hollanders already described is singular. Péron remarks that in passing from Van Diemen's Land to New Holland, one is at once struck by the extraordinary difference between them. They have absolutely

nothing in common, whether in their manners, customs, arts, instruments for hunting or fishing, dwellings, canoes, arms, the form of the skull, the proportions of the face, or their language. This remarkable dissimilarity prevails likewise in their colour. The indigenous inhabitants of Van Diemen's Land are much browner than those of New Holland; the former have short, woolly, and curly hair; among the latter it is straight, long and smooth.

The many points of resemblance which these proper Tasmanians of Van Diemen's Land bear to the Papoos of New Guinea, have induced us to include them in the same division. They have the same habit of painting their hair with a red ferruginous earth; of elevating small cicatrices upon the skin; of cooking their food upon wood fires; of living uncovered upon the ground without shelter along side of large fires; of fabricating elegant baskets with twigs of trees; and of fashioning small ornaments, especially a kind of ear-ring called *rodroy*. They are polygamous, and construct conical buildings over the tombs of their deceased relations.

Though exposed to a rigorous climate, they seldom build cabins for themselves, but merely raise a temporary shelter from the winds with the bark of a tree.

Their language differs so remarkably from the barbarous and innumerable dialects of Australia, that M. Labillardière at once declared them to be of a different origin.²

E. HOMO HYPERBOREUS.—HYPERBOREANS.

- Syn.* LES HABITANS DU NORD DES DEUX CONTINENTS.—Cuv. Reg. Anim. I. 85.
 H. SCYTHICUS γ . HYPERBOREUS.—Fisch. Syn. Mam. 5.
 H. HYPERBOREUS (in part).—Bory, Ess. Zool. I. 262.
 HYPERBORÉEN ou ESKIMAU (in part).—Less. Mam. 25.
 HYPERBORÉENNE.—Desmoul. Tab.
Icon. Cook and King, Voy. pl. LXXXV. and LXXXVI. (Natives of Kamtschatka.) Pl. XXXVIII. and XL. (Natives of Nootka Sound.) Pl. XLVI. and XLVII. (Natives of Pr. William's Sound.) Pl. XLVIII. and XLIX. (Natives of Oonalashka.)
 Desmoul. Hist. des R. Hum. pl. 1 and 2.

The obscure tribes which inhabit the northern extremity of the old continent under the names of Samoids, Yookaghirs, Koriaks, Tchoukches or Kamtschadales, and under the name of Esquimaux, have wandered in North America as far to the southward as Nootka Sound, Labrador, and the frontiers of Canada, belong to the Hyperborean races.³

The inhabitants of these desolate regions are of very small stature, their medium height being about four feet nine inches. Their persons are short and thickly made, with short legs, a large and flat head, the lower part of the face projecting greatly, the mouth wide, the ears large, and the beard very scanty. Their eyes are small, black, and angular; the skin olive-coloured and shining with grease. Their hair, black and bristly, is arranged, however, with much care. The men have a very harsh voice, nearly resembling that of the Ethiopian Negroes. The women, apparently very ugly to European eyes, are nearly of the same height as the men, and comparatively more muscular. Their soft, pendant, and pear-shaped mammae are very long from their earliest youth, and can be thrown over the shoulder to suckle their infants, which are usually carried on the back. The areolæ are large, the nipples long, wrinkled, and black as coal. They arrive very late at the period of puberty. "Absolument glabres, excepté sur la tête, elles accouchent avec une extrême facilité, ce que tient à une telle dilatation de certaines voies, qu'on a dit qu'elles élargissaient artificiellement ces parties en y portant sans cesse enfoncée une énorme cheville en bois."⁴

The complexions of all the Hyperborean races are much darker than those of the nations of Europe and Central Asia, and are generally blacker in proportion as they approach the Pole. It is not rare to find tribes living near the seventieth degree of latitude, who are deeper in tint than the Hottentots at the opposite extremity of the Old Continent, and almost as dark as the Ethiopians of its equatorial regions.

These tribes, though ever wandering from place to place, feel that strong attachment for their native wastes which incapacitates them from existing in the temperate regions of the globe. Clad in furs from head to foot, the Hyperborean fishes for his subsistence, or maintains extensive herds of Rein-deer. The Dog, after undergoing castration, shares his labours or draws his sledge. On the borders of the Northern Ocean, he

¹ QUOY ET GAIM. ZOOLOGIE DE L'URAN.—Voyage autour du monde sur la corvette l'Uranic et la Physicienne, par M. Freycinet; Zoologie, par MM. Quoy et Gaimard. Paris, 1824, et suiv.

² For a further account of this race, consult Péron's Voyage, and Labillardière (Voyage à la recherche de la Pérouse), passim.

³ E. Sabine in the Journal of Science, XIII.; Captain Parry's Journal of a Third Voyage; Captain Sir John Ross' Voyage of Discovery; and Scoresby's Arctic Regions.

⁴ Bory, Ess. Zool. I. 262.

is skilful in surprising the inhabitants of the deep, and is not even wanting in the art of taking the larger Cetacea. The Hyperboreans prefer the blubber of these animals to any other food; they delight in the oil thence procured, and drink whatever escapes being consumed in their lamps during the long night of a Polar winter. Besides the flesh of the animals killed in the chase, they partake of the smoke-dried carcases of Dogs, Rein-deer, or Fish, all of which are most esteemed when putrid or dried rather than when fresh. They make a kind of bread, which no stomach but their own appears capable of digesting, with the roasted and pounded extremities of Lichens, such as the Iceland Moss (*Cetraria Islandica*) and the Rein-deer *Cenomyce* (*Cenomyce rangiferina*), mixed with the bark of young Birches and Pines reduced to a coarse flour. Salt is seldom used by them, and they have little taste for spiritous or strong drinks, while they delight in oil and milk. A few tribes, such as the Kamtchatdales, are acquainted, however, with the art of extracting an intoxicating beer from a species of Mushroom usually accounted poisonous (*Agaricus acris*), which they drink under the name of *Machomor* to an excess which often occasions death. They build neither towns nor villages, and can hardly be said to exist in society. In their scattered huts, half-buried in the earth, the members of a polygamous family promiscuously reside, in the midst of smoke and the confusion of their domestic animals, where the idea of modesty never enters. Next to the Hottentot in the uncleanness of his person, the Hyperborean brings along with him a most insupportable odour.

F. HOMO AMERICANUS.—AMERICAN INDIANS.

- Syn.* LES AMÉRICAINS.—Cuv. Reg. Anim. I. 84.
 RACE AMÉRICAINNE.—Desin. Mam. 48.—Less. Mam. 25.
 HOMO SAPIENS, AMERICANUS.—z. Lin. Gmel. I. 22.—VAR. AMERICANA.
 —Blumb. Hand. et Abbild.

The enumeration which has been attempted in the preceding pages of the several races of mankind would now be complete, had not the genius of Columbus, at the latter end of the 15th century, disclosed to Europeans the wonders of a western continent, which by a singular injustice now bears the name of another. The aborigines of every part of that immense region exhibit, with slight exceptions, the same physical characters; and their innumerable dialects have those singular affinities and analogies, which fully establish the claims of the American Indians to be considered a distinct and original race. There are, however, important differences among them, which have led to their being subdivided into North American Indians (*Borealis*), and South American Indians (*Australis*).

I. BOREALIS.—NORTH AMERICAN INDIANS.

- Syn.* HOMO COLOMBICUS.—Bory. Ess. Zool. II. 1.—Fisch. Syn. Mam. 6.
 COLOMBIENS.—Desmoul. Tab.
Icon. Blumb. Dec. Cran. I. t. 9, 10. II. t. 20. IV. t. 38.
 North American.—Griff. Anim. King. I.

In this subdivision we include all those scattered tribes of Red-Indians whom the progress of civilization is gradually confining within narrow limits, but who once peopled the Canadas, the territory of the United States, the eastern part of Mexico, the Antilles or West India Islands, the mountain chain of the Andes, Terra Firma, and the Guianas, from Cumana to the Equator—under the names of Hurons, Sioux, Cherokees, Chippewas, Iroquois, Arkansas, Illinois, Apalaches, Chicacaeas, Mohicans, Oneidas, Carribees, Mexicans or Aztecs, Peruvians, &c. &c.

The North American Indians, wherever they have not been confounded with European or African blood, are tall, robust, and well made, stronger and more active than is usual with savages. Their limbs are not meagre like the Australian, but well proportioned. The skull is of an agreeable oval shape, but with the forehead flattened to so remarkable a degree, as induced the more early writers to imagine this depression of the forehead to be owing to the skilful application of bandages or planks to the surface of the head. Although it may be true that some tribes assist the natural peculiarity of the races, yet it is found among tribes who use no such art, such as the Mexicans, and being usually considered as a great beauty by the latter, the Aztec gods and heroes are represented with an extreme depression of the forehead amounting to exaggeration.¹ The nose of the North American Indian is long, well-defined, and aquiline. The mouth is moderately cleft, the teeth are placed vertically in the gums, and the lips are similar to those of a European. Their eyes are brown; their hair commonly black, straight, coarse, and glossy; of medium length, and

seldom reaching beyond the shoulders. It is said never to become grey with advancing years. The men have naturally but a scanty beard, and in general pluck the hair very carefully wherever it appears. The colour of their skin is reddish, approaching to the hue of copper. The females, condemned to the severest drudgery, and almost reduced to the condition of beasts of burthen, are not without their charms in some of the mountain districts, though elsewhere they are in general of low stature, with high cheek-bones, prominent eyes, and flat noses; and their breasts, though often well made, are in general somewhat pendulous and flat. Puberty commences at an early age.

The Indians, who wander over the extensive country situate between the Pacific Ocean and the Alleghany Mountains, in a state of savage independence, seem destined soon to undergo an inevitable extermination.² The warlike tribes of the Sioux, who traffic largely with the Anglo-Americans in furs, appear to have emigrated from the north-west. They use symbolical writing, like the Mexicans. The Chippeways are of a more pacific character, but passionately devoted to the abuse of spiritous liquors, which the avidity of the fur-dealer supplies in large quantities. Hieroglyphics are likewise in use with this tribe. The Menomenies have a fine expressive countenance, much intelligence, and a patriarchal simplicity of manners. Some considerable progress has been made in agriculture and domestic manufactures by the Cherokees, who employ Negro slaves to execute the most laborious parts of their employments. Among the numerous tribes who wander between the sources of the Missouri and the frontiers of Mexico, we find a great diversity of language, manners, and customs; yet there are some points in which they exhibit a remarkable similarity to each other. They wander from place to place, occasionally building huts or permanent lodges for hunting the Buffalo, the flesh of which forms their principal sustenance. Many nations go almost naked, though in general their dress consists of a robe of Buffalo skin, attached to the shoulders; an apron covering the waist and middle; and a rude form of boots called *moccasins*, attached to the legs. The females wear a cloak like the males, with an under garment of elk or deer-skin, reaching down to the knees. Feathers are worn on the heads of the chiefs, while various rude ornaments and showy garments distinguish their days of state. It is considered highly ornamental to paint the face red and black; their bodies are also painted during their warlike expeditions. Some tribes bore their noses, and wear different kinds of pendants; others slit their ears and load the helices with brass wire, so that the extremities almost drag on the shoulder. Horses are extensively used by the Indians of the plains westward of the Mississippi, but are seldom found to the eastward, where the difficult nature of the country renders it impassable to Horses.³

The North American Indian is reserved and circumspect in all his words and actions, and nothing ever induces him to betray the emotion of the moment. His thirst for vengeance is excessive, and cannot be eradicated.⁴ The same peculiarities of character extend to the Mexican Indians, who are melancholy, grave, and taciturn, when they are not under the influence of intoxicating liquors. Even the children of the Indians at the age of four or five years display a remarkable contrast to the Whites at these early ages, and delight to throw an air of mystery and reserve over their most trifling observations. But when once the state of repose, in which the Indian habitually indulges, is disturbed, the transition to a violent and ungovernable state of agitation is at once both sudden and terrific.⁵

The Mexicans and Peruvians had made considerable progress in the arts and sciences, before the barbarous persecutions of the Spaniards plunged them into a state of poverty and degradation. They had a most correct knowledge of the true length of the year, and the construction of the calendar; they framed geographical maps of their own country; they constructed woods, canals, and enormous pyramids, the sides of which were accurately directed to the four cardinal points.¹ Their civil and military hierarchies and their feudal systems presented a complicated and intricate form, indicative of no very modern origin. They cultivated no other grain than the maize (*Zea*), and they knew no preparation of milk, although the females of two species of the Ox might have contributed an abundant supply. The Mexicans still preserve a peculiar taste for painting and sculpture, as well as for flowers, with which they delight in ornamenting their persons and dwellings.

Some wild tribes of Mexican hunters still preserve a savage independence. The Apachees are a warlike and industrious nation, dreaded by the Spaniards, who are compelled to oppose a large force to their depredations.

Much ingenuity has been employed in tracing affinities and analogies between the languages of North America and the north-east coast of Asia, but without leading to any satisfactory result.

¹ A. Von Humboldt, *Vues des Cordillères et Monumens des Peuples indigènes de l'Amérique*, 2 vols. folio, 1811.

² Major Pike's Travels.

³ Hodgson's Letters from North America.

⁴ Lewis and Clarke's Travels. These officers penetrated for the first time across the continent of America to the Pacific Ocean.

⁵ Godman's American Natural History. Philadelphia, 1826. Vol. I. p. 21.

2. AUSTRALIS.—SOUTH AMERICAN INDIANS.

- Syn.* H. AMERICANUS.—Bory, Ess. Zool. II. 17.—Fisch. Syn. Mam. 6.
AMÉRICAINNE.—Desmoul. Tab.
- Icon.* Blumenb. Dec. Cran. V. t. 46, 47, and 48, VI. t. 58.
Pr. Max. Reis. pl. 2 and 3 (Puris Indians), pl. 7 (Patachos Indians of the Rio do Prado), pl. 10 and 17 (Boticudos Indians).

The races of South American Indians, differing materially from those already described, are still imperfectly known. They are widely dispersed over the extensive plains of the Amazon and Orinoko, Brazil, Paraguay, and part of Chile, under the names of Omaguas, Guaranas, Coroads, Atures, Otomacs, Boticudos, Charruas, Chaymas, &c. &c.

These races, with few exceptions, have their skulls oval-shaped, of a disproportionately large size, sunk between the shoulders, flattened on the vertex, with a broad forehead, but depressed to an extreme degree; the superciliary ridges very much elevated; the cheek-bones prominent; the eyes small and sunken; the nose flattened with expanded nostrils; the lips thick; the mouth wide, with the teeth placed almost vertically in the gums. The hue of their skin is neither black, yellow, nor copper-coloured, but a dark brown. Their hair is black, straight, and of the coarseness of horse hair.

Their stature is rather below the middle size. Hunting, and the use of a few nutritious roots, supply the simple sustenance of tribes whose intelligence is excessively limited. They are destitute of religion, and what is more remarkable, are said to be almost devoid of superstition. The bow and the arrow, the javelin and the club, are their only arms. Their aversion to the North American Indians is most decided, and they carry on a continual war with them at all points where they come in mutual contact.

Of the races situate to the East of the Andes and La Plata, we may notice the Omaguas, who assist the natural depression of their foreheads by artificial means; the Guaranas, Coroads, and Atures, obscure tribes, who are daily diminishing in numbers. The Otomacs include ants, gum, and, what is more remarkable, a kind of potter's clay, in their list of edible substances. This earth is kneaded into balls of a few inches in diameter, and roasted before a slow fire. When analyzed by Vauquelin, it was found to consist of 50 parts per cent. of silica, 40 of alumina, 4 of magnesia, 1 of oxide of iron, besides water. It is procured only from particular beds, and all kinds are not equally pleasing to their palates. Fish, lizards, fern roots, and other animal and vegetable substances, are also used for food, when they can be procured, but under any circumstances a ball of clay usually concludes the repast. The Puris, a ferocious tribe, are said to roast and eat the prisoners taken in war. All these tribes are of a very deep-brown colour. The Boticudos, of a light-brown, sometimes approaching almost to white, adopt the singular custom of inserting a very large and round block of wood into the lobe of each ear, and in the under lip, so as to give the entire countenance a most singular and characteristic appearance. The Charruas, a warlike tribe of Paraguay, have successfully resisted the attacks of Europeans; they are of a deep-brown complexion approaching to black.

At the southern extremity of the South American continent, we find several wandering tribes, very elevated in stature, whom M. Bory has raised to the rank of a distinct species, under the name of *Homo Patagonus*. They are known to navigators under the names of Patagonians, Puelehes, Araucans, or Tebuetlets. Exaggeration and the love of the marvellous have elevated the stature of the Patagonians to seven feet and upwards; yet it seems pretty well established that six feet, four inches, is no very extraordinary height among this people.

In the adjoining inland of Tierra del Fuego, we find the Pescherais, a diminutive and stunted race, scarcely taller than the Hyperboreans of the Northern Hemisphere.

SUB-VARIETIES OF THE HUMAN RACE.

All the preceding races of men are capable of producing by their union a fertile progeny, which possesses intermediate characters between those of its parents. These combinations give rise to most of the variations of features which may be observed in all quarters of the globe, but especially among the European colonies. In those ordinary instances of intermarriage, where the differences between the characters of the parents are inconsiderable, the variety thence resulting has no particular name assigned to it; but in alliances where the races are very remote, the progeny has been distinguished by various denominations.

The MULATTO proceeds from the Caucasian or White Race and the Negro, well known in the European colonies, as forming a dangerous caste called *men of colour*, or *petit blancs*, despised by the Whites of pure race as being of inferior blood, and detested by the Negroes, from their pretending to usurp the authority of Whites, without possessing a legitimate title. In his physical features, the Mulatto holds an interme-

diante station between his parents, both of whom he resembles in colour and form, in his half-curly hair, his muzzle slightly projecting, as well as in his moral and intellectual qualities. When Mulattoes intermarry, their posterity resembles themselves, and form a race called *Casque*, probably a corruption of the word *caste*. In general, they are well-made and robust, violent in their passions, talkative and volatile. In the East Indies there is a race of oriental Mulattoes, called *Bouganese*, the progeny of the Hindoo and Negro. They are browner and more meagre than the Mulattoes of European descent.

The MESTIZO, generally of feeble constitution, is the result of a union between the American Indian (*H. Americanus*) and the European.

The ZAMBI or LOBOS is the descendant of the African and American Indian. These individuals are of a dark-brown copper-colour, very muscular and robust. In Mexico they are called *Chino*.

The TEKO is the descendant of the Chinese and Malay.

The BASTER is the progeny of the Caucasian and Hottentot (*H. Capensis*). His skin is of the colour of dried citron. In respect to his intellectual character, he partakes more of the European than of the Hottentot, being braver and more energetic than the latter. The prominence of the cheek-bones continues in these unions for several generations. An excellent figure of this sub-variety is given in the Atlas to Péron's Voyage, pl. 55.

The BLACK BASTER results from the union of the Negro and Hottentot. This race is superior in stature to the common Baster; and the black complexion of the Negro is mitigated by the olive tint of the Hottentot. A female Hottentot, according to Le Vaillant (Première Voyage), is much more fertile when united to a White or Negro than to one of her own race.

The above are the principal unions of the first degree to which particular names have been assigned. But, as each of these sub-varieties may combine with another, and with the original races, these again with their progeny, and so on *ad infinitum*, there hence arise combinations of the second, third, fourth, and fifth degrees, after which they cease to have particular denominations.

Commencing with the unions of the second degree, the TERCEROON or MORISCO is the progeny of the Caucasian and Mulatto. Sometimes this race is incorrectly termed Quadroon.

The GRIFFE or CABER is the descendant of the Negro and Mulatto. This is sometimes called Zambo.

The QUATRALVI or CASTISSE proceeds from the American Mestizo and the Caucasian or White.

The ZAMBAIGI descends from the American and the Zambé.

The ZAMBO PRIETO results from the union of the Negro and the Zambé.

The TRESALVE is the progeny of the American and the Mestizo.

The DARK MULATTOES result from the American and the Mulatto.

To ascertain the purity of these several combinations of the second degree, let us put W for White, B for Black, and A for American; we then find

$$\text{The Terceroon or Morisco} \quad \frac{1}{2} \left(W + \frac{W+B}{2} \right) = \frac{3}{4} W + \frac{1}{4} B$$

$$\text{The Griffé or Caber} \quad \frac{1}{2} \left(B + \frac{W+B}{2} \right) = \frac{1}{4} W + \frac{3}{4} B$$

$$\text{The Quatralvi or Castisse} \quad \frac{1}{2} \left(W + \frac{W+A}{2} \right) = \frac{3}{4} W + \frac{1}{4} A$$

$$\text{The Zambaigi} \quad \frac{1}{2} \left(A + \frac{A+B}{2} \right) = \frac{3}{4} A + \frac{1}{4} B$$

$$\text{The Zambo Prieto} \quad \frac{1}{2} \left(B + \frac{B+A}{2} \right) = \frac{3}{4} B + \frac{1}{4} A$$

$$\text{The Tresalve} \quad \frac{1}{2} \left(A + \frac{A+W}{2} \right) = \frac{3}{4} A + \frac{1}{4} W$$

$$\text{The Dark Mulatto} \quad \frac{1}{2} \left(A + \frac{W+B}{2} \right) = \frac{1}{2} A + \frac{1}{4} W + \frac{1}{4} B$$

In the combinations of the third order,

The QUADROON proceeds from the White and the Terceroon. These are sometimes incorrectly termed Albinos.

The OCTAVOON descends from the White and Quatralvi.

The SALTATRAS is the progeny of the Mulatto and Terceroon.

The COYOTE proceeds from the Mestizo and Terceroon.

The GIVEROS descends from the Zambé and the Griffé.

The CAMBUJO is the result of the Mulatto and Zambaigi.

In respect to the purity of their blood, we find

$$\text{The Quadroon} \quad \frac{1}{2} \left(W + \frac{3W+B}{4} \right) = \frac{7}{8} W + \frac{1}{8} B$$

$$\text{The Octavoon} \quad \frac{1}{2} \left(W + \frac{3W+A}{4} \right) = \frac{7}{8} W + \frac{1}{8} A$$

¹ PR. MAX. REIS.—Reise nach Brasilien in den Jahren 1815 bis 1817, von Maximilian, Prinz zu Wied-Neuwied. Frankfurt, 1821.

The Saltatras . . . $\frac{1}{2} \left(\frac{W+B}{2} + \frac{3W+B}{4} \right) = \frac{5}{8} W + \frac{3}{8} B$
 The Coyote . . . $\frac{1}{2} \left(\frac{W+A}{2} + \frac{3W+B}{4} \right) = \frac{5}{8} W + \frac{1}{4} A + \frac{1}{8} B$
 The Giveros . . . $\frac{1}{2} \left(\frac{B+A}{2} + \frac{W+3B}{4} \right) = \frac{1}{8} B + \frac{1}{4} A + \frac{5}{8} W$
 The Cambujo . . . $\frac{1}{2} \left(\frac{W+B}{2} + \frac{3A+B}{4} \right) = \frac{3}{8} B + \frac{3}{8} A + \frac{1}{4} W$

The combinations of the fourth order, which have been distinguished by particular names, are the following :

The **QUINTEROON** descends from the White race and the Quadroon.

The **PUCHUELAS** is the progeny of the White and the Octavoon.

The **HARNIZOS** comes from the White and the Coyote.

The **ALBARASSADOS** is the descendant of the Mulatto and the Cambujo.

Proceeding, in the same manner as before, to calculate the purity of descent, we find

The Quinteroos . . . $\frac{1}{2} \left(W + \frac{7W+B}{8} \right) = \frac{15}{16} W + \frac{1}{16} B$
 The Puchuelas . . . $\frac{1}{2} \left(W + \frac{7W+A}{8} \right) = \frac{15}{16} W + \frac{1}{16} A$
 The Harnizos . . . $\frac{1}{2} \left(W + \frac{5W+2A+B}{8} \right) = \frac{15}{16} W + \frac{1}{8} A + \frac{1}{16} B$
 The Albarassados . . . $\frac{1}{2} \left(\frac{W+B}{2} + \frac{3B+3A+2W}{8} \right)$
 $= \frac{7}{16} B + \frac{3}{16} W + \frac{5}{16} A$

The only combination of the fifth order which we shall notice is

The **BARZINOS**, proceeding from the White and Albarassados, giving for its formula

$$\frac{1}{2} \left(W + \frac{7B+6W+3A}{16} \right) = \frac{11}{16} W + \frac{7}{32} B + \frac{3}{32} A$$

The remaining sub-varieties are not noticed by writers, as they present nothing remarkable. The combinations may proceed absolutely without limit, each preserving more or less the original character of its race, in proportion to its affinity with the several primitive stocks. It will be remarked that the preceding terms are mostly derived from the Spanish and Portuguese languages, because the several castes were first observed in the colonies of those nations.

The individuals resulting from alliances between remote races are in general vigorous and robust, and fully confirm the observations made by Buffon and others, that the crossing of races tends to perfect the individual. It is a singular fact, that the form of the head in the offspring is always more like that of the father than of the mother, and it is not unworthy of notice, that the same observation holds good in reference to mules, or the sterile progeny of different species.

To prevent the deterioration of the individual in the human race, it is unnecessary to resort to remote alliances between foreign races. A European, married to another of a foreign country or of a different family, may produce individuals as well-formed as those resulting from the union of a European and Negro. In consequence of the intercourse of families, the national characters of the primitive races are daily becoming more and more obliterated. The migrations of nations from the north to the south, the revolutions of empires, conquest and colonization, have further tended to blend the human species together. Thus, the Turkish and Persian blood becomes improved by their alliances with the Mingrelians, Circassians, and other Proper Caucasians. In the East Indies, the intercourse of the Europeans with the Hindoos has given rise to a sub-variety of the White races, called *Half-caste* or *Métis*. These are as troublesome in the East as the Mulattoes in the West Indies, and their consanguinity to the pure European is distinguished by several gradations.

The **CASTISSE**, the progeny of a White and a Half-caste Hindoo, is therefore three-fourths European and one-fourth Hindoo.

The **POSTISSE**, the descendant of the European and Castisse, is seven-eighths European and one-eighth Hindoo.

In proportion as these combinations are multiplied, all the great distinctive characters of the races become gradually effaced, and blended into each other, so that no definite characteristic remains.

The Terceroons and Quadroons, the progeny of the Mulatto and the White, are more or less of dark complexions. The females have their mucous membranes of a violet tinge; the Quadroons preserve the dark scrotum of the Negro. It is remarkable that the black tinge maintains itself longer in the nutritive and generative organs than in any other parts of the body.

In the preceding observations we have taken no notice of the Creole, this variety being entirely the result of climate. When a European marries another European, and settles between the tropics, his offspring is termed Creole, and the same name is applied to the offspring of Negro

parents, born in the East or West Indies. In fact, this word, derived from *create*, to generate, is applied indiscriminately to all persons born in the Indies, and even to the lower animals. It is, however, most commonly limited to the progeny of Europeans.

In the constitution of the Creole, we may trace the influence of a warm climate upon the human frame. He is in general well-made, of good stature, rather of meagre limbs, but of delicate frame. His passions are violent, naturally haughty, imperious, and accustomed to exercise a despotic rule over a host of slaves.

The female Creoles of the tropical regions of the globe are very liable to abortion, and yield little milk, for which reasons, their offspring is usually nursed by Negress slaves.

The Anglo-Americans and other inhabitants of the temperate parts of North America do not materially differ in constitution from other Europeans.

FICTITIOUS RACES.

Inaccurate observation and the love of the marvellous have given rise to imaginary races, which on further examination have proved to arise from individual malformation, disease, or the mistakes of early navigators.

The **ALBINO**, called *Blafard* on the continent of Europe; *Bedas*, *Chacrelas*, or *Kakerlaks*, in India; *White-Negro* or *Dondos*, in Africa; *Dariens* in America, is an individual malformation or degeneration in the colouring matter of the skin and hair, usually dying with the individual, but sometimes becomes hereditary, and is transmitted to their offspring. It presents the same characters in whatever race it appears, and is found likewise among the lower animals. (See before, pages 74 and 75.)

The human Albinos are of a feeble constitution, the skin of a dull white, the eyes weak with the iris red, and the hair of a pale yellow. They are most commonly found, or at least are most remarked, among the races of dark complexions. At Java, they are reported to form a wandering and proscribed race, roaming in the woods under the name of *Chacrelas*. Labillardière observed an Albino female of Malay descent upon one of the Friendly Islands. The Albinos of Ceylon, called *Bedas* or *Bedos*, appear to belong to the Hindoo race. They are also found among the Papoos; and have been seen, but very seldom, among the Hyperborcans. A White Negress from Madagascar was observed by M. Bory de St Vincent; she had two children, the one by a White, the other by a Negro. Each of these children presented intermediate characters between its parents, having the usual traits of the father combined with the Albino features and white hair of the mother. Albinos are reported to be common in the woods of the Isle of France. They are also common on the continent of Africa. In America, the most remarkable are the Dariens, who reside in the isthmus connecting the northern and southern portions of that continent.

The **CRETINS**, who are found in the mountain gorges of the Valois, have been improperly raised to the rank of a variety of the human race. They are usually found among the Japetic or Celtic races. Imbecile in mind, with a goitre disfiguring the anterior part of the neck, where the glands are materially altered, a yellowish skin, languishing manner, and extreme bodily weakness, these degenerate individuals drag on a wretched existence in some mountainous regions, such as the Pyrenees, the Alps, Styria, and the Carpathian chain. Sometimes they are born from well-formed parents, and sometimes they compose small families, generally hidden in the obscure recesses of the valleys. In most places they are looked upon with disgust; a healthy mountaineer would disdain to contract a matrimonial alliance with one of these unfortunate individuals; but in the Valois they are regarded with a superstitious veneration. It is said that Cretins are found in the Uralian mountains, the Himalayan, and the Andes. They have also been remarked in the heights of Sumatra.

It is almost unnecessary to repeat here the numerous fables with which credulous travellers have crowded their narratives. The *Quimos*, of the mountains of Madagascar, were represented as a variety, only three feet and a half in height, with long arms, the form of an Ape, a white and shrivelled skin, defending themselves with great courage, &c. &c. The *Men with tails*, who have been found in the Indian Ocean, and especially in the Island of Formosa, have dwindled down into ordinary apes before more accurate observations. A race of Malay women is described by Struys, *with beards* as long as their husbands'. The diminutive Africans, also, who live on Grasshoppers, as mentioned by Drake, until the age of forty, and in their turn are devoured by worms, must be placed in the same list. We no longer discover the Pygmies and Troglodytes of antiquity, who fought with the Cranes. One of the fathers of the Church gravely repeats a conversation which he had with a Centaur in Africa, where he saw men without a head, and one eye in the middle of the breast. Raleigh found the same kind of Cyclops in South America, where also the Amazons of the ancients have been resuscitated. Races have been mentioned with a single leg and thigh supporting their bodies like a column. Tritons or Sea-men, and Mer-maids or Sea-women, have likewise been taken in Holland, and taught to sew with great precision. It is humorous

to find in works, otherwise of some pretensions, such fables as that of the Hindoo race of Saint Thomas, with flat thighs, said to be found in the Island of Ceylon, or the six-fingered nations of the human race. We must not, however, confound the well-authenticated accounts of Porcupine-men with the above fictitious narrations.

CLASSIFICATION OF RACES.

Linnæus (A.D. 1766) was the first systematic writer who ventured to include Man as a member of the Animal Kingdom. He established the order Primates, consisting of four genera; 1. Homo; 2. Simia; 3. Lemur; and, 4. Vespertilio. The genus Homo, which he characterized by the brief phrase, "Nosce te ipsum," consisted of the *Homo sapiens*, and the *Homo ferus*, the latter founded on a few accidental instances of juvenile outcasts, while the former, subject to variation, *culturâ et loco*, was subdivided into five races; α Americanus; β Europæus; γ Asiaticus; δ Afer; and ϵ Monstrosus; the last being composed of all the defective individuals observed among the remainder. He avoided the error of those subsequent writers, who consider the races of men as so many distinct species. Yet his classification was exceedingly arbitrary, and in attempting to apportion the human race among the four divisions of an antiquated geography, he blended together a number of races, very different in their physical characters, and failed to notice the inhabitants of many extensive regions of the globe which cannot be referred with propriety to any of the principal continents.

Buffon (A.D. 1766), in the excellent treatise, "Sur les Variétés dans l'espèce Humaine," with his usual disregard to systematic arrangement, did not propose any natural subdivision of the races. He collected the results scattered over the innumerable voyages and travels of his day, and discriminated with caution among the mass of errors and contradictions with which their writings abounded. Subsequent travellers have added more precise information for correcting and completing the valuable treatise of Buffon, which even now may be read with pleasure and advantage. Already the critical eye of Buffon distinguished the Malay from the other Asiatics, and the Tartars from the Chinese. He admitted the physical differences of the Hyperborean races, distinguished the Hottentots from the other Africans, and acknowledged the unity of the Ethiopians.

Blumenbach (A.D. 1797) admitted five varieties of the human species; 1. Caucasica; 2. Mongolica; 3. Æthiopica; 4. Americana; 5. Malayana. These are little more than the old division of Linnæus, with the substitution of the Malayan variety in place of the H. Monstrosus, Linn. Our chief objection to this arrangement consists in the obvious impropriety of including the Americans and Malays, whose characters are not very decisive, in the same rank with the Caucasians, Mongolians, and Ethiopians. The Malayan division has now become insufficient to contain the numerous and varied races of the Southern Ocean.

Duméril (A.D. 1806) instituted the order Bimanes, which was a most decided improvement upon the order Primates of Linnæus, who placed intellectual Man in the same order with the Apes and Bats. He subdivided the human race into six varieties; 1. La Caucasiqne, or Arabe-Européenne; 2. L'Hyperboréenne; 3. La Mongole; 4. L'Américaine; 5. La Malaie; 6. L'Éthiopienne, or Nègre. His arrangement coincides pretty nearly with that of Blumenbach, with the manifest improvement of separating the Hyperboreans from the Mongolians.

The Baron Cuvier, in the first edition of the "Règne Animal" (A.D. 1816), admitted only three principal varieties; 1. Blanche ou Caucasiqne; 2. Jaune ou Mongolique; and, 3. Noir ou Éthiopique; at the same time remarking, that he did not know to which of the above to refer the Malays, Papoos, or Americans.

In the same year M. Malte-Brun published his enumeration of the human races, but without attracting much attention from systematic writers. He distinguished sixteen races. 1. Polaire. 2. Finnoise. 3. Slavonne. 4. Gothico-germanique. 5. Occidentales de l'Europe. 6. Grecques et Pélagiques. 7. Arabe. 8. Tartare et Mongole. 9. Indienne. 10. Malaie. 11. Noir de l'Océan Pacifique. 12. Basanée du Grand-Océan. 13. Maure. 14. Nègre. 15. De l'Afrique Orientale. 16. D'Amérique.

M. Virey, in the *Nouv. Dict. d'Hist. Nat.*, article Homme, which appeared A.D. 1817, was the first naturalist who ventured, in defiance of the received opinions, to divide mankind into two species, characterized by the magnitude of the facial angle.

His classification was as follows:

Genre Humaine.

1° Espèce, Angle facial de 85° à 90°.

- 1. Race Blanche, . . . { Arabe-Indienne.
Celtique et Caucasiqne.
- 2. Race Basanée, . . . { Chinoise.
Kalmouke-Mongole.
Lapone-Ostiaque.
- 3. Race Cuivreuse, . . . Américaine ou Caräibe.

2° Espèce, Angle facial de 75° à 80°.

- 4. Race Brune-foncée, . . Malaie ou Indienne.
- 5. Race Noire, . . . { Cafres.
Nègres.
- 6. Race Noirâtre, . . . { Hottentots.
Papous.

This enumeration, though more complete than those of any of his predecessors, with the exception of Malte-Brun, is still liable to many objections. Characters derived from the magnitude of the facial angle are too variable in Man to constitute a specific difference, and we may seek in vain for any other.

M. Desmarest, in his *Mammalogie* (A.D. 1820), adopting the hint of the Baron Cuvier, made the distinction of which all other writers appear not to have observed the importance. The three great races, which we have termed Normal, and the Anomalous, or more indistinct varieties of the human species, are here distinctly pointed out. He divided Man, the only species of the Genus Homo, as follows:

- † Variétés de races bien caractérisées.
 - A Race Caucasiqne.
 - B . Mongolique.
 - C . Éthiopienne ou Nègre.
- †† Variétés de races moins distinctes.
 - D Race Malaie.
 - E . des Papous.
 - F . Américaine.

This arrangement coincides exactly with that in the "Règne Animal." Hitherto the important differences between the Malays, Polyæsiens, and Australasians, passed unnoticed, and M. Desmarest failed to adopt the Hyperboreans of Duméril.

This was the state of the science (A.D. 1825) when the ingenious treatise of M. Bory de St Vincent appeared in the *Dict. Class. d'Hist. Nat.* art. Homme. Omitting to notice the distinction proposed by Cuvier and Desmarest between the Normal and Anomalous races, and persevering in the error begun by M. Virey, he incautiously distributed the Human race into no less than fourteen distinct species. Yet he has the merit of subdividing the White races with much accuracy, though the leading features had been previously laid down by Malte-Brun, and of distinguishing most of the varieties in the islands of the Southern Ocean.

His divisions are as follows:

- † Léiotriques.
 - * Ancient continent.
 - 1. Japétique.—H. Japeticus.
 - + Gens Togata.
 - 1°. Caucasiqne (Orientale).
 - 2°. Pélage (Mériqionale).
 - + + Gens Bracata.
 - 3°. Celtique (Occidentale).
 - 4°. Germanique (Boréale).
 - α Teutonc.
 - β Slavonc.
 - 2. Arabique.—H. Arabicus.
 - 1°. Atlantique (Occidentale).
 - 2°. Adamique (Orientale).
 - 3. Hindoue.—H. Indicus.
 - 4. Seythique.—H. Seythicus.
 - 5. Siniqne.—H. Sinicus.
 - 6. Hyperboréenne.—H. Hyperboreus.
 - 7. Neptunienne.—H. Neptunianus.
 - 1° Malaie (Orientale).
 - 2° Océanique (Occidentale).
 - 3° Papouc (Intermédiaire).
 - 8. Australasienne (H. Australasicus).
 - ** Nouveau Continent.
 - 9. Colombique (H. Columbicus).
 - 10. Américaine (H. Americanus).
 - 11. Patagone (H. Patagonus).
- †† Oulotriques.
 - 12. Éthiopienne (H. Æthiopicus).
 - 13. Cafer (H. Cafer).
 - 14. Mélanienne (H. Melaninus).
 - 15. Hottentote (H. Hottentotus).
- ††† Monstreux.
 - α . Crétins.
 - β . Albinos.

M. Desmoulin (A. D. 1826) published his *Tableau général du Genre Humain*, in which the number of species in the Human Genus was further augmented to sixteen. They were as follows:

- 1. Seythique, { 1. Indo-Germane.
2. Finnoise.
- 3. Turqne.

- 2. Caucásienne.
- 3. Semitique. { 1. Arabe.
2. Etrusco-Pélasge
3. Celtrique.
- 4. Atlantique.
- 5. Indoue.
- 6. Mongolique. { 1. Indo-Sinique.
2. Mongole.
3. Hyperboréenne.
- 7. Kourilienne.
- 8. Ethiopienne.
- 9. Euro-Africaine.
- 10. Austro-Africaine. . . { 1. Hottentote.
2. Houzouanas ou Boschismane.
- 11. Malaise ou Océanique, with 5 subdivisions.
- 12. Papoue.
- 13. Nègre Océanique, with 4 subdivisions.
- 14. Australasienne.
- 15. Colombienne, with 2 subdivisions.
- 16. Américaine, with 5 subdivisions.

In this classification the analogies of language are singularly violated in many instances, and subdivisions carried to a greater extent than the actual state of our knowledge seems to warrant.

Another writer on this subject is M. Lesson, who, in his *Manuel de Mammalogie* (A.D. 1827), has proposed the following arrangement :

- 1°. Race Blanche ou Caucásienne.
 - 1. Araméen.
 - 2. Indien, Germain, et Pelasgique.
 - 3. Scythe et Tartare.
 - 1. Malais.
 - 2. Océanien.
- 2°. Race Jaune ou Mongolienne.
 - 1. Mantchoux.
 - 2. Sinique.
 - 3. Hyperboréen ou Eskimau.
 - 4. Américain.
 - 5. Mongol-Pelagien ou Carolin.
- 3°. Race Noire ou Mélanienne.
 - 1. Ethiopien.
 - 2. Caffre.
 - 3. Hottentot.
 - 4. Papon.
 - 5. Tasmanien.
 - 6. Alfourous-Endamène.
 - 7. Alfourous-Australien.

Here M. Lesson has attempted to reduce all the races of Mankind to three principal divisions, chiefly characterized by colour. The Malays, though of a yellowish copper-colour, are placed among the White races; The Americans, though copper-coloured, are referred to the Yellow races; and the Hottentots, though brown, or yellowish-brown, are placed among the Black. Colour, we have always conceived, is one of the worst characteristics of races, and any classification which does not admit the distinction between the Normal and Anomalous races—which does not assume the analogies and affinities of language as the guide in the minor subdivisions of races—or which looks to mere varieties of colour, without attending to those of form as well as of intellectual character, is liable to insurmountable objections.

The latest writer whose observations have yet reached us is M. J. B. Fischer. His arrangement (A.D. 1829), though in many respects an improvement on those of his predecessors, is still faulty. Besides several minor defects, such as wholly omitting to distinguish the Tartar, Finnish, and Ottoman races, he places the South American Indian and the South Sea Islander in the same rank with the Caucasian, the Mongolian, and the Ethiopian. We shall, however, by exhibiting his arrangement, enable our readers to form their own conclusions respecting its merits.

- 1. Homo Japeticus.
 - α. a. Caucasicus (Orientalis).
 - b. Pelagius (Meridionalis).
 - c. Celticus (Occidentalis).
 - d. Germanicus (Borealis).
 - e. Slavonicus (Intermedius).
 - β. Arabicus
 - a. Atlanticus (Occidentalis).
 - b. Adamicus (Orientalis).
 - γ. Indiens.

- 2. H. Neptunianus.
 - β. Occidentalis.
 - γ. Papuensis.
- 3. H. Scythicus.
 - β. Sinicus.
 - γ. Hyperboreus.
- 4. H. Americanus.
 - β. Patagonus.
- 5. H. Columbicus.
- 6. H. Æthiopicus.
 - β. Caffer.
 - γ. Melanoides.
 - δ. Hottentottus.
- 7. H. Polynesiensis.

The classification of the human races is a subject which has long been totally neglected in our own country. All the systems which we have explained emanate either from France or Germany; while in this island, Man is either wholly omitted in our works on Natural History, as though he were something foreign to the Animal Kingdom, or the views promulgated date as far back as the writings of Blumenbach; so that, in our most modern systematic treatises,¹ we still find the human race divided into five varieties. Our own arrangement, which we subjoin to facilitate a comparison with those of preceding writers, is, we believe, the first yet presented to the British reader. It is hoped that the English terms by which we have designated some continental divisions, may not be supposed identical with the common geographical names. Many races of North American Indians are found to the southward of the Isthmus of Darien; the Finns are not confined to Finland, nor are the Arabians to be found only in Arabia. We have retained the Hottentots and Bushmen among the Negro races provisionally only, as it is very questionable whether they should not be transferred to the Anomalous Races, where they might be placed between the Papoos and Hyperboreans.

NORMAL RACES.

- I. CAUCASIANS.
 - A. H. Caucasicus.—Caucasians Proper
 - B. H. Japeticus.—Japetans.
 - 1. Pelagius.—Pelasgians.
 - 2. Germanicus.—Germans.
 - α. Teutonicus.—Teutonic Races.
 - β. Slavonicus.—Slavonian Races.
 - 3. Indo-Persicus.—Indo-Persians.
 - α. Indicus.—Hindoo Races.
 - β. Persicus.—Medo-Persian Races.
 - C. H. Celticus.—Celts.
 - D. H. Semiticus.—Arameans.
 - 1. Arabicus.—Arabians.
 - 2. Atlanticus.—Atlantic Races.
 - E. H. Scythicus.—Scythians.
 - 1. Othmanicus.—Ottoman Turks.
 - 2. Finnicus.—Finns.
 - 3. Tartaricus.—Tartars.
- II. MONGOLIANS.
 - A. H. Calmuccus.—Calmucks and Mongolians Proper.
 - B. H. Sinicus.—Chinese.
 - C. H. Sericus.—Mantchoos
 - D. H. Kurilianus.—Ainoos.
- III. NEGROES.
 - A. H. Æthiopicus.—Ethiopians.
 - B. H. Caffrarius.—Caffres.
 - C. H. Capensis.—Hottentots and Bushmen.

ANOMALOUS RACES.

- A. H. Malayensis.—Malays.
- B. H. Polynesiensis.—Polynesians.
- C. H. Australasicus.—Australasians.
 - 1. Australius.—Australians.
 - 2. Melaninus.—Oceanic Negroes.
- D. H. Papuensis.—Papoos and Tasmanians.
- E. H. Hyperboreus.—Hyperboreans.
- F. H. Americanus.—American Indians.
 - 1. Borealis.—North American Indians.
 - 2. Australis.—South American Indians

¹ Such as that of Major Hamilton Smith, in Griffith's *Anim. King.* vol. 5. Some Naturalists commence their systems with the *Simiada* or *Monkeys*, which are thus made to stand at the head of the Mammiferous Animals, as well as of the entire Animal Creation.

ORDER II.—QUADRUMANA.

MAMMALIA. WITH FOUR DISTINCT UNGUICULATED LIMBS, WITH THREE KINDS OF TEETH, AND FOUR HANDS.

SYNONYMS.

PRIMATES (in part).—Linn. Gmel. I. 21.—Fisch. Syn. Mam. I.
QUADRUMANES.—Cuv. Reg. Anim. I. 85.—Geoff. Ann. Mus.¹ XIX. 85.—
Temm. Mon. Mam.² I. pref. pag. 13 (excluding the Genus Galeopi-
thèque). Q. OU TETRACHIRES.—Dum. Zool. Anal. 9.
QUADRUMANA.—Ham. Smith, Syn.³ p. 4.
QUADRUMANA (Vierhander). Voigt, Thierr.⁴ I. 73.
POLLICATA (Daumenfüsser).—Illig. Prodr.⁵ 66.
VIERHANDIGE.—Schinz, Thierr.⁶ I. 94.

CHARACTERS OF THE ORDER.

THE TEETH consisting of Incisors, Canines, and Molars.
THE PECTORAL LIMBS generally pentadactylous, sometimes only tetradactylous.
THE HINDER LIMBS always pentadactylous.
THE FINGERS with Nails or Claws.
THE HEAD with its facial angle varying from 30° to 65°. THE EYES directed forwards. THE ORBITAL
and TEMPORAL FOSSÆ distinct. THE CLAVICLES perfect.
THE MAMMÆ usually two, sometimes four, always pectoral. THE PENIS free, and with a Serotum.
LIVE mostly in trees, where they climb with great facility.
FEED on fruits, roots, and insects.
INHABIT the tropical parts of the entire globe, rarely extending far beyond.

INDEPENDENTLY of the anatomical details already enumerated, which distinguish this order from that of Man, it presents a remarkable difference from our species in the conformation of the lower extremities. The thumbs of the hinder limbs are free and opposable to the fingers, which are long and flexible like those of the fore-hand. Hence all the species of this order climb trees with great ease, while it is only with the utmost difficulty that they can hold themselves upright, or walk in an erect position. The hands of the lower limbs then rest only upon the outer margins, and their narrow pelvis is very unfavourable to equilibrium.

In respect to their intestines, they are tolerably similar to our species; their eyes are directed forwards; the mammæ are pectoral; the penis hangs freely; the brain has three lobes on each side, the

hinder of which covers the cerebellum; and the temporal fossæ are separated from the orbits by a bony partition. In other respects they gradually degenerate from the form proper to Man, in exhibiting a muzzle more or less elongated, a tail, and a walk more exclusively quadrupedal. Yet the freedom of their fore-arms, and the complicated form of their hands, enable them to execute many actions and gestures similar to those of Man.

For a long time they have been divided into two genera; now in some measure become two small families, the APES and MAKIS, by the continual accession of new species. Between these it is necessary to place a third, the OUSTITIS, which cannot be referred with propriety to either of the preceding.

FAMILY I. SIMIA.—APES.

SYNONYMS.

SIMIA.—Linn. Gmel. I. 26 (in part).
SINGES.—Cuv. Reg. Anim. I. 86.—Desm. Mam. 48 (in part).—Geoff. Ann. Mus. XIX. 86.
QUADRUMANA (Vierhander) in part.—Illig. Prodr. 67.
APE.—Shaw,⁷ Gen. Zool. I. 1 (in part).
AFFEN.—Schinz, Thierr. AFFE.—Voigt, Thierr.

CHARACTERS OF THE FAMILY.

GENERAL FORM approaching to that of Man.
NAILS flat on all the fingers, and of the same form, excepting that of the thumb, which is the flattest.

To this family belong all the Quadrumana with four straight incisive teeth in each jaw, and with flat nails on all their fingers,—characters which assimilate them to Man more than to the succeeding families. Their molar teeth also, like ours, have only blunt tubercles, and they feed essentially on fruits; but their canine teeth passing beyond the others, supply them with an offensive weapon,

which is wanting in our species, and requires a vacant space in the opposite jaw to receive the projecting canine, when the mouth is shut.

Buffon subdivided the Apes into five tribes: 1. *Les Singes propres*, without tails; 2. *Papions*, with a short tail; 3. *Guenons*, with a long tail, and callosities on the buttocks; 4. *Sapajous*, with

¹ ANN. MUS.—Annales du Muséum d'Histoire Naturelle, par les Professeurs de cet établissement, Paris, 1802-1813. By the terms GEOFF. ANN. MUS. we quote the several memoirs by M. Geoffroy-Saint-Hilaire in the distinguished work just mentioned.

² TEMM. MON. MAM.—Monographies de Mammalogie, ou description de quelques genres de Mammifères, dont les espèces ont été observées dans les différens Musées de l'Europe, Paris, 1827 et seq.

³ HAM. SMITH, SYN.—Synopsis of the species of the class Mammalia, by Major Charles Hamilton Smith, forming vol. V. of Griff. Anim. King., London, 1827.

⁴ VOIGT, THIERR.—Das Thierreich, vom Baron von Cuvier, von F. S. Voigt, Leipzig, 1831.

⁵ ILLIG. PRODR.—Caroli Illigeri, Prodromus Systematis Mammalium et Avium, Berolini, 1811.

⁶ SCHINZ, THIERR.—Das Thierreich, von dem Herrn Ritter von Cuvier, aus dem Franzosischen von H. R. Schinz, Stuttgart und Tubingen, 1821.

⁷ SHAW, GEN. ZOO.—General Zoology, or Systematic Natural History, by George Shaw, M.D., London, 1800 et seq.

a long and prehensile tail, without callosities; 5. *Sagouins*, with a long tail, not prehensile, and without callosities. Erxleben adopted this division, and translated their names by the words Simia, Papio, Cereopithecus, Cebus, and Callithrix. Thus, the last two terms, which were used by the ancients to designate the Apes of Africa and the East Indies, were transferred to the Apes of America. It has since become necessary to suppress the genus *Papions*, founded solely on the shortness of the tail, because it broke too

much the natural affinities of species. All the others have been subdivided; and it has been requisite to remove out of the division the *Ouistitis*, formerly included among the *Sagouins*, as they do not correspond accurately with the characters of the remaining Monkeys.

The Apes may be divided, according as the number of their molar teeth is 20 or 24, into two principal tribes, which again require to be subdivided into several genera.

TRIBE I. CATARRHINA.—APES OF THE OLD CONTINENT.

SYNONYMS.

CATARRHINI (*κατα*, *kata*, down, *ῥίνα*, *rhina*, nostrils).—Geoff. Ann. Mus. XIX. 86.

LES SINGES PROPREMENT DITS, OU DE L'ANCIENT CONTINENT.—Cuv. Reg. Anim. 1. 87.

CHARACTERS OF THE TRIBE.

THE DENTAL FORMULA the same as in Man (see before, page 113).

THE NOSTRILS separated by a narrow partition, and opening beneath the nose.

THE TAIL never prehensile, sometimes wanting.

INHABIT the Old Continent.

The Apes of the Old Continent have the same number of molar teeth as Man; but they differ from each other by many characters which have furnished the distinctions to the following genera and species.

GENUS I. PITHECUS.—MEN-OF-THE-WOODS.

Syn. ORANGS PROPREMENT DITS.—Cuv. Reg. Anim. 1. 87.—F. Cuv. in Diet. des Sc. Nat. XXXVI. 27.

ORANG (Pithecus).—Geoff. Ann. Mus. XIX.—Isid. Geoff.¹ in Bélang. Voy. p. 22.

SIMIA (in part).—Linn. Gmel.—Illig. Prodr.—Fisch. Syn. Mam.

These are the only Apes of the Old Continent entirely without callosities on the buttocks. The hyoid bone, the liver, and cæcum, resemble those of Man. Their nose does not project, they have no cheek-pouches, nor any vestige of a tail.

This genus comprises but a single species, the Orang-Outang, of which the young alone has yet been carefully examined by Naturalists.

1. PITHECUS SATYRUS.—ORANG-OUTANG.

THE YOUNG.

Syn. L'ORANG-OUTANG.—Cuv. Reg. Anim. 1. 87.—F. Cuv. in Diet. des Sc. Nat. XXXVI. 281.—F. Cuv. et Geoff. Hist. Mam.—Isid. Geoff. in Bélang. Voy. p. 23.

ORANG-OUTANG.—Shaw, Gen. Zool. 1. 3.

MAN-OF-THE-WOODS.—Edw.² Glean. 1. pl. 213.

GREAT APE.—Penn.³ Quad. pl. 36.

JOCKO.—Buff. Hist. Nat. suppl. VII.

DER EIGENTLICHE ORANG-UTANG.—Voigt, Thierr. 1. 74.

DER ORANG-UTANG (WALDMENSCH).—Schinz, Thierr. 1. 98.

SIMIA SATYRUS.—Linn. Gmel. 1. 26.—Erxl. p. 6.—Blumenb. Hand. et Abbild.—Fisch. Syn. Mam. p. 9.—Kuhl,⁴ Beitr.—Tiles,⁵ Naturh. Russ.

PITHECUS SATYRUS (Orang roux).—Geoff. Ann. Mus. XIX. 87.—Desm. Mam. 50.—Less. Mam. 30.—(Orang-Outang).—Ham. Smith, Syn. p. 5 (Red or Asiatic Orang-Outang).—Jard. Syn.⁶ p. 204.

SIMIA AGRIAS.—Schreb.⁷ Saugth.

SIMIA ABELH.—Fisch. Syn. Mam. p. 10.

PONGO ABELH.—Less. Mam. 31.

*Icon.*⁸ LE JOCKO.—Audeb.⁹ Sing.

L'ORANG-OUTANG Femelle.—F. Cuv. et Geoff. Hist. Mam.

ORANG-OUTANG.—Abel. Chin.¹⁰

Donovan,¹¹ Nat. Rep. pl. 58 and 59.

Vosm.¹² Descr. pl. 14 and 15.

Camp.¹³ Kort Bericht.

RED OR ASIATIC ORANG-OUTANG.—Wils.¹⁴ Illustr. pl. 5, fig. 1 and 3.

THE ADULT (very probably).

Syn. GROOTE ORANG-OUTANG OF OOST-INDISCHE PONGO.—Wurmb.¹⁵ in Verhandl. van het Batav. Genootsh. 11. p. 245.

PONGO WURMB.—Geoff. Ann. Mus. XIX. 89.—P. WURMB.—Desm. Mam. 52.—Less. Mam. 32.

SINGE DE WURMB.—Audeb. Sing. p. 21.

PAPIO WURMB.—Latreille in Buff.¹⁶ ed. Sonn. XXXVI. p. 296.

SIMIA WURMB.—Fisch. Syn. Mam. p. 32.

LE PONGO.—F. Cuv. in Diet. des Sc. Nat. XXXVI. 285.

Icon. PONGO (squellette).—Audeb. Sing. Anat. pl. 2.

SPECIFIC CHARACTERS.

THE MUZZLE short in the young, very long in the adult.

THE FOREHEAD elevated in the young, greatly depressed in the adult.

THE PECTORAL LIMBS very long, reaching as low as the ancles.

THE EXTERNAL EAR medium size like that of Man.

THE HANDS narrow, and the FINGERS elongated.

THE TAIL, CHEEK-POUCHES, and CALLOSITIES, all wanting.

THE HAIR scanty, of a brownish red in the young, black in the adult.

INHABITS Cochinchina, the Peninsula of Malacca, and especially the Island of Borneo.

The Orangs, properly so called, have their arms sufficiently long to reach the ground when they stand upright, while their thighs, on the contrary, are very short.

¹ ISID. GEOFF. IN BÉLANG. VOY.—Voyage aux Indes-Orientales, pendant les années 1825 à 1829, par M. Charles Bélanger.—Mammifères par M. Isidore Geoffroy-St-Hilaire, Paris, 1834.

² EDW. GLEAN.—Gleanings of Natural History, by G. Edwards, London, 1758 et seq.

³ PENN. QUAD.—History of Quadrupeds, by Th. Pennant, London, 1793.

⁴ KUHLE, BEITR.—Beiträge zur Zoologie und vergleichenden Anatomie von J. H. Kuhl, Frankfurt. 1820 et seq.

⁵ TILES, NATURH. RUSS.—Naturhistorische Früchte der ersten Kaiserlichen Russischen Weltumseglung, von W. G. Tilesius, Petersburg, 1813.

⁶ JARD. SYN.—Synopsis of the Simiadae, at the conclusion of the Naturalist's Library, vol. 1. Monkeys, by Sir William Jardine, Bart., Edinburgh, 1833.

⁷ SCHREB. SAUGTH.—Die Säugethiere in Abbildungen nach der Natur mit Beschreibungen, von J. C. D. Schreber, Erlangen, 1775 et seq.

⁸ The only good figure of the Orang-Outang for a long time was that of Vosmaer, made after a specimen kept at the Hague. That of Buffon (Suppl. VII. pl. I.) is faulty at all points; that of Allamand (Buff. d'Holl. XV. pl. XL.) is a little better, and has been copied in Schreber, pl. II. B. That of Camper, copied in Schreber, pl. II. C. does not want precision, but it is easy to see that it was not drawn after the living animal. Bontius, Med. Ind. 84, presents a creature of his own imagination, although Linnæus made it the type of his Troglodytes (Amœn. Acad. VI. pl. I. § 1). There are some tolerably good figures in Griff. Anim. King., and in Krusenstern's Voyage, pl. XCIV. and XCV., but all taken from young specimens.—*Note of the Baron Cuvier.*

⁹ AUDEB. SING.—Histoire Naturelle des Singes et des Makis, par J. B. Audebert, Paris, An. 8 (1799-1800).

¹⁰ Narrative of a Journey in the Interior of China, and of a Voyage to and from that country, in the years 1816 and 1817, by Dr Clarke Abel, London, 1818.

¹¹ DONOVAN, NAT. REP.—The Naturalist's Repository, or Monthly Miscellany of Exotic Natural History, by Edward Donovan, London, 1821 et seq.

¹² VOSM. DESCR.—Description de l'espèce de Singe, &c. nommé Orang-Outang, par A. Vosmaer, Amsterdam, 1778.

¹³ CAMP. KORT BERICHT.—Kort bericht wegens de Ontleeding van verschiedene Orang-Outangs, van P. Camper, Amsterdam, 1778.

¹⁴ WILS. ILLUSTR. ZOOL.—Illustrations of Zoology, by James Wilson, Edinburgh, 1831. The synonym *Red*, applied to the Orang-Outang, is at least premature, inasmuch as the adult appears to become black. This appellation is also adopted in Jardine's Naturalist's Library, and in Jard. Syn.

¹⁵ Wurmb's Paper in Verhandlingen van het Bataviaasch Genootschap der Konsten en Wetenschappen, Batavia, 1792 et seq.

¹⁶ BUFF. ED. SONN.—Histoire Naturelle, par M. Le Clerc de Buffon. Nouvelle Edition, par C. S. Sonnini, Paris, An. 7 and 8 (1798-1800).

Orang is a word in the Malayan language signifying *reasonable creature*, and applied equally to Man, the Orang-Outang, and the Elephant. *Outang* [or rather *Utan*, according to Mr Marsden] signifies *wild*, or *belonging to the woods*, and thus the earlier navigators, translating these words, gave the animal the name of *Man-of-the-Woods*.

The Orang-Outang, of all animals, is the most similar to Man in respect to the shape of its head, the size of the forehead, and the volume of its brain. Yet the exaggerated expressions of some writers on those points seem to originate in the circumstance that only young individuals have been examined by them, and every thing leads us to believe that their muzzle becomes more elongated with advancing years.

The body of the Orang-Outang is covered with thick red hair, the face is bluish, and the thumbs of the hinder limbs are very short in comparison to the remaining fingers. Its lips are susceptible of a singular elongation, and enjoy a great facility of motion.

The fore-hands of the Orang-Outang are shaped exactly like those of Man, excepting that the thumb is very short, reaching only to the first joint of the index or first-finger. The hinder-hands have likewise five fingers, but the thumb is placed much lower than in the human species, and in its ordinary position, instead of lying parallel to the fingers, it forms a right angle with them. The fingers of the hinder-hands have the same structure as those of the fore-hand, and are equally free in their movements, and all, without exception, have nails. The calves of the legs as well as the buttocks are but slightly prominent.

It is highly probable that the Orang-Outang has the same number of teeth as Man; yet this cannot be stated positively, until the adult has been carefully examined. All the descriptions hitherto given of its teeth apply merely to the milk or first teeth of the young animal. If it be true that the Pongo is really the adult Orang-Outang, then they are precisely of the same number as in the human species. In the upper jaw, the first incisor is very broad and wedge-shaped; the second terminates likewise in a line, but its inner surface is inclined towards the first incisor, by the action of the very large canine tooth next to it. This canine, which is separated from the second incisor by a small interval, is very long, strong, thick, and hollow beneath, from the action of the opposite tooth. The first and second false molars are divided by a longitudinal furrow into two portions, worn off obliquely, and presenting two blunt tubercles, one on the inner margin, and the other on the outer. The three real molars which follow are nearly of equal size, their crowns flat, and apparently worn down by constant use. In the lower jaw, the two incisors are equal in size, but the first terminates in a straight line, and the second in an oblique one, beginning towards the first incisor, and ending towards the canine. The latter is very strong, long, and sharp, yet somewhat less than the canine of the upper jaw, and its shape is rendered triangular by an elevated crest on its internal surface, partly formed by the action of the canine and of the first incisor of the opposite jaw. The first false molar is cut off obliquely before and behind, forming a very thick conical tubercle, presenting an oblique plane to the upper canine, and strongly supported, against which the animal can exercise great force in cutting and tearing. The other molars resemble those of the upper jaw.

The neck of the Orang-Outang is very short; the tongue smooth; the nose wholly flattened at the base, and on a level with the rest of the face at this part, but projecting slightly at its extremity; the nostrils open beneath, as in all other Apes of the Old Continent. The eyes resemble those of other Apes; the iris is brown, and the ears are exactly similar to those of our own species; the nails are black.

Almost the whole body is covered with hair, which is darker and thicker in some parts than in others. The colour of the skin is generally a blueish slate; but the ears, the circles around the eyes and mouth, and the inside of all the four hands, tend towards a flesh copper-colour. The hair of the head, fore-arm, and legs, is of a deeper red than elsewhere. It is thickest on the head, back, and upper part of the arm; but very scanty on the belly, and still more so on the face. The upper-lip, nose, and palms of all the four hands, are the only parts entirely naked. The hair of the whole body is rather woolly, and of the same nature throughout; on the fore-arm it points upwards towards the elbow, while on the upper-arm the points are directed downwards. The skin, especially that of the face, is thick and shrivelled, while beneath the neck it hangs so loosely as to appear like a *gôitre*, when the animal lies on its side.

Camper discovered, and accurately described, the two membranous sacs which communicate with the ventricles of the glottis of this animal, and render its voice hoarse; but he was wrong in stating that the nails are always wanting on the thumbs of the hinder hands.

The Orang-Outang is entirely formed for climbing and residing in trees, as it walks with great difficulty. When ascending a tree, it seizes the trunk by all the four hands, and uses neither arms nor thighs as a Man would do in similar circumstances. It passes easily from tree to tree, when the branches touch, so that in its native tropical forests there can be but little occasion to come near the ground. In general, all its movements are slow, and seem to be executed with pain, when performed on a flat surface. It first rests the fore-hands firmly on the ground, raises itself on its long arms, and throws the body forwards by passing the hinder-hands between the arms, and carrying them beyond the fore-hands; then, resting on its hinder-hands, it advances the upper part of the body, supports itself again upon the wrists of the fore-arm, and repeats the same movements. It is only when supported by its fore-hand that it ventures to walk on the hinder-hands; sometimes it rests upon the palms, but most usually upon their external margins only, as though it wished to preserve the fingers from all contact with the ground. Whenever it ventures to rest upon the entire palm, it holds the last two phalanges of the fingers curved up, excepting the thumb, which remains open and at a distance. When resting, it sits down on the thighs, with the legs crossed, according to the Oriental custom. It reposes indiscriminately on the back or the sides, drawing up the legs towards the body and crossing the arms on the breast. When about to sleep, it is fond of being well covered, and for this purpose makes use of every kind of clothing placed within its reach.

When young, such only as it has hitherto been seen in Europe, it is rather a gentle animal, easily tamed, and readily becoming attached. From its conformation it is capable of imitating a great number of our actions; but its intelligence does not appear to hold so high a rank as has been reported, or even much to surpass that of the Dog.

The Orang-Outang makes use of its fore-hands in the same manner in general as we do, and it seems only to require experience to be able to do so in nearly all instances. It often raises its food to the mouth by means of its fingers, but sometimes also seizes them with its long lips, and drinks by sucking up, as all animals with long lips usually do. It makes use of the sense of smell to distinguish the nature of its food, and seems to trust greatly to this sense on all occasions. Fruit, pulse, eggs, milk, and meat, are eaten by the Orang-Outang indiscriminately. It is very fond of bread, coffee, and oranges, and on one occasion swallowed the contents of an inkstand without experiencing any injury. It seems to have no stated hour for its meals, but, like a child, is ready for its food at all times. Both the sense of sight and that of hearing are very acute. Music produces no effect upon this animal.

When molested, the Orang-Outang strikes its opponent with the hand, and attempts to bite; but these actions appear in general to proceed rather from impatience than ill-nature, as it is commonly mild, affectionate, and very fond of society. It delights in being caressed; gives real kisses to the object of its attachment; and seems fond of sucking the fingers of the persons who approach, yet it never sucks its own. Whenever it is very anxious for any thing, its cry is sharp and guttural. Then all its signs are very expressive: it inclines the head forward to show its disapprobation; pouts when its wants are not immediately satisfied; and when in a passion, cries out very loudly, rolling itself on the ground, and its neck, at the same time, swelling out in a singular manner.

The history of the Orang-Outang has been rendered very obscure by the earlier authors, from its having been confounded with the remainder of the larger Apes, and especially with the Chimpanzee. After submitting their writings to a severe criticism, it has been found that the Orang-Outang inhabits only the most eastern portions of the Old World—such as Malacca and Cochin-China, and especially the great island of Borneo, whence it has been transported, though rarely, to Java.

There is so strong a resemblance between the Orang-Outang and an Ape of Borneo, which is yet only known by its skeleton, and by the name of Pongo,¹ in the proportions of all its parts and the disposition of the fossæ and sutures of its skull, that we can

¹ Audeb. *Singes*, pl. anat. II.—This name of *Pongo*, corrupted from that of *Boggo*, which is given in Africa to the Chimpanzee and Mandrill, was applied by Buffon to a pretended large species of Orang-Outang, which was nothing more than the product of his own imagination. Wurmh, a naturalist of Batavia, applied it to the animal, described by him for the first time, of which Buffon had not the smallest idea (See the *Memoirs of the Batavian Society*, tom. ii. p. 245). The idea that it might be nothing more than the adult Orang-Outang occurred to me on seeing the head of a common Orang, with its muzzle projecting much more forward than that of the young individuals hitherto described, and I made my views public in a Memoir read at the *Académie des Sciences* in 1818.—MM. Tilesius and Rudolphi appear also to have made the same conjecture. See the *Memoirs of the Academy of Berlin* for 1824, p. 131.—*Note of the Baron Cuvier*.

scarcely help believing it to be the adult, either of the Orang-Outang, or at least of some species nearly allied to it; although the great projection of its muzzle, the smallness of its cranium, and the height of the branches of its lower jaw, might perhaps lead to a different conclusion. The length of its arms, and of the apophyses of its cervical vertebræ, with the swelling of the bone of its heel, are favourable to the upright position and the facility of walking on two feet. This is the largest of all the Apes, and a most formidable animal, approaching to Man in height.

Mr J. Harwood (Trans. Linn. xv. p. 471) describes the feet of an Orang-Outang, fifteen inches in length, which dimensions appear to announce a very considerable height. He would have inferred that the Pongo was the adult Orang-Outang, had not the skeleton of the Pongo in the Royal College of Surgeons, London, exhibited one lumbar vertebra more than the skeletons of the Orang-Outang. This objection appears, however, to have no real weight, as the same variation has been observed more than once in the human species.

The Pongo, or adult Orang-Outang, is very rare in Borneo, where it bears the character of having great strength and ferocity. The only specimen hitherto obtained defended itself vigorously with large branches of trees; so that it became impossible to take it alive.

On the skull of the Pongo there is a singular ridge of bone, passing from the occiput to the vertex, and there dividing into two branches, extending towards the external sides of the orbits. Two other lateral crests divide the occiput into equal portions, and reach as far as the auricular fossæ.

The excessive length of its arms show, that when the adult stands on all the four hands, its body must assume a diagonal position, nearly approaching to the perpendicular. In this attitude, the enormous projection of its muzzle requires a considerable muscular power to sustain its weight, and it is doubtless for this purpose that the skeleton possesses those enormous cervical apophyses, whose length is not equalled in any known Mammiferous animal. The height of the skeleton in the Paris Museum is 4 French feet, or about 4 ft. 3 in. English, from the top of the head to the palms of the hinder-hands. Many scattered notices of this animal, in its young state, are interspersed among the British and Foreign Journals.¹

GENUS II. TROGLODYTES.—PYGMIES.

Syn. CHIMPANSÉS.—Cuv. Reg. Anim. I. 89.

TROGLODYTES.—Geoff. Ann. Mus.—Desm. Mam.

SIMIA (in part).—Linn. Gmel.—Illig. Prodr.—Fisch. Syn. Mam.—Temm. Mon. Mam.

The arms of the other Orangs [the Chimpansés of the Baron Cuvier] reach only as low as the knees. These animals have no forehead, and their cranium curves backwards immediately from the ridge of the eye-brows.

Like the preceding, this genus comprises only a single species.

1. TROGLODYTES NIGER.—CHIMPANSEE.²

Syn. LE CHIMPANSÉ.—Cuv. Reg. Anim. I. 89.

ORANG-OUTANG, HOMO SYLVESTRIS, or PYGMY.—Tyson,³ Anat. Pyg.

PONGO.—Buff. Hist. Nat. Suppl. VII.

DER SCHIMPANSEE.—Voigt, Thier. I. 76.—Schinz, Thier. I. 99.

SIMIA TROGLODYTES.—Linn. Gmel. I. 26.—Blumenb. Handb. et Abbild.—F. Cuv. in Dict. des Sc. Nat. XXXVI. p. 285.—Kuhl, Beitr.—Fisch. Syn. Mam.

TROGLODYTES NIGER (Trogloodyte Chimpanzé).—Geoff. Ann. Mus. XIX. 87.—Desm. Mam. 49.—Less. Mam. 29.—Isid. Geoff. in Bélang. Voy. 21.

SIMIA PYGMÆUS and S. SATYRUS.—Schreb. Säugth.

TROGLODYTES LEUCOPYMNUS.—Less. 4 Illustr. Zool.

Icon. LE PONGO.—Audeb. Sing.

Tyson, Anat. Pyg. pl. 1.

Less. Illustr. Zool. pl. 32 (var. à Coccix blanc).

BLACK ORANG OF AFRICA.—Wils. Illustr. Zool. pl. 5, fig. 2.

SPECIFIC CHARACTERS.

THE MUZZLE short. THE FOREHEAD very low. THE SUPERCILIARY RIDGES prominent.

THE EXTERNAL EARS very large, but of human form. THE NOSE flat.

THE PECTORAL LIMBS reaching down to the knees.

THE HANDS broad, pentadactylous. THE FINGERS of medium length.

THE NAILS very flat, as in Man.

THE TAIL and CHEEK-POUCHES wanting.

THE CALLOSITIES slightly developed.

THE HAIR black, long on the back, and scanty elsewhere.

INHABITS the coasts of Angola and some other parts of Africa.

The Chimpansee is covered with black or brown hair, scanty in front. If we may credit the reports of travellers, it approaches or surpasses the stature of Man; but we have as yet seen no specimen in Europe which would indicate so great a size.

It inhabits Guinea and Congo, lives in troops, constructs huts of boughs, arms itself with stones and clubs, using them in repelling Men and Elephants from their dwellings; pursues the Negresses [most probably a fable], and sometimes carries them off to the woods, &c.

Naturalists have long been in the habit of confounding this species with the Orang-Outang. When domesticated, it is sufficiently docile to be dressed, to walk, to sit, and to eat according to our manner.

This animal, like the preceding, is chiefly organized for climbing trees. Owing to the great strength of the four fingers of its pectoral limbs, it can swing upon them for hours without inconvenience. It walks with difficulty on all-fours, clenching the fingers, and resting upon the knuckles, so as to avoid placing the palms upon the ground. It very rarely assumes the erect attitude, though it can run nimbly on the hinder-limbs for a short distance. During this movement, it assists the equilibrium of the body by placing the fore-hands upon the thighs.

The hair is usually black, upon a skin of a light yellow. Occasionally, a few scattered white hairs appear in various parts of the body, especially near the uropygium, sometimes forming a patch upon the buttocks.⁵ On the back of the thighs and on the fore-arms, the points of the hair are directed upwards, while they point downwards in every other part of the body where they happen to be present. There is no hair on the palms of all the hands, and the abdomen is almost naked.

The canines in all the young specimens hitherto examined scarcely project beyond the line of the other teeth, to which they are continuous and approximated, as in Man. The dentition of the adult is unknown.

For a long time it has been supposed, that callosities did not exist in the Chimpansee, yet they have lately been detected in a rudimentary state by M. Isidore Geoffroy-St-Hilaire, and thus it may be remarked with truth, that no Ape of the Old Continent, excepting the Orang-Outang, is wholly destitute of callosities.⁶

The Chimpansee, when young, and residing in its native regions, is active and cheerful, but soon grows languid and dull, on being transported to our ungenial climate. Here it delights in warm clothing, rolling itself carefully in a blanket on retiring to rest. Its cry presents little variation; sometimes it emits a kind of howl or loud barking noise, when irritated; at other times, it cries like a petted child; or utters a sound like *hem*, pronounced in a grave tone, especially on being presented with sweetmeats. The habits of a female specimen, bought, by Captain Payne, from a native trader from the banks of the Gaboon, are thus described by Dr Traill.

¹ See, in particular, RICHARD OWEN, On the Osteology of the Chimpanzee and Orang-Utan, in the Transactions of the Zoological Society of London, vol. I. ;—J. HARWOOD, An Account of a Pair of Hinder-Hands of an Orang-Outang, in the Transactions of the Linnæan Society, XV. ;—JEFFRIES' Account of the Dissection of a Simia Satyrus, in the Philosophical Magazine, LVII. ;—FREN. CUVIER, Description d'un Orang-Outang, in the Annales du Muséum, XVI. ;—TIEDEMANN, Das Gehirn des Orang-Outangs, in the Zeitschrift für Physiologie, II. ;—and RUDOLPH, Ueber den Orang-Utan und Beweis dass derselbe ein junger Pongo sey, in the Abhandlungen der Kön. Preussischen Akademie der Wissenschaften zu Berlin, for 1824. Also, the Mémoire sur les Orangs-Outangs, by M. Cuvier and Geoffroy-St-Hilaire, published in the Magasin Encyclopédique, III., wherein the genus *Orang* was first proposed.

² This is the *Quojas Morou* or *Angola Satyr* of Tulpius, who gives a bad figure of it (Obs. Med. p. 271), which is represented much better by Tyson (Anat. of a Pygmy, pl. 1), copied by Schreber, pl. 1, B. Scotin has given a tolerable figure, copied in Amœn. Acad. VI. pl. 1, fig. 3, and in Schreb. I. C. A specimen kept by Buffon, preserved in the Museum, is represented rather indifferently in the Hist. Nat. XIV. 1, under the name of Joeko. The same specimen is figured much better in Leacé (Traité du Mouvement Musc. pl. 1, fig. 1) under the name of Quimpesé. It is the same given by Audebert, under the name of Pongo, but after the stuffed specimen merely.—*Note of the Baron Cuvier.*

³ TYSON, ANAT. PYG.—The Anatomy of a Pygmy, by Dr Edward Tyson, London, 1699.

⁴ LESS. ILLUSTR. ZOO.—Illustrations de Zoologie, ou Recueil de Figures d'Animaux, par R. P. Lesson, Paris, 1831.

⁵ One of these traits of albinism, more than usually developed, led M. Lesson to raise his *Trogloodytes leucopymnus* to the rank of a distinct species.

⁶ The Baron Cuvier places the Orang-Outang and the Chimpansee together in the genus *Orang*, characterised chiefly by the absence of callosities. This genus must now be suppressed. See the Dict. Class. d'Hist. Nat. XV. 447.—M. J. B. Fischer confirms the preceding observation, by remarking, "Nates etiam in hac specie esse callosas, nuperrime innotuit."

The Chimpanzee "ate readily every sort of vegetable food; but at first did not appear to relish flesh, though it seemed to take pleasure in sucking the leg-bone of a fowl. At that time it did not relish wine, but afterwards seemed to like it, though it never could endure ardent spirits. It once stole a bottle of wine, which it uncorked with its teeth, and began to drink. It shewed a predilection for coffee, and was immoderately fond of sweet articles of food. It learned to feed itself with a spoon, to drink out of a glass, and shewed a general disposition to imitate the actions of men. It was attracted by bright metals, seemed to take pride in clothing, and often put a cocked hat on its head. It was dirty in its habits, and never was known to wash itself. It was afraid of fire-arms; and, on the whole, appeared a timid animal."¹

GENUS III. HYLOBATES.—GIBBONS.

Syn. LES GIBBONS.—Cuv. Reg. Anim. I. 90.
HYLOBATES (*ὄλις, hyle*, wood, *βασίς, bates*, wandering).—Illig. Prodr. 67.—Kuhl, Beitr.—Temm. Mon. Mam.—Isid. Geoff. in Bélang. Voy. SIMIA (in part).—Linn. Gmel.—Erxl.—Fisch. Syn. Mam. PITHECUS (ORANG) in part.—Geoff. An. Mus. XIX.—Desm. Mam.

GENERIC CHARACTERS.

THE MUZZLE short. THE SUPERCILIARY RIDGES prominent. THE EARS medium size.

THE PECTORAL LIMBS excessively long, reaching to the hinder-hands.

THE HANDS pentadactylous. THE FINGERS long and narrow.

THE NAILS of the thumbs flat; the remainder convex and semi-cylindrical.

THE CHEEK-POUCHES and TAIL wanting.

THE CALLOSITIES always present, and more or less prominent.

THE HAIR very dense.

INHABIT Sumatra, Java, the Sonda, and Molucca Islands, Borneo, and some parts of Hindoostan.

The Gibbons must be distinguished from the species already described. They have the long arms of the Orang-Outang, and the low forehead of the Chimpanzee, with the callosities of the Guenons; but they differ from the latter in being destitute of a tail or cheek-pouches. They are found only in the most secluded parts of India and the Eastern Archipelago.

This genus contains five species.² Two have long been known, but specimens of the remainder have only very recently been sent to Europe for the first time, by MM. Diard and Duvaucel.

The Gibbons compose a most natural and well-defined group in the order of Quadrumanous animals. They resemble the preceding genera in having no tail or cheek-pouches, while they preserve the rudimentary forehead of the Chimpanzee; yet the existence of well-defined callosities exhibits a descent in the scale of organized being, connecting them more nearly with the lower genera of Apes. The most striking peculiarity in the countenances of the Gibbons arises from their having the chanfrin, or ridge of the nose, concave, which in the Chimpanzee is convex and very prominent. They are covered by a dense coat of hair, having the same direction on the fore-arm as in the succeeding genera.

The dentition of the Gibbons has been examined in three species (2, 4, and 5). In the upper jaw, the first incisor terminates in a straight line, slanting obliquely inwards; the second, smaller than the first, slopes towards the canine. The latter is very long, greater in breadth than in thickness, trenchant on its external margin, having two longitudinal furrows on its internal surface, separated by a projecting crest, the hinder furrow broader and deeper than the anterior one. The second false molar is larger than the first, both with two blunt tubercles, the one on the internal margin being smaller than that on the external. The three true molars go on increasing in size from the first to the third. Each is composed of four tubercles, two of equal size on the external margin, and two on the internal, the hinder tubercle being much smaller than the one before it. These tubercles are formed by furrows dividing the tooth into unequal portions. In the lower jaw, the first incisor is small, terminated by a straight line; the second is rounded on its internal surface, and terminates in a point. The canine is more square than in the upper jaw, and terminates behind by a heel; its internal surface having the two furrows and crest as in the opposite jaw. The first false molar placed obliquely has only a single point; the second has two, one within, the other without. Three real molars follow, increasing in size. Their surfaces have five tubercles, two in front, and three behind, arranged triangularly. Here we find the first instance of this kind of molar.

1. HYLOBATES ALBIMANUS.—WHITE-HANDED GIBBON.

Syn. LE GIBBON NOIR.—Cuv. Reg. Anim. I. 90.
LE GIBBON AUX MAINS BLANCHES.—Geoff. Cours.³ Leç. 7, p. 33.
SIMIA ALBIMANA.—Vigors and Horsfield in Zool. Jour. XIII. 107.
HYLOBATES ALBIMANUS.—Isid. Geoff. in Bélang. Voy. p. 29.
SIMIA LAB.—Linn. Gmel. I. 27.—Fisch. Syn. Mam. Suppl. p. 534.
SIMIA LONGIMANA.—Schreb. Saigth.
LONG-ARMED APE.—Penn. Quadr. 99.—Shaw, Gen. Zool. I. 12.
GIBBON.—Ham. Smith, Syn.
COMMON GIBBON and WHITE-HANDED GIBBON.—Jard. Syn.
Icon. LE GIBBON.—Audeb. Sing.
LE GRAND GIBBON.—Buff. Hist. Nat. XIV. pl. 2.

SPECIFIC CHARACTERS.

HAIR whitish on the hauds; a whitish circle round the face; black or dusky brown elsewhere.

CALLOSITIES small.

INHABITS the East Indies.

This animal is covered with thick dark hair, and its face is surrounded with a whitish circle.

But its more important distinction from the other Gibbons consists in the whitish patches of hair upon the backs of all the hands, from which its specific name is derived.

The arms of this Gibbon are so long, that, when seated, it can place the elbows upon the ground, and, resting its head between its hauds, goes quietly to sleep. It always moves in an erect posture, even when resting on all the four hands, as the arm is nearly as long as the body and legs taken together. Its eyes are large but sunken; its ears naked; its face flat, of a deep tan-colour, and rather resembling that of Man.

The manners of this Gibbon are mild and quiet. Its movements are not precipitate like those of the lower Apes, and it eats with gentleness its food, consisting of bread, fruits, or nuts. It seems very delicate, avoiding cold and moisture, and does not long survive an absence from its native country. The height of the adult is between three and four feet. It is found more particularly on the Coromandel Coast, Malacca, and the Molucca Islands.

2. HYLOBATES VARIEGATUS.—VARIED GIBBON.

Syn. LE GIBBON BRUN.—Cuv. Reg. Anim. I. 90.
LE WOUVOU (*Hylobates agilis*).—F. Cuv. Dict. des Sc. Nat. XXXVI. 288.
PITHECUS VARIEGATUS.—Geoff. Ann. Mus. XIX. 88.—Desm. Mam. 51.
SIMIA VARIEGATA.—Fisch. Syn. Mam. 11.
HYLOBATES VARIEGATUS.—Kuhl, Beitr. 6.
LITTLE GIBBON and ACTIVE GIBBON.—Ham. Smith, Syn., and Jard. Syn.
Icon. WOUVOU. Mâle, fem., et petit.—Geoff. et F. Cuv. Hist. Mam.
PETIT GIBBON.—Buff. Hist. Nat. XIV. pl. 3.

SPECIFIC CHARACTERS.

THE ADULT MALE.

HAIR on the back, loins, thighs, and hinder part of the head, yellow or clear brown; round the face greyish white; elsewhere brown.

CALLOSITIES small.

THE ADULT FEMALE.

HAIR whitish only on the eyebrows; otherwise resembling the male.

THE YOUNG.

HAIR of a uniform clear yellow.

INHABITS Sumatra.

Their agility is extreme; they live in pairs; and the Malay name Wouwou is derived from their cry.

The height of the Varied Gibbon, when erect, is about three feet. Its hair is of the same nature throughout, dense and apparently woolly. Its thighs, which are much shorter than the arms, are very much turned outwards. The fingers of the hinder-hands are short, the thumbs long and capable of bending backwards; in the fore-hands, the fingers are long and the thumb very short. The nose has this peculiarity, that the nostrils open upon the sides; so as almost to form an exception to the character of the tribe Catarrhina.

The manner in which the colours of these Gibbons vary with the sex and age of the individual, render a minute description of their tints useless, if not impossible. They live rather in isolated couples than in fami-

¹ Observations on the Anatomy of the Orang-Outang (Chimpanzee), by Dr Thomas Stewart Traill, in the Memoirs of the Wernerian Natural History Society, vol. III. Edinburgh, 1817-20.

² The Baron Cuvier (Reg. Anim.) admits only four species, but he confounds the *Ounko* of Fred. Cuvier with the *Gibbon noir*. Temminck (Mon. Mam.) admits four as being well known, and one as doubtful. Desmarest (Mam. et Suppl.) describes five species, of which the *H. variegatus* and *H. agilis* are identical. Fischer (Syn. Mam.) and Isid. Geoff. (Bélang, Voy.) enumerate five. Sir William Jardine (Naturalist's Library and Syn.) describes seven species, two of which are purely nominal.

³ GEOFF. COURS.—Cours de l'Histoire Naturelle des Mammifères, par M. Geoffroy-St-Hilaire. Paris, 1829.

lies, and are the rarest of all the Sumatra Gibbons. Their agility is almost that of a bird, and perceiving the approach of danger at an immense distance, they immediately take flight. Climbing rapidly to the tops of the trees, the Varied Gibbon seizes the most flexible branch, and balancing itself two or three times before making its spring, clears a distance of fourteen or fifteen yards, several times in succession, without showing any signs of fatigue. When in confinement, though still active, it exhibits no signs of this extraordinary muscular power. Its abilities are not very considerable, yet it seems susceptible of some slight education, is inquisitive, familiar, sometimes gay, but always greedy. Its forehead is very low, and its larynx destitute of any membranous sac.

3. HYLOBATES LEUCISCUS.—ASH-GREY GIBBON.

- Syn.* LE GIBBON CENDRÉ.—Cuv. Reg. Anim. I. 90.
 PITHECUS LEUCISCUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SIMIA LEUCISCA.—Fisch. Syn. Mam.
 HYLOBATES LEUCISCUS.—Kuhl, Beitr. 6.—F. Cuv. Dict. des Sc. Nat. XXXVI. 289.—Geoff. Cours, Le. 7.
 DIE ASCHGRAUE GIBBON.—Voigt, Thier. I. 77.
 WHITE GIBBON.—Shaw, Gen. Zool. I. 12.
 THE WOW-WOW.¹—Hann. Smith, Syn.—Jard. Syn.
Icon. LE MOLOCH.—Audeb. Sing.
 SIMIA LEUCISCA.—Schreb. Säugth. pl. 3, B.

SPECIFIC CHARACTERS.

HAIR soft and woolly, of a uniform ash-grey; the face black, or dark grey; the circle round the face clear grey.

CALLOSITIES very large.

INHABITS the Molucca and Sonda Islands.

This species lives among the reeds, and climbs the highest stems of the bamboo, balancing itself on them by means of its long arms. This is also called Wouwou by the natives.

The black face of the Ash-Grey Gibbon contrasts forcibly with the colour of the hair on the rest of the body. Its height is rather more than three feet. The habits of this Gibbon are little known, our knowledge of it resting merely upon two specimens in the Paris Museum, and a few observations made by Camper upon the living animal.

4. HYLOBATES RAFFLESII.—RAFFLES' GIBBON.

- Syn.* LE GIBBON OUNKO, HYLOBATES RAFFLEI.—Geoff. Cours. Leg. 7.
 SIMIA RAFFLESII.—Fisch. Syn. Mam. Suppl.
 PITHECUS LAR.—Geoff. Ann. Mus. XIX.
 SIMIA LAR UNGKA-ETAM.—Raffles in the Linn. Trans. XIII. 242.
 SIMIA CONCOLOR.—Fisch. Syn. Mam.
 HYLOBATES RAFFLEI.—Isid. Geoff. in Bélang. Voy.
 SIMIA HOOLOCK.—Harlan in the Transactions of the American Philosophical Society.
 THE HOOLOCK (II. Hoolock).—Jard. Syn.
Icon. OUNKO, mâle et fem.—Geoff. et F. Cuv. Hist. Mam.
 SIMIA CONCOLOR.—Harlan, Journ. Acad. Nat. Sc. Philad. V. pl. 9.

SPECIFIC CHARACTERS.

THE MALE.

HAIR black, changing to brown according to the angle at which the light is reflected, eyebrows white, and cheeks grey.

CALLOSITIES small.

THE FEMALE.

HAIR of the eyebrows clear grey, and cheeks black, elsewhere resembling the male.

INHABITS Sumatra, and the territory of Assam in British India.

This animal, called *Ungka-etam* by the Malays, is smaller than the Varied Gibbon, which it resembles in most other respects, excepting colour. It is confounded with the White-Handed Gibbon by the Baron Cuvier, as well as by its first describer, Sir Thomas Stamford Raffles.²

It has been stated that the females of this species have the fingers united as in the Syndactylous Siamang; such, however, is not the case, as we are assured by M. Isidore Geoffroy-St-Hilaire.

To this species we must assign the *Simia concolor* and *Simia hoolock* of Dr Harlan, which some Naturalists would consider as distinct species.³

Dr Burrough thus describes the habits of the latter animal. The Hoolocks, he observes, "walk erect, and, when placed upon a floor, or in an open field, balance themselves very prettily, by raising their arms over their head, and slightly bending their arm at the wrist and elbow, and then run tolerably fast, rocking from side to side; and if urged to greater speed, they let fall their hands to the ground, assist themselves forward, rather jumping than running, still keeping the body, however, nearly erect. If they succeed in making their way to a grove of trees, they then swing with such astonishing rapidity from branch to branch, and from tree to tree, that they are soon lost in the jungle or forest." To these particulars he adds among others, that the principal food of the animal was the banana, that it was fond of spiders and flies, but disliked flesh; that its temper was mild, and its cry loud and shrill, consisting of whoo-who-who, repeated for five or ten minutes without intermission.

5. HYLOBATES SYNDACTYLUS.—SYNDACTYLOUS GIBBON.

- Syn.* LE SIAMANG.—Cuv. Reg. Anim. I. 90.
 PITHECUS SYNDACTYLUS.—Desm. Mam. Suppl. 531.
 SIMIA SYNDACTYLA.—Raffles in the Linn. Trans. XIII.—Fisch. Syn. Mam.
 HYLOBATES SYNDACTYLUS.—Isid. Geoff. in Bélang. Voy.
 THE SIAMANG.—Hann. Smith, Syn.—Jard. Syn.—Stark, Elem.⁴
Icon. SIAMANG.—F. Cuv. et Geoff. Hist. Mam.
 SIMIA SYNDACTYLA.—Horsf. Zool. Jav.⁵

SPECIFIC CHARACTERS.

THE MALE.

THE HINDER HANDS with the first and second phalanges of the index and middle fingers united by the integuments.

THE THROAT with a large naked space beneath.

CALLOSITIES small.

THE HAIR generally black, reddish upon the eyebrows and chin.

THE FEMALE.

THE HINDER HANDS with the first phalanx only of the index and middle fingers united: otherwise resembling the male.

INHABITS Sumatra.

We must now notice the Syndactylous Gibbon, as being the most remarkable species of this genus, from its having the first and second fingers of the hinder hands united together by a narrow membrane reaching the entire length of the first phalanx [in the females, and to the end of the second phalanx in the males]. The animals of this species live together in numerous troops, which are conducted by brave and vigilant leaders, making the forests resound with their deafening cries at the rising and setting of the sun. The larynx is supplied with a membranous sac.

These animals are very common in the forests of Sumatra. They are slow in their motions, dull and stupid; they climb without security, and leap without agility, so that, on surprising them, they are easily captured, yet they can hear a noise at the distance of a mile from the object, when they immediately take fright and abscond. If found upon the ground apart from trees, they are sure to be taken. At first they attempt to flee, but their body being too high and heavy for their short and meagre thighs, inclines forward, and their arms performing the office of stilts, they advance forward by jerks like a lame old man, whom fear has compelled to make a great effort. However numerous the troop, a wounded Syndactylous Gibbon is deserted by his companions, except it be a young one, when the mother, who carries, or stands near her progeny, falls with it, and raising a hideous yell, throws herself with open mouth and extended arms upon the assailant. The care which the mothers bestow on their young is very remarkable, and M. Duvaucel, by means of proper precautions, has seen them carefully washing their progeny in the river, regardless of the cries of the young ones. This species often falls an easy prey to the Tiger, through the paralyzing influence of fear.

In respect to their intelligence, the Syndactylous Gibbons stand nearly the lowest of the Monkey tribe. They are almost equally insensible to kind or unkind treatment. Hatred, as well as gratitude, are alike strangers to these animated machines. Mostly in a crouching posture, rolled up

¹ This practice of adopting the barbarous and vernacular names of animals as specific, is certain to plunge the science into inextricable confusion. Thus the name *Wouwou* is applied by the Malays indiscriminately to the Varied and Ash-grey Gibbons, and the appellation *Ounko*, both to Raffles' and the White-handed Gibbon. Savages are not likely to care much about specific distinctions, and all such terms as *Ounko*, *Wouwou*, *Siamang*, *Hoolock*, should be suppressed, wherever their use is likely to be attended with confusion.

² Descriptive Catalogue of a Zoological Collection, made on account of the Hon. East India Company, in the Island of Sumatra and its vicinity, by Sir Thomas S. Raffles, in the Transactions of the Linnean Society, vol. XIII. London, 1818-22.

³ After an attentive examination of the characters assigned to these animals, we can find nothing which cannot be stated with equal correctness of the Gibbon of Raffles, excepting the alleged absence of callosities, which has probably arisen from want of care in the stuffing of the specimens.

⁴ STARK, ELEM.—Elements of Natural History, by John Stark. Edinburgh, 1828.

⁵ HORSF. ZOOLOG. JAV.—Zoological Researches in Java and the neighbouring Islands, by Dr Thomas Horsfield. London, 1825.

in its long arms, with the head resting between its knees, the Syndactylous Gibbon utters a disagreeable cry, like that of a Turkey, and apparently without any motive. When in confinement it takes its food with indifference, raises it to the mouth without eagerness, and allows it to be taken away without astonishment. The manner of drinking consists in plunging the fingers in water, and then sucking them.

The forehead is almost wholly wanting, the eyes are sunk in their orbits, the nose is broad and flat. The nostrils, placed likewise in this species on the sides of the nose, are very large; the mouth opens the whole extent of the jaws, and the cheeks are buried under the projecting cheek-bones. A large naked sac, oily, and flabby like a goitre, hangs under the throat: the hair is glossy, soft, long, and thick, of a deep black, except on the eyebrows and chin, where it is reddish. The thighs being arched inwards are always bent. The guttural sac of this animal extends and swells largely, occasioning the peculiarity of its cry. It is rather above three and a half feet in height.

All the Apes of the Old Continent, which now remain to be described, have the liver divided into several lobes: the cœcum large, short, and without appendage; and the hyoid bone shaped like a buckler.

GENUS IV. CERCOPITHECUS.¹—GUENONS.

Syn. LES GUENONS.—Cuv. Reg. Anim. I. 91.

CERCOPITHECUS (in part).—Briss.² Reg. Anim. 193.—Erxl. 22.—Illig. Prodr. 68.—Temm. Mon. Mam.

CERCOCEBUS (in part) ET CERCOPITHECUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.

SIMIA (in part).—Linn. Gmel.—Fisch. Syn. Mam.

GENERIC CHARACTERS.

THE MUZZLE slightly elongated. THE STOMACH round, and of medium size.

THE BODY and LIMBS slender.

THE THUMBS of the anterior hands short.

THE NAILS of the thumbs flat, the remainder semi-cylindrical.

THE HANDS pentadactylous.

THE TAIL long.

THE CALLOSITIES and CHEEK-POUCHES always present.

THE HAIR plentiful.

THE LAST MOLAR of the lower jaw with four tubercles only.

INHABIT Africa.

With a muzzle projecting about 60°, the Guenons have cheek-pouches, a tail, and callosities, while the last true molar in the lower jaw, like the other two, has only four tubercles. The species are very numerous, varying greatly in size and colour. These animals are abundant in Africa, where they live in troops, and make great havoc in gardens and cultivated fields. They may be easily tamed.

This genus contains fifteen species, the reality of which cannot reasonably be doubted.³ Three others, noticed by writers of good authority, are apparently referable to this genus, but the information given is as yet insufficient fully to establish their claims.

The dentition of the Guenons has been verified upon all the species. In the upper jaw, the first incisor is twice as broad as the second; the latter is narrow, and does not rise to the level of the first. The canine is very long, sharp, and trenchant on its hinder part, and a small interval separates it from the incisors. The first false molar, which touches the canine, presents externally a conical point, and internally an oblique plane, swelling in the middle, and circumscribed at its lower part by a projecting border. The second false molar is larger than the first, and has the same form, except that the internal border is so much elevated, as to appear almost like a tubercle. The three real molars are nearly of equal size, and composed of four similar tubercles, arising from a horizontal and a transverse furrow, intersecting each other at right angles, and dividing the tooth into four equal parts. In the lower jaw, the first incisor, though smaller than the corresponding tooth in the opposite jaw, is still larger than the second incisor. It terminates in a straight line, while the second incisor is sloped off towards the canine. The latter mentioned

tooth is not so strong as the canine of the opposite jaw, but is sharp, rounded, and terminated at its base behind by a very prominent heel, divided by a slight groove into two lobules. The first false molar presents no conical point, but is remarkable for an inclined plane extending anteriorly and externally, much longer than the other, upon which the internal and flat part of the opposite canine glides by a movement exactly similar to that exhibited by the carnassier teeth of the carnivorous animals, being in fact the same as the action of a pair of scissors. The second false molar exhibits a conical tubercle in front, and a circular depression towards the middle of the hinder part. The three following molars increasing gradually in size from the first to the third, exactly resemble the molars of the opposite jaw.

The Guenons, in respect to their organization, seem to hold a medium station among all the Apes of the Old Continent. The head is tolerably round, although the muzzle projects, and their facial angle is about 50°. Their ears are of medium size, and similar in form to those of man. The nose is flat, their forms light and slender, their tail and limbs elongated, but not so much so as in the Solemn Apes (*Semnopithecus*), while, on the contrary, the thumbs of their anterior hands, though short, are longer than those of the latter. The callosities of all the species are very strong, and their cheek-pouches well marked. Their teeth have very prominent tubercles, and are not worn down by detrition as in the Solemn Apes. This arises from the circumstance that the Guenons live principally upon fruits and roots, while the Solemn Apes feed chiefly upon leaves. The stomach of the Guenons is round and of medium size. There is no important variation in the colours of the sexes.

These animals are evidently formed for residing on trees, which are at once their abode and place of refuge. On being alarmed, they instantly take flight, and leaping rapidly from bough to bough, soon disappear. The leap is their habitual pace, for they can walk on two limbs only with considerable difficulty, and they are equally unadapted for making any rapid progress upon four. Hence they never willingly adopt these paces, excepting for very short distances, or when they are not hurried.

Their cheek-pouches, which are large, serve as magazines for depositing their food. Numerous troops disperse themselves in the fields and gardens near their native forests, pillage them of fruit, and, filling their cheek-pouches, retreat on the slightest alarm to their inaccessible abodes in the woods.

There is something hasty and capricious in the manners of the Guenons, which strikes an observer at the first glance. Nothing can fix their attention for any length of time to one object. The dread of continual torture serves to command it for a moment; and in a few rare instances they have been known to become attached by kind treatment. Their curiosity is very great; but, when apparently occupied in attentively examining some object, the slightest circumstance is sufficient to divert their attention, and the object in their hands is instantly allowed to fall to the ground. It is interesting to remark the rapidity and caprice with which they change every moment their temper and occupations.

Although there are many species of Apes in Africa, yet it is remarked by travellers that they do not mix promiscuously, but that each occupies a separate district.

All the Guenons yet known are of African origin. One species is said to come from Bengal, but this is most probably an error.

I. CERCOPITHECUS RUBER.—RED GUENON.

Syn. LE PATAS.—Cuv. Reg. Anim. I. 91.

SIMIA RUBRA.—Linn. Gmel. I. 42.—Fisch. Syn. Mam. 24.

CERCOPITHECUS RUBER.—Geoff. Ann. Mus. XIX. 96.—Desm. Mam. 59.

RED MONKEY.—Penn. Quadr. 208.—Shaw, Gen. Zool. I. 49.

Icon. Patas mâle adulte.—Geoff. et F. Cuv. Hist. Mam.

LE PATAS À QUEUE COURTE.—Audeb. Sing.

PATAS À BANDEAU NOIR femelle.—Geoff. et F. Cuv. Hist. Mam.

Buffon, Hist. Nat. XIV. pl. 25 and 26.

SPECIFIC CHARACTERS.

THE HAIR of a bright yellowish-red above, white beneath, a black or a white band over the eye.

INHABITS Senegal.

The Red Guenon is remarkable for the brilliancy of its coat, which is of so bright a red on the upper part, that it appears as if exaggerated by the hand of a painter. There are two varieties of this species, the one

¹ Cercopithecus (*κίρκος*, *kirkos*, tail, and *πίθηξ*, *pithēx*, an Ape), Apes with tails, a name in use among the ancient Greeks.—*Note of the Baron Cuvier.*

² BRISS. REG. ANIM.—Le Règne Animal, divisé en IX. classes, par M. Brisson. Paris, 1756.

³ The Baron Cuvier, in the second edition of the *Règne Animal*, enumerates only thirteen species. Two others have since been established, making the number as stated in the text. The catalogues of most other systematic writers run very wide of the mark. Temminck (Mon. Mam.) asserts that there are 19 or 20, but does not specify them. Geoffroy (Ann. Mus.) distributed the species of this genus among two genera (Cercopithecus and Cercocœbus), and his example was followed by Desmarest. But the institution of the genus *Semnopithecus* by Fred. Cuvier occasioned the latter (*Cercocœbus*) to be suppressed in all works of any authority, and reduced the number of species in the genus *Cercopithecus* from 20 or 21 to 13. However, the Catalogues of British Zoologists still exhibit the old division *Cercocœbus*, which rests upon no real basis, in addition to the new genus *Semnopithecus*, thus multiplying sub-divisions without any adequate reason. Major Hamilton Smith, Sir William Jardine, and Mr Stark, have followed M. Desmarest pretty closely, merely omitting *C. maurus*. Of their 18 species, at least five are fictitious or referable to other genera. These nominal species are *C. auratus*, *latibarbatus*, *pileatus*, *albocinctus*, and *Atys*.

with a black, the other with a white band over the eyes. They are not so capricious as the other Guenons. The damage occasioned by these animals in the cultivated fields of Senegal, at the seasons when the millet and other grain become ripe, is incalculable. Forty or fifty Guenons assemble together. One Guennn mounts upon a tree as an outpost, listening and watching on every side, while the remainder are plundering. As soon as he perceives any one approaching, the sentinel cries out like an enraged person to give notice to the remainder, who start off with their booty on hearing the signal, and leap with prodigious agility from tree to tree. The females, who carry their young clinging against the abdomen, run off with the rest, with the same agility as if they had no burthen to carry. These animals do not agitate their jaws, when displeased, like the other Guenons, and they walk more frequently upon all the four hands than on two only. They are from a foot and a half to two feet in length from the point of the muzzle to the insertion of the tail; and the tail is not so long as the body and head taken together.

The body is slender. The head medium size; with the cranium slightly lengthened and flattened upon the vertex; the forehead projecting above the orbits of the eyes, and above the upper part of the nose. The face is flesh-coloured, the nose covered with short black hair; the eyes sunken; a black or white band passing over the eye, resembling a prolonged eyebrow; the hair very plentiful upon the cheeks, forming cheek-tufts; the ears naked. Its bright yellowish-red hair, which extends over the forehead, the vertex, occiput, upper part of the neck, the back, sides, crupper, sometimes only the upper part of the tail, and sometimes the whole tail, and the thigh, are not without some mixture of black and grey, proceeding from the circumstance that many of the hairs are black on the points and elsewhere grey. The red hair becomes paler upon the outside of the arm, the fore-arm and leg; while it finally tapers, upon the cheeks, tip of the muzzle, neck, lower part of the neck, arm-pits, the inner surfaces of all the limbs, the breast and the belly, to a white, mixed in several points with yellow, pale-red, and grey. The hair throughout is generally rough and glossy. The nails are black, the palms of the hands brown.

Mr Bennett remarks, that a specimen in the Gardens of the Zoological Society of London was "lively and active, but somewhat irascible if disturbed or handled. It was, however, too young to be dangerous. When pleased it danced on all-fours in a peculiar and measured step, which was far from being ungraceful; although after a time it became ludicrous from its regular monotony."

2. CERCOPITHECUS ÆTHIOPS.—COLLARED MANGABEY GUENON.

- Syn.* LE MANGABEY À COLLIER.—Cuv. Reg. Anim. I. 91.
CERCOCEBUS ÆTHIOPS.—Geoff. Ann. Mus. XIX.
CERCOPITHECUS ÆTHIOPS.—Desm. Mam. 62.
SIMIA ÆTHIOPS.—Fisch. Syn. Mam. 23.—Linn. Gmel. I. 38.
WHITE EYELID MONKEY.—Penn. Syn. p. 114.
- Icon.* Mangabey à collier.—Geoff. et F. Cuv. Hist. Mam.
Le Mangabey var. A.—Audeb. Sing.
Buff. Hist. Nat. XIV. pl. 33.

SPECIFIC CHARACTERS.

THE HAIR slate grey above, whitish beneath,¹ also on the temples, and on the back of the neck; bright chestnut-brown on the top of the head; a greyish band beneath the ear.

THE EYELIDS white.

INHABITS the Western coast of Africa.

Buffon says that this animal comes from Madagascar, while Haselquist assigns it to Abyssinia. The fact is, as we are assured by Sonnerat, there are no Apes at all in Madagascar.

It possesses so many intimate relations to the following species, (3) that Buffon and Pennant confounded them together under the common names of Mangabey and White Eyelid Monkey. Yet their differences, slight as these may be considered by some, are found to be so invariably the same in numerous individuals, that we cannot hesitate to pronounce them distinct species. Their variations, it will be remarked, are chiefly in the colours of the head and neck.

The height of the Collared Mangabey Guenon is about a foot and a half, being rather less than that of the species next to be described. Its hair is very long and soft to the touch. The first incisor of the upper jaw being very broad, renders its grin at once obvious and peculiar. It may be readily distinguished from the other White-eyelid Monkey by the bright chestnut-brown on the upper surface of its head, and the collar of pure white crossing the fore-part of its neck, and including the large bushy cheek-tufts, which extend backwards, beneath and behind the ears.

3. CERCOPITHECUS FULIGINOSUS.—COLLARLESS MANGABEY GUENON.

- Syn.* LE MANGABEY SANS COLLIER.—Cuv. Reg. Anim. I. 91.
CERCOCEBUS FULIGINOSUS.—Geoff. Ann. Mus. XIX.
SIMIA FULIGINOSA.—Fisch. Syn. Mam. 24.
CERCOCEBUS CYNOMOLGUS.—Geoff. Ann. Mus. XIX.
WHITE EYELID MONKEY.—Penn. Quadr. p. 201.—Shaw, Gen. Zool. I.
- Icon.* LE MANGABRY.—Audeb. Sing.—Buff. Hist. Nat. XIV. pl. 32.
MANGABEY femelle.—Geoff. et F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR uniform slate-grey above; whitish beneath; black on the backs of the hands.

THE EYE-LIDS white. THE EARS violet-grey.

INHABITS Congo and the Gold Coast.

Buffon thought that this animal came from Madagascar, and believed it to be a variety of the preceding.

Though one of the most common species of Guenons, it was a long time before its native country was indicated with precision. Continually in motion, it exhibits in captivity the most grotesque attitudes. The males are chiefly remarkable for their agility, and evasive motions by a singular grin approaching to a laugh, at the same time showing their incisors, which are always very large. They are constantly in the habit of holding the tail turned forwards upon the back, and not elevated in a semicircular form, as in most of the other Guenons. The length from the muzzle to the insertion of the tail is about two feet; the height from the shoulders to the palm about 1½ feet. The females are usually more tranquil, and fonder of caresses than the males. "A l'époque du rut, c'est-à-dire chaque mois, elles éprouvent aux parties génitales un gonflement considérable, qui, près de l'anus est très-large, et qui, après s'être rétréci tout-à-coup, descend vers la vulve et l'entourc. Alors on voit paraître une véritable menstruation."

When in captivity, their docility is considerable. Audebert notices one individual which danced on the tight rope, holding a balance-pole in its hands; took up a book, placed it on a table, and turned over the leaves with much ease, making grimaces at it as though it contained some provoking intelligence. The same writer significantly remarks, "On sent que le fouet du maître jouoit ici un grand rôle."

The muzzle is thick and projecting; the circle round the eyes prominent. The face varies in colour, sometimes being of a deep flesh-coloured tint; sometimes blackish on the fore part of the muzzle, and the remainder copper-coloured. Above the eyelids there is constantly a white band in the form of a crescent, very striking; there are coarse hairs on each side of the nose, and others stiff and bristly on the lower part of the forehead just above the nose. The ears are naked, violet-coloured, without margin, and slightly folded back at their extremities. The hairs of the cheek-tufts are directed backwards, whitish, with a grey band. The hair of the entire upper part of the body as well as of the tail is a slate-grey, with a slight tinge of yellow upon the head; that of the throat, breast, belly, and the interior of the limbs, of a greyish-white. The extremities of the limbs, from the fore-arm in front, and from the heel behind, are of a deep black. The tips of the fingers are very thick, especially of the thumb; and the nails are flat.

4. CERCOPITHECUS SABÆUS.—GREEN GUENON.

- Syn.* LE CALLITRICHIE.²—Cuv. Reg. Anim. I. 91.
CERCOCEBUS SABÆUS.—Geoff. Ann. Mus. XIX.
CERCOPITHECUS SABÆUS.—Desm. Mam. p. 61.
SIMIA SABÆA.—Linn. Gmel. p. 32.—Fisch. Syn. Mam. 21.
GREEN MONKEY.—Penn. Syn. 113.—Quadr. p. 203.—Shaw, Gen. Zool. I. 42.
- Icon.* Callitriche mâle.—Geoff. et F. Cuv. Hist. Mam.
Le Callitriche.—Audeb. Sing.—Ménag. du Mus.³—Buff. Hist. Nat. XIV. pl. 37.

SPECIFIC CHARACTERS.

THE HAIR yellowish-green above, tending to a grey upon the limbs; whitish beneath; the cheek-tufts and the tip of the tail yellowish.

THE FACE black. THE SCROTUM greenish; surrounded with yellow hair.

INHABITS Senegal.

The Green Guenon possesses many points of resemblance to the Malbrouck (5). It is one of the most beautiful of the Monkey tribe, its hair being disposed in alternate rings of black and yellow, which, by combining,

¹ By the term *above*, we understand all the superior and exterior parts of the body, such as the shoulders, back, sides, arms, and fore-arms, thighs and legs, feet and tail; by the term *beneath*, all the inferior and interior parts of the body, such as the neck, breast, belly, and the inner surfaces of all the limbs.

² The name of Callitrix is assigned by Pliny (l. VIII. c. 54) to an Ape of Ethiopia, furnished with a beard and a bushy tail, probably the Ooanderoo. Buffon applied it arbitrarily to the above species.—*Note of the Baron Cuvier.*

³ MÉNAG. DU MUS.—La Ménagerie du Museum National d'Histoire Naturelle, par les Citoyens Lacépède et Cuvier. Paris.—An. X.—(1801.)

give it, when viewed at a certain distance, the appearance of a bright green. This tint, so unusual among Mammiferous animals, probably induced Buffon to apply the term *Callithrix* (signifying *beautiful hair*) to this animal.

We know little regarding the habits of the Green Guenons when in the wild state, excepting the short notice of Adanson. They keep together in troops, most frequently on trees, maintain a profound silence, and would pass unnoticed, were it not for the branches which they break and throw down on the passenger. In places where Man does not often penetrate, they do not fear him; and, though some fall down mortally wounded, the remainder do not take flight on that account.

In confinement they are not easily tamed. One individual in the Paris Menagerie always continued ferocious. "Les femmes lui causaient une fureur d'une autre espèce, qu'il témoignait de la manière la plus brutale." His voice was a kind of growl, commencing in a grave and ending in an acute tone, resembling that of the Baboons, but not so loud. F. Cuvier describes it by the syllable *grou*. Most frequently it remained seated, with the eyes closed. Its colour became deeper in winter, and the hair of the breast and belly fell off in large quantities during summer, so as to leave them almost bare.

Its body, though slender, approaches in form to that of the Malbrouck Guenon. The head is pyramidal, the muzzle elongated; the upper part of the orbits low in front, projecting greatly just above the nose; the ears large, rounder than in the Malbrouck Guenon. The hair on the upper part of the body of a yellowish-green, as already described; the external surface of the limbs more grey, the yellow hairs having nearly disappeared. The lower parts of the body, and the internal surfaces of the limbs, beneath the cheek, throat, and neck, are of a yellowish white. The colour of the back is continued on the upper side of the tail to its extremity, which is ornamented by a long pencil of yellow hairs. The face, ears, and hands, are black; the cheek-tufts yellowish, with the hairs directed backwards, and dispersed so as to form a kind of ruff. The skin of the scrotum is greenish, and surrounded with yellow hairs.

5. CERCOPITHECUS FAUNUS.—MALBROUCK GUENON.

- Syn.* LE MALBROUC.—Cuv. Reg. Anim. I. 92.
CERCOPITHECUS CYNOSUROS.—Geoff. Ann. Mus. XIX.
DOG-TAILED MONKEY.—Shaw, Gen. Zool. I. I, p. 32.
SIMIA FAUNUS.—Linn. Gmel. I. p. 31.
SIMIA CYNOSUROS.—Fisch. Syn. Mam. 22.
Icon. Malbrouck.—Geoff. et F. Cuv. Hist. Mam.
Le Callitriche var. A.—Audeb. Sing.—Buff. Hist. Nat. XIV. pl. 29,
copied in Schreb. Säugeth. pl. XIV. C.
Simia Cynosuros.—Scopoli, Deliciae Floræ, et Faunæ Insubr. I. pl. 19.

SPECIFIC CHARACTERS.

THE HAIR greenish-grey above, ash-coloured beneath and on the limbs; no yellow on the tail; a white band above the eye; tufts of white hair on each side of the face.

THE FACE black, flesh-coloured round the eyes.

THE SCROTUM bright ultramarine.

THE CALLOSITIES bright red.

INHABITS

This animal is said to inhabit the forests of Bengal. If this be true, which has not yet been satisfactorily proved, it forms a remarkable exception to the other Guenons, which are all confined to Africa. Its agility is extreme, but it seldom permits its voice to be heard, which is at best but a feeble or sharp cry, or a low growl. The males when young are tolerably docile, but become exceedingly unmanageable when arrived at the adult period of life; the females continue mild, and seem susceptible of some attachment. The irritability of the males, though excessive, is always tempered by a certain degree of caution; they are fond of attacking an enemy from behind with their teeth and nails, darting off immediately before he can turn, but not losing sight of him so as to prepare for a new sally. They use their hands with much address, seizing the smallest objects between the thumb and first finger, notwithstanding the shortness of the former. The rind of fruits and roots is carefully peeled off with their teeth, and they smell over every object before tasting it. They drink by supping up.

Their ears are similar to ours, but without the helices. "Les mâles paraissent toujours disposés à l'accomplissement. Les femelles ont l'ouverture du vagin très simple, avec un clitoris fort petit." In general, it would appear that these Guenons are less disposed to breed in confinement than the Apes of most other genera. The remarkable colour of the scrotum is the most striking characteristic of the Malbrouck Guenon.

Its body, unlike the other Guenons, is strong and muscular; its head tolerably large, and pyramidal; its muzzle projecting; and its lips very

extensible. The upper part of the body is generally of a greenish grey, resulting from the mixture of alternate hairs with yellow and black tips; the lower parts of the body and beneath the tail are grey from the mixture of hairs tipped with white and black. All the hairs are, however, grey at their base. The hairs on the sides of the cheeks are very long, and directed backwards, forming very prominent cheek-tufts; the muzzle is black, flesh-coloured around the eyes, the latter character being more perceptible in the young than in the adults; the ears and palms of the hands are black; the callosities very red, especially at periodical seasons; the scrotum very voluminous, of a bright ultramarine, within which the penis is almost concealed.

6. CERCOPITHECUS ERYTHROPYGUS.²—VERVET GUENON.

- Syn.* LE VERVET.—Cuv. Reg. Anim. I. 92.
CERCOPITHECUS PYGERYTHRÆUS.—Desm. Mam. Suppl. p. 534.
SIMIA PYGERYTHRA.—Fisch. Syn. Mam.
CERCOPITHECUS PUSILLUS.—Desmoulin in Dict. Clas. d'Hist. Nat. VII. 568.
Icon. VERVET MÂLE.—Geoff. et F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR greyish-green above, white beneath, red around the anus, black on the point of the tail.

THE SCROTUM greenish, surrounded by white hair.

INHABITS the Cape of Good Hope.

This animal differs from the Malbrouck Guenon in having its scrotum [greenish] surrounded with white hair, and red hair near the anus.

It possesses many points of general resemblance to the Guenons with greenish hair, already described (4) and (5). M. Lalande brought several specimens to Europe from the Cape of Good Hope, in the forests of which he found them very plentiful, without meeting with any of the others, which tends to confirm the idea that it forms a distinct species. It is found only in the woods remote from the colony.

Its face and ears are black, flesh-coloured around the eyes, a very prominent band of white hair across the forehead, the cheek-tufts white, the upper part of the body greyish-green, changing into a grey upon the limbs; the scrotum of a very brilliant green; the arms surrounded with hairs of a deep-red; all the hands black from the joints of the heels and wrists, and the tip of the tail black.

7. CERCOPITHECUS GRISEO-VIRIDIS.—GRIVET GUENON.

- Syn.* LE GRIVET.—Cuv. Reg. Anim. I. 92.
CERCOPITHECUS GRISEO-VIRIDIS.—Desm. Mam. p. 61.
SIMIA SUBVIRIDIS.—F. Cuv. in Dict. des Sc. Nat. XX. p. 26.—Fisch. Syn. Mam.
Icon. Grivet mâle.—Geoff. et F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR greenish above, excepting the limbs and tail, which are grey; white beneath, also the tufts of the cheeks.

THE SCROTUM bright green, surrounded with bright yellow hair.

INHABITS Nubia.

The green scrotum surrounded with yellow hair serves to distinguish this animal from the Malbrouck Guenon.

It possesses a strong general resemblance to the other Green Guenons in size and general proportions. According to Cailliaud, it is found in the forests of Nubia.

The upper parts of its body are of a dingy green, resulting from annulated hairs of dark grey and bright yellow; the hairs on the thighs are similar, but with very little yellow; the hair on the backs of the hands marked with alternate rings of grey and white. The cheek-tufts, as well as a band over the eyes, are white; the face, the ears, and the palms of all the hands, of a violet-black; the circle round the eyes flesh-coloured. There are a few scattered hairs, like bristles, on the superciliary ridge between the eyes.

It has the savage disposition of all the larger kinds of Guenons, and bears that strong specific affinity to the Malbrouck and Green Guenons which seems to indicate the transition from the one form to the other. It resembles the Malbrouck in the general colours of the hair, but differs from it in the shape of the head, which is not so round; in the colour of the scrotum, which is of a bright green instead of ultramarine; and in that of the hairs surrounding these parts being white in the Malbrouck, and bright yellow in the Grivet. This appellation seems wholly accidental and arbitrary, being the name to which the individual in the Paris Menagerie used to answer when called.

There is a strong general affinity among the Green, Malbrouck, Vervet, and Grivet Guenons, which would constitute them a distinct group.

¹ The *Cercopithecus barbatus* of Clusius, which Linnaeus quotes as an example of his *faunus*, is rather an *Ooangeroo* than a Malbrouck.—Note of the Baron Cuvier.
² *Erythropygus*, from *ἐρυθρός*, red, and *πυγή*, anus.

8. CERCOPITHECUS TALAPOIN.—TALAPOIN GUENON.

- Syn.* LE TALAPOIN.—Cuv. Reg. Anim. I. 92.
 CERCOPITHECUS TALAPOIN.—Geoff. Ann. Mus. XIX. p. 93.—Desm. Mam. p. 56.
 SIMIA TALAPOIN.—Linn. Gmel. I. p. 35.—Fisch. Syn. Mam. 21.
 TALAPOIN MONKEY.—Penn. Syn. 114.—Shaw, Gen. Zool. I. 1, p. 46.
Icon. MELARINE, jeune fem.—Geoff. et F. Cuv. Hist. Mam. Buff. Hist. Nat. XIV. pl. 40.

SPECIFIC CHARACTERS.

THE HAIR greenish above, whitish beneath, the tufts of the cheeks whitish.

THE NOSE black, in the middle of a flesh-coloured face.

INHABITS

This animal comes probably from Africa, though its precise locality has not yet been verified. It belongs to the same group of Guenons with those now about to be described.

The head is round, and the muzzle projects but slightly; the ears are large, round, and naked; the nose, the ears, and the palms of all the hands, are black; the circle round the eyes and the tip of the lips flesh-coloured. The hair on the cheeks, temples, forehead, the top of the head, the occiput, above and on the sides of the neck, the back, loins, crupper, the sides of the breast and belly, as well as the external surfaces of the limbs and the backs of the hands, are covered with a mixture of yellowish green and black, each hair being dark-grey through a great part of its length from the root, afterwards greenish-yellow, and terminating in black. The lower jaw, the inferior surface of the neck, throat, breast, belly, armpits, and the inner surfaces of the limbs, are whitish, with some slight tinges of yellow; the tail beneath is of an ash-grey. The nails of all the thumbs are round and flat.

9. CERCOPITHECUS MONA.—VARIED GUENON.

- Syn.* LA MONE.—Cuv. Reg. Anim. I. 92.
 CERCOPITHECUS MONA.—Geoff. Ann. Mus. XIX. 95.—Desm. Mam. p. 58.
 SIMIA MONA.—Linn. Gmel. 34.—Fisch. Syn. Mam.
 VARIED APE.—Penn. Quadr. and Syn.
 VARIED MONKEY.—Shaw, Gen. Zool. I. 17.
Icon. LA MONE.—Audeb. Sing.
 Mone mâle.—Geoff. et F. Cuv. Hist. Mam.
 SIMIA MONA.—Schreb. Säugth. pl. 15.
 SIMIA MONACHA.—Ibid. pl. 15. B.
 Buff. Hist. Nat. XIV. pl. 36.

SPECIFIC CHARACTERS.

THE HAIR of the body brown; the limbs and tail black; the belly and inside of the arms white; a black band on the forehead; the top of the head greenish-yellow; the tufts of the cheeks straw-coloured; a white spot on each side near the insertion of the tail.

THE EARS and HANDS flesh-coloured.

INHABITS Africa.

This Guenon, according to Buffon, F. Cuvier, and others, is playful, gentle, and affectionate; yet an adult specimen, preserved in the Gardens of the Zoological Society of London, deserved no such good character, but showed, on the contrary, a temper as capricious and savage as any of its tribe.¹

The name Mona appears to be of Arabic origin, and is applied by the Moors of Barbary to all Apes with long tails. This Guenon is about a foot and a half in length; and seems to thrive well in our climates.

The head is small and round; the muzzle thick and short; the eyelids, nose, and lips, naked and flesh-coloured; the intervals of the eyes blueish. The top of the head is of a bright greenish-yellow, resulting from the intermixture of hairs which are wholly black at the points, afterwards of a greenish-yellow beneath the black, and finally of an ash-colour near their roots. The back and sides are of a bright brown, speckled with black; above the limbs, thighs, and the top of the tail, of a pure slate-grey passing into black. The breast, belly, and the inner surfaces of the limbs, are of a dazzling white. The cheek-tufts are straw-coloured, mixed with black points; a black marginal band commencing from the centre of the forehead extends on each side to the ear, and is thence prolonged down the shoulders and fore-arms. Two very white spots appear on each side of the tail above the thighs. The hair surrounding the callosities is reddish; the tail is black, and arched forwards over the back; the palms of all the hands are naked and brown, the nails short, black, and flattish.

The Varied, Spotted, Moustache, Vaulting, Winking, and Diadem Guenons, constitute a group of small and agreeable Monkeys.

10. CERCOPITHECUS DIANA.—SPOTTED GUENON.

- Syn.* LE ROLOWAL.—Cuv. Reg. Anim. I. 92.
 EXQUIMA².—Marcgr. Brasil, p. 227.
 CERCOPITHECUS DIANA.—Geoff. Ann. Mus. XIX. 96.—Desm. Mam. p. 60.
 SIMIA DIANA.—Linn. Gmel. I. 32.—Fisch. Syn. Mam. 19.
 SIMIA ROLOWAL.—Fisch. Syn. Mam.
 SPOTTED or DIANA MONKEY and PALATINE MONKEY.—Shaw, Gen. Zool. I. 37 and 38.—Penn. Syn. and Quadr.
Icon. LA DIANE.—Audeb. Sing.
 Buff. Hist. Nat. Suppl. VII. pl. 20.

SPECIFIC CHARACTERS.

THE HAIR dark slate-grey, spotted with white above; white beneath; the crupper of a purplish-red; inside the thighs orange.

THE FACE surrounded with white. The Beard whitish, long, and scanty.

INHABITS Guinea.

Linnæus assigned the name of *Diana* to this Guenon, from the fancied resemblance of the crescent-shaped hairs ornamenting its brow to the ancient representations of that goddess. Mr Bennett describes the specimen in the Gardens of the Zoological Society of London as "one of the most graceful and good-tempered of its tribe. Like the greater number of them, its disposition is more mild and pliant in youth than after it has attained its full maturity. It is fond of being caressed, and nods and grins with peculiar expression when pleased; but, after a certain age it becomes more sedate, and seldom indulges in those antics." Gardens and Menagerie, Vol. i. p. 36.

The body is rather slender; the head elongated; the face triangular and black; the ears rather small and round; the hair on the top of the head short and black, with a border formed of stiffer hairs than the rest, in which some are pure white. The cheek-tufts rather long; a white pointed beard, about two inches in length, and scanty, appears behind a small brownish black spot at the tip of the chin. The sides of the head and neck as far as the ear, the breast, and the interior surfaces of the limbs, are white; the hinder part of the head and neck, the shoulders, sides, the external surface of the arms, and the upper parts of the thighs, are covered with dark hairs, annulated with yellowish-white, which gives them a greenish tinge. A purplish-red patch, in the form of an isosceles triangle, beginning about two-thirds the length of the back, extends down to the loins for a base; the anterior hands are black, as well as all the hinder limbs, with the exception of the fore part of the thigh, which is divided by a narrow and oblique band of white hairs reaching from the base of the tail to the knee. The insides of the thighs are orange, the circle round the callosities white.

11. CERCOPITHECUS CEPHUS.—MOUSTACHE GUENON.

- Syn.* LE MOUSTAC.—Cuv. Reg. Anim. I. 92.
 CERCOPITHECUS CEPHUS.—Geoff. Ann. Mus. XIX. 20.—Desm. Mam. 57.
 SIMIA CEPHUS.—Fisch. Syn. Mam.
 MOUSTACHE MONKEY.—Penn. Syn. and Quadr.—Shaw, Gen. Zool. I. I, 44.
Icon. Le Moustac.—Audeb. Sing.
 Moustac mâle.—Geoff. et F. Cuv. Hist. Mam.
 Buff. Hist. Nat. XIV. pl. 39.

SPECIFIC CHARACTERS.

THE HAIR greenish-brown above, greenish-grey upon the limbs, with a slight tinge of yellow; dark-grey beneath.

THE FACE blueish-black, tending to black near the lips.

THE TAIL grey near the insertion; elsewhere orange-red.

THE UPPER LIP with a white moustachio.

INHABITS Guinea.

The habits of this species, so remarkable for the singular ornament on the upper lip, are not far different from others of its congeners. It is mild in captivity; and specimens vary greatly in size.

The body is rather slender; the head round; the muzzle slightly elongated; the nose projecting at its origin between the eyes; the face of a blueish black; the upper lip with a white moustachio; the circle of the mouth covered with black hair; the upper part of the head and body, and the external surface of the limbs, are of a brown, speckled with green, resulting from the manner in which the hairs of these two colours are interspersed; a white spot before each ear, and near the eyes; the hair greyish-brown at the base of the fore-limbs, darkening towards their extremities; the hinder hands not so deep as the others; beneath the chin of a dirty white, blending into the dark grey beneath the belly; the internal surface of the arms and thighs of a uniform grey; the tail brown at its base, blending into an orange-red, which is the colour of its latter portion.

¹ The Gardens and Menagerie of the Zoological Society Delineated. By E. T. Bennett. London, 1835, vol. i. p. 40.

² The figure in Marcgravius connected with the description of the *Exquima* is that of an Ouarine Howler, while the figure of the *Exquima* refers to the description of the Ouarine or Guariba Howler. This transposition has occasioned many errors in their synonyms.—*Note of the Baron Cuvier.*

12. CERCOPITHECUS PETAURISTA.—VAULTING GUENON.

- Syn.* L'ASCAGNE.—Cuv. Reg. Anim. I. 93.
 CERCOPITHECUS PETAURISTA.—Geoff. Ann. Mus. XIX. 95.—Desm. Mam. p. 59.
 SIMIA PETAURISTA.—Linn. Gmel. I. 35.—Fisch. Syn. Mam. 18.
 VAULTING MONKEY.—Shaw, Gen. Zool. I. 1, 51.
Icon. Ascagne, femelle.—Geoff. et F. Cuv. Hist. Mam.
 LE BLANC-NEZ.—Audeb. Sing.—Ménag. du Mus.
 L'Ascagne.—Audeb. Sing. (var.)

SPECIFIC CHARACTERS.

THE HAIR greyish or greenish-brown above; grey beneath; the upper part of the nose black; the lower white; a white tuft before each ear.

THE FACE covered with black hair; sometimes naked and violet blue; always flat.

THE UPPER LIP with a black moustachio.

INHABITS the Coast of Guinea.

This interesting little animal is one of the smallest and most docile species of the genus. It is at once recognised by the white patch on its nose, consisting of smooth, short, and closely set hairs. It is lively, and active in its manners, and generally good-tempered in its disposition. A specimen in the Gardens of the Zoological Society of London was by no means familiar, appearing particularly anxious to conceal its face, crying out and kicking with all its might when handled for the purpose of examination.

The head is round; the ears large; the hair of the forehead and cheeks rather short. The top of the head, the upper part of the neck, the back, the sides, and the external surfaces of the limbs, are covered with hair of a dark brown, sometimes with yellow and grey intermixed; the lips naked and brown, covered with scattered hairs; the root of the nose between the eyes black; a white spot upon the nose, formed of very thick and short hairs, cut off horizontally on its upper part, and bordered beneath by the nostrils. The under part of the neck and the sides of the head are white, sometimes tinged with yellowish, which is prolonged towards the breast and belly, where a reddish tinge sometimes prevails. The inner surfaces of the limbs are of a whitish-grey. The hinder limbs and hands are more grey than those before, and without any greenish tinge. The tail is of a dirty white beneath, separated by a line from the greenish-brown of the upper part; the anterior hands are black. Its usual length is from ten to twelve inches, and that of the tail is usually 15 to 18 inches, though it commonly wants some of its vertebrae.

There is a variety of this species with the face naked and of a blueish-violet, figured by Audebert under the name of L'Ascagne.

13 CERCOPITHECUS NICTITANS.—WINKING GUENON.

- Syn.* LE HOCHÉUR.—Cuv. Reg. Anim. I. 93.
 CERCOPITHECUS NICTITANS.—Geoff. Ann. Mus. XIX. 95.—Desm. Mam. 58.
 SIMIA NICTITANS.—Linn. Gmel. I. 33.—Fisch. Syn. Mam. 18.
 WINKING MONKEY.—Penn. Quadr. and Shaw, Gen. Zool.
Icon. Le Hocheur.—Audeb. Sing.
 Hocheur.—Geoff. et F. Cuv. Hist. Mam.
 GUENON À NEZ BLANC PRO-EMINENT.—Buff. Hist. Nat. Suppl. VII. pl. 18.

SPECIFIC CHARACTERS.

THE HAIR black or brown, speckled with white.

THE NOSE prominent and white, in the middle of a blueish-black face.

INHABITS Guinea.

In respect to its form, proportions, habits, and disposition, this Guenon approximates nearly to the Spotted Guenon (10) already described.

The Winking Guenon is about eighteen inches in length, and the tail twenty-eight. The naked parts of the face and ears are blueish-black, the eyelids flesh-coloured, the hands entirely black, and the skin of the body white, slightly tinged with black. On the naked parts of the face only a few isolated dark hairs are to be seen. But the nose is entirely covered with short and thick hair, black between the eyes, and of a fine white throughout the rest of its length. The head and upper parts of the body, as well as the cheek-tufts, are black, speckled with yellowish hairs. The sides are black, speckled with white; the breast brownish-white. The neck, limbs, and tail, are entirely black, and a black line separates the cheek-tufts from the rest of the face. On the lower jaw, on the inner surface of the thighs, and under the arms, the hair is grey. These colours are formed for the most part by hairs which are grey at their base, and annulated with black and yellow, or black and white through the remainder of their length.

These last five species (9, 10, 11, 12, and 13) are small, and prettily varied in their colours. They are very mild in their manners, and are common in Guinea.

14. CERCOPITHECUS DIADEMATUS.—DIADEM GUENON.

- Syn.* LE GUENON À DIADÈME.—Isid. Geoff. in Belang. Voy.
 SIMIA LEUCAMPYX.—Fisch. Syn. Mam.
 SIMIA DIANA.—Desmoulins in Dict. Clas. d'Hist. Nat. VII. 565.
Icon. Diane femelle.—Geoff. et F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR of the body and cheeks greenish-grey, speckled with black; a whitish band like a crescent across the forehead; the tail speckled with white; elsewhere black.

INHABITS the Western Coast of Africa.

This Guenon was figured and described by M. Fred. Cuvier as a variety of the C. Diana. It is, however, very different from the Spotted Guenon (10), as may be readily perceived on comparing their descriptions.

A specimen of this animal lived for many years at the Paris Menagerie. On its first arrival, the upper part of the neck, shoulders, arms, fore-arms, neck, breast, belly, and tail, were uniformly black, but not of so deep a tint as in the lower parts of the body; the back and sides were speckled with black and white, the hairs having small alternate rings of black and white. The cheek-tufts were speckled also with black and white, and a slight tinge of yellow might be remarked in the white band, shaped like an inverted crescent upon the forehead, just above the eyes. Yellow hairs could be discovered only under the callosities, and very few in number. The entire face was of a violet colour, of which the blue predominated upon the cheeks, while the red seemed concentrated upon the muzzle and eyelids. The hands were entirely black, and the eyes of a brownish-yellow. In the course of a few years, the general distribution of these colours did not change, but the white rings of the hairs on the back became yellow, and this colour had increased upon the cheek-tufts. The hair which covered the internal surface of the thighs became varied with grey and white rings, which gave these parts a mild grey appearance, and the hairs of the tail were covered with similar rings, but the grey had almost become black. The entire coat of the animal was very thick on the upper part, and thin beneath, where the skin, as well as on the remainder of the body, had a violet tinge.

15. CERCOPITHECUS PYRRHONOTUS.—EHRENBERG'S GUENON.

- Syn. et Icon.* LE NISNAS mâle.—Valenciennes in F. Cuv. et Geoff. Hist. Mam.
 DER NISNAS.—Ehrenb. Symb. I. pl. X.

SPECIFIC CHARACTERS.

THE HAIR bright red above; white beneath, and on the outside of the limbs.

THE FACE entirely black.

THE SCROTUM bright green.

INHABITS Abyssinia.

This new species was recently discovered by M. Ehrenberg in Abyssinia, and brought to the Royal Prussian Menagerie, near Potsdam. It is known to the inhabitants of Darfoor by the name of Nisnas, and has many relations to the Red Guenon. It appears, however, to be more robust, its muzzle is broader and more obtuse, the tail longer, and the face entirely black, while the Red Guenon (1) is black only on the nose.

It is of a fine brick-red colour upon the body, on the arms, the anterior part of the thighs, and on the tail. This hue becomes feeble, and passes into a straw-colour on the occiput; the forehead is rather of a deeper red than the back; the cheeks white; the naked portion of the face is blackish; the fore-arms, legs, and the hinder parts of the thighs, of a pure white; the palms of all the hands black.

DOUBTFUL SPECIES.

1. C. BARBATUS of Clusius, Exot. p. 371, described by Linn. (Syst. Nat. I. p. 36), is an obscure species, by some referred to C. Diana. It is merely said to be black and brown above, white beneath, the beard white and ending in a point; the tail ending in a tuft.

2. C. HIRCINA.—Shaw, Gen. Zool. I. p. 58. This is the Goat Monkey of Pennant, Quadr. p. 212, described with a blue naked face ribbed obliquely, a long beard like that of a Goat; the whole body and limbs deep brown; the tail long, from a specimen said to be in the British Museum.

3. C. JOHNI.—Fisch. Syn. Mam. p. 25. The hair of a shining black, and bristly, the head greyish-brown. The hairs of the head very spinous, giving the animal a peculiar aspect. It is said to come from Tellichery, in the East Indies. (John. Beschreib. einiger Affenarten in Neuen Schiften der Gesellsch. Naturf. Freunde I. p. 215.)

IMAGINARY SPECIES.

1. *C. AURATUS* (Geoff. Ann. Mus. XIX.) is undoubtedly the same as the *Semnopithecus Pyrrhus* of Dr Horsfield.

2. *C. LATIBARBATUS* (Geoff. Ann. Mus. XIX.) is identical with the *Semnopithecus leucopymnus* of Otto. This is the Purple-faced Monkey of Pennant and Shaw; probably also the Broad-toothed Baboon of the latter.

3. *C. PILEATUS* (Geoff. Ann. Mus. XIX.—Desm. Mam. and others) is identical with the *C. Talapoin* of Buffon. The colours of the specimen described by Geoffroy had become altered by being preserved for a long time in alcohol.

4. *C. ALBO-CINEREUS* (Desm. Mam. Suppl.) We are assured by M. Isidore Geoffroy that no animal was brought from India by MM. Diard and Duvaucel, answering to the description of Desmarest, nor does any *Guenon* from that country exist in the collections of the Paris Museum.

5. *C. ATYS*, figured by Audebert under the name of *L'Atys*, is undoubtedly an Albino variety of some other species, of *Macacus cynomolgus* according to Temminck (Mon. Mam.), or of *Semnopithecus auratus* according to Isidore Geoffroy.

6. *C. FUSILLUS* (Desmoul. in Dict. Class. d'Hist. Nat. Art. Guenon) rests upon three very young specimens, which have since been proved to be merely the young of the *C. erythropygus*, or *Griwet Guenon*.

7. *LA GUENON COURONNÉE* of Buffon (Hist. Nat. Suppl. VII. pl. 16) is a *Macacus*, probably *M. Sinicus*.

GENUS V. NASALIS.—PROBOSCIS-APES.

Syn. *NASALIS* (NASIQUE).—Geoff. Ann. Mus. XIX.—Isid. Geoff. in Bélang. Voy.

SEMNOPIITHEQUES (in part).—Cuv. Reg. Anim.—Temm. Mon. Mam. *SIMIA* (in part).—Fisch. Syn. Mam.

The Proboscis-Apes are included by some Naturalists [among whom is the Baron Cuvier] with the Solemn-Apes; yet when we consider that, besides their remarkable nasal prominence, they differ from the latter in several important points of their organization, it appears advisable to place them in a group intermediate to the *Guenons* and *Solemn-Apes*.

As yet we are acquainted only with one species.¹

I. NASALIS LARVATUS.—KAHAU PROBOSCIS-APE.

Syn. *LE NASIQUE OU KAHAU*.—Cuv. Reg. Anim. I. 94.

NASALIS LARVATUS.—Geoff. Ann. Mus. XIX.—Isid. Geoff. in Bélang. Voy.

CERCOPITHECUS NASICUS.—Lacépède.—Desm. Mam.

SEMNOPIITHECUS NASICUS.—F. Cuv. Mam.

Icon. *SIMIA NASICA*.—Schreb. Säügh. pl. 10 B. and 10 C.

GUENON À LONG NEZ.—Buff. Hist. Nat. Suppl. VII. pl. 11 and 12.

PROBOSCIS-MONKEY.—Penn. Quadr. pl. 104 and 105.

LE KAHAU.—Audeb. Sing.

SPECIFIC CHARACTERS.

THE MUZZLE very short. THE FOREHEAD rather prominent. THE NOSE very broad, excessively elongated, pierced beneath with two enormous nostrils.

THE HANDS pentadactylous; the anterior long, thumbs short.

THE NAILS rather flat, broad and thick on the hinder thumbs.

THE TAIL longer than the body.

THE CALLOSITIES and CHEEK-POUCHES always present.

THE HAIR abundant: yellowish passing to a clear red on the breast, neck, and arms; reddish on the back, and upper part of the head.

INHABITS Borneo, and perhaps also Cochín-China.

This Ape lives in Borneo in numerous troops, which assemble in the morning and evening on the branches of large trees, near the margins of rivers. *Kahau* is its cry. Its nose is excessively long, and projecting in the form of a sloped spatula.

This characteristic nasal prominence distinguishes the Proboscis-Ape from every other mammiferous animal. The nose is between four and five inches in length, narrow at its extremity, and in the middle there is a furrow, which appears to divide it into two lobes. The nostrils, separated by a narrow septum, are large, and open horizontally. They are placed at the very extremity of the nose, which is very much elongated in front, so that they do not adjoin the upper lip. The entire face, as well

as the nose, is wholly destitute of hair, and the skin is of a dark brown, blended with blue and red. The head is round, covered on the top, behind, and on the sides, with a short tufted hair of a reddish-brown. The ears, almost hidden under the hair, are naked, thin, broad, round, and blackish, with a visible slope on their margin. The forehead is low, the eyes rather large, and remote from each other, without eyebrows, and destitute of eyelashes beneath, while the latter are tolerably long on the upper eye-lid. The mouth is large, and furnished with strong canine teeth; but we are without any minute description of the dentition. The body is massive, and covered with a reddish-brown, more or less deep upon the back and sides, tending towards orange-red on the breast. It is of a yellow mixed with grey on the abdomen, thighs, and arms. On the chin, and over the neck and shoulders, the hair is much longer than on any other part of the body, and contrasts remarkably with the dark and naked skin of the face. The tail is very long, furnished with short yellowish hairs; the hands and feet are naked within, and covered externally with short yellowish hairs, mixed with grey. All the nails are black, those of the thumbs are flat, the remainder convex.²

The colour of these animals varies with their age. Their height is rather above three feet.

IMAGINARY SPECIES.

1. *N. INCURVUS* (Vigors and Horsfield, Zoological Journal, No. 13) rests upon the examination of a single specimen, which would appear to be merely a young individual of *N. larvatus*.

GENUS VI. COLOBUS.³—THUMBLESS-APES.

Syn. CERTAINES GUENONS SANS POUCE.⁴—Cuv. Reg. Anim. I. 93.

COLOBUS.—Illig. Prodr.—Geoff. Ann. Mus.

LES COLOBES.—Temm. Mon. Mam.

SIMIA (in part).—Linn. Gmel.—Fisch. Syn. Mam.

GENERIC CHARACTERS.

THE MUZZLE short. THE FACE naked.

THE ANTERIOR HANDS tetradactylous, the THUMBS being wanting.

THE HINDER-HANDS pentadactylous; the thumbs placed very remote from the fingers.

THE TAIL long and slender, with a tuft at the end.

THE CALLOSITIES and CHEEK-POUCHES always present.

THE LAST MOLAR of the lower jaw with five tubercles.

INHABITS Africa.

This genus, now consisting of three species,⁵ is admitted by several Naturalists with some doubt. In respect to the form of their cranium, and the characters of their dentition, they exactly resemble the *Solemn-Apes*; and the peculiarity of their anterior hands merely arises from the want of the last phalanx and nail of the thumb, which is very short in the genus *Semnopithecus*. They bear the same relation to the Apes of the Old World as most of the *Ateles* to the other Apes of America.

I. COLOBUS COMOSUS.—ROYAL THUMBLESS-APE.

Syn. *COLOBUS POLYCOMOS*.—Geoff. Ann. Mus. XIX.—Desm. Mam.

SIMIA COMOSA.—Shaw, Gen. Zool.

ATELES COMATUS.—Geoff. Ann. Mus. VII. 273.

SIMIA POLYCOMOS.—Fisch. Syn. Mam.

Icon. FULL-BOTTOMED MONKEY.—Penn. Quadr. pl. 46.

GUENON À CAMAILL.—Buff. Hist. Nat. Suppl. VII. pl. 17.

Schreb. Säügh. pl. 10 D.

SPECIFIC CHARACTERS.

THE HAIR of the head light yellow mixed with black, very long, and hanging down upon the back and shoulders; elsewhere black.

THE TAIL white.

INHABITS Sierra Leone.

This Thumbless-Ape is known to the Negroes of Sierra Leone by the name of *King of the Monkeys*, apparently from the beauty of its coat, and the singular head of hair, resembling a large periwig or a diadem, according to the views of the observer. This hair is much esteemed for various purposes, chiefly ornamental. The face is black; the body and limbs are furnished with a very short and shining hair of a beautiful black, contrasting remarkably with the colour of the crest, which is long and bushy, and of a yellowish tinge mixed with black, and still more so with the tail, of

¹ A second species proposed by Vigors and Horsfield in the Zoological Journal, No. 13, is not admitted by other Naturalists.

² See an excellent description of the Proboscis-Ape by the Baron Wurm, in the Verhandl. van het Batav. Genootsch. III. p. 145 (Memoirs of the Batavian Society).

³ *Colobus*, from *κολοβος*, mutilated.

⁴ Pennant describes certain thumbless *Guenons* (*Simia polycomos* and *Simia ferruginea*), of which Illiger has formed his genus *Colobus*, but not having yet been able to see them, I avoid noticing them in the text. M. Temminck assures us that they resemble the genus *Semnopithecus* in respect to their cranium and teeth.—*Note of the Baron Cuvier*.

⁵ Geoffroy-St.-Hilaire (Ann. Mus. XIX.) was only aware of the two species described by Pennant. Kuhl (Boitr.) admitted three, one of which is altogether nominal. Desmarest followed Kuhl, but doubted the reality of *Colobus ferrugineus*. Temminck confirmed the existence of *C. ferrugineus*; and finally, Ruppell discovered a third species, the description of which is here presented for the first time to the British reader.

a snowy whiteness, and terminating in a large tuft of hair. This animal is rather more than three feet in height when standing erect. Its limbs are very slender.

2. COLOBUS FERRUGINEUS.—BAY THUMBLESS-APE.

Syn. SIMIA FERRUGINEA.—Shaw, Gen. Zool.—Fisch. Syn. Mam.
COLOBUS FERRUGINOSUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
COLOBUS TEMMINCKII.—Kuhl Beitr.—Desm. Mam.
BAY MONKEY.—Penn. Quadr.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dark bay on the back, light bay beneath and on the cheeks, black on the top of the head, and on the limbs.

THE TAIL black.

INHABITS Sierra Leone.

This animal, first described by Pennant along with the preceding, was conjectured by Buffon, Lacepède, and Desmarest, to be merely a variety of the Royal Thumbless-Ape (1); its specific reality has, however, been recently proved by M. Temminck, as well as its identity with *Colobus Temminckii*.

3. COLOBUS RUPPELII.—MANTLED THUMBLESS-APE.

Syn. et Icon. COLOBUS GUEREZA.—Rupp. Neue Wirbelth.¹

SPECIFIC CHARACTERS.

THE HAIR of the body, face, top and hinder part of the head and limbs, black; the chin, neck, side of the head, and margin of the forehead, white; a mantle of long white hair, hanging from the shoulders, sides, and crupper, covering the thorax, loins, and thighs.

THE TAIL with the first half black, ending in a long white tuft.

THE CALLOSITIES black, edged with white.

INHABITS Abyssinia.

The Mantled Colobus² is found in small families on the loftiest trees usually in the neighbourhood of running water. It is active, lively, and taciturn, generally of a harmless disposition, and not inflicting those depredations upon the cultivated fields so common among the other Apes. Its food consists of fruits, grain, and insects; during the whole day, it is occupied in seeking its food, at night it sleeps on the trees. The agility of this Ape is great. Ruppell witnessed downward leaps of forty feet in height. The Thumbless-Ape of Abyssinia is found only in the low grounds of the Provinces of Godjam, Kulla, and especially in Damot. The natives of the last named place hunt these animals regularly at stated periods, and the singular mantle is considered among them as a mark of distinction, and worn as an ornament upon their leathern bucklers. Guereza is the name by which this Ape is known to the Abyssinians.

The face, eyes, top of the head, neck, the interseapular region, shoulders, breast, abdomen, the first half of the tail, the limbs, and feet, are of a beautiful velvet black. The edge of the forehead, the temporal region, the side of the neck, chin, and throat, are of a snowy whiteness, as is also the singular mantle composed of long silky hairs, extending from the shoulders and sides of the body upon the chest, abdomen, and haunches. There is likewise a white margin round the black callosities of the buttocks. The hinder half of the tail is very bushy and white. Each hair is marked with several grey rings, which gives it a silvery grey appearance. On the hands and face, white hairs are mixed upon a dark ground. The hair above the head is long and soft to the touch; the white hair on the sides of the body, forming the mantle, is more than a foot in length. The callosities, the soles of the feet, and nails, are black; each nail is rather long, convex, and compressed. The colours of the sexes or of the young do not vary; but in the young females, the hair of their mantle is rather shorter. The length of the adult from the point of the nose to the base of the tail is³ two feet and a half; and the tail is as long as the body.

IMAGINARY SPECIES.

1. C. TEMMINCKII (Geoff. Ann. Mus. XIX., and Desm. Mam.), resting upon a single specimen in Bullock's Museum, now in the possession of M. Temminck, is identical with *C. ferruginea* according to the latter.

GENUS VII. SEMNOPITHECUS.³—SOLEMN-APES.

Syn. LES SEMNOPITHÈQUES.—F. Cuv.⁴ Dents des Mam. p. 14.—Cuv. Reg. Anim. I. 93.

SEMNOPITHECUS.—Desm. Mam. Suppl.—Isid. Geoff. in Bélang. Voy. LASTOPYGA, and CERCOPITHECUS (in part).—Illig. Prodr.—Desm. Mam. PYGATHRIX and CERCOPITHECUS (in part).—Geoff. Ann. Mus. XIX. SIMIA (in part).—Linn. Gmel. I.—Fisch. Syn. Mam.

GENERIC CHARACTERS.

THE MUZZLE very short. THE NOSE scarcely projecting.

THE LIMBS long. THE BODY slender and elongated.

THE TAIL very long.

THE HANDS pentadactylous; the anterior narrow and very long, with the anterior thumbs very short.

THE CALLOSITIES always present.

THE CHEEK-POUCHES rudimentary or altogether wanting.

THE HAIR very long and abundant.

THE LAST MOLAR of the lower jaw with five tubercles.

INHABIT the East Indies.

The Solemn-Apes differ from the Guenons in having a small additional tubercle in the last molar tooth of the lower jaw. They are peculiar to the Oriental countries, while their elongated limbs, and especially their very long tail, give them a singular air. Their muzzle scarcely projects more than in the Gibbons, and they are equally provided with callosities. Further, they appear to be almost destitute of cheek pouches. Their larynx is supplied with a sac.

Eleven species⁵ compose this natural group, first instituted by M. Frédéric Cuvier, after a careful examination of the Entellus Solemn-Ape (2).

The dentition of all the species has not yet been carefully verified. That of the Negro Solemn-Ape (5) exhibits the following peculiarities: In the upper jaw, the first two incisors are nearly of the same size and form. The canine following them immediately afterwards is slightly longer, terminating in a point, and presenting on its internal border a strong worn-down surface, which renders its margins trenchant in some degree. The first and second false molars usually exhibit a point on their external and an oblique plane on their internal surface. The three following molars are each composed of four tubercles formed by a very deep transverse furrow, and a longitudinal furrow which is less deep than the former, and cuts it at right angles. These three teeth are nearly of the same size. In the lower jaw, the two incisors are similar to, though slightly broader than, those of the opposite jaw. The canine is pointed and slightly stronger than the opposite one, and also presents a single oblique plane on its internal surface. The first false molar is usually composed of a single obtuse point, though sometimes we may remark a small heel behind the point. The second false molar resembles the first, its crown being merely somewhat flatter. Of the two real molars which follow, the first is the smaller, and both of them are composed of four tubercles, resembling those in the opposite jaw, already described. Lastly, the third molar, which is the largest, besides its four tubercles, has a fifth, in the form of a heel at the hindermost part.

The Solemn-Apes are remarkable for mildness of disposition, great intelligence, and a slowness of motion quite opposed to the vivacity and petulance of the Guenons. It is in India, and chiefly in the islands of the Indian Archipelago, that these animals are found in great numbers. They are treated by the natives with a kind of religious veneration, which they probably owe to the mildness of their manners and the gravity of their deportment. Some of the animals composing this genus have been for a long time confounded with the Guenons; but the most of them are only very recently discovered. The anatomical investigations of Dr A. W. Otto (Nov. Act. Acad. Cur. XII.)⁶ have proved that in one species at least (9) the stomach is more than three times as large as in the Guenons, and that it differs from theirs equally in its structure, its form, and volume. The left portion forms a broad cavity, while the right is narrow, and convoluted so as perfectly to resemble an intestine, and the entire organ is so very considerable, that its whole curvate measures not less than two feet and three or four inches. It further resembles an intestine from being fixed by two well marked muscular bands, one placed along each portion, and as these bands are much narrower than the stomach itself, the walls of that organ usually expand and form, as in the colon, an

¹ RUPP. NEUE WIRBELTH.—Neue Wirbelthiere zu der Fauna von Abyssinien gehörig, von Dr Edward Ruppell. Frankfurt am Main, 1837.

² Ludolphus (Ætliop. l. c. 10) notices this Ape under the title of "Animalium e genere eorum, quæ Hollandi Sanguinem vocant." His indifferent figure is erroneously referred by Erxleben (Syst. p. 57) to the Hapale Jacchus.—Salt appears to have seen a fragment of the Skin (Travels in Abyssinia, Appendix, p. 41); and Bennett mistook it for the Colobus comatus.

³ Semnopithecus, from *σέμνος*, *semnos*, *solemn*, and *πίθηξ*, *pithēx*, an ape.

⁴ F. CUV. DENTS DES MAM.—Des dents des Mammifères considérées comme caractères Zoologiques, par M. F. Cuvier. Strasbourg et Paris, 1825.

⁵ Only six species, in addition to *Nasalis larvatus*, were known to the Baron Cuvier. Temminck admits the number stated in the text. The lists of British Systematic writers are very defective in respect to this genus, in no instance extending beyond six species.

⁶ NOV. ACT. ACAD. CUR.—Nova Acta Physico-Medica Academiae Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum—1757 et seq. Dr Otto's Memoir will be found in Vol. XII. published in 1825.

uninterrupted course of spacious compartments, tied by small muscular fibres, which gradually lose themselves transversely between the muscular bands.

Other species of *Semnopithecus* have more recently been dissected by Professor Duvernoy of Strasbourg, who finds their stomachs equally voluminous and remarkable in their form, though slightly different from those already described.

These animals are said to feed chiefly on leaves; a kind of provision for which the structure of their stomach appears specially adapted, in some respects approaching to that observed in the Ruminantia. Their cheek-pouches are so small, that they can hardly be said to exist.

1. SEMNOPITHECUS NEMÆUS.—COCHIN-CHINA SOLEMN-APE.

- Syn.* LE DOUC.—Cuv. Reg. Anim. I. p. 93.
 PYGATHRIX NEMÆUS.—Geoff. Ann. Mus. XIX.
 LASIOPYGA NEMÆUS.—Illig. Prodr.—Desm. Mam.
 SIMIA NEMÆUS.—Linn. Gmel. I. 34.
 SEMNOPITHECUS NEMÆUS.—F. Cuv. Mam.—Geoff. Cours.—Isid. Geoff. in Bélang. Voy.
 COCHIN-CHINA MONKEY.—Penn. Quadr.—Shaw, Gen. Zool.
Icon. Le Douc.—Audeb. Sing.
 Douc femelle.—F. Cuv. et Geoff. Hist. Mam.
 Buff. Hist. Nat. XIV. pl. 41.

SPECIFIC CHARACTERS.

THE HAIR of the body, upper parts of the head and arms, of a slate-grey, faintly dotted with black; the fore-arms, throat, tail, and a triangular space on the rump, pure white; the thighs, fingers, and backs of the hands, black; the thighs and tarsi of a bright red; the face light orange; a red and black collar more or less complete round the neck; tufts of yellowish or whitish hairs on the cheeks.

INHABITS Cochin-China.

This species, known long previously to any of the remainder, is remarkable for the bright and varied colours of its hair.

M. Diard brought several specimens from Cochin-China to Europe, of different ages and sexes, thereby proving that they do not undergo any considerable variation, and at the same time correcting the error of Buffon and Daubenton, who refused callosities to this species.¹ The length of the adult is about two feet three inches, exclusive of the tail; but unfortunately we are as yet wholly unacquainted with its habits and manners.

2. SEMNOPITHECUS ENTELLUS.—ENTELLUS SOLEMN-APE.

- Syn.* L'ENTELLE.—Cuv. Reg. Anim. I. p. 94.
 CERCONITHECUS ENTELLUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SEMNOPITHECUS ENTELLUS.—F. Cuv. Mam.—Geoff. Cours.—Isid. Geoff. in Bélang. Voy.
 SIMIA ENTELLUS.—Dufresne, in Bulletin de la Société Philomatique for 1797.—Fisch. Syn. Mam.
Icon. L'Entelle (young).—Audeb. Sing.
 Entelle mâle (young).—L'Entelle vieux (adult).—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE ADULT.

HAIR of the body yellowish-grey, mixed with black hairs on the back and limbs; straw-yellow, approaching to orange, on the sides; black hairs on the eyebrows directed prominently forwards; the tail almost black.

THE YOUNG.

HAIR of the body nearly white, interspersed with black and yellowish hairs; a white beard directed forwards.

THE FACE and HANDS naked. THE SKIN bluish-black.

INHABITS Hindoostan.

This species, along with some others, is especially venerated in the religion of the Brahmans.

It bears with them the name of Houlman, and holds a very respectable place among at least thirty thousand divinities. Towards the end of the wet season it becomes very plentiful in Bengal. The pious votaries of Bramah permit their gardens to be wasted, and their tables stripped

before their eyes, by herds of Entellus Monkeys, while the visits of the latter, though doubtless inconvenient, are always regarded as a great honour. "From the respect in which the Entellus Monkeys are held by the natives, it appears that, whatever ravages they may commit, the latter dare not venture to destroy them, and only endeavour to sear them away by their cries. Emboldened by this impunity, the Monkeys come down from the woods in large herds, and take possession of the produce of the husbandman's toil with as little ceremony as though it had been collected for their use; for, with a degree of taste which does them credit, they prefer the cultivated fruits of the orchard to the wild ones of their native forests. Figs, cocoa-nuts, apples, pears, and even cabbages and potatoes, form their favourite spoil. The numbers in which they assemble render it impossible for the sufferer to drive them away without some more efficient means than he is willing to employ."²

It will be observed, that a considerable difference exists between the young and the adult in the colour of the hair. In addition to the variations already noticed, the cranium undergoes considerable depression with increasing years; it ceases to have any forehead, and the profile view exhibits merely the arc of a large circle, so greatly do its cerebral contents diminish. These organic changes are followed by a corresponding variation in the intellectual character. The young Entellus exhibits an astonishing degree of penetration in perceiving the qualities of objects, a great susceptibility to kind usage, and an invincible propensity to obtain by cunning whatever he is unable to acquire by force. In the adult mildness and apathy resume the place of his former intelligence. The old Entellus is fond of solitude, slow in his movements, alike incapable either of planning or executing any device to obtain his object.

The Entellus Solemn-Ape, as well as the Simpai (3) and the Negro (5), possesses a sub-guttural pouch, which communicates with the larynx. Its cheek-pouches, if not altogether wanting, are at least very slightly developed. The cæcum is long and capacious; the liver composed of unequal lobes; the right lung has four lobes, while the left has only three. Owing to the great length of its limbs, and especially of the hinder, and the general proportions of the body, it appears well adapted for making prodigious leaps.

The specimen brought by Thunberg died on its passage homewards, and those lately in the Paris and London Zoological Gardens being unable to endure the rigour of our climate, have not long survived.

3. SEMNOPITHECUS MELALOPHUS.—SIMPAL SOLEMN-APE.

- Syn.* LE CIMEPAYE.—Cuv. Reg. Anim. I. 94.
 SIMIA MELALOPHOS (SIMPAL).—Raffles, in Linn. Trans. XIII. 245.—Fisch. Syn. Mam.
 SEMNOPITHECUS MELALOPHUS.—Desm. Mam. Suppl.
Icon. Cimépaye (young).—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR of a very bright reddish-brown above; whitish beneath; a crest with black hairs intermixed on the upper and hinder parts of the head.

THE FACE and EARS bluish. THE HANDS black.

INHABITS Sumatra.

The Solemn-Ape, called *Simpai* by the Malays, from its cry, was first described by our distinguished countryman Sir Thomas S. Raffles, from specimens procured for him in the woods near Bencoolen by MM. Diard and Duvaucel. It is not less remarkable for its colours than for the peculiar shape of the face. The hair is very long, silky, and of a brilliant reddish-brown on the back, sides, neck, tail, the outer surfaces of its limbs, the backs of the hands, the forehead, and cheeks. The chest, abdomen, and the inner surfaces of the limbs, are whitish; a circle, or rather a crest, of black hairs intermixed with brown cover the upper and hinder parts of the head, and a few scattered black hairs may also be seen along the back and upon the shoulders. The face is bluish as low as the upper lip; both lips and chin are flesh-coloured. The eyes are brown, the ears bluish, like the face; the hands are black beneath, and so are the callosities. The hairs of the cheeks, directed backwards, form cheek-tufts; the abdomen is almost naked; and the hair on the inner surfaces of the limbs is very scanty when compared with that on the remainder of the body. The length of the animal, exclusive of the tail, is about one foot seven inches, and the tail is long and tapering, exceeding thirty inches. The line of the face may be noticed as singularly straight and perpendicular, at least in the young.

¹ The genus *Lasiopyga* (from *λασιος*, *lasios*, hairy, and *πυγή*, *pygē*, anus) was instituted by Illiger, to contain the Cochin-China Solemn-Ape, which Buffon had stated to be destitute of callosities, from the examination of a specimen altered in the stuffing. M. Diard having sent several Cochin-China Apes to the Natural History Museum of Paris, it is now certain that they have callosities. Hence the genus *Lasiopyga* of Illiger, founded upon this error, must be suppressed.—*Note of the Baron Cuvier.*

The above observation applies equally to the genus *Pygathrix* of Geoffroy (*Ann. Mus.*) Sir William Jardine preserves the fictitious genus *Lasiopyga* throughout his volume on the Monkeys in the Naturalist's Library, published in 1833; the error had, however, been corrected by Fred. Cuvier (*Hist. Mam. art. Douc.*) as early as 1825, and again noticed by the Baron Cuvier in the Second Edition of the *Règne Animal*, which appeared in 1829.

² E. T. Bennett after Thunberg (Travels in Europe, Asia, and Africa, Upsal, 1793), and Wolf (Residence in Ceylon, Berlin, 1782).

4. SEMNOPITHECUS COMATUS.—CRESTED SOLEMN-APE.

- Syn.* LE CROO.¹—Cuv. Reg. Anim. I. 94.
 SIMIA CRISTATA (CHINGKAU).—Raffles, in Linn. Trans. XIII. 244.
 PRESBYTIS MITRATA.—Eschscholz, in Kotzeb. Voy. III. p. 353.
 SIMIA COMATA.—Fisch. Syn. Mam.
Icon. Croo.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE ADULT.

THE HAIR of the body iron-grey above; white beneath, and along the under surface of the tail; long black hairs, forming an elevated crest, on the top of the head.

THE YOUNG.

THE HAIR of a reddish fawn colour.

INHABITS Sumatra.

The Crested Solemn-Ape, which is identical, according to Temminck, with the *Presbytis mitrata* described in Kotzebue's Voyages, occurs frequently in the forests near Bencoolen, in the Island of Sumatra. It is about two feet in length, and fourteen inches in height, when standing on its four hands; the tail is nearly two feet and a half. The hairs of the crest are long, and diverge round the face. The colour of the young animal contrasts remarkably with that of the adult, being of a reddish fawn.

There is a variety of this species with the hair light grey, or whitish, called Chingkau Puti by the natives.

5. SEMNOPITHECUS MAURUS.—NEGRO SOLEMN-APE.

- Syn.* LE TEHINCOU.—Cuv. Reg. Anim. I. 94.
 SIMIA MAURA (LOTONG).² Raffles, in Linn. Trans. XIII.—Linn. Gmel. I. 39.—Fisch. Syn. Mam.
 CERGOPITHECUS MAURUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SEMNOPITHECUS PRUINOSUS.—Desm. Mam. Suppl.
 NEGRO MONKEY.—Penn. Quadr.—Shaw, Gen. Zool.
Icon. Tehincou.—F. Cuv. et Geoff. Hist. Mam.
 SEMNOPITHECUS MAURUS.—Horsf. Zool. Jav.
 BLACK MONKEY.—Edw. Glean. pl. 311.

SPECIFIC CHARACTERS.

THE ADULT.

THE HAIR black, sometimes with a white spot beneath the origin of the tail.

THE YOUNG.

THE HAIR entirely reddish-brown; afterwards varied with black spots. INHABITS Sumatra and Java.

This animal has long been known under the name of LA GUENON MAURE, by which Buffon distinguished it (Suppl. VII.), and was supposed by him to have come from Guinea. The hair, which is uniformly black in the adults, is very scanty on all the inferior parts of the body, and especially on the abdomen. The ears and face are naked, excepting the lips and sides of the mouth, where some white hairs may be observed; the colour of the skin is bluish. The hair on the hands is scanty, the skin of the hands and callosities black. The iris of the eye is of a bright orange-yellow. The hair diverges from the crown of the head, so as to project over the forehead in front, and to form a kind of crest behind. According to Raffles, it is not easily tamed.

The young, instead of being black, are at first reddish-brown, and it is not until they have cast their hair that they gradually assume the dark hue of the adult.

6. SEMNOPITHECUS FLAVIMANUS.—YELLOW-HANDED SOLEMN-APE.

- Syn.* LE SEMNOPITHÈQUE AUX MAINS JAUNES.—Isid. Geoff. in Bélang. Voy.
Icon. SEMNOPITHECUS FLAVIMANUS.—Less.³ Cent. Zool. pl. 40.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown above, white beneath; a tuft of long grey hairs above, and on the back of the head; hands of a clear yellow.

INHABITS Sumatra.

In form this Solemn-Ape approaches nearly to the Simpai (3), but is sufficiently well characterized by the colour of the hands. The upper part of the body is of a clear reddish-brown in which black hairs are intermixed; the dark hairs are much less abundant on the sides, and consequently the reddish tint becomes much more pure. The inner surface of the arms is of the same whitish tint as the under part of the body; and the under surface of the tail is white throughout the first quarter of its

length, and afterwards reddish, which is the colour of the entire upper surface. The external regions of the hinder limbs, of the fore-arms and hands, are of a fine deep gold-yellow, inclining to red upon the thighs and fore-arms, and very pale upon the fingers. The internal surface of the limbs, beneath the body and head, as well as the very long hairs which cross the hinder surface of the cheeks, are white.

This animal is of the same dimensions as the Simpai, but its tail is longer. It has the same remarkable tuft on the head as *S. melalophus* and *S. comatus*, but the forehead, and sides of the head, as far as the ears, are covered with hairs of the ordinary length, of a bright gold-yellow, inclining to red. The hairs in the middle of the crest are, on the contrary, very long, and form a kind of compressed cap. In *S. melalophus* the crest is black, while it is of a dirty white in *S. flavimanus*, with the exception of the anterior part, which is blackish.

The face appears to be blackish, the eyelids white, and the nails brownish.

The specimen, first described by Isidore-Geoffroy and figured by Lesson, was sent from Sumatra by Diard and Duvaucel.

7. SEMNOPITHECUS FASCICULARIS.—KRA SOLEMN-APE.

- Syn.* SIMIA FASCICULARIS (KRA).—Raffles, in Linn. Trans. XIII. 246.
Icon.

SPECIFIC CHARACTERS.

THE HAIR of the back and upper part of the head reddish-brown; the tail and sides of the body grey; lighter beneath, and on the limbs.

THE FACE brown, covered with short grey hairs.

INHABITS Sumatra and the Malay Islands.

These animals, for our knowledge of which we are indebted to Sir T. Stamford Raffles, occur very frequently in the forests of the Malay Islands in large companies. Their name is derived from their cry; they are not easily tamed.

The body is about twenty inches in length, and the tail rather more. The cheeks are furnished with light grey tufts much longer than the beard. The eyelids, particularly the upper ones, are white; the eyes are brown, the eyebrows prominent, and the muzzle projecting. The nose is prominent between the eyes and flat at its point, where the nostrils open obliquely some way above the lip. The ears are rather round, and pointed obtusely behind.

A whiter variety, with a reddish shade on the back, is distinguished by the natives.

A smaller animal, probably the young of the Kra, is called Kra Buku by the natives. It agrees in most respects with the Kra, but is not more than a foot in length, and occurs very commonly. The head has very little hair on the temples, and it wants the circle round the face.

8. SEMNOPITHECUS CUCULLATUS.—HOODED SOLEMN-APE.

- Syn.* LE SEMNOPITHÈQUE À CAPUCHON.—Isid. Geoff. in Bélang. Voy.
Icon. Bélang. Voy. pl. I. (Mammifères.)

SPECIFIC CHARACTERS.

THE HAIR of the body dark-brown; of the limbs and tail, black; of the head, light brown.

THE TAIL very long.

INHABITS Hindoostan.

This Ape was discovered by M. Leschenault de la Tour, in the mountains of the Ghants. Subsequently M. Bélanger found several individuals in the western Ghants, and Dussumier brought some specimens from Bombay to the Paris Museum.

The upper part and sides of the head, as well as the throat, are yellowish-brown, and, by their clear tint, contrast remarkably with the remainder of the hair, which is dark-brown on the flanks, loins, and thighs; blackish on the medial line of the back, and on the thighs, legs, and arms; while the fore-arms, all the hands, and the tail, are pure black. Beneath the body, and on the internal surface of the arms and thighs, the hair is scanty. The nails are black. The face is mostly naked, as in the other Solemn-Apes, and surrounded by a circle of black bristles, stiff, and tolerably long. On the sides of the face, these bristles are not numerous, and point outwards; while on the forehead the bristles are very abundant, and are more or less directed upwards. This arrangement is found in other Solemn-Apes, and remarkably so in the Entellus. The ears are covered with black hairs, and strike the eye prominently in the middle of the light-brown hairs of the remainder of the head. The length of this animal is about two feet, and the tail is slightly shorter.

¹ The name *Croo* is given by the Malays indiscriminately to certain Apes of Sumatra belonging to the genera *Macacus* and *Semnopithecus*, from their cries. It is written *Erro* by Desmarest, and *Crro* by Desmoulins, but both of these appear to be typographical errors.

² There is some variation in respect to these Malayan names. Raffles calls the *S. comatus* *Chingkau*, and the *S. maurus*, *Lotong*.—*Note of the Baron Cuvier*. We must remark, however, that Raffles always gives the Malayan characters, and he is certainly the best authority.

³ LESS. CENT. ZOOLOG.—*Centurie Zoologique, ou Choix d'Animaux Rares*. Par R. P. Lesson. Paris, 1830.

9. SEMNOPITHECUS LEUCOPRYMNUM.—OTTO'S SOLEMN-APE.

Syn. LE SEMNOPITHÈQUE AUX FESSES BLANCHES.—Isid. Geoff. in Bélang. Voy.
CERCOPITHECUS LATIBARBATUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.

Icon. CERCOPITHECUS (?) LEUCOPRYMNUM.—Otto in Nov. Act. Acad. Cur. XII.
pl. 46 bis.—pl. 47 (skull and stomach).
PURPLE-FACED MONKEY.—Penn. Quadr. pl. 43, fig. 2.

SPECIFIC CHARACTERS.

THE HAIR blackish above; dark brown beneath; top of the head and neck brown; throat, under part of the neck, and hinder parts of the cheeks, yellowish-grey; a triangular whitish patch behind; tail whitish. INHABITS Ceylon.

The animals belonging to this species are said by Pennant to be very harmless, feeding on leaves, or buds of trees, and soon becoming tame. We are indebted to Dr Otto for an excellent figure, accompanied by a most minute description of the anatomical structure, and especially of the remarkable peculiarities of the stomach, which have already been noticed in our general observations upon the Genus Semnopithecus.

The length of the animal is about one foot, eight inches, and of the tail about a foot and a half; the forehead is broad, and the snout projects but slightly, the facial angle being rather more than 60°. The fingers and toes are remarkably slender, and the abdomen appears of very small dimensions. The upper part of the head and neck is of a deep brown; the body and limbs black; the internal surface of the limbs and the under part of the body passing to a blackish brown; the throat, under part of the neck, and hinder part of the cheeks, are covered with long hair of a yellowish-grey; the tail is whitish in the adult. A large triangular patch of greyish-white, commencing on the medial line of the back, about four inches above the origin of the tail, covers the entire of the buttocks, and the upper part of the thighs.

A young specimen, brought from Ceylon by M. Leschenault de la Tour, has lately been added to the Paris Museum.

10. SEMNOPITHECUS VELLEROSUS.—LONG-HAIRED SOLEMN-APE.

Syn. LE SEMNOPITHÈQUE À FOURRURE.—Isid. Geoff. in Bélang. Voy.
Icon.

SPECIFIC CHARACTERS.

THE HAIR of the body black, and very long on the back and sides; throat, side of the head, and tail, yellowish-white; a large grey spot on the buttocks, and on each side near the origin of the tail; the tail whitish. INHABITS

This species, described by Isidore Geoffroy, is of the same size as the Cochin-China Solemn-Ape (1), but very nearly allied both in form and colour to Otto's Solemn-Ape (9). The hair of the limbs and tail is rather short, that of the head is slightly longer, but on the upper part of the body and on the sides it attains the unusual length of five, six, and seven inches. All these hairs are smooth, recumbent, and directed backwards; those beneath the body, on the contrary, are slightly frizzled, and disposed very irregularly.

The body, limbs, and upper part of the head, are of a brilliant black. The throat and lower part of the neck, on the contrary, are covered with hair of a dirty white; but on each side, on the hinder and internal part of the thigh and on the buttocks, we find a large spot of clear grey, passing to a yellow, round the callosities. The hairs composing this spot are mostly of a greyish-white, but a great many black hairs are interspersed. The tail is entirely white.

The above description was obtained from a skin, purchased by Delalande in the Brazils, where it had in all probability been transported from the East Indian Archipelago. Its mutilated state did not permit the colours of the face, hands, fore-arms, and lower part of the legs, to be accurately described.

11. SEMNOPITHECUS AURATUS.—GOLDEN SOLEMN-APE.

Syn. CERCOPITHECUS AURATUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA AURATA.—Fisch. Syn. Mam.

Icon. SEMNOPITHECUS PYRRIUS.—Horsf. Zool. Jav.

SPECIFIC CHARACTERS.

THE HAIR of a uniform golden-yellow above, paler beneath.

INHABITS Java and the Molucca Islands.

This animal, called *Lutung* by the Javanese, agrees with the Negro Solemn-Ape (5) in all respects excepting colour. The tint extending over the upper parts of the animal, and over the exterior of the limbs, is

essentially different from the fulvous tint in the young of the *S. Maurus* before the change of colour to black takes place. The hair is long, soft, and silky; reddish-brown, with a beautiful golden gloss on the back, head, tail, and extremities, varying slightly in its degree of intensity as it approaches the sides and forehead; beneath and along the interior of the extremities it is pale yellowish, with a golden lustre. The long, shaggy and thickly disposed hair, which covers the upper parts, is separated by a regular boundary stretching along the hypochondriac region, from the hair on the abdomen, which is very thickly disposed, curled, silky, and of a very delicate texture.

The specimen described by Geoffroy-St.-Hilaire under the name of *Cercopithecus auratus*, appears to have over the knee-pan a black spot, which is wanting in the Javanese specimen illustrated by Dr Horsfield.

IMAGINARY SPECIES.

1. *S. EDWARDSII* (Fisch. Syn. Mam.), derived from the Middle-sized Black Monkey, figured in Edwards' Gleanings, pl. 311, is probably identical with *S. Maurus*.

2. *S. FULVO-GRISEUS* (Desmoulin, in Diet. Class. d'Hist. Nat.) is founded, according to Isid. Geoffroy, upon two specimens, one of which is a young *S. leucoprymnus*, and the other probably a *S. comatus*.

GENUS VIII. MACACUS.—MACACOS.

Syn. LES MACAQUES et LES MAGOTS.—Cuv. Reg. Anim. I. 94, 96.
MACACUS.—Lacépède.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.
CERCOCEBUS (in part), INUUS, PAPIO (in part).—Geoff. Ann. Mus. XIX.
SIMIA (in part).—Linn. Gmel.—Fisch. Syn. Mam.
GUENON (in part).—Temm. Mon. Mam.

GENERIC CHARACTERS.

THE MUZZLE large and rather elongated. THE FACIAL ANGLE about 40°. THE NOSE but slightly projecting.

THE LIMBS robust, of medium length. THE BODY rather short and thick.

THE ANTERIOR THUMBS short. THE NAILS of the thumbs flat, the remainder cylindrical.

THE TAIL, varying in length, sometimes replaced by a simple tubercle.

THE CHEEK-POUCHES and CALLOSITIES always present.

THE HAIR generally abundant on the fore part of the body.

THE LAST MOLAR of the upper jaw, with five, and of the lower jaw, with six tubercles.

INHABIT the East Indies, North of Africa, and the Rock of Gibraltar.

The Macacos¹ resemble the Solemn-Apes in having additional tubercles to their last molars, and the Guenons in their callosities and cheek-pouches. Their limbs are thicker and shorter than those of the first, their muzzle more prominent, and the superciliary ridges more elevated than in either. Though tolerably docile in early youth, they become intractable with age. They all have a sac which communicates with the larynx under the thyroid cartilage, and is filled with air when they cry. The tail hangs down, and takes no part in their movements. They produce at an early age, but are not completely adult until the ages of four or five years. The period of their gestation lasts about seven months, and the females often have, during the rutting season, "des énormes gonflemens aux parties postérieures."² The greater part of these animals are peculiar to the East Indies.

This group has been instituted to contain such Apes as have their characters intermediate to those of the genera Cercopithecus and Cynocephalus. It is by no means a well defined or rigorous division, but blends insensibly into the characters of these adjacent groups. The facial angle in some species becomes as low as 30°, in others above 40°. The muzzle is shorter than that of the Cynocephali, and longer than that of the Cercopithecii, yet the differences, which are considerable with some species, become nearly evanescent in others. In respect to habits and disposition, they are intimately connected with both genera, some of the species being nearly as fierce, destructive, intractable, and lascivious as the Baboons, while others, again, have the volatility and caprice of the Guenons.

The characters of their dentition do not differ materially from those of the Guenons, already described, excepting in respect to the last molars. In the upper jaw, the last molar is terminated by a very small unequal tubercle, accompanied by several small dentatous at its external surface. The canine is rounded, and not flattened at its internal surface, and the

¹ The name *Macaco* is applied indiscriminately to all Monkeys by the Negroes on the coast of Guinea, and the slaves of the West Indian colonies. Maregravius describes a species with *nares clausas bifidas*, and these vague words, adopted solely after him, have remained as one of the characteristics of the *Macaque* of Buffon, although nothing of the kind is to be seen.—*Note of the Baron Cuvier*.

² It was this circumstance which led Aelian to remark that Apes were to be seen in India, afflicted with *prolapsus uteri*.—*Note of the Baron Cuvier*.

external surface exhibits a strongly marked depression. In the lower jaw, the heel of the last molar is composed of two tubercles, the external one, equal in size to the one in front of it, and the internal much smaller. These particulars were drawn from the examination of a *M. Sinicus*, and they appear to belong equally to all the other species of the genera *Macacus* and *Cynocephalus*.

The *Macacos* may be arranged in three sections, depending on the length of the tail; the Long-tailed *Macacos* (*Cercocebes*); the Short-tailed *Macacos* (*Maimons*); and the Tail-less *Macacos* (*Magots*).

(A.) LONG-TAILED MACACOS. (CERCOCEBES.)

The first section contains five species. These approach nearly to the *Guenons*, and many authors have placed them in the same group; others have formed the genus *Cercocebus* by uniting them to some *Guenons* with longer muzzles, and arranged them immediately after the *Guenons*. Indeed, the Long-tailed *Macacos* bear much resemblance to the *Guenons* in their general form. Their muzzle is shorter than in the other sections, the brain more voluminous, the body not so clumsy and massive, the tail is as long or longer than the body, and some are rather mild in their dispositions.

1. *MACACUS SINICUS*.—CHINESE-BONNETED MACACO.

- Syn.* LE BONNET CHINOIS.—Cuv. Reg. Anim. I. 95.
SIMIA SINICA.—Linn. Gmel. I. 34.—Fisch. Syn. Mam.
CERCOCEBUS SINICUS.—Geoff. Ann. Mus. XIX. 98.
MACACUS SINICUS.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.
Icon. Le Bonnet Chinois.—Audeb. Sing.—Buff. Hist. Nat., Suppl. VII. pl. 16.
 Bonnet Chinois.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR of a bright gold-yellow above, white beneath; the face flesh-coloured; the hair on the top of the head arranged in rays, forming a kind of bonnet.

INHABITS Bengal and Ceylon.

The Chinese-Bonneted Monkey, so called from the manner in which the hair diverges on the top of the head, displays the usual disposition of the *Guenons*, exhibiting, when in confinement, a mixture of playfulness and malice extremely amusing. It seems to share the religious veneration of the Hindoos in common with many other Apes.

All the upper parts of the body are of a brilliant gold-yellow, resulting from hairs which are grey at the base, but covered with rings of black and yellow through the rest of their length, in which, however, the yellow rings predominate. The tail is slightly browner; the cheek-tufts, the inner surface of the limbs, the under part of the neck, the breast, and abdomen, are whitish; the hands, feet, and ears, blackish, and its face flesh-coloured; the under-lip only is margined with black. The eyes are brown. The hair of the head appears to hang down in long tufts, rather than to compose a compact bonnet. In the young, this ornament is more divided, and exactly resembles the hair of the next species, to which it is very nearly allied.

2. *MACACUS RADIATUS*.—RADIATED MACACO.

- Syn.* LE TOQUE.—Cuv. Reg. Anim. I. 95.
CERCOCEBUS RADIATUS.—Geoff. Ann. Mus. XIX. 98.
MACACUS RADIATUS.—Desm. Mam. 64.—Isid. Geoff. in Bélang. Voy.
SIMIA RADIATA.—Fisch. Syn. Mam.
Icon. LE BONNET CHINOIS.—Buff. Hist. Nat. XIV. pl. 30?
 Toque Mâle.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR of the head and body greenish-brown above, white beneath; the limbs grey externally; the tail brownish or blackish above, white beneath.

INHABITS the East Indies.

This animal, which occurs most frequently on the Malabar Coast, is remarkable for the singular form of its head and muzzle, and in these respects differs remarkably from all other known *Macacos*. These have the muzzle thick and clumsy, while in the Radiated *Macaco* it is thin and narrow, and the forehead is naked and full of wrinkles. It is further characterized "par la forme du gland de la verge. Chez les autres *Macacos* cet organe est simplement pyriforme; chez les *Toques*, il se compose de trois parties distinctes; l'antérieure, qui est en forme de poire, et le postérieure, formée de deux bourlets épais; de sorte que, dans l'érection la coupe longitudinale de ce gland présenterait la figure d'une feuille à trois lobes, les deux latéraux arrondis, et le moyen allongé."

The hair is silky, and of a greenish-grey, owing to the hairs, which are grey at their innermost half, being divided throughout the remainder of

their length by rings of black and dirty yellow. The diverging hairs on the upper part of the head are not very long, but their radiated form is constant in all the species hitherto examined. The skin of the hands has a violet tinge, that of the face and all other naked parts is flesh-coloured.

3. *MACACUS CYNOMOLGUS*.—COMMON MACACO.

- Syn.* LE MACAQUE DE BUFFON.—Cuv. Reg. Anim. I. 95.
CERCOCEBUS CYNOMOLGUS.—Geoff. Ann. Mus. XIX.
MACACUS CYNOMOLGUS.—Desm. Mam. 65.
SIMIA CYNOMOLGUS.—Linn. Gmel. I. 31.—Fisch. Syn. Mam.
MACACUS IRUS.—F. Cuv. in Mém. Mus. I. IV.
Icon. Macaque mâle, femelle adulte, jeune mâle, tête de femelle d'un jour.
 —F. Cuv. et Geoff. Hist. Mam.
 Buff. Hist. Nat. XIV. pl. 20.—Schreb. Säugth. pl. 13.

SPECIFIC CHARACTERS.

THE HAIR greenish-brown, dotted with black above, whitish beneath; the tail blackish above, ash-coloured beneath.

INHABITS Sumatra and Java.

Though wholly unacquainted with the peculiarities of the Common *Macaco* in its wild state, we are fortunately in possession of many important facts, obtained by M. Frederic Cuvier, from the examination of several living specimens of different ages and sexes, in the Paris Ménagerie. He was thus enabled to record the several phenomena of reproduction, as well as the changes which the young undergo from birth to their mature age.

The adult is rather more than one foot nine inches in length, and the tail about one foot eight inches. Its entire form is heavy and clumsy, especially in the fore part of the body. The head is broad, flattened at the vertex, and very strong in proportion; the muzzle is short and obtuse, the nose flat, and a strong crest, advancing over the eyelids, covers the eyes. The fingers are united by a membrane as low as the second phalanx. The colours of its coat arise from the intermixture of golden-yellow hair, with black, over a greyish ground, from the combination of which it presents a general tint of pale greenish-brown; all the inferior parts are of a light grey, as well as the inner surface of the limbs. The tail is blackish, the feet entirely black, the face flesh-coloured and almost naked. Between the eyes there is a spot much whiter than any of the surrounding parts. The cheek-tufts are composed of short greenish hairs. The head is destitute of any crest or hairy appendage, and the hairs lie flat with their points directed backwards, those of the cheeks are grey, scanty, and directed forwards. The iris is brown. The parts of generation are flesh-coloured, the gland pear-shaped; and the scrotum remarkably large. The canine teeth are long and very strong.

The female is considerably smaller than the male, being only about fifteen inches in length; her form is more compact. The head is smaller, and the superciliary crest, which entirely covers the eyelids, is not nearly so prominent. The canine teeth are small, and do not pass beyond the incisors, and this peculiarity is common to all the females of the genus. The face is surrounded with long grey and straight hairs, giving it a bristly appearance, of which the male is wholly deprived. The hair on the top of the head is directed towards the medial line, and forms rather an elevated crest, extending from the top of the forehead to the occiput. In other respects the female entirely resembles the male.

At birth, the head of the young *Macaco* is rather long in front, compared to its dimensions from right to left; the muzzle projects, but the forehead is straight. The skin is flesh-coloured, excepting between the interval of the eyes, where it is white. All the hairs are black, and appear in greatest plenty on the upper parts of the body; the under parts are nearly naked. The hair at the end of the tail appears long, and terminates in a tuft. On the top of the head it extends from the medial line, pointing obliquely backwards, and, finally uniting in the occiput, forms a kind of crest. It has two pectoral mammae, the callosities are prominent, but are not yet become hard.

In the course of the first year, the muzzle gradually lengthens, and the head becomes narrower, the superciliary crest being still wanting. The incisives appear, and the first canine begins to protrude in the lower jaw. After the first casting of the hair, the greenish hair of the adult succeeds, excepting on the fore-part of the top of the head, and the face is not yet surrounded with those thick hairs which afterwards appear. All its proportions resemble those of the adult, and the interval separating the eyes is always white. In the third year, the young male very much resembles the adult female.

The Common *Macaco* is one of the most untractable animals of the genus, and yields with difficulty to the ordinary methods of taming. It rests either on all the four hands, or upon the callosities, and eats in either

¹ Mém. Mus.—Mémoires du Muséum d'Histoire Naturelle de Paris, par les Professeurs de cet établissement. Paris, 1816, et seq.

of these positions by raising the food to the mouth with the fore-hands, or by seizing it with the mouth itself. Before swallowing it always fills the cheek-pouches, and it drinks by sucking up. When retiring to rest, it sleeps on the side, with the limbs folded up, and the head between the legs, or else in a sitting posture, with the back curved and the head resting upon the breast. Its voice is a hoarse cry, becoming very loud when the animal is enraged, but when pleased it emits a soft kind of whistle. The period of gestation in the female is seven months, "et ses parties de la génération ne paraissent point entourées, à l'époque du rut, de ces exubérances si remarquables, et quelquefois si monstrueuses chez d'autres espèces de Macaques, de Babouins, et même de Guenons. Ils s'accouplent chaque jour trois ou quatre fois, à la manière à-peu-près de tous les quadrupèdes. Pour cet effet, le mâle empoignait la femelle aux talons, avec les mains de des pieds de derrière, et aux épaules, avec ses mains antérieures, et l'accouplement ne durait que deux ou trois secondes."

VAR. *AYGULA*.—EGRET MACACO.

Syn. L'AIĞRETTE.—Cuv. Reg. Anim. I. 95.

CERCOCEBUS AYGULA.—Geoff. Ann. Mus. XIX.

Icon. Buff. Hist. Nat. XIV. pl. 21.—Schreb. Säugth. pl. 22.

L'AIğrette.—Audeb. Sing.

The Egret Macaco (L'AIğrette), figured in Buffon, XIV. pl. 21, appears to be merely a variety distinguished by a bunch of long hair on the top of the head.

There are two other varieties, the one with long and thick hair of a deeper green, the other marked with black on several parts of the body.

4. *MACACUS AUREUS*.—TAWNY MACACO.

Syn. TAWNY MONKEY.—Penn. Quadr. I. 211.

LE MACAQUE ROUX-DORÉ.—Isid. Geoff. in Bélang. Voy.

Icon. Bélang. Voy. pl. 2. (Mammifères).

SPECIFIC CHARACTERS.

THE HAIR of the body orange-red, dotted with black above, tawny on the sides, greyish beneath.

INHABITS Bengal, Pegu, Java, and Sumatra.

This animal was first noticed by Pennant, from a living specimen in Brookes' exhibition; lately, skins have been sent from the East Indies to the Paris Museum by Leschenault, Renaud, Duvaucel, and Diard, procured from the localities above-mentioned. It is very common in the markets of Calcutta.

In every respect excepting colour it greatly resembles the Common Macaco, the greenish tint of the former being replaced by red. The upper part of the head and body is covered with hairs, grey at their base, with the points annulated with black and red, forming by their combination an orange-red, dotted with black. The limbs are greyish externally, and white on their internal surface; the under part of the body and under surface of the tail are likewise white. The flanks are tawny, the red blending insensibly into grey. The cheeks are covered behind with long white hairs directed backwards. The eyelids are white, and are separated on the medial line by some black hairs. Finally, there is usually found beneath the chin a bunch of red hair pointing downwards.

This animal is merely said by Pennant to be "very ill-natured."

5. *MACACUS MONTANUS*.—MOUNTAIN MACACO.

Syn. et Icon. *MACACUS GELADA*.—Rupp. Neue Wirbelth. pl. 2. (Säugthiere.)

SPECIFIC CHARACTERS.

THE HAIR very long on the back and hinder part of the head; body deep reddish-brown above, blending into light wood-brown¹ on the head, neck, sides, limbs, and tail; beneath the body, the fore-arms, and all the hands, dark-brown.

THE TAIL ending in a tuft.

THE FACE and CALLOSITIES naked and blackish grey.

THE THROAT and UPPER PART OF THE BREAST each with a naked space in front.

This well characterized Macaco was discovered by Ruppell in the elevated mountain chain of the Abyssinian provinces of Haremat, Simen, and Godjam, at a height of about 8000 feet above the level of the sea. It is found in numerous families throughout those rocky regions which are overgrown with bushes, but always upon the ground, differing in this respect very remarkably from most other Quadrumanous animals. Seeds, roots, and the young buds of plants, form its usual food, which it seeks for in large companies. Its devastations upon the cultivated fields of the natives are very frequently experienced; by night, it remains concealed in the holes and clefts of the rocks. When attacked, it emitted a loud hoarse bark, and attempted to defend itself.

In the adult male, the hinder part of the head, the cheek-tufts in front,

the parotid region, neck, and back, are densely covered with hair about ten inches in length, giving the animal the appearance of being covered with a mantle, which hangs down over the neck and arms. The hair of the forehead, ears, and neck, the cheek-tufts, as well as the hinder-legs and tail, are hazel colour or wood-brown; that of the sides and along the back is a deep reddish-brown blending into hazel. On the fore part of the neck and breast, there are two large naked spots, flesh-coloured and angular, with their corners directed to each other, somewhat resembling the form of an hour-glass. These naked spots are marked with rings, in which grey and white hairs are scantily dispersed. The naked callosities of the buttocks are closely approximated to each other, their colour being blackish-grey. The nails are black, long, and arched; those of the fore-hands being much larger than on the hinder. The tail is long, very hairy, and terminates in a thick tuft. The entire animal has a very massive appearance, owing to the thick and long hair in which it is enveloped. It carries its body bent rather backwards, but in a horizontal position; and holds the tail curved upwards near the root, but with the tuft hanging vertically downwards. The hair round the face stands erect, giving the animal a wild and formidable appearance, especially when it shows its teeth. It is known to the inhabitants by the name of *Gueressa*.

The young males have the hair of the neck much shorter and more plentiful, and the deep reddish-brown colour appears over the whole; as the animal increases in size, it gradually acquires the light hazel tint. The adult female is altogether as deeply coloured as the young male. The adult male is about 3 feet 2 inches in length.

(B.) SHORT-TAILED MACACOS. (MAIMONS.)

Some species of Macacos are distinguished by having a short tail.

In this section, which contains four species, the muzzle becomes more elongated, and the tail, which is always less than the body, in some of the species is excessively short. The Rhesus and Pig-tailed Macacos form the types of the subdivision.

6. *MACACUS SILENUS*.—WANDEROO MACACO.

Syn. LE MACAQUE À CRINIÈRE.—Cuv. Reg. Anim. I. 94.

PAPIO SILENUS.—Geoff. Ann. Mus. XIX. 102.

MACACUS SILENUS.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.

LION-TAILED MONKEY.—Penn. Quadr.

SIMIA SILENUS.—Linn. Gmel.—S. *LEONINA*.—Linn.

Icon. L'OUANDEROU.—Audeb. Sing.

Ouanderou femelle.—F. Cuv. et Geoff. Hist. Mam.

Buff. Hist. Nat. XIV. pl. 18.—Schreb. Säugth. pl. 11.

SPECIFIC CHARACTERS.

THE HAIR black; a large greyish crest and white beard surround the head; the under part of the body white; the tail ending in a tuft.

INHABITS Ceylon and Hindoostan.

This animal, first noticed in Knox's Ceylon, is called Nil-Bandar by the natives. The adult is exceedingly frolicous, but the young appears susceptible of some education. It frequents the woods.

The abdomen, the breast, and the circle round the head, are white; the remainder of the body is of a fine black. The hairs are generally long, especially round the head, where a greyish crest appears on each side of the forehead, uniting in a white beard on the chin, and extending backwards over the cheeks. The tail terminates in a tuft. The callosities are reddish, but the face and hands black.

The earlier accounts of this animal are, as usual, full of fable and exaggeration. According to Father Vincent Maria, "All the other Monkeys pay such profound respect, that they submit and humiliate themselves in his presence, as though they were capable of appreciating his superiority and pre-eminence. The princes and great lords hold him in much estimation, because he is endowed above every other with gravity, capacity, and the appearance of wisdom. He is easily trained to the performance of a variety of ceremonies, grimaces, and affected courtesies, all which he accomplishes in so serious a manner, and to such perfection, that it is the most wonderful thing to see them acted with so much exactness by an irrational animal." (Vincent Maria fide Benuett.)—Robert Knox, in his Historical Relation of Ceylon, tells us, with more probability, that "They do but little mischief, keeping in the woods, eating only leaves and buds of trees; but when they are caught they will eat anything." The specimen in the Museum of the Zoological Society of London being young, "was extremely active, and occasionally very troublesome, but at the same time a perfectly good-tempered fellow. He was very strong, and had his teeth been full-grown, would in all probability have proved a dangerous animal." (E. T. Bennett, Gardens and Menagerie of the Zoological Society.)

¹ Wood-Brown—Colour of the hazel-nut,—No. 105. Werner's Nomenclature of Colours. By Patrick Syme. Edinburgh, 1821.

7. MACACUS RHESUS.—RHESUS MACACO.

- Syn.* LE RHÉBUS.—Cuv. Reg. Anim. I. 96.
 INUUS RHESUS.—Geoff. Anim. Mus. XIX.
 MACACUS RHESUS.—Desm. Mam.
 MACACUS ERYTHRÆUS.—F. Cuv.—Isid. Geoff. in Bélang. Voy.
Icon. Le Rhébus.—Audeb. Sing.
 LE PATAS À QUEUE COURTE.¹—Audeb. Sing.
 Rhébus mâle adulte, Rhébus femelle âgé de 49 jours, Rhébus femelle à face brune, Maimon femelle.—F. Cuv. et Geoff. Hist. Mam.
 Buff.² Hist. Nat., Suppl. VII. pl. 14.

SPECIFIC CHARACTERS.

THE HAIR greenish-grey above, passing to bright yellow on the loins and thighs; whitish beneath.

THE FACE flesh-coloured.

INHABITS Bengal.

The Rhesus Macacos frequent the forests on the banks of the Ganges in large numbers. Encouraged by the reluctance of the Hindoos to destroy animals, they carry their depredations to the very suburbs of the cities. Their disposition appears most untractable. During extreme youth, a certain degree of familiarity may be encouraged with impunity; but they soon become mischievous, and age renders them ferocious. Their ferocity is the more dangerous from its being combined with considerable foresight and intelligence.

All the upper parts of the body are of a fine greenish-grey, resulting from hairs which are entirely grey at their base and throughout great part of their length, while their points are either black or yellow. This yellow becomes paler on the arms and legs, so as to render these parts almost grey; while it assumes a brighter hue upon the loins and thighs. The throat, neck, breast, abdomen, and the internal surfaces of all the limbs, are white. The tail is greenish above and grey beneath. The skin of the face, the ears, and hands, is of a clear copper-colour, and destitute of hairs. The thighs appear of a bright reddish-yellow, extending upon the crupper over the origin of the tail. The hairs are very fine and silky; plentiful on the upper parts of the body, but scanty beneath. An extreme flaccidity may be remarked in all animals of this species, and the young have those hanging folds of skin on each side of the throat, which in other animals are seen only in old age.

In the female, the thighs are of a bright red; and this colour, which is entirely owing to the blood, appears on the legs, and upwards upon the crupper, towards the insertion of the tail, especially during the rutting season. At this period the nipples are rose-coloured.

The males differ from the females only in having their cheek-tufts more bushy, their proportions more massive, their height greater, and their canines stronger.

8. MACACUS NEMESTRINUS.—PIG-TAILED MACACO.

- Syn.* LE MAIMON.—Cuv. Reg. Anim. I. 96.
 INUUS NEMESTRINUS.—Geoff. Ann. Mus. XIX.
 SIMIA NEMESTRINA.—Linn. Gmel. I.
 MACACUS NEMESTRINUS.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.
Icon. Le Maimon.—Audeb. Sing.
 SINGE À QUEUE DE COCHON, mâle, adulte.
 SIMIA PLATYPGOS.—Schreb. Säugeth. pl. 5, B.
 PIG-TAILED MONKEY.—Edw. Glean. pl. 214 (young).
 Buff. Hist. Nat. XIV. pl. 19.

SPECIFIC CHARACTERS.

THE HAIR greenish-brown above; with a black band on the top of the head, extending along the back to the tail; whitish beneath.

THE TAIL very short and curved backwards.

INHABITS Java and Sumatra.

These animals have the same manners and disposition as the preceding. Their general colour is of a deep greenish-brown, proceeding from grey hairs annulated with black and yellow. The top of the head, for the breadth of two or three fingers, is black, and this shade extends along the neck, back, and tail, but gradually acquiring the greenish-brown tinge. The latter colour covers the shoulders, becoming more yellow upon the fore-arm. The thighs are likewise green, but with a mixture of grey; the cheeks, the under part of the chin and neck, the breast, abdomen, under surface of the tail, and the internal surfaces of all the limbs, are white or flesh-coloured. Before the ears, at their base, and on the cheeks

beneath the eyes, there are some blackish hairs, and behind the ears they are entirely black. The dark brown face is almost naked from the eyes to the mouth, with the exception of a few long and black hairs. The ears and the palms of the hands are naked, and of the same colour as the face, so are also the callosities. The males and females resemble each other in colour, and the young are of a brighter yellow than the adults.

9. MACACUS MAURUS.—URSINE MACACO.

- Syn.* LE MACAQUE DE L'INDE.—Cuv. Reg. Anim. I. 96.
 MACACUS ARCTOIDES.—Isid. Geoff. in Bélang. Voy.
 MACACUS MAURUS.—F. Cuv.
Icon. MACAQUE DE L'INDE.—F. Cuv. et Geoff. Hist. Mam.
 Isid. Geoff.³ Etud. Zool. pl. 11. (var.)

SPECIFIC CHARACTERS.

THE HAIR of a uniform dark brown.

THE FACE, EARS, and HANDS, black.

THE TAIL very short.

INHABITS the East Indies.

The characters of this species are obvious and decisive, forming a gradual transition into the third division, or Tailless Macacos. It rests, however, merely upon a single specimen, sent by M. Alfred Duvaucel from the East Indies, and has by some been considered identical with *M. niger* (11). The specific name *Maurus* is derived from the colour of the face and hands, and that of *Ursine* from the resemblance of its hair to that of the Brown Bear (*Ursus Arctos*).

There is a variety of this species, sent by M. Diard from Cochinchina, and figured by M. Isidore Geoffroy (Etud. Zool. pl. 11), under the name of *Le Macaque Ursin*, which appears to differ from the above, in having the nose alone black, with the face and hands flesh-coloured. Its dark brown hair is also scantily dotted with clear red. The specimen was about two feet ten inches in length.

(C.) TAILLESS MACACOS. (MACOTS.)

These are merely Macacos, in which a small tubercle supplies the place of a tail.

10. MACACUS INUUS.—BARBARY MACACO.

- Syn.* LE MAGOT COMMUN.—Cuv. Reg. Anim. I. 96.
 INUUS EGAUDATUS.—Geoff. Ann. Mus. XIX.
 MACACUS INUUS.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.
 SIMIA SYLVANUS, SIMIA INUUS.—Linn. Gmel. I. 27, 28.
Icon. LE MAGOT.—Audeb. Sing.
 Magot mâle.—F. Cuv. et Geoff. Hist. Mam.
 Buff.⁴ Hist. Nat. XIV. pl. 7 and 8.

SPECIFIC CHARACTERS.

THE HAIR of a bright greyish-yellow.

THE TAIL tuberculous.

INHABITS the North of Africa and the Rock of Gibraltar.

Of all Apes, the present species seems best capable of enduring our climate. Originally from Barbary, it has become naturalized upon the most inaccessible parts of the Rock of Gibraltar.

In size the Barbary Macaco never exceeds a middle-sized Dog. The top and sides of the head, the cheeks, neck, shoulders, the corresponding parts of the back, and the fore part of the anterior limbs, are of a bright gold-yellow, mixed with a few black hairs. The other parts of the body are of a greyish-yellow. Each hair is of a dark grey at its base, and annulated with yellow and grey throughout the rest of its length. The face and ears are wholly naked, and of a bright flesh-colour. The tips of the ears are covered with long hairs, the hands are blackish and well furnished with hair. The cheek-tufts are thick and directed backwards. All parts of the body are covered with hair, having the points directed downwards, excepting on the fore-arm, where they point upwards. The entire coat is very long, dense, and uniform; for which reason, these Monkeys become best able to resist the cold during the winter.

The Barbary Ape walks habitually on all its four hands, but without ease, as it is more especially organized for climbing. It sleeps either on the side, or in a sitting posture, with the head between its hind-legs. It raises the food to its mouth by the hand, or seizes it with the lips; and

¹ The two individuals which served as models to the designs of Audebert are in the Paris Museum. I have examined them, and they belong to the same species.—*Note of the Baron Cuvier.*

² The *Macaque à queue courte*, figured in Buff. Hist. Nat. Suppl. VII. pl. 13 (*Simia erythræa* of Schreber), appears to be a Common Macaco (*M. cynomolgus*), the tail of which has been cut.—*Note of the Baron Cuvier.*

³ ISID. GEOFF. ETUD. Zool.—Etudes Zoologiques, par M. Isid. Geoffroy-Saint-Hilaire. Paris, 1832.

⁴ The *Pithèque* of Buffon, Suppl. VII. pl. 4 and 5, is merely a young Barbary Macaco. His *Petit Cynocephale*, pl. 6, and the *Cynocephalus major* and minor of Prosper Alpin, are likewise of this species.—*Note of the Baron Cuvier.*

⁵ Πιθηκος is the Greek name for Apes in general; and the Ape, whose anatomy is given by Galen, is nothing else than a Barbary Macaco, although Camper considered it to be an Orang-Outang. M. De Blainville has remarked this error, and I have confirmed his observations by comparing with the two species every thing referred by Galen to his Pithecus.—*Note of the Baron Cuvier.*

smells every suspected object very carefully. Almost every kind of food can be given it. In the wild state, fruits and leaves form its habitual diet; in confinement it eats fruit, bread, and boiled vegetables, especially carrots and potatoes. It drinks by sucking in. When enraged, its jaws are agitated with astonishing rapidity, its movements become violent, and it emits a loud and hoarse cry, which becomes rather mild when the passion subsides. Its strong canine teeth, and its thick and long, though flat nails, are capable of inflicting severe wounds. A natural fondness for society induces it to adopt any little animals which may be placed with it: these are carried about, loaded with caresses, and cannot be taken away without putting the Barbary Macaco in a violent passion. These animals have the highest affection for their young, which they preserve in a state of great cleanliness. Their geographical range does not extend eastward beyond Egypt.

II. MACACUS NIGER.—BLACK MACACO.

- Syn.* SIMIA NIGRA.—Cuv. Reg. Anim. I. 98.—Fisch. Syn. Mam.
CYNOCEPHALUS NIGER.—Desm. Mam. Suppl. pl. 534.—Isid. Geoff. in
Bélang. Voy.
MACACUS NIGER (THE BLACK APE).—Bennet, Gard. Zool. Soc. I.
189.
Icon. Quoy et Gaim. Vny. de l'Astr. Mammifères, pl. 6,—pl. 7 (anatomical).
Gray, Spicil. Zool. pl. 1, fig. 2.

SPECIFIC CHARACTERS.

THE HAIR entirely black; a tuft of long hair forming a crest on the top of the head.

THE TAIL tuberculous.

INHABITS the Molucca Islands.

The present species is arranged by the Baron Cuvier, Desmarest, and others, among the Baboons (Cynocephalus); but it wants the terminal nostrils of that Genus, and ought, therefore, to be considered as a true Macacus; at the same time it indicates the passage towards the Baboons, to which in other respects it bears a near affinity.

The hair on all parts of the body is of a pure and shining black, very long and woolly; that of the cheeks shorter, blacker, and more dense, forming cheek-tufts, and the entire upper part of the head is ornamented with a crest of hair which is very long towards the occiput. The callosities are of a bright red. The face is broad and prominent, narrowed at the nostrils, and abruptly truncated, with the nostrils placed obliquely on the upper surface. The projection of the muzzle is not disagreeable to the eye; and its countenance, unlike that of the Baboons, is agreeable and intelligent.

DOUBTFUL SPECIES.

1. *M. CARBONARIUS*, figured in F. Cuv. et Geoff. Hist. Mam. under the name of LE MACAQUE À FACE NOIRE, appears to differ from the *M. cynomolgus* merely in having a black face.
2. *M. SPECIOSUS*, illustrated in the work just mentioned under the name of LE MACAQUE À FACE ROUGE, differs from *M. cynomolgus* only in having its tail considerably shorter, and a brighter reddish tint upon the face.
3. *M. ARCTOIDES* (Isid. Geoff. in Bélang Voy.) seems to be a variety of the *M. Manus* of Fred. Cuvier.

GENUS IX. CYNOCEPHALUS² BABOONS.

- Syn.* LES CYNOCÉPHALES ET LES MANDRILLS.—Cuv. Reg. Anim. I. 97 and 98.
CYNOCEPHALUS.—Briss. Reg. Anim. (in part).—Illig. Prodr.—Desm. Mam.—Isid. Geoff. in Bélang. Voy.
PAPIO (in part).—Briss. Reg. Anim.—Erxl.—Geoff. Ann. Mus. XIX. 101.
SIMIA (in part).—Linn. Gmel.—Fisch. Syn. Mam.
CYNOCÉPHALE.—Temm. Mon. Mam.

GENERIC CHARACTERS.

THE MUZZLE much elongated, and truncated at the extremity. THE FACIAL ANGLE from 30° to 35°. THE NOSTRILS terminal.

THE LIMBS very robust, and nearly of equal length.

THE CHEEK-POUCHES and CALLOSITIES always present.

THE HAIR wanting about the callosities.

THE LAST MOLAR of the upper jaw with five, and of the lower jaw with six, tubercles.

INHABIT Africa and some adjacent parts of Asia.

The Baboons have the teeth, cheek-pouches, and callosities of the preceding genus, but in addition to these characters, their muzzle is very much elongated, and truncated at the extremity, where

the nostrils are placed. The latter circumstance occasions their physiognomy to resemble that of a Dog, rather than of the other Apes. Their tail varies in length.

These, in general, are large, ferocious, and dangerous Apes; most of them are found in Africa.

From the particulars above mentioned, it will readily be perceived that the Baboons approach more nearly in their characters to the lower orders of Mammiferous animals than to any other Apes of the Old World. With them the vertical position is rendered still more difficult to maintain, and their habitual mode of progression is consequently on all the four hands. The forests are not their favourite places of resort; in general they either prefer the mountains, or localities interspersed with hillocks, rocks, and brushwood. Notwithstanding the clumsiness of their forms, they climb trees with much ease, and exhibit no small agility in their leaps. Travellers notice, probably with some exaggeration, the danger which females, residing in the neighbourhood of the Baboons, undergo from the ferocity of the males. Negresses are said to have been forcibly carried off by the Cynocephali, and even to have lived very happily with them for several years, while the animals, detaining them in caverns, supplied them regularly with provisions, &c. These statements derive their probability from the fact that adult Baboons exhibit the most frantic and outrageous gestures at the sight of a woman, especially a very young one. When visited by the latter in the menageries, they rush against the bars of their cage, shake them with all their might, accompanying this violence by the most terrific cries or disgusting gestures, which are heightened still more if the object of their regard happens to be accompanied by a male of her own species.

All these animals attain a considerable size, which is nearly that of a Wolf. When attacked, they defend themselves vigorously; but, though ferocious, do not usually attack others, except at a distance, by throwing branches of trees, or menacing them by their cries. Their dispositions present a singular compound of passion and ferocity, blended with much intelligence and cunning. In a few seconds, they pass from one extreme to another, from indifference to the most violent passion, without any apparent cause for the sudden change. Their fury, when in confinement, is capable of rising to a pitch sufficient to occasion death itself. M. F. Cuvier tells us that he has seen several expire from the consequences of their passion.

Being without the elevated hinder limbs of most other Apes of the Old World, they walk on all the four hands with greater ease, though far from equalling, in this respect, the true quadrupeds. Their movements on the ground are always constrained, their walk slow, and their run is merely a kind of trot or shuffling gallop. Rarely they stand in an erect posture, and advance only a few steps in this manner. During their extreme youth, the agility with which they climb trees is remarkable; in old age, they usually continue resting on their callosities. Their chief food consists of fruits and roots, with the tender leaves and young shoots of certain plants. When about to eat, they always commence with filling their cheek-pouches, and drink the fluid, by sucking inwards, like other animals with long and moveable lips. These animals are said by M. F. Cuvier to be “très-lascifs, toujours disposés à l'accouplement, et, bien différents des autres animaux, les femelles reçoivent les mâles même après la conception. Celles-ci, lorsqu'elles ne sont pas pleines, entrent tous les mois en rut; et cet état se manifeste par un gonflement considérable, causé par l'accumulation du sang dans les organes génitaux, et les parties qui les avoisinent et il est accompagné d'une véritable menstruation.” Their growth is slow, and they do not become completely adult until the eighth or tenth year. The females are smaller and milder than the males.

The Baboons compose a very natural group of Quadrumanous animals, consisting of six well-authenticated species, which may be recognised at a single glance by their terminal nostrils. They admit of being arranged under two sections, distinguished by the length of their tail, the Proper Baboons (Papios), with tails nearly as long as the body; and the Mandrills, with a very short tail. The dentition of all these animals perfectly resembles that of the Macacos already described. Their tail rises upwards near its base, and the remainder, if any, not being susceptible of muscular motion, falls perpendicularly downwards.

(A.) PROPER BABOONS. (PAPIOS.)

Syn. LES CYNOCÉPHALES.—Cuv. Reg. Anim. I. 97.

The Proper Baboons cannot be regarded as generically distinct from the Mandrills; at the same time, they are destitute of those singularly bright coloured markings, which distinguish the latter from all other Mammiferous animals, if we except the greenish scrotum found in the Grivet, Vervet, and Green Guenons, with the bright ultramarine of the Malbrouck.

¹ GRAY, SPICIL. ZOOLOG.—Spicilegia Zoologica, or Original Figures and Short Systematic Descriptions of new and unfigured Animals. By John Edward Gray.

² Cynocephalus (from *κυνον*, *kuōn*, dog, and *κεφαλή*, *kephalē*, head) is a term well known to the ancients, and this animal occupies a prominent place in the symbolical figures of the Egyptians, where it represents Thoth or Mercury.—Note of the Baron Cuvier.

1. CYNOCEPHALUS SPHINX.—GUINEA BABOON.

- Syn.* LE PAPION.—Cuv. Reg. Anim. I. 97.
 PAPIO SPHINX.—Geoff. Ann. Mus. XIX.
 SIMIA SPHINX.—Linn. Gmel. I.—Fisch. Syn. Mam.
 CYNOCEPHALUS PAPIO.—Desm. Mam.
- Icon.* Le Papion.—Le Papion, var. A.—Audeb. Sing.
 Le Papion mâle, Papion femelle très jeune.—F. Cuv. et Geoff. Hist. Mam.
 SIMIA CYNOCEPHALUS.—Brongn.¹ in Journ. d'Hist. Nat. I. pl. 21.
 Le Papion.—Buff. Hist. Nat. XIV. pl. 13.

SPECIFIC CHARACTERS.

THE HAIR yellow, tending more or less towards brown, the cheek-tufts yellow.

THE FACE black. THE TAIL long.²

INHABITS Africa.

Specimens of this animal vary in size, probably owing to some difference in their ages. The adult is ferocious, and of brutal manners.

The face, the ears, and the palms of all the hands, are entirely black; the upper eyelids white. Its general colour is a yellowish-brown, resulting from hairs covered alternately with small rings of black and clear brownish-yellow, so that the animal, when viewed very closely, appears speckled with these colours. The cheek-tufts are yellowish, and directed backwards. The hair on the back of the neck is longer than on any other part of the body; the inner surfaces of the legs and thighs are scantily covered, as well as the lower part of the belly, beneath the neck, and on the breast; the bases of the hairs are usually grey. The females and young do not differ from the adults in colour, but much so in form. They are not so robust, and their muzzles are much less elongated.

This species may at once be distinguished from the following, by the cartilage of its nostrils projecting forwards beyond the other parts of the muzzle. It is found on the coast of Guinea, also in the Island of Meroe, and rarely in Sennar, according to Calliaud.

2. CYNOCEPHALUS BABOUIN.—LITTLE BABOON.

- Syn.* LE BABOUIN.—Cuv. Reg. Anim. I. 97.
 PAPIO CYNOCEPHALUS.—Geoff. Ann. Mus. XIX.
 SIMIA CYNOCEPHALUS.—Linn. Gmel. I.—(S. cynocephala).—Fisch. Syn. Mam.
 CYNOCEPHALUS BABOUIN.—Desm. Mam.—C. ANTIQUORUM.—Schinz. Thier. I.
- Icon.* Babouin mâle.—F. Cuv. et Geoff. Hist. Mam.—F. Cuv. in Mem. du Mus. pl. 19.
 LE PETIT PAPION.—Buff. Hist. Nat. XIV. pl. 14.

SPECIFIC CHARACTERS.

THE HAIR greenish-yellow above, clear yellow beneath, cheek-tufts whitish.

THE FACE flesh-coloured. THE TAIL medium length.

INHABITS Northern Africa.

This species is nearly allied to the preceding.

It occupied an important place in the Theogony of the ancient Egyptians, and was worshipped at Hermopolis, where a celebrated temple stood in its honour. It is probably this species, which appears represented so frequently among the hieroglyphics of that singular people. The upper parts of the body are of a pretty uniform greenish-yellow, and this results from hairs covered with large yellow rings alternating with small black ones, so that the former predominate, and the greenish tint ensues. All the lower parts of the body are of a paler yellow than the upper, and the tufts of hair on each side of the face are whitish. The young are of the same general colour as the adults, but beneath they are of a dirty white. Their muzzle is not so prominent, and the colour of the thighs, instead of being red, is deep brown. The nostrils of the adult, placed at the extremity of the muzzle, are separated above by a very well-marked groove, and the lateral cartilages do not advance as far forward as the central. The tail, elevated at its origin, soon hangs downwards, and terminates at the ham, or hinder part of the knee. The face is of a bright flesh colour, rather paler around the eyes.

VAR. ANUBIS.—ANUBIS BABOON.

- Syn.* SIMIA ANUBIS.—Fisch. Syn. Mam.
Icon. Anubis.—F. Cuv. et Geoff. Hist. Mam.

The Anubis Baboon differs from the Little Baboon already described in being of a deeper green, its muzzle more elongated, and the cranium flatter.

3. CYNOCEPHALUS PORCARIUS.—CHACMA BABOON.

- Syn.*³ LE PAPION NOIR.—Cuv. Reg. Anim. I. 97.
 PAPIO PORCARIUS.—Geoff. Ann. Mus. XIX.
 SIMIA PORCARIA.—Linn. Gmel. I.—Fisch. Syn. Mam.
 SIMIA SPHINGIOLA.—Herm.⁴ Obs. Zool. I. p. 2.—Fisch. Syn. Mam.
 CYNOCEPHALUS PORCARIUS.—Desm. Mam.
 URSINE BABOON.—Penn. Quadr. I. No. 104.
- Icon.* Le Papion var. B.—Audeb. Sing. (incorrect).
 CHACMA mâle très vieux.—Tête d'un très jeune individu.—F. Cuv. et Geoff. Hist. Mam.
 Simia porcaria.—Bodd.⁵ Abhandl. in Naturf. XXII. pl. 1 and 2.
 LONG-NOSED MONKEY.—Penn. Quadr. I. No. 111.
 LA GUENON À FACE ALLONGÉE.—Buff. Hist. Nat. Suppl. VII. pl. 15.
 SINGE NOIR.—Le Vaill. Voy. II.

SPECIFIC CHARACTERS.

THE HAIR black, with a yellowish or greenish tinge; the cheek-tufts grey.

THE FACE and HANDS black. THE TAIL very long, with a tuft at the end.

INHABITS the Cape of Good Hope.

This species resembles the preceding in form and manners. The adult has a long mane, and the tail, which terminates in a tuft, extends as low as the heel.

Several animals of this species, called Choak-kama or Chacma by the Hottentots, were preserved for a long time in the Paris Menagerie. An incident occurred with a male specimen, brought by Captain Baudin from the Cape of Good Hope along with its female, serving forcibly to illustrate the peculiar disposition of these animals. Though rather mild when first imported, it soon lost its docility. Having one day escaped from its cage, the keeper imprudently threatened it with a stick; in an instant the animal flew upon him, and inflicted three deep wounds upon his thigh with its strong canine teeth, which penetrated as far as the femur, so that the life of the man was for a long time rendered precarious. To induce the animal to return to its cage, the following stratagem was adopted. The keeper had a daughter, who often fed the Baboon, and for whom it had at all times exhibited a powerful attachment. She placed herself at the side of the cage, opposite to the door at which the animal was to enter, and a man was made to approach the young woman as if he were about to caress her. The moment the Baboon perceived this movement, it raised a frightful cry, and throwing itself in the fury of its jealousy upon the individual, rushed into the cage, which was instantly closed from behind.

The greenish-black hue of its coat proceeds from hairs which are grey at the base, and otherwise black, excepting some rings of yellow more or less dingy. The face, ears, and the palms of the hands, are naked, and few hairs are to be seen on the internal surfaces of the arms and thighs. The fingers, especially of the hinder hands, are covered with short, coarse, and black hairs; the tail terminates in a strong black tuft; and the neck is furnished with long hairs, forming a mane, which is wanting in the female. The skin of the hands, face, and ears, is of a violet-black; but the circle round the eyes has a paler tint, and the upper eyelid is white as in the Mangabey Guenon. The nostrils are separated above by a deep furrow, the upper and anterior portion of the head is wholly flat, and the callosities are very small.

4. CYNOCEPHALUS HAMADRYAS.—DOG-FACED BABOON.

- Syn.* LE TARTARIN DE BELON.⁶—Cuv. Reg. Anim. I. 98.
 PAPIO HAMADRYAS.—Geoff. Ann. Mus. XIX.
 SIMIA HAMADRYAS.—Linn. Gmel. I.—Fisch. Syn. Mam.
 CYNOCEPHALUS HAMADRYAS.—Desm. Mam.
- Icon.* TARTARIN mâle.—Tartarin femelle jeune.—F. Cuv. et Geoff. Hist. Mam.
 Cyn. Hamadryas, male, female, and young.—Ehrenb. Symb. pl. 11.
 DOG-FACED MONKEY.—Penn. Quadr. I. pl. 43, fig. 1.
 SINGE DE MOCCO.⁷—Buff. Suppl. VII. pl. 10.

¹ M. Brongniart's Paper on Simia Cynocephalus, in the JOURNAL D'HIST. NAT. (Journal d'Histoire Naturelle, par MM. Lamarek, Bruguières, Olivier, Haüy, et Lepelletier, Paris, 1792).

² Those figures which represent the tail short, as in Buff. Hist. Nat. XIV. pl. 13 and 14, are made after mutilated specimens. M. Brongniart has represented the former with some precision, but under the improper name of Simia Cynocephalus. His figure is copied in Schreber, pl. 13 B.—Note of the Baron Cuvier.

³ All these fictitious species have arisen from the greater or less state of preservation of the specimens, or differences of age.—Note of the Baron Cuvier.

⁴ J. Herrmanni Observationes Zoologicae, Edidit F. Hammer, Argent. 1804.

⁵ Boddaert Abhandlung über den Affen mit dem Schweinskopfe (Der Naturforscher, Halle, 1774 to 1804).

⁶ See fol. 101 of L'Histoire de la Nature des Oiseaux, avec leurs Descriptions, &c., par P. de Belon du Mans. Paris, 1555.

⁷ This has been copied in Schreber, but the colouring is faulty.—Note of the Baron Cuvier.

SPECIFIC CHARACTERS.

THE MALE.

THE HAIR of a blueish-grey, very long on the neck and checks, forming a mane.

THE TAIL long and tufted.

THE FEMALE AND YOUNG.

THE HAIR of a dark greenish-grey. No mane. THE FACE flesh-coloured.

INHABITS Arabia, Persia, and Ethiopia.

This animal is likewise exceedingly brutal and ferocious.

The blueish-grey colour of its fur has a slight tinge of green, resulting from rings which are alternately black and yellowish-grey. The hinder parts of the body are paler than the anterior, the fore-limbs almost black, the cheek-tufts and abdomen whitish. The face, ears, and hands, are of a deep-brown, the buttocks red, as in all the adult Baboons. A well-marked groove separates the nostrils above. The hair of the mane is about six or seven inches in length, commencing from the neck, and covering all the anterior parts of the body. The abdomen and inner surface of the thighs are scantily covered, and the tail terminates in a small tuft.

The female differs from the male in having no mane, and her hair is of a dark greenish-grey. The young males resemble the adult females.

M. Ehrenberg saw several wild individuals of this species in Arabia. They live together in small families.¹

(B.) MANDRILLS. (LES MANDRILLS, CUV.)

Of all Apes, the Mandrills have the longest muzzle (about 30°); their tail is very short; they are likewise very brutal and ferocious. The nose does not differ from that in the preceding section.

In this section, two species alone are now admitted by Naturalists.

5. CYNOCEPHALUS MORMON.—VARIEGATED BABOON.

- Syn.* LE MANDRILL.—Cuv. Reg. Anim. I. 98.
 PAPIO MORMON.—Geoff. Ann. Mus. XIX.
 SIMIA MORMON ET MAIMON.—Linn. Gmel. I.—(S. MAIMON.)—Fisch. Syn. Mam.
 CYNOCEPHALUS MORMON.—Desm. Mam.
Icon. Le Mandrill.—Audeh. Sing.—Ménag. du Mus.
 Mandrill mâle vieux.—Mandrill mâle jeune.—F. Cuv. et Geoff. Hist. Mam.
 LE MANDRILL, BOGGO, CHORAS.—Buff. Hist. Nat. XIV. pl. 16, 17.—Suppl. VII. pl. 9.
 GREAT BABOON.—Penn. Quadr. I. pl. 40 and 41.—RIBBED-NOSE BABOON (young).
 VARIEGATED BABOON.—Shaw, Gen. Zool. I. pl. 10.

SPECIFIC CHARACTERS.

THE MALE.

THE HAIR greyish-brown, olive-brown above, white beneath, a citron yellow tuft under the chin.

THE CHEEKS with bright purple stripes. THE BUTTOCKS bright purple. THE NOSE bright scarlet, likewise the CALLOSITIES.

THE FEMALE AND YOUNG.

THE HAIR nearly the same as the male, no tuft under the chin.

THE CHEEKS with a few small blue stripes.

THE FACE otherwise black.

INHABITS Guinea.

In the adult males, we find the nose red, especially at the point, where it becomes scarlet, and this circumstance has very erroneously occasioned the adult to be set down as a distinct species² from the young. The parts of generation and the circle of the anus are of the same colour, and the buttocks are of a bright purple, so that one can scarcely imagine an animal so hideous and extraordinary. It attains nearly the size of Man, and the Negroes of Guinea hold it in much dread. Many traits of its history have been confounded with those of the Chimpansee, and consequently of the Orang-Outang.

The adult Variegated Baboon (S. Mormon, Linn. and Choras, Buff.) presents a singular and revolting combination of characters, in which the

peculiarities of Man are brought into close and degrading approximation to those of the brute. Its bright and yellow eyes are deeply sunk in beneath a low forehead, and approximate so nearly to each other, as to impart a peculiar air of ferocity to the countenance. Its muzzle is enormous, terminating in a round and flat surface of a bright scarlet, continually moistened by a disgusting mucus. The cheeks are very prominent, and furrowed with longitudinal ridges of a bright blue, changing into violet. A narrow stripe of crimson, running along the centre of the nose, divides the face into two parts, giving it a wounded or lacerated appearance. Its hair is of a greyish-brown, spotted with yellowish-brown, especially near the head; white on the breast and abdomen, as well as inside the thighs, on the neck, and behind the ears. The tail being very short, is continually erect, disclosing the brilliant hues of red and blue already noticed. Its limbs are exceedingly muscular, and its strength is much superior to that of Man.

The hair owes its colour to alternate rings of black and yellow, forming by their combination a greenish-brown, common to many Apes, but of a darker hue in the Variegated Baboon than in any others. A white band commences from each ear, and passing upwards is interrupted at the vertex. The skin round the eyes is of a violet-brown. The hairs on each side of the head, being very long, unite together on the summit, forming a kind of crest, the centre of which is sometimes elevated into a pointed tuft.

The colours of Mammiferous animals are in general dull and tarnished, Nature having sparingly bestowed upon them those vivid hues, which she has so liberally distributed among the feathered tribes. By a singular exception, however, the Mandrills, when arrived at mature age, exhibit such dazzling combinations of red and blue, as may vie with the colours of the brightest birds. These brilliant reflections do not proceed from the hairs, but from the skin itself; yet they are not inherent in its substance, but depend upon the vital energy of the animal. Before the adult period of life, they are scarcely seen, and they become dull and tarnished whenever the animal is indisposed.

The young Variegated Baboon (S. Maimon, Linn.), before the appearance of its canine teeth, has a broad and short head, with the body rather thick; the face is black, with only the sides of each jaw blue and furrowed, while the thighs present no particular colour. As soon as the canines begin to appear, the body and limbs become longer, while the physiognomy gradually acquires the characters of the adult.

The females always remain of smaller size than the males, and their skin does not acquire any bright or vivid colours, while the nose never becomes entirely red. At the rutting period, which occurs every month, the vulva is surrounded by a monstrous protuberance, resulting from the accumulation of blood in those parts, and generally assuming a spherical form. When the rutting period is over, this spherical protuberance gradually diminishes, but reappears in about twenty-five or thirty days.

It is singular that no animals, excepting the Baboons, distinguish women in a crowd from the other sex; at the same time, no species gives more striking marks of this singular partiality than the Variegated Baboon. It marks out the youngest ladies, however disguised by the fashion of the day, invites them by voice and gesture, and there can be little doubt that if unconfined, the danger of the fair ones would be very imminent. May not these have been the Satyrs of antiquity? George and Frederic Cuvier are of opinion that they were wholly unknown to the ancients.

Originally from Africa, and especially from the regions near the Gulf of Guinea, they do not appear to have extended as far south as the Cape of Good Hope.

Camper and Vicq-d'Azyr have described the membraneous sac, which communicates with the larynx, and serves to render their voice hoarse. They emit a kind of growl, which may be expressed by the syllables *ao-ao*.

6. CYNOCEPHALUS LEUCOPHÆUS.—DRILL BABOON.

- Syn.* LE DRILL.—Cuv. Reg. Anim. I. 99.
 SIMIA LEUCOPHÆA.—F. Cuv. in Ann. Mus. IX.—Fisch. Syn. Mam.
 CYNOCEPHALUS LEUCOPHÆUS.—Desm. Mam.
Icon. Drill mâle, Drill très vieux, Drill très jeune, Drill femelle.—F. Cuv. et Geoff. Hist. Mam.—Ann. Mus. IX. pl. 37 (young).

SPECIFIC CHARACTERS.

THE MALE.

THE HAIR yellowish-grey; white beneath, and on the side of the head.

¹ To this place the Baron Cuvier has referred his *Simia nigra* in the following words:—"We must distinguish from the other *Cynocephali*, a species entirely black and without any tail (*S. nigra*, Cuv.), but the head of which resembles the others." The last portion of this sentence does not appear to have been stated with M. Cuvier's usual precision, as the nostrils are not terminal. We have accordingly followed Bennett in considering this animal as a true *Macacus* (see *Macacus niger* already described). Isid. Geoffroy forms this animal into a third section, under the name of *Cynopitheques*, *Cynocéphales-Magots*, or *Tailless Baboons*, analogous to the *Magots* or *Tailless Macacos* of the preceding genus.

² We have ourselves seen, along with M. Geoffroy, two or three Mandrills, or *S. maimon*, change into *Choras*, or *S. mormon*, in the Menagerie of the Museum. The tuft of hair which is added to the characters of the *Mormon* is often found also in the *Maimon*.—*Note of the Baron Cuvier*.

THE FACE black. THE UNDER-JAW bright red.
THE TAIL very short and slender; bright red near the base.

THE FEMALE AND YOUNG.

THE HAIR greenish-grey above; white beneath, on the lower jaw, and on the side of the head; cheek-tufts brownish. THE FACE black.

THE TAIL very short and slender, greyish-white.

INHABITS Africa.

This animal was first described by M. Fred. Cuvier, who has given us a very complete account of the species in all the different stages of its growth. It bears many points of resemblance to the Variegated Baboon already described, and seems to share the same propensities. The upper parts of the body are, however, of a deeper green, and there is more white on the other parts. It wants the deep blue stripes upon the face, as well as the scarlet and violet-blue colouring of the buttocks.

DOUBTFUL SPECIES.

1. THE CRESTED BABOON (*Simia cristata* of Fisch.), from Africa, is described by Pennant (Quadr. No. 101) from a faded specimen in the

Leverian Museum. Shaw (Zool. I. p. 26) copies Pennant's description, but erroneously assigns it to India.

2. THE LONG-NOSED MONKEY (Penn. Quadr. No. 111), the *Guenon à museau alongé* of Buff. Hist. Nat. Suppl. VII., and the *Simia nasuta* of Shaw, is probably identical with the *Chacma Baboon* already described. Also, the *PRUDE MONKEY* of Penn. Quadr. No. 111.

3. THE WOOD BABOON, CINEREOUS BABOON, and YELLOW BABOON (Penn. Quadr. Nos. 95, 96, and 97), are identical either with *Cynocephalus mormon*, or *C. leucophæus*. As to which of these should claim the preference, it is impossible to decide, for the bright colours of the *Manorills* fade after death, and Pennant's descriptions are merely derived from skins belonging to the Leverian Museum.

IMAGINARY SPECIES.

1. LE BABOUIN CHEVELU (*Papio comatus*), Geoff. Ann. Mus. XIX. is identical with *Cynocephalus porcarinus*.

To these we shall add,

2. The Little Baboon of Pennant, *SIMIA APEDIA* (Linn. Gmel. I. 28), which is probably the young of some species of *Macacus*.

ADDITION TO

GENUS I. PITHECUS.—MEN-OF-THE-WOODS.

(See pages 147—149.)

Before concluding the Natural History of the Apes of the Old Continent, it will be necessary briefly to notice the important acquisition made to Zoological science by the recent discovery of the adult Orang-Outang,¹ as well as the highly probable existence of two species of *Pithecus* in the Island of Sumatra.

1. PITHECUS SATYRUS.—ORANG-OUTANG.

THE ADULT.

Add. Syn. ORANG DE WURMB.—Geoff. Cours. d'Hist. Nat. 1^e leç. 31.

Icon. Temm. Mon. Mam. II. pl. 41 (old male).—Pl. 42 (old female).—Pl. 43 (views of the head).—Pl. 44 (young).—Pl. 45 and 46 (skeleton).

SPECIFIC CHARACTERS.

THE ADULT MALE AND FEMALE.

THE MUZZLE very prominent; a large protuberance on each cheek, in the male only. THE FOREHEAD much depressed.

THE PECTORAL LIMBS very long, reaching as low as the ancles.

THE EXTERNAL EAR, EYES, MOUTH, and NOSE, small.

THE HANDS narrow, THE FINGERS long; THE THUMBS of the hinder-hands most commonly without nails.

THE TAIL, CHEEK-POUCHES, and CALLOSITIES, all wanting.

THE HAIR long and scanty, of a deep chestnut brown; a long and pointed beard, yellowish-red, in the male only; the eyelashes wanting.

THE YOUNG.

THE MUZZLE prominent; no protuberance on the cheeks. THE FOREHEAD elevated. THE HAIR of the same colour as the adult; no beard; otherwise resembling the adult.

INHABITS Borneo and Sumatra.

The adult Orang-Outang, which is now ascertained to be identical with the *Pongo* of the Baron Van Wurmb, is the largest of all known quadrumanous animals, approaching very nearly to Man in stature. An old male in the possession of M. Temminck is above four feet three inches in height; but one in the possession of the Dutch Scientific Expedition, established at Banjarmassing, in the Island of Borneo, has attained the extraordinary stature of five feet seven inches. The head of the adult male is of singular dimensions; the cheeks are prolonged laterally, and bear a very prominent swelling on each side, in the form of a crescent. These fleshy protuberances give a deformed appearance to his face, while the excessive prolongation of the muzzle, and thickness of the lips, above which its very diminutive nose appears engrafted, combine in rendering its countenance one of the most hideous in the entire range of the Animal Kingdom. Its protuberances are nearly six inches in length, and about two inches in thickness. They resemble those excrecences which are found in certain species of Hogs, and in all the known species of *Phacocharus*; their texture consists of an adipose substance, hard to the touch, disposed in a very abundant cellular tissue. Nothing is yet known of the functions to which this peculiar organization may be subservient. It is only developed in the male, when very nearly adult, probably about

the age of eight or ten years, and there is no appearance of it in the females.

The forehead of the adult male is almost wholly naked. The orbits are prominent, the eyes one-third smaller than those of Man. It has no eyelashes, but its diminutive eyelids are surrounded by a few stiff hairs. The nose is depressed, blending into the growth on the cheeks, and projecting only at the point, on the sides of which the nostrils open. These are separated by a partition, extending beyond their lower margin, and blending into the thick upper lip; the latter, as well as the lower lip, is very thick and fleshy. The lower jaw terminates in a very broad chin, truncated, and projecting beyond the upper jaw; it bears in the male a long and pointed beard. The month is a horizontal cleft, very small in proportion to the height of the animal. All these parts are nearly destitute of hair, excepting a few scattered ones, of a yellowish-red, on the temporal ridges. The lateral parts of the lips are supplied with a kind of moustachio, arising at the angles of the nose, and extending to the angle of the mouth. The ears are small, and formed like those of Man, with a fixed lobe. The hinder part of the head is of a roundish form; all the hairs with which it is covered proceed from a common centre, and are disposed in rays; the vertex stretching far behind terminates in a depressed occiput.

All parts of the trunk are heavy, massive, and destitute of elegance, owing to the extreme size of the haunches and the volume of the abdomen. The breast is almost naked; the hairs become more abundant along the sternum to the abdomen, where they are neither so long nor dense as to cover the skin, which may be perceived throughout. The back as far as the haunches is still less hairy, but the sides of the body are abundantly supplied with long hairs, which fall down upon those with which the legs are covered. The fore-limbs are very considerably longer than the hinder; they nearly touch the ground, when the animal stands erect; and the fore-arm especially is of considerable length. These parts are very hairy, but less so towards the hands and fingers, where they are very short. All the hairs of the fore-arm point towards the elbow, where they unite with those of the humerus, and end in a point. The fingers, as well as the metacarpus and metatarsus, are much longer than those of Man, and hence the thumb is placed at a considerable distance behind. The hinder-thumbs are rather short, perfectly opposable to the other fingers, and forming, with the index of the hinder-hands, a semicircle. This organization plainly indicates that the Orang-Outang is not adapted for walking on two feet, but that it is wholly organized for climbing trees. Its movements on the ground are constrained, either when erect or on all the four hands.

M. Temminck has examined six individuals of different ages killed in the wild state, without being able to find the slightest indication of a nail upon the thumb of the hinder feet, and the skin covering the last phalanx of the thumb is not even harder than in any other place. A seventh specimen, which lived for several years in captivity, had the thumb of the right hinder-hand without a nail, but a perfect nail appeared upon the left. Two other skeletons, in the collection of the King of Holland, had nails on all their thumbs, and these also died in captivity. The much agitated question may therefore be fairly considered as decided, and the thumbs of the hinder-hands are wanting in the normal state of the Orang-Outang. All the other fingers are furnished with black nails, longer and more curved than those of Man. The same relative length prevails

¹ Our account of the Orang-Outang was written in June 1838, and we have now (Oct. 1838) just received the excellent description of M. Temminck, with lithographic views of the adult.

among the fore-fingers as in Man, but the index of the hinder-hands is invariably the longest of all, and the other fingers diminish gradually to the fourth finger, which is the shortest. The naked parts of the hands present the same arrangement of the papillæ of the skin in concentric curves, and as the papillæ on the tips of the fingers are very fine, we may infer that the organ of touch is extremely delicate in the Orang-Outang.

All the naked parts of the body and head, excepting the orbits and the lips, are of a blueish slate grey. The hair is uniformly throughout of a deep chestnut brown, more or less glossy, but the beard and moustachios are of a yellowish-red. There is no difference in the colours of the male and female, even in their different periods of age. The young of the year, those of five, six, or eight years, do not vary in this respect from the full-grown adults; but there is a slight difference in the quantity of hair, the young being more plentifully furnished than the adult.

None of the individuals in the possession of M. Temminck have true callosities; the epidermis being merely hardened by the frequent sitting posture. The teeth of the old animals, especially the males, are much used by detrition, so that their original structure and the crown have totally disappeared. The canines of the males are much stronger than those of the females, which are regularly straight and conical; while those of the males are very strong compared with the other teeth, and their direction outwards is strongly marked.

On comparing the skeleton of the adult male with that of Man, several modifications were noticed in its structure. The seven vertebræ of the neck form a column as long as that of Man, but their spinous processes, commencing with that of the axis, are vastly longer, though but slightly forked at their extremity. The hole for the passage of the spinal cord is much narrower than in Man. The variation in the magnitude of the facial angle, according to the ages of individuals, is very remarkable.

In the skulls of two very old males, it was from	35° to 37°
In a female nearly adult,	38°
In a female at the period when the last molar was appearing,	40°
In an individual of less size,	48°
In two individuals about 1 ft. 11 in. high,	52°
In a very young specimen about 1 ft. 6 in. high,	65°

TRIBE II.—PLATYRRHINA.—APES OF AMERICA.

SYNONYMS.

PLATYRRHINI (πλατύς, *platūs*, broad, ῥίνα, *rrhina*, nostrils).—Geoff. Ann. Mus. XIX. 104.
 LES SINGES DU NOUVEAU CONTINENT.—Cuv. Reg. Anim. I. 99.
 CEBUS.—Fisch. Syn. Mam. 37.

CHARACTERS OF THE TRIBE.

THE DENTAL FORMULA, $\frac{2 + C + (3 F + 3) M}{2 + C + (3 F + 3) M} = \frac{18}{18} = 36$

THE NOSTRILS separated by a broad partition, and opening on the sides of the nose, the genus *Eriodes* excepted.
 THE CALLOSITIES and CHEEK-POUCHES always wanting.
 THE TAIL always long, sometimes prehensile.
 INHABIT America.

THE Apes of the New Continent have four molar teeth more than the others, making thirty-six teeth in all; they have long tails, no cheek-pouches; the buttocks hairy, and without callosities; the nostrils [usually] pierced in the sides of the nose, and not beneath. All the larger Quadrumanous animals of America belong to this division; their great intestines are less inflated; their cæcum longer and thinner than in the Apes of the Old Continent.

These Quadrumanous animals form a natural group, wholly distinct from those hitherto described. Buffon was the first to notice the remarkable difference in their characters, which would almost seem to evince that they belonged to different creations. It will be recollected that the Apes of the Old World have, with the single exception of the Orangs, their buttocks destitute of hair, while natural and inherent callosities cover those parts; they most commonly have cheek-pouches for holding their provisions; and the partition of their nostrils is narrow, and opens beneath the nose as in Man. All these characters are wanting in the Apes of America. The partition of their nostrils is, with a few exceptions, very thick; the nostrils open on the sides of the nose and not beneath; their buttocks are entirely covered with hair, and they have no callosities. They are wholly destitute of cheek-pouches, and they differ not only specifically from the Quadrumanous animals of the Old Continent, but generically, and these primary variations in the characters, which their generality renders highly remarkable, draw along with them a number of subsidiary differences, rendering the subdivision at once natural and satisfactory.

2. PITHECUS ABELII.—RED ORANG.
 THE YOUNG.

Syn. ORANG ROUX.—Temm. Mon. Mam. II. 136.
 JEUNE ORANG-OUTANG.—Marion de Procé in Ann. des Sc. Nat. V. (2d series), p. 313.
Icon. ORANG-OUTANG.—Abel. Chin. p. 318.

The existence of a species of Red Orang in the Islands of Sumatra and Borneo is rendered extremely probable, by the discovery that the young Orang-Outang is of the same dark chestnut brown colour as the adult. Hitherto, Dr Abel's Orang-Outang, as well as the notice of M. Marion de Procé, have been considered as referring to the young Orang-Outang; but they now appear to belong to the young of an unknown species, which may be called the Red Orang.

It differs from the young of the Orang-Outang in being covered with long red hair; that of the head extends in front upon the forehead, producing the appearance of a periwig. It has long eyelashes, and its muzzle is not prominent.

ADDITION TO

GENUS VIII. sp. 8.—MACACUS NEMESTRINUS.—PIG-TAILED MACACO.

(See page 164.)

Add. Syn. SIMIA CARPOLEGUS.—Raffles, in Linn. Tran., XIII. 243.

The Pig-tailed Macaco, called Bruh by the Malays, is very common in the neighbourhood of Bencoolen. Of the three varieties found there, the Bruh-setopong is the largest, the most docile, and most intelligent. It is much esteemed by the inhabitants, who train it to ascend trees for the purpose of gathering cocoa-nuts, in which service it is very expert. When sent to gather this fruit, it selects the ripe nuts with great judgment, and pulls no more than it is ordered. Its height is about two feet when sitting. The other varieties, called Bruh-selasi and Bruh-puti, are of a darker colour, more intractable, and less intelligent.

Although in the normal and perfect state of these Apes of America, we find six molar teeth on each side and in each jaw, it occasionally happens, as well as with those of the other Continent, that a less number is found either when young individuals have not acquired their full complement of teeth, or when individual specimens have lost some of them through old age. Hence it will sometimes happen that only five molars will be found, as in the Apes of America. M. Geoffroy has, however, noticed on one occasion the existence of seven molars on each side of the upper jaw, in a very old *Cebus Apella*; and the same number of molars have been found by M. Isidore Geoffroy in both jaws, but only on one side, of an *Ateles pentadactylus*.

Buffon first proposed the subdivision of the Apes of America into two sub-tribes, the SAPAJOS and SAGOINS, according as their tails are, or are not, prehensile. Subsequently M. Spix separated them into GYMURI, or Naked-tails, wherein the extremity of the tail is naked and callous beneath, and TRICHURI, or Hairy-tails, where it is entirely covered with hair. Were it not for the genus *Cebus*, or Weepers, whose tails are at once hairy and prehensile, these two divisions would coincide; the Sapajoes and Gymuri being otherwise prehensile and naked, while the Sagoins and Trichuri are not prehensile, and are covered with hair over the entire surface of the tail.

The prehensile nature of the tail, upon which Buffon's subdivision is founded, is at once a striking and singular adaptation of an organ, which in most other animals is either rudimentary, or hangs uselessly downwards. It becomes among the Sapajoes in some respects a fifth hand, by which the animal can seize distant objects without moving its body, or hang suspended from the branches of a tree, even after life is extinct.

SUB-TRIBE I.—CATECHURA,¹—SAPAJOOB.

SYNONYMS.

HELOPITHECI (Helopithèques).—Geoff. Ann. Mus. XIX. 105.
 LES SAPAJOUS.—Buff. Hist. Nat.—Cuv. Reg. Anim.
 CEBUS.²—Erxl. p. 44.

CHARACTERS OF THE SUB-TRIBE.

THE TAIL prehensile, and long.

Some of the American Apes have their tails *prehensile*; that is to say, its extremity is capable of rolling itself with sufficient force round other bodies, so as to seize them like a hand. These are more particularly styled *SapajooB*.

GENUS I. MYCETES.³—HOWLERS.

Syn. LES ALOUATTES.—Cuv. Reg. Anim. I. 99.
 MYCETES.—Illig. Prodr. 70.—Kuhl. Beitr.—Desm. Mam.
 STENTOR.—Geoff. Ann. Mus. XIX. 107.
 CEBUS (in part).—Fisch. Syn. Mam.—Erxl. p. 44.
 SIMIA (in part).—Linn. Gmel. I.

GENERIC CHARACTERS.

THE HEAD pyramidal. THE FACE oblique. THE FACIAL ANGLE 30°.
 THE HYOID BONE cavernous, capacious, and appearing externally.
 THE TAIL naked beneath the point.
 THE HANDS pentadactylous. THE NAILS short and convex.
 INHABIT South America.

At the head of the SapajooB we may place the Howlers, which are distinguished by their pyramidal head. Their upper jaw descends much lower than the cranium, while the ascending branches of the lower jaw are much elevated, for receiving a bony drum, formed by a vesicular expansion of the hyoid bone, which communicates with the larynx, and gives an enormous volume and terrific tone to their voices. Hence their name of *Singes hurleurs*, Brullaffe, or Howlers. The prehensile portion of their tail is naked beneath.

This genus contains several species, the distinctive characters of which are not yet very definitively fixed, as the colour of the hair, upon which it is founded, varies according to the differences of age and sex.

These animals are at once distinguished from all other Apes by the expansion of the throat, and by their terrific howl, resembling the grunting of a herd of swine. Though monogamous, they are found in troops of fifteen or twenty, and fill the air at the rising and setting of the sun with their mournful howls, which may be heard to a very remote distance. The concert usually commences with the note of a single Howler, whose example is speedily followed by all the remainder. These Apes are by no means nimble, but heavy, stupid, and lazy. They feed chiefly on leaves. When perceived by the hunters in their inaccessible retreats among the dense foliage of lofty trees, surrounded by rocks and rivers, they do not fly with the agility of the other Apes, nor do they take flight to any distance, but moving slowly, and howling piteously, they climb higher towards the tops of the trees. The females carry their young clinging to the back or under the belly. As the Howlers are in general very large and fat, they are in great request among the Colonists and Indians, who use them as food. They are dressed with the skins on, well singed, and roasted before a fire. Bouilli à la singe is likewise accounted very palatable; but the resemblance of the animal to a human child, especially about the head, gives the dish a revolting appearance. This kind of food is easily procured, as the Howlers are at once discovered by their cries, and the slowness with which they take to flight commonly exposes the entire troop to certain death.

This genus is natural, well defined, and characterized by having its limbs of medium length, and all terminated by five fingers, the anterior thumb being half as long as the first finger, very confined in its movements and scarcely opposable, but especially by the remarkable form of the skull and hyoid bone. The skull is pyramidal, and shaped in such a manner, that when it is made to rest upon the dentary margins of the upper jaw, that is to say, when the plane of the palate is held horizontally, the occipital foramen is on a level with the upper part of the orbits. The position of the occipital foramen is likewise singular; it recedes back-

wards, and instead of being placed at the base of the skull, is perpendicular to it. The lower jaw is excessively developed, especially in its branches, which are so extensive, as to equal the entire skull in extent of surface. They form two deep partitions, containing between them a large cavity, in which is deposited a hyoid bone modified in a remarkable manner. The body of that bone is transformed into an osseous chest, with very thin and elastic sides, presenting a large opening behind, on the sides of which are articulated two pairs of horns, forming the half of an ellipsoid, when they have attained their full growth. This chest is about two inches and a half in each diameter, and almost square. In consequence of this enormous growth, the hyoid bone extends beneath the lower jaw, and forms a projection, covered externally and concealed by a long and thick beard. The precise manner in which this apparatus influences the sound, so as to produce a volume so enormous, has not yet been distinctly explained. The larynx does not differ from that of the Weepers (Cebus), except by the presence of two membranous saes, into which the ventricles open, and communicate with the hyoid bone.

The females of the Howlers, as well as those of other American Apes, do not appear to be subject to the "écoulement périodique;" they produce only one young one at a time, and this they carry on the back. They appear to have much affection for their young. D'Azara seems to consider them as polygamous, but Spix positively assures us that they are not so. They are domesticated with difficulty, and, as far as we know, have never yet been seen alive in Europe.

At the present date, only four species are plainly recognizable; but this number has been more than doubled by the vague indications of several German and French writers.

I. MYCETES SENICULUS.—ROYAL HOWLER.

Syn. L'ALOUATTE ROUSSE.—Cuv. Reg. Anim. I. 99.
 STENTOR SENICULUS.—Geoff. Ann. Mus. XIX.
 MYCETES SENICULUS.—Kuhl. Beitr.—Desm. Mam.—Latr.
 CEBUS SENICULUS.—Erxl. p. 46.—Fisch. Syn. Mam.
 SIMIA SENICULUS.—Linn. Gmel.—(Mono Colorado).—Humb.⁴ Obs.
 Zool. p. 342 and 354.
 ROYAL MONKEY.—Penn. Quadr. No. 132, a.
Icon. L'Alouate.—Audeb. Sing.
 Buff. Hist. Nat. Suppl. VII. pl. 25.

SPECIFIC CHARACTERS.

THE HAIR of the head, arms, hands, and tail, deep brownish-red; elsewhere, bright yellowish-red; a beard long and bushy.

THE FACE naked and black.

INHABITS French Guiana, Carthagea, and the banks of the Magdalena.

The Royal Howler, about the size of a large Fox, of a bright yellowish-red, deeper on the head, [limbs], and tail, often comes to us from the woods of Guiana, where it lives in troops.

Its food consists of leaves rather than fruits, and its cry is composed of short and hoarse sounds, proceeding from the depth of the throat, resembling the grunting of a Hog, but infinitely louder. When first captured, this animal is very savage; but when brought up in captivity, we are told that it loses its voice, becomes melancholy, and does not long survive.

The face of the Royal Howler is black, and naked with the exception of a few scattered red hairs, some scanty black hairs for eyelashes, and a few on the lips. The hair of the forehead is deep brownish-red, very short and thick, and pointing backwards, while the hair of the occi-

¹ Catechura—from κατεχω, *katechō*, to hold fast, and ουρα, *oura*, a tail.

² Cebus, or Cebus (Κηπος)—names of an Ethiopian Ape, which appears, from Ellis's description (XVII. c. 8), to have been the Red Guenon (*Cercopithecus ruber*).—*Note of the Baron Cuvier*.

³ Mycetes—from μυκητης, *mukētēs*, howling.

⁴ Humb. Obs. Zool.—Recueil d'Observations de Zoologie et d'Anatomie Comparée, faites dans l'Océan Atlantique, dans l'Intérieur du Nouveau Continent, et dans la Mer du Sud, pendant les années 1799 à 1803, par Al. de Humboldt et A. Bonpland. Paris, 1811.

put points forwards, occasioning a very small tuft at the vertex. On the temples and cheeks it is of the same colour, but very long; the beard is very broad and bushy. The hair of the arms from the shoulder to the elbow, as well as of the back, sides, breast, and abdomen, is bright yellowish-red; that of the fore-arms, hands, thighs, legs, and tail, of a very deep brownish-red. The tail is as long as the body and head taken together.

2. MYCETES URSINUS.—URSINE HOWLER.

Syn. L'ALOUATE OURSON.—Cuv. Reg. Anim. I. 99.

STENTOR URSINUS.—Geoff. Ann. Mus. XIX.

MYCETES URSINUS.—Kuhl. Beitr.—Desm. Mam.—Pr. Max.¹ Beitr. II. 48.

CEBUS URSINUS.—Fisch. Syn. Mam.

SIMIA URSINA (Araguato de Caracas).—Humb. Obs. Zool. p. 329 and 355.

Icon. Mycetes ursinus.²—Pr. Max. Abbild.³

Humb. Obs. Zool. pl. 30.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown throughout, scanty on the abdomen; the beard strong and thick.

THE FACE naked and blackish.

THE naked portion of the TAIL black.

INHABITS Brazil.

The Ursine Howler does not differ greatly from the preceding species.

It abounds in the primitive forests of Brazil, where it interrupts the silence of night by its stunning howl, resembling the sound of a drum. The natives regard it as very excellent game, especially in winter, when it is very fat. Being of a very mild nature, it is easily tamed when taken young; but the slowness of its movements, and the disagreeable monotony of its howl, must render it by no means a very agreeable domestic animal. It appears to inhabit a great portion of South America.

The hair, which is of a uniform reddish-brown, is much darker in the young, but approaches in the adult to a rusty red, or reddish-brown. M. Humboldt, who frequently observed the females carrying their young upon the shoulders, did not remark any difference in the colours of the sexes. They are found in immense numbers, sometimes as many as forty being seen on a single tree. The leaves of trees, rather than the fruit, appear to be their habitual food. When domesticated, they are more steady than most other Monkeys, and apparently of a less delicate constitution.

VAR. FUSCUS.—BROWN HOWLER.

Syn. STENTOR FUSCUS.—Geoff. Ann. Mus. XIX.

MYCETES FUSCUS.—Desm. Mam.—Kuhl. Beitr.

Icon. Spix,⁴ Sim. et Vespert. Bras. pl. 30. (Mycetes fuscus mas.)

This is considered by some to be the Ouarine of Buffon, but it undergoes much variation. Though generally of a dark chestnut brown, with the back and head passing to a bright chestnut, and the points of the hairs golden yellow, it seems scarcely distinguishable from the Ursine Howler already described.

There appear to be some other species, which are of a black, brown, or paler colour. In one of them this pale tint is ascertained to belong to the female [and young].

3. MYCETES CHRYSURUS.—GOLDEN-TAILED HOWLER.

Syn. Stentor chrysurus (L'Hurler à queue dorée).—Isid. Geoff. Mém. Mus. XVII.

Icon. Isid. Geoff. Etud. Zool. pl. 7 (Mammifères).

SPECIFIC CHARACTERS.

THE HAIR of the back, sides, and hinder half of the tail, bright golden yellow; elsewhere dark chestnut brown.

THE FACE almost naked.

INHABITS Columbia.

The Golden-tailed has long been confounded with the Ursine Howler. It occurs frequently on the banks of the Magdalena, where it is known by the name of Araguato, which term is applied indiscriminately to several different species of Monkeys, all agreeing, however, in having a beard.

Like most other Monkeys, it lives in troops. M. Roulin informs us, that when a troop of these Howlers is passing from one tree to another, all the individuals composing it act in a manner precisely similar to each other, as in the school-boys' game of "follow-the-leader;" they leap successively to the same points, and place their hands in the same positions, as if each individual were obliged to imitate the motions of the animal preceding it.

On the hinder half of the tail, and on the upper surface of the body, from the shoulders to the insertion of the tail, the hair is of a very brilliant golden yellow; on the rest of the tail it is of a light chestnut brown; while on the remainder of the body, head, and limbs, it is of a very dark chestnut brown, especially on the limbs, where it merges into a violaceous tint. The face is almost wholly naked, but less so than in the Royal Howler.

4. MYCETES NIGER.—BLACK HOWLER.

Syn. STENTOR NIGER.—Geoff. Ann. Mus. XIX.—Desm. Mam.

CEBUS CARAYA.—Fisch. Syn. Mam.

SIMIA CARAYA.—Humb. Obs. Zool. p. 355.

MYCETES NIGER.—Pr. Max. Beitr. II. 66.

LE CARAYA.—D'Azara,⁵ Quadr. Parag. II. p. 208.

Icon. MYCETES BARBATUS.⁶—Spix, Sim. et Vespert. Bras. pl. 32 (male).—Ib. pl. 33 (fem. and young).

Mycetes niger.—Pr. Max. Abbild. (fem).

SPECIFIC CHARACTERS.

THE MALE.

THE HAIR soft and long; entirely black, tending to reddish on the breast; the beard very long.

THE FEMALE AND YOUNG.

THE HAIR light greyish-yellow.

INHABITS Brazil.

This Howler, called *Bugiu* by the Brazilians, is found plentifully in the interior of Minas Geraes and Bahia, among the low forests, distinguished by the name of Catinga. They live much retired, but always in numerous troops. In some parts of Bahia, the males are becoming very rare, owing to their being much hunted for their elegant black fur, which is used for ornamenting hats and saddles. They have the sagacity, when attacked, of sheltering themselves behind trunks and branches; and unless surprised by a sudden shot, they place themselves in such a position, that their bodies when deprived of life cannot fall to the ground. On this account the hunter loses the greater part of his game, as the trees which they frequent are almost inaccessible. The flesh of this species is preferred by the Portuguese and South American Indians to that of Ducks and several other animals.

The Black Howler is generally very corpulent. Its hair is plentiful above, but very scanty on the interior surface of the entire body, excepting on the centre of the breast, where there is a tuft of black hairs found in both sexes. The hair of the body, limbs, tail, and beard, is of a shining black in the adult male; on the top of the head and back of the neck it tends slightly to a brown, and to a greyish-white on the fingers. The hairs lie flat on the back and tail, are directed forwards on the top of the head; while they are short, straight, and directed backwards, on the forehead. The entire face is surrounded by a very dense beard; but is naked on the forehead, beneath the eyes, on the lips and chin, with a few scattered black, stiff, and short hairs, mixed with others of considerable length. The ears are round, very distinct, and slightly hairy behind. The tail is nearly as long as the body, very thick, with about a fourth part of its under surface callous, and sloping gradually to a point. The nails are rather long, black, slightly curved, and the thumb of the hinder-hands flattened. Its voice resembles the croaking of a Frog. The female has the same characters, excepting that her body is less corpulent; the back, and sometimes the upper surface of the tail, is blackish; the remainder of the body of a greyish-yellow, the beard less dense, shorter, divided near the throat, and of a greyish or reddish-yellow. The forehead is broader, and marked on the sides and at the centre of the forehead by dark brown lines; the tail is less thick and callous beneath for nearly one-half of its length. The young have the same characters as the females, excepting that the dark hues become deeper with their age.

¹ PR. MAX. BEITR.—Beiträge zur Naturgeschichte von Brasilien, von Maximilian, Prinzen zu Wied. Weimar, 1825.

² Regarding the *Mycetes ursinus* of Prince Maximilian, the Baron Cuvier remarks, "It appears to be much browner than the *ursinus* of M. Geoffroy, and to approach more nearly to the *M. fuscus* or the *M. discolor* of Spix, pl. 30 and 34. It is this last which appears to be the *Stentor fuscus* of Geoff." We do not coincide in this opinion of the Baron. It appears to us that Spix, pl. 34 (*M. discolor*), is the *Cebus Belzebul* of Erxleben, and merely a variety of the *Stentor niger* of Geoffroy; while Spix, pl. 30 (*M. fuscus*), is identical with the *S. fuscus* of Geoffroy, and a variety of the *M. ursinus*. See the Synonyms in the text.

³ PR. MAX. ABBLD.—Abbildungen zur Naturgeschichte Brasiliens, herausgegeben von Maximilian, Prinzen von Wied. Weimar, 1824—1831.

⁴ SPIX, SIM. ET VESPERT. BRAS.—Simiarum et Vespertilionum Brasiliensium Species Novae, ou Histoire Naturelle des Espèces Nouvelles de Singes et de Chauve Souris, observées et recueillies pendant le voyage dans l'Intérieur du Brésil, exécuté par ordre de S. M. Le Roi de Bavière, dans les années 1817 à 1820, publiée par Jean de Spix. Monachii, 1823.

⁵ D'AZARA, QUADR. PARAG.—Essais sur l'Histoire Naturelle des Quadrupèdes de la Province du Paraguay, par Don Félix d'Azara, écrits depuis 1783 jusqu'en 1796, traduits par M. L. E. Moreau-Saint-Méry, Paris, 1801.

⁶ Maregravius (Bras. 227) describes a species of Howler entirely black and bearded. The figure will be found at p. 228 of that work, but under the erroneous name of *Expánna*. It seems to be the *Mycetes barbatus* of Spix, pl. 32. The female, pl. 33, is of a pale yellowish-grey, and the male will be found to be the *Mycetes niger* of Kuhl and Prince Maximilian of Wied Neuwied. The *Caraya* of Azara, said to be black, with the breast and belly dark red, and the female of which is brownish, will probably belong to this species.—Note of the Baron Cuvier.

M. Spix, while on a hunting expedition, observed a female of this species, which had been wounded, continuing to carry a young one on her back, until fainting through loss of blood, she employed her dying efforts in throwing her young one upon the adjoining branches to a place of safety.

VAR. STRAMINEUS.—STRAW-COLOURED HOWLER.

Syn. STENTOR STRAMINEUS.¹—Geoff. Ann. Mus. XIX.

SIMIA STRAMINEA (ARABATA).—Humb. Obs. Zool. p. 355.

Icon. MYCETES STRAMINEUS.—Spix, Sim. et Vespert. Bras. pl. 31.

This animal is in all probability a mere variety of age or sex of the Black Howler, from which we can find no essential ground for specific distinction. It was found by M. Spix in the forests between the Rio Negro and Solimaens towards Peru. Its hair is of a uniform straw colour, tending in some places towards orange yellow. It is much smaller than the Black Howler, and is probably a young male of the first or second year.

VAR. RUFIMANUS.—RED-HANDED HOWLER.

Syn. MYCETES RUFIMANUS.²—Desm. Mam.—Kuhl. Beitr.

CEBUS BELZEBUL.—Erxl. p. 44.—Fisch. Syn. Mam.

SIMIA GUARIBA.—Humb. Obs. Zool. 355.

SIMIA BEELZEBUL.—Linn. Gmel. I. 355.

PREACHER MONKEY.—Penn. Quadr. I. No. 132.

Icon. MYCETES DISCOLOR.—Spix, Sim. et Vespert. Bras. pl. 34.

The Red-handed variety blackish, with the latter half of its tail and its hands reddish, is smaller than the Black Howler, and approaches still nearer to this type than the straw-coloured variety already described. It probably represents a male about to assume the characteristics of the adult.

DOUBTFUL SPECIES.

1. M. FLAVICAUCATUS, THE YELLOW-STRIPED HOWLER (Kuhl Beitr. and Desm. Mam.), is in all probability a variety of some of the species already described, perhaps the young of M. chrysurus. It was found on the banks of the Amazon, where it is known by the name of Choro. The face is yellowish-brown, and scantily supplied with hair; the body is dark-brown; and the tail, shorter than the body, has a yellow stripe on each side. M. Humboldt distinguishes it under the name of Simia flavicauda—(Choro).—Obs. Zool. p. 343 and 355. It is the Stentor flavicaudatus of Geoff. Ann. Mus. XIX.

All the Sapajoes which now remain to be described (Les Sapajoes ordinaires, *Cuv.*) have the head flat; the muzzle slightly projecting, and the facial angle about 60°. Some of them have the thumbs of the fore-hands wholly or partially concealed beneath the skin, while the prehensile portion of their tail is naked beneath.³

GENUS II. ATELES.—SPIDER-MONKEYS.

Syn. LES ATÈLES (in part). *Cuv. Reg. Anim.* I. 101.

ATELES (in part).—Geoff. Ann. Mus. XIX. 105.—Spix, Sim. et Vespert. Bras.

LES ATÈLES.—Isid. Geoff. Mém. Mus. XVII.

SIMIA (in part).—Linn. Gmel. I.

SPECIFIC CHARACTERS.

THE HEAD rounded.—THE FACIAL ANGLE about 60°.—THE FACE perpendicular.—THE EARS large and naked.

THE HYOID BONE slightly cavernous, not appearing externally.

THE TAIL naked beneath the point.

THE FORE-HANDS tetradactylous, the thumb being wanting or rudimentary.—THE HINDER HANDS pentadactylous.—THE NAILS wide, and semicylindrical.

THE LIMBS long and thin.

INHABIT South America.

All these animals come from Guiana and Brazil; their fore-hands are very long and thin; while their mode of progression is singularly slow. They bear a remarkable similarity to Man, in the disposition of some of their muscles, and they alone of all animals have the biceps eruralis constructed as in the human species.

The Spider-Monkeys are generally mild, timid, melancholy, lazy, and very slow in their movements, so as always to appear in pain or unwell; yet, when there is any occasion for exertion, they can exhibit much agility, and clear a very considerable space at a single leap. They live in troops, on the elevated branches of trees, and feed chiefly on fruits. We are likewise assured that they eat Roots, Insects, Mollusca, and small Fish, that they seek for Oysters at low-tide, and break the shells between two stones. Some add that they use the point of the tail as a bait for Crabs and small Fish. Dacosta and Dampier relate that, when the Spider-Monkeys are desirous of passing across a river, or from one tree to another, without touching the ground, they take fast hold of each other by the tail, so as to form a kind of chain, which is made to oscillate, until the lowermost Monkey has been swung sufficiently near to the object, which it seizes, and then draws after it all the others. The tail, besides its most ordinary use, that of rendering their position secure by grasping the branch of a tree, is employed by them for several purposes. It serves to seize objects at a distance, without obliging them to move the body, or even the eyes, the sense of touch being so admirably developed in its callous portion as to render the co-operation of another sense on most occasions unnecessary. Sometimes they roll the tail round the body, so as to protect themselves from the cold, to which they are very sensitive, or two individuals clinging closely together, roll their tail round each other. It has been ascertained that they sometimes use the tail for carrying food to the mouth; but for this purpose they usually employ their hands, which, though wanting the thumb, and of a disagreeable form, owing to their great length and narrowness, are far from being awkward. The genus is widely dispersed throughout South America, and contains several species, which are nearly allied, and greatly resemble each other in the colours of their hair. Like the Orang-Outang, they walk with great difficulty, and when on all the hands, they close the latter, and place the outer surfaces upon the ground. When sitting down on the haunches, they sometimes draw the hinder part of the body forwards by fixing the fore limbs upon the ground, and using them like a pair of crutches.

The cerebral cavity is rounded and voluminous, and forms nearly two-thirds of the entire skull. Their orbits, broad and deep, are remarkable in the adults for a kind of crest, appearing on the superior and exterior portion of their circumference. The lower jaw is rather deep, and its branches broad, but not so much as in the Howlers. The hyoid bone resembles that of several Apes of the Old Continent, such as the Guenons and Baboons. It is analogous to that of the Howlers, but smaller, and does not impart any volume to their voice. The Spider-Monkeys and succeeding genera emit a mild and sonorous whine, resembling the fluted cry of some birds.

The molar teeth in both jaws are small, with their crowns irregularly rounded. The upper incisors are very unequal in size, the first being much longer and broader than the second; in the lower jaw, the incisors, on the contrary, are equal in size, but are considerably larger than the molars. Their nails are wide and semicylindrical; the ears large and naked. The nostrils are of an elongated shape, situate at a distance from each other and wholly lateral, being exactly placed on the sides of the nose. The clitoris is excessively long, so that the sexes are distinguished with difficulty. M. Isidore Geoffroy found it to be two inches and a half in length in a female of Ateles Brissonii. The tail being much longer than the body, is naked beneath for a third part of its length from the point. Their hair is silky and generally long, as in the Howlers. The forehead is covered with scanty hairs, which are directed, at least partially, from the front backwards. All the other hairs of the head are very long, and point from behind forwards, so that at the places where the points meet a kind of crest or tuft, more or less distinctly pronounced, is formed, the disposition of which varies according to the species. These latter characters serve to distinguish a Spider-Monkey from the succeeding genera, at the first glance, without submitting them to any detailed examination.

The Genus ATELES, as originally proposed by Geoffroy-St-Hilaire (Ann. Mus. VII.), contained five species, one of which (Le Camail) belongs more properly to the genus Colobus of the Old World. This error M. Geoffroy was one of the first to acknowledge, and he accordingly substituted (Ann. Mus. XIX.) the Chuva of Humboldt in its place, leaving the total number of species five as before; but the discovery by Prince Maximilian of a new species with a very small thumb, subsequently induced Desmarest (Mam. p. 72) to separate the genus into two sections

¹ The Alouatte couleur de paille, Stentor stramineus, Geoffr. and Mycetes stramineus of Spix, pl. 31, of a yellowish-grey, appears from its skull to differ in the species; but it may be merely a female of one of the preceding. We may easily comprehend, regarding the Howlers generally, that if their characters possess so little certainty, their synonyms must have still less.—*Note of the Baron Cuvier.*

² Maregravius (Bras. 226) speaks of a black Guariba with brown hands. This animal Spix refers to his Seniculus niger (see the Mém. de Munic for 1813, p. 333). It is the Mycetes rufimanus of Kuhl.—*Note of the Baron Cuvier.*

³ The Baron Cuvier here proceeds to remark, that "These Sapajoes have been formed into the genus Ateles by M. Geoffroy (Ann. Mus. VII. 260). Two species (Ateles pentadactylus and Eriodes tuberifer) have been separated from the remainder by M. Spix, to form the genus Brachyteles, and serving to connect the genera Ateles and Lagothrix together. The remaining Ateles to which M. Spix reserves the name of Coïta, Buff. are entirely deficient of any apparent thumb on the fore-hands." For this arrangement, which has justly been considered as wholly artificial, we have ventured to substitute another, apparently better suited to the present state of the science.

characterized by the presence or absence of this rudimentary appendage. Spix, carrying these views still farther, proposed the genus *BRACHYTELES*, and the Baron Cuvier, adopting them in the Second Edition of the "Règne Animal," assigned two species to the genus *Brachyteles*, and retained five in the genus *Ateles*. The excellent Memoir of M. Isidore Geoffroy (Mém. Mus. XVII. published in 1828) clearly demonstrated, however, that this arrangement should be regarded as purely artificial, violating as it does the most natural analogies. Three additional species have likewise been discovered since the Baron Cuvier published his last Edition, so that the genus *Ateles* would now contain ten species, were not three of them assigned to M. Isidore Geoffroy's new genus *ERIODES*, which will doubtless be universally adopted.

The term *Ateles*, from *ατελής*, *imperfect*, is, strictly speaking, inapplicable, as one species has the thumb, although rudimentary. It is, however, a well characterized division, being in the New World analogous to the *Semnopithecii* and *Colobi* of the Old. The *Ateles* have the same slowness, gravity, and mildness; their head, likewise, is round; their limbs long and thin; the abdomen voluminous, and the tail long. They are essentially destined to live on trees. When on the ground, their movements are excessively awkward; they drag themselves along, rather than walk, and, instead of resting the fingers or the soles of the feet upon the ground, so as to be either digitigrade or plantigrade, they rest on the inner side of their fore-hands, and the outer margin of the hinder. These uncouth crawling gestures have led to their being called *Spider-Monkeys*; but they atone for their awkwardness upon the ground by their agility when on trees. They run along the smallest branches with the greatest activity and address, and leap from tree to tree, though separated by a considerable interval; for, as they live chiefly on fruit, they have no occasion even to come to the ground except when they require water. They assist each other in danger, and attack a stranger by throwing small branches at him, or even their own excrements. When attacked by hunters, and one of them has been wounded, the remainder fly to the tops of the trees and raise the most lamentable cries, while the injured animal, placing its hands on the wound, watches the flowing of the blood until it loses consciousness and dies. It then commonly remains suspended by the tail; for this organ has the property of closing itself at the extremity, though it remains extended throughout the rest of its length.

These animals are easily tamed, while kindness and attention render them very affectionate. It has even been stated, that they learn to assist in different domestic offices; but this requires confirmation.

I. ATELES PANISCUS.—COAITA SPIDER-MONKEY.

Syn. LE COAITA.—Cuv. Reg. Anim. I. 101.

ATELES PANISCUS.—Geoff. Ann. Mus. VII. and XIX.—Desm. Mam.

SIMIA PANISCUS.—Linn. Gmel. I. 36.—Humb. Obs. Zool. p. 353.

FOUR-FINGERED MONKEY.—Penn. Quadr. I. No. 133.

Icon. Coaita femelle.—Geoff. et F. Cuv. Hist. Mam.

Le Coaita.—Audeb. Sing.

Buff. Hist. Nat. XV. pl. 1.

SPECIFIC CHARACTERS.

THE HAIR entirely black. THE FACE naked and flesh-coloured.

THE FORE-HANDS tetradactylous, the thumb being wanting.

INHABITS Guiana and Brazil.

This animal is wholly covered with black hair, like the following species, but is absolutely without a visible thumb on the fore-hand; its face is flesh-coloured.

Though long known as a distinct species, its history has always been more or less confounded with that of other Monkeys. It certainly does at first sight appear paradoxical, that an animal apparently organized for rapid motion, with long and slender limbs, and a tail capable of acting like a fifth hand, should move with slowness and constraint; yet, when upon the ground, its arms and legs seem to move with pain to the animal, and to require the influence of some urgent motive for action. When on a tree, however, we are assured by Pennant and others, that the activity of this animal is very great. It does not appear to be destitute of intelligence; it is mild and affectionate to its keeper. At all times the tail is firmly rolled round any object within its reach, as if to protect the individual from an accidental fall. Audebert tells us, that he saw one specimen raising straw and hay to its mouth with the tail, in nearly the same manner as an Elephant uses its trunk. These animals are said to be found in numerous troops in the woods of Guiana and Brazil, suspended from the branches of trees.

The entire body of the Coaita Spider-Monkey is covered with black, glossy, long, and coarse hairs, rather scanty beneath, and without the slightest trace of woolly hairs. The face, as well as the skin of the body, is of a brownish flesh-coloured tint, and the hands are black. Its ears resemble ours, but they want the lobe; the abdomen is of very great capacity, and seems to announce the presence of voluminous intestines. The cry of this animal is acute and plaintive. The mammae of the female, placed

beneath the arm-pits, are marked by a black nipple. The clitoris is enormously developed, being nearly two inches in length.

2. ATELES PENTADACTYLUS.—FIVE-FINGERED SPIDER-MONKEY.

Syn. LE CHAMEK.—Cuv. Reg. Anim. I. 100.

ATELES PENTADACTYLUS.—Geoff. Ann. Mus. VII. and XIX.

SIMIA CHAMEK.—Humb. Obs. Zool. p. 353.

ATELES SUB-PENTADACTYLUS.—Desm. Mam.

Icon.

SPECIFIC CHARACTERS.

THE HAIR entirely black. THE FACE naked.

THE FORE-HANDS with a rudimentary thumb.

INHABITS Guiana, Brazil, and Peru.

The Five-fingered Spider-Monkey differs from the preceding in having the thumb slightly apparent; yet this consists only of a single phalanx, and wants the nail. The hair is wholly black.

So great is the resemblance between this species and the Coaita in form and colour, that they were long regarded as identical. Their skulls are, however, very different. That of the Five-fingered Spider-Monkey is broader, shorter, flatter towards the suture of the parietal bones, and more expanded towards the temples. The lower jaw-bone is likewise proportionably larger; the inferior margin is straight, while it is vaulted in the Coaita; and the ascending branches are so extensive, that we might almost imagine that they served, as in the Howlers, to support a hyoid bone of unusual magnitude. The thumb differs greatly in the two species. In the Coaita Spider-Monkey, the bone of the metacarpus is, at most, only half the length of the adjoining bone, and the terminal phalanx is so small, that it forms but a fifth part of the length of the preceding; these two bones are slender in proportion, so that they are lost in the common integuments, without permitting the slightest trace of them to appear externally. In the Five-fingered Spider-Monkey, the same bones are found, their chief difference consisting in their thickness, but the bone of the metacarpus is not quite so long. The first and only phalanx is still less so, being about a third of its length; but it is much broader, especially near the extremity. This phalanx, detaching itself wholly from the second bone of the metacarpus, constitutes the thumb of the Chamck. It is very short, and wholly wants the second phalanx as well as the nail, which terminates the fingers of most other Monkeys.

The hair, like that of the Coaita, is coarse, rough, dry, and of a deep black.

3. ATELES ATER.—BLACK-FACED SPIDER-MONKEY.

Syn. LE CAYOU.—Cuv. Reg. Anim. I. 101.

ATELES ATER.—F. Cuv.

ATELE COAITA DE CAYENNE.—Geoff. Ann. Mus. XIII.—Desm. Mam.

Icon. Cayou.—Geoff. & F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR and FACE very black.

THE FORE-HANDS tetradactylous.

INHABITS South America.

This animal has its face black, like the remainder of its body.

The hairs are long and silky, but rather dry and coarse, like those of the Coaita; they are as long on the head and tail as on the remainder of the body, where they point in the usual direction, from the front backwards; while on the head their points are directed forwards. The skin is black throughout, the pupil of the eye brown, and the organs of generation flesh-coloured. The ear is oval, and the antihelix remarkable for its large size.

4. ATELES MARGINATUS.—STRIPE-FACED SPIDER-MONKEY.

Syn. LE COAITA À FACE BORDÉE.—Cuv. Reg. Anim. I. 101.

ATELES MARGINATUS.—Geoff. Ann. Mus. XIII. and XIX.

SIMIA MARGINATA (CHUVA).—Humb. Obs. Zool. p. 354 and 340.

Icon. COAITA À FRONT BLANC, femelle.—F. Cuv. et Geoff. Hist. Mam.

Ann. Mus. XIII. pl. 10.

SPECIFIC CHARACTERS.

THE HAIR black, a margin of yellowish hairs round the face of the male; whitish in the female.

THE FACE flesh-coloured. THE FORE-HANDS tetradactylous.

INHABITS Brazil.

These Monkeys occur frequently on the banks of the Rio Santiago and Amazon. M. Humboldt was informed by the Indians, that they live in numerous bands apart from the Marimondas (*Ateles Brissonii*). The male is rather ill-tempered, the female mild and intelligent.

When seated, they raise the tail perpendicularly upwards, and roll the point into a spiral curve. Their physiognomy bears a very striking resemblance to that of a Negro.

The Stripe-faced Spider-Monkey is entirely covered with long, black, and silky hairs, much scantier on the lower parts of the body than on the upper. The internal surfaces of the hands and the naked portion of the tail are violet-coloured. The hairs of the back, sides, thighs, legs, arms, and tail, are directed in the usual manner; those of the head point from the front backwards, while the hairs of the forehead rise almost erect upwards, and form, when opposed to the others, a kind of crest, so that the yellowish or whitish ornament of the forehead is the first object which attracts the attention of the observer. The hair of the fore-arm near the elbow is directed backwards.

5. ATELES BRISSONII.—BRISSON'S SPIDER-MONKEY.

- Syn.* LE COAITA À VENTRE BLANC.—Cuv. Reg. Anim. 1. 101.
ATELES BELZEBUTH.—Geoff. Ann. Mus. VII. and XIX.
SIMIA BELZEBUTH (MARIMONDA).—Humb. Obs. Zool. p. 325 and 353.
CEBUS BRISSONII.—Fisch. Syn. Mam.
LE BELZÉBUTH.—Briss. Reg. Anim. p. 211.
Icon. Belzebuth (young).—Geoff. et F. Cuv. Hist. Mam.—Ann. Mus. VII. pl. 16.

SPECIFIC CHARACTERS.

THE HAIR dark brown above; yellowish-white beneath; changing into yellowish-red on the abdomen.

THE FACE violet-black; flesh-coloured round the eyes. THE FORE-HANDS tetradactylous.

INHABITS Guiana.

This animal is widely dispersed throughout Spanish Guiana, where it is known by the name of Marimonda. Its hair is dark brown, very long and shining on the upper part of the back. The hair of the occiput and vertex is directed forwards, while that of the forehead points backwards, thereby forming a tuft on the top of the head, and contributing towards its extreme ugliness. The face is naked and black, while the tips of its very extensible lips, and the point of its nose, are of a reddish-white. The mouth is surrounded with stiff grey hairs; the neck and chin are almost naked; the eyes brown, and furnished with long black eyelashes. The abdomen, the interior of the thighs, and the inferior surface of the tail, are covered with yellowish-red hair, the points of which, when strongly illuminated, give a slight metallic reflection.

The Marimonda of the banks of the Orinoco is excessively slow in its movements, of a melancholy, mild, and timid disposition. Through excess of timidity it is very apt to bite even those who are attending to its wants; and it announces its approaching passion by making a grimace and raising the cry *oo-oh*. Of all prehensile tails, that of Brisson's Spider-Monkey exhibits the greatest perfection. It can raise even a straw, and fully equals the trunk of the Elephant, so that, as Humboldt remarks, it seems as if the very eyes of this Monkey were placed at the end of its tail. Without turning its head, this little animal can introduce its tail into the smallest holes for the object of its search. This organ, however, is not observed to raise food to the mouth, that office being always fulfilled by the hands. When collected together in large numbers, they interlace their limbs and tails in the most grotesque forms. Their attitudes announce the greatest apathy and indolence, while the joints of their limbs are so flexible, that they almost appear dislocated. When exposed to the burning heat of the sun, they throw the head backwards, their eyes are directed upwards, and, folding their arms on the back, they remain motionless in this extraordinary position for hours together.

In young specimens, the hair is of a dirty white beneath, and greyish-black above.

6. ATELES HYBRIDUS.—MONGREL SPIDER-MONKEY.

- Syn.* L'ATÈLE MÉTIS (MONO-ZAMBO).—Isid. Geoff. Mém. Mus. VII.
Icon. ATELES HYBRIDUS.—Isid. Geoff. Etud. Zool. pl. 1 (Mammifères).

SPECIFIC CHARACTERS.

THE HAIR clear brown above; yellowish on the thighs; white beneath; a white circular patch on the forehead.

THE FACE dark brown. THE FORE-HANDS tetradactylous.

INHABITS Columbia.

The present species differs remarkably in the general colour of the hair from its congeners, which are either black or dark brown. It is at once known by the white patch placed in the centre of its forehead. Beneath the head, the body, and along the tail, as far as its callous portion, the Mongrel Spider-Monkey is of a dirty white; the upper parts are generally of a clear brown, which passes into a pure brown on the head, the fore-limbs, thighs, and beneath the tail, and into a well defined pure yellow

low on the thighs, as well as on the sides of the tail, and a part of the lower extremity.

This animal is very common in the Valley of the Magdalena, where it is known by the name of Marimonda, a name common to several other Monkeys. It is likewise termed Zambo or Mono-Zambo, from the resemblance which its colour bears to that of the Zambis, or descendant of the African and American Indian. The Mongrel Spider-Monkeys live in troops of twelve or fifteen individuals, and the traveller through the woods is informed of their presence by the noise which they make in throwing themselves from one branch to another. The females appear much attached to their young, which they carry on their backs from place to place. An old female, embarrassed by her young one, had a considerable leap to make; M. Roulin saw an old male place himself on the extremity of the branch, and make it oscillate so as to bring it to the level of the female, who took advantage of the proper moment to effect her passage. Their attention to the young is shared by both sexes.

This species rests upon several adult females and one young male in the Paris Museum. M. Roulin admits its reality, and assigns it to Columbia.

7. ATELES MELANOCHIR.—BLACK-HANDED SPIDER-MONKEY.

- Syn.* ATELES MELANOCHIR.—Desm. Mam.
Icon. ATÈLE MELANOCHIR (femelle).—Geoff. et F. Cuv. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR on the top of the head, and the outside of the arms, legs, and tail, black; whitish beneath; elsewhere grey tinged with yellow.

THE FACE flesh-coloured round the eyes and mouth, elsewhere black.

THE FORE-HANDS tetradactylous.

INHABITS Peru.

Of the present animal little is known. It seems to have all the characteristics of the other Spider-Monkeys; such as being mild, affectionate, sociable, and excessively slow in its movements.

The head, limbs, and tail, are covered with black hairs above; the inner surface of the arm and fore-arm, down to the fore-hands, is white, as well as the inner surfaces of the legs and thighs, the inferior surfaces of the neck, breast, and abdomen, the sides of the thighs, and the inferior surface of the tail; the shoulders are of a yellowish-grey, and the remainder of the upper parts of the body, as well as the cheek-tufts, are of a pure grey. All the hands, and the naked portion of the tail, are black, likewise the cheeks and the lower half of the nose; but the circles round the eyes and mouth are flesh-coloured. The hair is entirely composed of silky filaments; those on the black as well as the white parts of the body are of a uniform shade throughout, while those on the grey parts are annulated with black and white, more or less mixed with yellow.

DOUBTFUL SPECIES.

1. THE BAY SPIDER-MONKEY (*Ateles fuliginosus*), is known to us only by the description in Kuhl, Beitr. p. 26, taken from an individual in the Paris Museum. From the silence of the French Naturalists, and the want of any figure of this species, we are inclined to place it here until an opportunity occurs for examining a perfect specimen.

2. GEOFFROY'S SPIDER-MONKEY (*Ateles Geoffroyi*), appears from Kuhl's description (Beitr. p. 26) to be identical with the *Ateles Melanochir* of Desmarest.

GENUS III. ERIODES.¹—WOOLLY-MONKEYS.

- Syn.* LES ERIODES.—Isid. Geoff. Mém. Mus. XVII. 138.

GENERIC CHARACTERS.

THE HEAD rounded. THE FACIAL ANGLE about 60°. THE EARS small and hairy.

THE NOSTRILS separated by a very narrow partition, and almost opening beneath the nose.

THE TAIL naked beneath the point.

THE FORE-HANDS tetradactylous or pentadactylous. THE HINDER-HANDS pentadactylous. THE NAILS compressed, excepting those of the hinder thumbs, which are large and flat.

THE LIMBS long and thin. THE HAIR very woolly.

INHABIT South America.

These Monkeys bear a general resemblance to the Spider-Monkeys already described, in their long and meagre limbs, but differ in several important points of their organization. Externally, they may be at once distinguished by the woolly nature of their hair, their short hairy ears, the compressed form of their nails, as well as by the remarkable anomaly in the disposition of their nostrils. In the last particular, they may be considered as holding a medium rank between the Apes of the Old Continent

¹ Eriodes, from ἐριώδης, woolly. The term *Wollaffe* (Woolly-Monkeys), given by Kuhl to the genus *Lagothrix*, seems to be more applicable to the present.

and those of America, being in fact more nearly allied to the former than to the latter. Their nostrils are rounded, very nearly approximate to each other, and are rather inferior than lateral, owing to the extreme thinness of the partition of their nostrils. The nails bear more resemblance to those of some Carnivorous animals, such as the Dogs, than of the Spider-Monkeys; they are compressed, and may be described as formed of two laminae surmounted by a blunted crest. The nails on the thumbs of the hinder-hands are, however, an exception to this rule, being broad and flat as in Man. Their ears are small, and for the most part covered entirely with hair.

The molar teeth of the Eriodes are generally very large and quadrangular. Their incisive teeth, in both jaws, are arranged nearly in a straight line; they are very small, of equal length, and much less than the molars, by which characters the dentition of the Woolly-Monkeys may be distinguished from that of all other Sapajoes, excepting the Howlers.

Their hair is soft to the touch, woolly and very short. That of the head, still shorter than on the body and tail, is directed backwards; and this arrangement, being opposite to that of the Spider-Monkeys, gives to their physiognomy an aspect wholly different.

The Woolly-Monkeys live together in troops, among the branches of trees; they leap with much agility, and greatly resemble the preceding or succeeding genera, in their manners, as far as the latter have been ascertained.

I. ERIODES HEMIDACTYLUS.—DWARF-THUMBED WOOLLY-MONKEY.

- Syn.* ERIODES HEMIDACTYLUS.—Isid. Geoff.
ATELES HYPOXANTHUS.—Desm. Mam.—Less. Mam.—Kuhl, Beitr.
Icon. Mém. Mus. XVII. pl. 22.

SPECIFIC CHARACTERS.

THE HAIR yellowish fawn-colour, tending to black upon the back; the tail and hands of a brighter yellow.

THE FORE-HANDS pentadactylous; the THUMB being very short, with a small compressed NAIL.

THE FACE flesh-coloured, spotted with grey.

INHABITS Brazil.

This species was discovered by Delalande in 1816, but has always been confounded with the Ateles hypoxanthus of Prince Maximilian. It may, however, be at once distinguished from its having the thumb of the fore-hand unguiculated, very narrow, short, and scarcely reaching to the origin of the first finger, so as to be wholly useless to the animal for any practical purposes. Its hair is in general yellowish-fawn, assuming a darker tint upon the back. The hands and tail are of a purer yellow than the remainder of the body. There is a naked space at the base of the tail and near the anus, surrounded by hair of a ferruginous red. The face, which is completely naked in the neighbourhood of the eyes, appears to be spotted with grey over a flesh-coloured ground. The habits of this animal are unknown.

2. ERIODES ARACHNOIDES.—THUMBLESS WOOLLY-MONKEY.

- Syn.* LE COAITA FAUVE.—Cuv. Reg. Anim. I. 101.
ATELES ARACHNOIDES.—Geoff. Ann. Mus. VII., XIII., and XIX.
Desm. Mam.
ERIODES ARACHNOIDES.—Isid. Geoff. Mém. Mus. XVII.
SIMIA ARACHNOIDES.—Humb. Obs. Zool. p. 354.
Icon. Ann. Mus. XIII. pl. 9.

SPECIFIC CHARACTERS.

THE HAIR is yellowish fawn-colour above; yellowish-white beneath; reddish on the outside of the limbs and beneath the tail; the eyelashes long and black.

THE FACE flesh-coloured.—THE FORE-HANDS tetradactylous.

INHABITS Brazil.

This animal is easily distinguished from all other Woolly-Monkeys known at present, by the absence of any external appearance of a thumb on the fore-hands. Its hair is generally of a clear yellowish-fawn colour, passing into reddish-grey upon the head, and into bright red beneath the tail, upon the hands, and especially near the hinder wrists or heels. Some specimens are, however, sometimes found of a uniform clear yellow. The hair of the ears is of a deeper chestnut tinge, that of the forehead approaches to white, set off by a row of long, stiff, and black eyelashes, with which the forehead is bordered. Its hair has this peculiarity, that it gives out a fawn-coloured tint, when rough and bristled as it usually appears, but passes into a chestnut brown when perfectly smooth. This proceeds from the circumstance that the tips of the hair are of a fawn-colour, while their points being of a deeper brown near the head and ears, occasion the latter tint to predominate on those parts of the body.

We are at present ignorant of its habits and manners. It comes from Brazil, where it bears the name of *Macaco veruello*. Several specimens exist in the Paris Museum.

3. ERIODES TUBERIFER.—TUBEROUS WOOLLY-MONKEY.

- Syn.* LE MIRIKI (typographical error for MIRIKI).—Cuv. Reg. Anim. I. 100.
ERIODES TUBERIFER.—Isid. Geoff. Mém. Mus. XVII.
Icon. BRACHYTELES MACROTARSUS (fem).—Spix, Sim. Vespert. Bras. pl. 27.
ATELES HYPOXANTHUS (male).—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR yellowish-grey; the base of the tail and anal region yellowish-red.

THE FACE flesh-coloured.

THE FORE-HANDS with a rudimentary thumb, rarely bearing a NAIL.
INHABITS Brazil.

The Tuberos Woolly-Monkey, known to the inhabitants of Brazil by the names of *Mono* and *Miriki*, is the largest Quadrumanous animal of South America. It inhabits the lofty primeval forests of the interior, in those desert regions overrun with wood, which are seldom visited by Man.

This animal may be easily distinguished from the preceding, by having its thumbs rudimentary, and appearing externally under the form of simple tubercles, which, according to the observations of M. Spix, always want the nail, though the contrary is asserted by others. The hair on the upper part of the body is short, and rather thick, of a yellowish fawn-colour, as in the rest of its congeners, blending into a fiery red towards the roots of the hair, behind the thighs and legs, on the fingers, and beneath the tail. The hair of the head is rather darker, but becomes lighter about the face. The latter is of an oblong form, naked, flesh-coloured, slightly tinged with grey, and bears long, black, and stiff hairs on the margin of the forehead and eyelashes. The cranium is broad and arched; the ears prominent, truncated on the margin, hairy, of a deep brown beneath and behind; while the lower jaw slightly ascends at the inferior angle.

These large Monkeys are very plentiful in the maritime provinces from St Paul to Bahia. They travel about in troops during the day, and make the air resound with their loud cries. On perceiving a hunter, they ascend quickly to the tops of the highest trees, and leap swiftly and silently from branch to branch, until they are lost in the gloom of their impenetrable forests.

GENUS IV.—LAGOTHRIX.—GLUTTONOUS MONKEYS.

- Syn.* LES LAGOTHRIX.—Cuv. Reg. Anim. I. 101.
LAGOTHRIX.—Geoff. Ann. Mus. XIX.—Desm. Mam.
GASTRIMARGUS.—Spix, Sim. et Vespert. Bras.

GENERIC CHARACTERS.

THE HEAD rounded. THE FACIAL ANGLE about 50°. THE EARS very small.

THE TAIL naked beneath the point.

THE HANDS pentadactylous.

THE NAILS slightly compressed.

THE LIMBS of moderate length.—THE HAIR rather woolly.

INHABIT South America.

These animals have the head round, like that of the Spider-Monkeys, their thumbs are developed as in the Howlers, and the tail is partly naked, as in both. They all come from the interior of South America, and are said to be singularly gluttonous in their habits.

The genus Lagothrix, containing two species only, was instituted by M. Geoffroy-Saint-Hilaire, and may be distinguished from any of the preceding by its having the limbs much shorter, and especially by the fore-hands being pentadactylous, as in the Howlers and Weepers (*Cebus*), the latter of which it greatly resembles in the general proportions of the body. The fingers are of moderate length, and the first or index is even short. The nails of the anterior hands are slightly compressed, not excepting even those of the thumbs, and in respect to their shape, are intermediate to those of the Ateles and Eriodes. On the hinder-fingers, excepting the thumb, the nails are still more compressed, and similar to those of the Eriodes, especially in respect to the three last fingers. The head in the Gluttonous Monkeys is rounded, and their hair soft to the touch, very fine, and almost as woolly as in the Eriodes; but their incisive teeth and nostrils resemble those of the Ateles. Their facial angle is 50°, and their ears are very small.

It is to Humboldt that we are indebted for the discovery of these animals, which still remain but little known, whether in their organization or manners. We are merely informed that they live together in numerous troops, and appear to be very mild in their disposition; they often stand

erect upon their hinder hands. Spix, having found them in Brazil, adds, that they have a harsh, disagreeable voice, and that they are very gluttonous, for which he gives them the name of *Gastrimargus*; but the rule of priority warrants us in preferring the name given by Geoffroy.

I. LAGOTHRIX CANUS.—GREENISH GLUTTONOUS MONKEY.

- Syn.* LE GRISON.—Cuv. Reg. Anim. I. 101.
LAGOTHRIX CANUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA CANA.—Humb. Obs. Zool. p. 354.
Icon. GASTRIMARGUS OLIVACEUS.¹—Spix, Sim. et Vespert. Bras. pl. 28.

SPECIFIC CHARACTERS.

THE HAIR grey olive above; black or dark brown beneath; very black and frizzled on the head. THE FACE and HANDS black.

INHABITS the banks of the Amazon.

These animals are known to the Brazilians by the name of *Barigudos*, from their singular gluttony. They acquire a great size, and were found in troops, occupying the highest trees in the neighbourhood of the great river Solimões. When once tamed, they become very familiar, and, approaching the dinner table, sit down patiently on their haunches, waiting for boiled meat or oranges, of which they are very fond, though the latter often prove fatal to them. One specimen was brought over as far as the Azores, but died there from the cold. Towards the month of November, they are seen in great numbers carrying their young ones on the back or belly.

This species is olive-coloured throughout, and greatly resembles a Negro in the face, by the dark, short, thick, and woolly hair of the head; by its hue, which is very black; by the remarkable whiteness of the teeth, and its flat, short, and depressed nose. Its hair is extremely short and thick; grey olive above, and black or dark brown beneath; on the head, on all the hands, the inner surfaces of the limbs, and beneath the tail, it is entirely black; each hair on the back is of a dirty white, annulated with light yellowish-grey, pointed with black. The tail is longer than the body, very strong, hairy, and naked beneath for about a quarter of its length from the point. The hair under the body is rather black. The face is somewhat square, and the parts round the eyes are naked. Before the ears and behind the cheeks, the hair is turned back so as to form a kind of dark cowl. The ears are extremely short, truncated, and covered with slightly brown hairs. The incisive teeth are almost square; the canines are strong; the anterior hands slightly elongated; the nails black or grey, long, nearly triangular, and slightly curved; those on the thumbs of the hinder-limbs are almost flat.

The female and young are distinguished by having the cowl not so black as in the male.

2. LAGOTHRIX HUMBOLDTII.—HUMBOLDT'S GLUTTONOUS MONKEY.

- Syn.* LE CAPARO.—Cuv. Reg. Anim. I. 101.
LAGOTHRIX HUMBOLDTII.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA LAGOTHRICHA (Caparro).—Humb. Obs. Zool. p. 321 and 354.
Icon. GASTRIMARGUS INFUMATUS (fem.).—Spix, Sim. et Vespert. Bras. pl. 29.

SPECIFIC CHARACTERS.

THE HAIR deep brown, tipped with black.

THE FACE and HANDS black.

INHABITS the banks of the Rio Guaviare and Rio Iça.

Though greatly resembling the preceding species in many respects, this animal may at once be distinguished by its neck and body being more slender. Its face is not so square, nor its lower canines so long. The head and entire body are of a deep brown, approaching in many places to black, especially on the breast and hands. All the hairs of the body are directed backwards, and are mostly black on their points. The cowl on the head nearly resembles that of the species just described. All the nails are black, triangular, and shorter than in the former; that of the longest finger of the fore-hand is not compressed.

Some of the females have the back and head of a paler brown, approaching to grey; sometimes the hair becomes wholly white, with the points black, so as to produce the effect of a uniform grey.

IMAGINARY SPECIES.

1. LAGOTHRIX INFUMATUS (Le Lagotrichie enfumée) of Isid. Geoffroy, Dict. Class. d'Hist. Nat. art. Sapajou, founded upon the *Gastrimargus infumatus* of Spix, is absolutely identical with Humboldt's Gluttonous Monkey, on the authority of Temminck (Mon. Mam.)

GENUS V. CEBUS.—WEEPERS.

- Syn.* LES AUTRES SAPAJOUS.—Cuv. Reg. Anim. I. 102.
CEBUS (Sajou).—Geoff. Ann. Mus. XIX.—Desm. Mam.
CEBUS (in part).—Erxl.—Fisch. Syn. Mam.
SIMIA (in part).—Linn. Gmel. I.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short. THE FOREHEAD slightly projecting. THE FACIAL ANGLE about 60°.

THE BODY and LIMBS medium size.

THE TAIL prehensile, and entirely covered with hair.

THE HANDS pentadactylous. THE NAILS compressed.

INHABIT South America.

The remaining Sapajous have the head round, and the thumb distinct, while at the same time the tail is wholly covered with hairs, although it still continues to be prehensile. Their species are much more numerous, and almost as difficult to characterize distinctly as those of the Howlers.

The Weeper Monkeys are of a mild disposition, their movements quick and lively; they are very readily tamed; and it is from their little fluted cry that they derive the name of *Singes Pleureurs*, or WEEPERS.

The genus *Cebus* appears to occupy the same station in the New World as *Cercopithecus* does in the Old, each being in an eminent degree the type of its tribe. All the animals belonging to this division come to us from Guiana and Brazil, where they live in troops, on the elevated branches of trees. They feed chiefly on fruits, but willingly devour Insects, Mollusca, and Annelides, or even sometimes meat. They are believed to be monogamous. The females usually produce a single young one at a time, which they carry about with them on the back, and treat with the most affectionate attention. Many instances are known of their producing in confinement in Europe. Some of them are noticed by travellers under the name of *Singes musqués*, or Musky Monkeys, in consequence of the strong odour of musk which they emit, especially during the rutting season. They make their little fluted cry on all ordinary occasions, but when agitated by passion, whether jealousy, fear, or joy, their voice becomes strong, approaching to a noisy bark. These animals are of great agility and intelligence, very quick, and always in motion, yet docile and easily educated. M. Isidore Geoffroy noticed one individual, after many unsuccessful attempts to break a nut, first with its teeth, and then on the wood work of its cage, expertly making use of a bar of iron for that purpose. They have not the same volatile character as the Guenons of Africa, but resemble them in the indelicacy of their behaviour. They require to be kept very warm in our climates, and are extremely liable to diseases of the chest, when exposed to cold or moisture. These Monkeys are rather common in most large cities.

The limbs of the *Cebus* Monkeys are strong, powerful, and elongated; consequently, they leap with remarkable agility. Their anterior thumbs are rather short, not very free in their motions, and but slightly opposable to the fingers, as is the case with the Howlers and Gluttonous Monkeys. Their nails are cylindrical and somewhat flat: the tail is nearly the length of the body; sometimes it is wholly covered with long hairs, at other times the hairs on the terminal portion are excessively short, from its friction against other bodies, but it never exhibits a true callosity. M. F. Cuvier notices the existence of a slight callosity at the extremity of the tail of the *Cebus hypoleucus*, but this is at variance with our observations upon an individual of that species. The hyoid bone has its central portion enlarged, but it does not appear externally; the head is rather round, the face broad and short, and the eyes very large and approximated to each other. The opening of the nostrils is broad, but rather narrow from above downwards. The dentary margins are almost parallel to each jaw; the molar teeth of medium size, and six in number on each side of both jaws, as in all the other Sapajous. In one solitary instance M. Geoffroy found seven molars on each side of the upper jaw, in a very old individual of his *Cebus variegatus*, which we consider identical with *C. xanthosternus* of Prince Maximilian. The incisive teeth are arranged almost in a straight line, the first incisor being the larger in the upper jaw, while the second is the larger in the lower; the canines are very strong in all old individuals. The cerebral cavity is very voluminous; it is broad, and at the same time extends far from the back forwards; the occipital hole is situated directly under the base of the skull. The tail, being entirely covered with hair, is an organ of motion, but not of touch. The males have an external scrotum, and the glans resembles an inverted pyramid, the base being outermost.

¹ According to the Baron Cuvier, the *Gastrimargus olivaceus* of Spix is identical with *Lagotrix Humboldtii* of Geoffroy, while *G. infumatus* is the same as *L. canus*. These synonyms, we think, should be transposed, as in the text. It must be admitted, however, that the characters given by Geoffroy do not correspond very accurately with the representations of Spix.

There is no genus of Mammiferous animals, wherein the species are so difficult to characterize as the present. The earlier writers admitted but few species. Brisson recognised three, Linnæus four, Gmelin six, Buffon two, and the Baron Cuvier thought that possibly there might only be one. A more accurate acquaintance with these animals serves to announce that their species are fully as numerous as the Guenons of the Old World; that there exists much constancy in their distinctive characters; that the observed variations in the colours of their hair are inconsiderable; and that the differences in their external markings must be ascribed rather to the internal organization of each species and its influence upon their colouring, than to external and accidental circumstances.

The lists of systematic writers are in general very incorrect, and the catalogue of doubtful species more numerous than might be desired. We think, however, that twelve species may be safely admitted in the present state of our knowledge, without much risk of ultimate error.¹

(A.) PROPER WEEPERS. (SAJOUS.)

Some of the Weeper Monkeys have the hair on the forehead of a uniform length.

1. CEBUS APELLA.—COMMON BROWN WEEPER.

- Syn.* LE SAJOU.—Cuv. Reg. Anim. I. 102.
 CEBUS APELLA.—Erxl.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SIMIA APELLA.—Linn. Gmel. I.—Humb. Obs. Zool. p. 355.
 CAPUCIN MONKEY.—Penn. Quadr. No. 185.
Icon. LE SAJOU BRUN.—Buff. Hist. Nat. XV. pl. 4.
 Le Sajou.—Audeb. Sing.—Mém. Mus. (male and female).
 SAI (var.)—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR black on the head and hands; brown on the back, breast, and belly; yellowish-white on the arms, shoulders, and sides of the face and forehead; a black band along the cheek.

THE FACE dark brown.

INHABITS Guiana.

It was doubtless from confounding this species with several of its congeners, that the Baron Cuvier and others were led to suppose that it undergoes much variation. We have seen many specimens of the Common Brown Weeper, and have found them to bear so minute a resemblance to each other, as to leave no doubt as to their specific distinctness from all those so-called varieties. The "Sajou" of Audebert accurately represents this species; and it must be noticed that his figure does not differ more from the "Sai" of M. Frédéric Cuvier, than might have been anticipated from the circumstance that the latter is drawn after the living animal, and the former from a stuffed specimen.

The characteristic colours of this species already mentioned result from hairs, which are, throughout their entire length, of the same colour as the points. Each cheek is divided into two parts by a dark band, arising near the anterior margin of the ear, from the black cowl on the top of the head, and passing in a curved line downwards to the chin, so as to meet the corresponding band of the other cheek. All the hairs are silky and soft, occasionally assuming a woolly appearance. The skin of the hands and face, as well as of the parts covered with hair, is dark brown.

2. CEBUS GRISEUS.—GREYISH WEEPER.

- Syn.* CEBUS GRISEUS.—Desm. Mam.—Fisch. Syn. Mam.
Icon. LE SAJOU GRIS.—Buff. Hist. Nat. XV. pl. 5.
 LE SAJOU mâle.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR yellowish-brown above; lighter beneath; a black cowl on the top of the head; the cheeks, breast, shoulders, and fore-arms, white.

THE FACE and EARS flesh-coloured. THE HANDS dark violet.

INHABITS

Of this animal there is little particular to record, so much is the character of the genus likewise that of the species. We are not certain of its native country, which may probably be French Guiana. All its hairs are

silky, long, thick, and always grey at their base, whatever may be their colour at the points. The hinder part of the head, the neck, back, sides, the hinder part of the thighs, and the upper surface of the tail, are yellowish-brown; the abdomen and lower part of the thighs are of the same colour, but paler, and the under surface of the tail is of a dirty yellow; on the top of the head there is a black patch or cowl. The fore-part and sides of the head, the upper-part of the arms, the anterior surface of the fore-arm, the neck, and breast, are white. The face and ears are flesh-coloured, the hands and feet of a dark violet, and this colour prevails upon the scrotum; all these parts are nearly destitute of hair.

3. CEBUS CAPUCINUS.—CAPUCHIN WEEPER.

- Syn.* LE SAI.—Cuv. Reg. Anim. I. 102.
 CEBUS CAPUCINUS.—Erxl.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SIMIA CAPUCINA.—Linn. Gmel. I.—Humb. Obs. Zool. p. 355.
 WEEPER MONKEY.—Penn. Quadr. I. No. 136.
Icon. Le Sai.—Buff. Hist. Nat. XV. pl. 8.—Audeb. Sing.
 SAJOU BRUN (femelle).—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR dusky brown, with golden reflections; lighter on the face, shoulders, and fore-arms; a black cowl on the top of the head, ending in a point on the centre of the forehead.

THE FACE and HANDS violet-grey.

INHABITS Guiana.

This animal has its muzzle remarkably thick and short; its entire body is covered with soft and silky hairs, which are dusky brown throughout the greater part of their length, but are bright golden yellow at the points, communicating a greenish tinge to the animal, when viewed by a transmitted light, and emitting bright golden reflections, if seen obliquely. The fore-arms, the fore-part of the shoulders, the cheeks, and the temples as far as the ears and the sides of the forehead, are of a lighter brown approaching to yellow; the top of the head is black, in the form of a cowl, which is prolonged over the eyes, and ends in a point about the centre of the forehead. The dorsal line is darker than the other parts of the body; the hair is light, and very scanty beneath. The skin on all the naked portions of the body is of a violet-grey.

4. CEBUS HYPOLEUCUS.—WHITE-THROATED WEEPER.

- Syn.* CEBUS HYPOLEUCUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SIMIA HYPOLEUCA (CARIBLANCO).—Humb. Obs. Zool. p. 337 and 356.
Icon. SAI À GORGE BLANCHE mâle.—F. Cuv. et Geoff. Hist. Mam.
 Sai à gorge blanche var. A.—Audeb. Sing.
 Buff. Hist. Nat. XV. pl. 9.

SPECIFIC CHARACTERS.

THE HAIR on the arms and sides of the head white; on the neck and breast yellowish-white; elsewhere black.

THE FACE, FOREHEAD, and EARS, flesh-coloured. THE HANDS, and other parts of the body, violet-grey.

INHABITS the Banks of the Magdalena.

The White-throated Weeper is one of the species most commonly met with in Europe, where it is brought from Brazil or Guiana. Humboldt found several individuals near the Rio Sinn, and was informed by the Indians that they lived together in numerous troops, wholly distinct from the Common Brown Weepers (*C. Apella*).

The entire face, forehead, and ears, are naked, and of a pure flesh colour. The hands, and all the inferior parts of the body, likewise naked, are of a violet-grey. The hair is white on the sides of the cheeks, and on the arms from the elbows to the shoulders; on the neck and breast they are yellowish, but elsewhere of a very deep black. M. Frédéric Cuvier remarks, that "the White-throated Weeper alone has the point of its tail naked, but not by any means to the extent of the Coïta Spider-Monkey, for example. This character," he adds, "is proper to the species, and may serve to distinguish it from all other Sapajoes." The tails of all the Weepers are liable to lose their hair at the point from friction, and even sometimes they may become callous; but that this is not a char-

¹ It will be readily perceived that we here depart widely from the views of the Baron Cuvier regarding the species of this genus. His observations, sufficiently vague, have now become, through the progress of science, in many respects obsolete; they are as follows:—

"The *Sajous* and *Sais* differ so much from brown to yellowish and whitish, that one would be tempted to constitute them into so many distinct species, if we had not also the intermediate varieties. Such are the *Simia trepida*, *syrichtha*, *lugubris*, and *flava* of Linnæus and Schrober, as well as some of those which are distinguished by Geoffroy (Ann. Mus. XIX. 111 and 112). Spix, again, has multiplied these species to a still greater extent, and on very insufficient grounds. We should approximate to the *Sajou* (*C. Apella*, Linn.) the *C. robustus* of Prince Maximilian, which even appears to us nothing more than an adult *Sajou*. The *Macrocephalus* of Spix, pl. 1, does not appear to belong to a different species. We approximate to the *Sai* (*Simia Capucina*, Linn.), the *Sai à gorge blanche* of Buffon (*C. hypoleucus*); the *C. libidinosus* of Spix, pl. 2; the *C. xanthosternus* of Prince Maximilian, or *C. xanthocephalus* of Spix, pl. 3; and the *C. cuculatus*, id. pl. 6. We would rather be disposed to regard as distinct species, the *Sajou à pieds dorés* of Fred. Cuvier; the *Sajou brun* or *C. unicolor* of Spix, pl. 4; and the *Simia flava* of Schreber, pl. 31, B. from which the *C. gracilis* of Spix, pl. 5, appears to differ merely in the stuffing; but we are still in want of numerous observations made in the localities where these animals inhabit, before we can be satisfied that the species are not arbitrarily determined."

"After the *Sajou cornu* (*Simia fatuellus*, Linn. Gmel.) should come the *C. cirrifer* of Geoff. and a *Cebus* of the same name of Prince Maximilian, but which is different, *C. cristatus* of Fred. Cuvier."

acteristic of the species, we have had an opportunity of ascertaining from a living specimen, in the collection now forming for the Zoological Society of Edinburgh. The tail of our *Cebus hypoleucus* is entirely covered with hair, and no trace of a callosity is visible on any part.

All the movements of this animal are exceedingly brisk and lively. It is also very gentle and intelligent; its eye too is quick, so that it watches all one's gestures, and appears to comprehend them; nay, it almost seems to read one's thoughts.

5. CEBUS CHRYSOPUS.—GOLDEN-LIMBED WEEPER.

Syn. CEBUS CHRYSOPES.—F. Cuv.

Icon. SAJOU À PIEDS DORÉS.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR dusky brown above, white beneath; a white circle round the face; bright golden yellow upon the limbs.

THE FACE and EARS brown. THE HANDS bluish-grey.

THE TAIL bushy; dusky brown towards the base, elsewhere yellowish-white.

INHABITS

The height and proportions of this Weeper, for a knowledge of which we are indebted to M. Frédéric Cuvier, do not differ materially from those already described. Its head is very large and round; the face is naked, and rather brown, and surrounded by a broad circle of white hairs, which covering the forehead and cheeks as far as the ears on both sides, meet beneath the lower jaw. The remainder of the head is of a dusky brown, and this colour extends along the upper part of the back; the sides of the body and shoulders are somewhat lighter, while the neck, breast, belly, and the inner surfaces of the thighs, are white. The tail near its origin is, on the upper surface, of the same colour as the back, elsewhere it is yellowish-white. All the limbs are of a bright golden yellow. The skin of the fingers and palms of all the hands is bluish, and the ears are of the same colour as the face. The hairs are thick, soft, and very silky, on all the upper parts of the body, but more scanty beneath, especially on the abdomen; the tail is very bushy.

M. Cuvier informs us that he had an opportunity of studying the habits of this animal only for a short time; and that its dispositions served to correspond with those of the other Weepers. It exhibited the same petulance and caprice: its voice was something like a slight whistle, during its joy; and when alarmed or in wrath, its cry was sharp and rough.

6. CEBUS ALBIFRONS.—WHITE-FRONTED WEEPER.

Syn. SIMIA ALBIFRONS (OUAVAPAVI).—Humb. Obs. Zool. p. 323 and 356.

CEBUS ALBIFRONS.—Geoff. Ann. Mus. XIX.—Desm. Mam.—Fisch. Syn. Mam.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dark grey above, lighter beneath; the top of the head greyish-black; limbs of a yellowish-brown.

THE FACE bluish-grey. THE FOREHEAD and ORBITS pure white.

INHABITS the Banks of the Orinoco.

This Weeper-Monkey is only known to us from the description of the Baron Humboldt. It inhabits the forests near the Cataracts of the Orinoco, is mild, active, and not so noisy as its congeners in that locality. Numbers of them are found together in troops. At Maypures, M. Humboldt found a domesticated individual, which every morning caught a Pig, and mounting on its back, rode during the whole day over the savannah which surrounded the cabins of its Indian masters. The same individual was likewise in the habit of riding on the back of a Cat which had been brought up along with it in the house of the missionary of Maypures, while puss suffered patiently the petulance of her more intelligent companion.

The White-fronted Weeper, or Ouavapavi of the Cataracts, may be distinguished at once by the contrast between the pure white of the forehead and orbits, with the bluish-grey of the remainder of the face. Its head is in the form of a greatly elongated oval. The hair of the body is dark grey, lighter towards the breast and belly, but darker towards the limbs, where it becomes of a yellowish-brown. The top of the head is of a grey approaching to black, forming a cowl; a greyish streak extends towards the nose along the centre of the forehead; the eyelashes are of a very dark grey. The eyes are large, brown, and very vivid; the ears have a margin, and are covered with hair; the tail is nearly as long as the body, ash-coloured above, whitish beneath, and of a dark brown at the point, which has no callosity. The nails are all rounded, and very slightly convex. A stripe of very dark grey extends along the dorsal line.

7. CEBUS FULVUS.—FULVOUS WEEPER.

Syn. CEBUS FULVUS.—Desm. Mam.

CEBUS FLAVUS.—Geoff. Ann. Mus. XIX.—C. ALBUS.—Id.

Icon. SIMIA FLAVA.—Schreb. Säugth. pl. 31. B.

CEBUS FULVUS (var.)—D'Orb.¹ Voy. pl. 3 (Mammifères).

CEBUS UNICOLOR.—Spix, Sim. et Vespert. Bras. pl. 4.

SPECIFIC CHARACTERS.

THE HAIR entirely yellow or brownish-yellow, deeper on the top of the head.

THE FACE and HANDS dark violet-grey.

INHABITS Brazil.

The Yellow Weeper was first noticed by Marcgravius under the name of *Caitia* (Bras. 227). Its body is robust, the head large and round, while the face is shortened. The colour of its hair is a uniform clear brown or brownish-yellow, becoming deeper along the centre of the back, and especially on the top of the head, but assuming a greyer tint towards the limbs and tail. The ears are short and naked; the face is of a dark violet-grey; the eyes light brown; the tail is thick, and nearly as long as the body; the nails are yellow. This description is taken from a male, found by M. Spix in the forests of Teffé, a branch of the Rio Solimões.

M. D'Orbigny has lately published the figure of a Fulvous Weeper much brighter in its colour than the *C. unicolor* of Spix, but its description has not yet appeared. The *Cebus albus* of M. Geoffroy is an Albino variety of this species.

8. CEBUS ROBUSTUS.—GREATER WEEPER.

Syn. DER BRAUNE MICO.—Pr. Max. Beitr.

CEBUS ROBUSTUS.—Kuhl. Beitr.—Desm. Mam.

Icon. Cebus robustus.—Pr. Max. Abbild.

CEBUS MACROCEPHALUS.—Spix, Sim. et Vespert. Bras. pl. 1.

SPECIFIC CHARACTERS.

THE HAIR of the head almost black; the limbs and tail brownish-black; elsewhere reddish-chestnut brown.

THE FACE grey flesh-colour. THE HANDS violet-grey.

INHABITS Brazil.

This animal, as its specific name denotes, is strong and muscular, especially in the limbs and tail, and very thickly covered with hair. Its body is thick and round, the face is broad, greyish flesh-coloured, and scantily covered with hair. On the top of the head, a small tuft appears slightly elevated. The head is black; the hands, the inner surface of the limbs, the fore-arms, the lower part of the legs, and the tail, are of a glossy brownish-black; the whole body is thickly covered with long, soft, and shining hairs of a reddish-chestnut brown, which, however, are grey at their roots, and the belly is but scantily covered. The face often becomes surrounded with grey hairs through age.

The Greater Weeper is common in Brazil, but has not been found to the South of the Rio Doce. The females often have a yellowish-red band across the shoulder. Their cry is very similar to that of the Common Horned Weeper.

9. CEBUS XANTHOSTERNUS.—YELLOW-BREADED WEEPER.

Syn. DER GELBBRUSTIGE AFFE.—Pr. Max. Beitr.

CEBUS XANTHOSTERNUS.—Kuhl. Beitr.—Desm. Mam.

CEBUS VARIEGATUS (young).—Geoff. Ann. Mus. XIX.

SIMIA VARIEGATA.—Humb. Obs. Zool. p. 356.

Icon. CEBUS XANTHOSTERNUS.—Pr. Max. Abbild.

CEBUS XANTHOCEPHALUS (fem.)—Spix, Sim. et Vespert. Bras. pl. 3 (young).

LE SAI À GROSSE TÊTE (C. MONACHUS).—F. Cuv. et Geoff. Hist. Mam. (young).

SPECIFIC CHARACTERS.

THE HAIR on the top of the head, back of the neck, and tail, black; arms and legs brownish-black; breast, neck, belly, and upper-arms, reddish-yellow; the back brown.

THE FACE and HANDS dark violet-grey.

INHABITS Brazil.

The Yellow-breasted Weepers bear much similarity to the species just described. They are found in great numbers in the forests near Rio Janeiro, whence they make excursions upon the plantations of maize, oranges, and other fruits. In the *Cebus xanthocephalus* of Spix, the head and back of the neck are of the same colour as the breast, and in the *Cebus*

¹ D'ORB. VOY.—Voyage dans l'Amérique Méridionale, exécuté dans le cours des années 1826 à 1833, par M. Alcide D. D'Orbigny. Paris, 1834, et seq.

Monachus of Frederic Cuvier they are white,—variations which are in all probability owing to mere differences of age. Temminck and Prince Maximilian have verified this last observation. We find in the *Cebus variegatus* of Geoffroy another instance of the undue multiplication of species.

10. *CEBUS BARBATUS*.—BEARDED WEEPER.

Syn. *CEBUS BARBATUS*.—Geoff. Ann. Mus. XIX.—Desm. Mam.—Kuhl Beitr.

Icon. LE SAI (Var. B).—Audeb. Sing.

SPECIFIC CHARACTERS.

THE HAIR yellowish-brown; reddish beneath; a yellowish-white beard extending over the cheeks; the top of the head dark yellowish-brown.

THE FACE flesh-coloured. THE HANDS black.

INHABITS Guiana.

This animal differs from the Capuehin Weeper, in having its hair much more yellow; that which surrounds the head is of a yellowish-white; on the top of the head it is dark yellowish-brown; the hair covering the arms is yellow, and changes into red on approaching the fore-hands, which are black, as well as the hinder. The hair on the breast and belly is red, and that of the back and tail yellowish-brown, mixed with grey. On all parts of the body it is very long and silky. The above description was taken from a living specimen in the Paris Menagerie. This animal was perfectly familiar, and imitated all the gestures of its masters. When seated, it used to curl the tail round its body.

(B.) HORNED WEEPERS. (SAJOUS CORNUS.)

The remaining Weepers have the hair of the forehead differently disposed in tufts.

11. *CEBUS FATUELLUS*.—COMMON HORNED WEEPER.

Syn. LE SAJOU CORNU.—Briss. Reg. Anim. p. 195.—Cuv. Reg. Anim. I. 102.

CEBUS FATUELLUS.—Erxl.—Geoff. Ann. Mus. XIX.—Desm. Mam.

SIMIA FATUELLUS.—Linn. Gmel. I.

HORNED MONKEY.—Penn. Quadr. I. No. 138.

Icon. Sajou cornu.—Buff. Hist. Nat. Suppl. VII. pl. 29.—Audeb. Sing.

Cebus fatuellus.—Pr. Max. Abbild.

Sajou cornu mâle.—F. Cuv. et Geoff. Hist. Mam. (var.)

GENERIC CHARACTERS.

THE HAIR brownish-black; paler on the shoulders and upper arms; a yellowish-white band on the margin of the cheeks; a crest of upright hair on the forehead, ending in a tuft on each side.

THE FACE and HANDS violet-coloured.

INHABITS Brazil.

The Horned Weepers, first described by Brisson, abound on the east coast of Brazil, especially in the neighbourhood of Rio de Janeiro, and in the great woods near Cabo Frio. They sometimes are found alone, or in pairs; more usually in small troops ascending the trees in search of fruit, but apparently in perpetual motion. Generally they are very lively, and quick in their movements; the young especially are exceedingly ludicrous, and easily become attached to their master. From the continual watchfulness of these animals, the hunters find it very difficult to surprise them, and this they usually effect by imitating their sonorous whistle with the mouth. On perceiving the enemy, the troop soon effects its escape by wide springs out of the reach of the guns. They become very fat during the cool season of the year, and are then considered excellent game.

These animals acquire a larger size than the other Weepers. They are of a sooty brown almost approaching to black upon the head, body, limbs, and tail, becoming a paler brown on the shoulders and upper-arms; a band of yellowish-white hairs runs along the margin of each cheek, and meets in a very narrow line beneath the chin. The entire skin, whether naked or covered with hair, is violet-coloured. Instead of lying back upon the head, the hairs of the front stand erect, and form a crest terminated at each extremity by a bunch of hairs much longer than the remainder, from which circumstance the animal has derived its specific name. All the lower parts of the body are much more scantily covered than the upper, and these again are much thicker in winter than in summer. Then the frontal bunches increase in size, the hairs on the cheeks grow longer, and the entire animal appears of a much larger size, and in some degree out of shape. The horns, egrets, or tufts, do not appear until the animal has acquired its canine teeth; that is to say, until it has become adult. The base of its nose is rather broader than in the rest of its congeners, and is folded longitudinally, so as to give the animal a morose appearance, although it is in reality very mild and affectionate.

12. *CEBUS CIRRIFER*.—CIRCLED WEEPER.

Syn. *CEBUS CIRRIFER*.—Geoff. Ann. Mus. XIX.—Desm. Mam.—Pr. Max. Beitr.—Fisch. Syn. Mam.

SIMIA CIRRIFERA.—Humb. Obs. Zool. p. 356.

CEBUS LUNULATUS (young).—Kuhl Beitr.—*C. LUNATUS*.—Desm. Mam.

Icon. *CEBUS CIRRIFER*.—Pr. Max. Abbild.

Variété du Sajou cornu.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR dark brown above; lighter beneath; a margin of whitish hairs round the face; the hairs of the head erect, in the form of a Horse's shoe.

INHABITS Brazil.

This animal differs from the Common Horned Weeper, just described, in having the tints of its hair much darker; its back and sides of a dusky chestnut brown; the breast and belly of a paler brown; the fore-part of the arm, the neck, and the under part of the lower jaw, of a yellowish-brown; the arms, limbs, and tail, black, and the temples of a dirty white.

There is a variety of this species, figured by Fred. Cuvier, as a variety of the Horned Weeper; it differs in having the hair of the back black, of the shoulders brown, and of the summit of the head deep brown. White whiskers also ornament the cheeks, and ascend crescent-shaped to the centre of the forehead. These characteristic differences are not great; but yet, as remarked by M. Cuvier, it is only by comparing and contrasting all these varieties that the specific characters can finally be adopted, and this consideration imparts an importance to descriptions and correct drawings which otherwise they could not individually possess.

DOUBTFUL SPECIES.

1. THE FEARFUL MONKEY of Pennant (Quadr. I. No. 134), the *Cebus trepidus* of Erxleben and Geoffroy, is absolutely identical with *C. frontatus* of Kuhl and Desmarest. Its hair is chestnut brown; that on the head is still darker, rather long, and elevated in a crest. We find it figured by Audebert (Sing.) under the name of "Sajou, var. A.," and in Edwards' Gleanings, pl. 312, under the title of the Bush-tailed Monkey. It is probably identical with some of the preceding, perhaps *C. cirrifer*.

2. THE *CEBUS GRACILIS* of Spix (Sim. et Vespert. Bras. pl. 5) is yellowish-brown above; whitish beneath; the top of the head and occiput of a deeper brown; the body slender. This is probably an individual of *Cebus fulvus*, altered in the stuffing.

3. THE *CEBUS CUCULLATUS* of Spix (Sim. et Vespert. Bras. pl. 6) has the hair of the head directed forwards; a white circle round the face; the head and back brownish; the limbs and tail dusky; the shoulder, throat, and breast, whitish; the remainder of the body of a rusty red. This is, perhaps, a female of one of the species already described.

4. THE *CEBUS LEIDINOSUS* of Spix (Ib. pl. 2) is of a reddish-yellow; a dark brown cowl on its head, and a white circle round the face. That peculiarity in its behaviour, denoted by the specific name, seems rather to have been accidental to the individual described by Spix.

5. THE ANTIGUA MONKEY (*S. Antiguensis*) of Shaw, Gen. Zool. I. p. 78, is blackish-fulvous, white beneath, with black limbs, the face black, with bearded cheeks; and the tail brown. It was exported from Antigua, but its real country was unknown.

IMAGINARY SPECIES.

1. *CEBUS NIGER* of Geoffroy, Desmarest, and Kuhl, derived from the Sajou nègre of Buffon, Suppl. VII. pl. 28, is a melanic variety of *C. Apella*, according to Humboldt.

2. *C. VARIEGATUS* of Kuhl, Geoffroy, and others, is the young of *C. xanthosternus*, according to Temminck. It is likewise the *C. xanthocephalus* of Spix.

3. *C. ALBUS* of Geoffroy and others is an albinó variety of *C. fulvus*.

4. *C. LUNULATUS* of Kuhl (*C. LUNATUS* of Desmarest) is the young of the *C. cirrifer* of Prince Maximilian.

5. *SIMIA MORTA*; and,

6. *SIMIA SYRICHTA* of Linnæus (Gmel. I. 38), are founded upon imperfect specimens.

7. *C. FRONTATUS* of Kuhl and others (the Bush-tailed Monkey of Edwards) is identical with *C. trepidus*, noticed above.

8. *C. MACROCEPHALUS* of Spix is the *C. robustus* of Prince Maximilian.

9. *C. UNICOLOR* of Spix is the same as the Fulvous Weeper (*C. fulvus*).

10. *C. XANTHOCEPHALUS* of Spix should be referred to the *C. xanthosternus* of Prince Maximilian.

11. *C. FLAVUS* of *SIMIA FLAVA* of systematic authors is the same as *C. fulvus*.

12. *C. MONACHUS* of F. Cuvier is the young of *C. xanthosternus*.

ORDER QUADRUMANA.

SUB-TRIBE II.—CHALANURA.¹—SAGOINS.

SYNONYMS.

- GEOPITHECI (Geopithèques).—Geoff. Ann. Mus. XIX. 112.
 LES SAGOINS² (in part).—Buff. Hist. Nat.
 LES SAÏMIRIS, LES SAKIS, et LES NOÏTHORES.—Cuv. Reg. Anim. I. 103, 104.
 CALLITHRIX (in part).—Erxl. p. 55.

CHARACTERS OF THE SUB-TRIBE.

THE TAIL not prehensile, or imperfectly so, generally bushy and long.
 THE HABITS diurnal or nocturnal. HANDS always pentadactylous.

The remainder of the American Apes either have the tail depressed, and imperfectly prehensile, or it is not at all prehensile, and hangs loosely downwards. The latter are known in general by the name of *Sakis*.

GENUS VI. CALLITHRIX.—SQUIRREL-MONKEYS.

- Syn.* CALLITHRIX.—Geoff. Ann. Mus. XIX.—Kuhl Beitr.—Desm. Mam.
 CALLITHRIX (in part).—Erxl.
 SAGINUS.—Less. Mam.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short. THE FACIAL ANGLE about 60°. THE EYES and EARS large.

THE BODY and LIMBS medium size. HABITS diurnal.

THE TAIL longer than the body, and covered with short hairs.

THE NAILS short and flat on the thumbs; long and narrow on the fingers.

INHABIT South America.

The prettily coloured hair observed in some of the animals belonging to this Genus has occasioned the term *Callithrix*, or *beautiful hair*, to be applied to them, although it is not by any means applicable to all the species. The manners of the greater part of them are but little known. It has been ascertained, however, that they are in general very intelligent; that they live on fruits, insects, and sometimes on small birds, or other animal food, and that they occur abundantly in troops or small families, in the equatorial parts of the New World. Some of the species seem to be delicately sensible to slight alterations of temperature and moisture, and they soon languish and die under the influence of the heats of the low-grounds near the coast.

Some authors, among whom is the Baron Cuvier, have separated the Varied Squirrel-Monkey (*C. sciurea*) from the remainder, on account of the superior development of its cranium; but this circumstance does not appear, in our opinion, to be sufficient to justify a generic distinction. The eyes in all of them are of considerable size, and the orbits are completely circular; the internal ear is supplied with large auditory chambers. But in all the species, excepting the first, the cerebral cavity is not very capacious; the occipital hole is placed more in arrear, and the interorbital partition is wholly osseous.

The dentition of the whole of this genus is very uniform. In the upper-jaw the incisor nearest the medial line is double the size of the external one, their shape being alike, the lower margin is roundish, the outer side sloping, and the inner aspect much curved. The canine is of moderate size. The first false molar is smaller than the other two, and they are all shaped alike. The last of the true grinders is smaller than the other two, and of a peculiar form, exhibiting two circular crests within its inner margin, and one on the outer. The teeth of the lower jaw correspond with the description above supplied of the Howlers, with the exception of the last molar.

We are acquainted with eight species; some of them, however, are but imperfectly known. Many imaginary species have to be expunged from the lists of our predecessors.

In the first species (LES SAÏMIRIS of the Baron Cuvier), the tail is depressed, and scarcely ceases to be prehensile; the head is very flat; and there is a membranous expansion at the interorbital partition of the skeleton.

I. CALLITHRIX SCIUREA.—VARIED SQUIRREL-MONKEY.

- Syn.* LE SAÏMIRI.—Cuv. Reg. Anim. I. 103.
 CALLITHRIX SCIUREUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 SIMIA SCIUREA.—Linn. Gmel. I.
 LE TITI DE L'ORÉNOQUE (*S. sciurea*).—Humb. Obs. Zool. p. 332 and 357.

SAGINUS SCIUREUS.—Less. Mam.

ORANGE-MONKEY.—Penn. Quadr. I. No. 137.

SQUIRREL-MONKEY.—Shaw, Gen. Zool. I. 77.

Icon. Saimiri.—F. Cuv. et Geoff. Hist. Mam.

Le Saimiri.—Audeb. Sing.—Buff. Hist. Nat. XV. pl. 10.

Calitrix entomophagus.—D'Orb. Voy. pl. 4 (Mammifères).

SPECIFIC CHARACTERS.

THE HAIR greenish-yellow above; white beneath; the upper-arms and thighs grey; the lower-arms and legs bright orange.

THE FACE and HANDS flesh-coloured. THE MUZZLE black.

INHABITS the Banks of the Orinoco.

The Varied Squirrel-Monkeys are very common in the regions to the south of the Cataracts of the Orinoco; but the smallest and handsomest are those of the Cassiquiare. Their bodies exhale a slight odour of musk. The expression of their countenance resembles that of a child; they have the same innocence of aspect, the same malicious smile, and they pass with equal rapidity from the extremity of delight to that of sadness. The Indians assert that they shed tears like a human being; and M. Humboldt remarked in one specimen that its eyes became moistened when it was uneasy or under the influence of fear. The *Titi*, as it is termed by the natives, is in continual motion, and all its movements are light and graceful. It seldom becomes irritated, like the *Marousets*, but seems continually occupied in playing, leaping, and catching Insects or Spiders, the latter of which it prefers to all other food. It has the singular habit of looking attentively at the mouth of the person who speaks; and if it happen to sit on his shoulder, attempts to play with his teeth or tongue. It is a formidable enemy of all collectors of Insects, and however carefully they may conceal their specimens, the Varied Squirrel-Monkey is sure to devour them, without even wounding itself with the pins by which the spoils are fixed. As an instance of its sagacity, M. Humboldt informs us that one of these little animals could distinguish uncoloured plates of Insects from those which represented Quadrupeds or any other subject. Whenever it saw the engraving of a Grasshopper or a Wasp, its hand was instantly extended to grasp that object. Being accustomed to live in a moister and cooler climate than that of the coast, the Varied Squirrel-Monkey soon loses its liveliness when removed from the forests of the Orinoco to Cumana or Guayra, and it seldom survives this change of locality above a few months.

The upper parts of its body are of a greenish-yellow, which assumes a greyish tint upon the upper-arms and thighs, and changes into a bright orange on the fore-arms and legs. The tail has the same greenish tint as the back, but becomes black towards the point; the abdomen, breast, neck, cheeks, and a circle round the ears, are white; there is, however, a spot of greenish-yellow in the middle of the white hairs of the cheeks. The tip of the muzzle, the nostrils at the corners of the mouth, and the under part of the chin, are black, the remainder of the face and the other naked parts of the body are flesh-coloured; likewise the nails, which are black only at the points. The eyes are brown; the hands perfectly formed, but the thumbs are opposable only on the hinder; the nails of the thumbs are flat and broad, those of the fingers long and narrow. The scrotum is very voluminous, and the remainder of these parts very similar to the corresponding arrangements in the human species.

This animal never uses the tail for prehensile purposes, yet it often rolls up the point, and, when any thing is conveniently placed, encircles the extremity of the tail round that object, but it is unable to do so with any considerable force. When seated, its hinder limbs are extended forwards, and the fore-hands rest upon them. It sleeps in this sitting posture,

¹ Chalanura, from *χαλαίνω*, to let loose, and *ουρά*, a tail.

² All the American Monkeys, having the tail not prehensile, are included by Buffon, along with the *Ouistitis*, under the common name of *Sagouins* (CALLITHRIX, Erxl.) This name of *Sagouin*, or *çagui*, is applied in Brazil to all the smaller Quadrumanous animals having the tail not prehensile. M. Geoffroy assigns to his genus *Callithrix* (which forms only a subdivision of the *Callithrix* of Erxleben), and to his genera *Aotus* and *Pithecia*, the common appellation of *Geopithecus*, or *Ground-Monkeys*.—*Note of the Baron Cuvier*.

merely resting the head between the thighs, which then touch the ground. The thumb of the fore-hands is parallel to the fingers, that of the hinder is completely opposable. Its cry consists of a mild and acute whistle, which it repeats three or four times in rapid succession.

In the other species (LES CALLITHRIX of the Baron Cuvier), the tail is slender, and the teeth do not project outwards. They have for a long time been united with the Saimiris, but the head of these Sagouins is more elevated, and their canines much shorter.

2. CALLITHRIX PERSONATA.—MASKED SQUIRREL-MONKEY

- Syn.* LE SAGOIN À MASQUE.—Cuv. Reg. Anim. I. 104.
CALLITHRIX PERSONATUS.—Geoff. Ann. Mus. XIX.—Kuhl, Beitr.—
Desm. Mam.—Pr. Max. Beitr.
SIMIA PERSONATA.—Humb. Obs. Zool. p. 357.
Icon. SAUASSU (Callithrix personatus).—Pr. Max. Abbild.
Callithrix personata (mas.)—Spix, Sim. et Vespert. Bras. pl. 12.
CALLITHRIX NIGRIFRONS (mas.)—Ibid. pl. 15.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown or yellowish; the head black; the tail chestnut-brown; the back of the neck whitish in the male.

THE FACE and HANDS black.

INHABITS Brazil.

This is one of the most agreeable Monkeys in the Brazils. It was found by Spix near Rio de Janeiro, but abounds between the Rio Parahyba and Rio Doce. It is commonly seen in little communities consisting of two or three families. Its cry is sharp and loud, with a kind of rattle, occasioned by a peculiar form of the larynx. When domesticated, it becomes very gentle and sociable. The natives call it *Sauassu*, by which name it is also known to the Brazilians.

The Masked Squirrel-Monkey is at once known by the deep black hue of its head and hands, while the tail is chestnut-brown. Its hair is very bushy, deep brown near the roots, and chestnut-brown at the points. The black hair of the head hangs downwards to a considerable length around the face.

3. CALLITHRIX TORQUATA.—WHITE-THROATED SQUIRREL-MONKEY.

- Syn.* LE SAGOIN EN DEUIL OU LA VEUVE.—Cuv. Reg. Anim. I. 104.
CALLITHRIX TORQUATA.—Hoffmannsegg in Mag.¹ Gesellsch. Naturf.
Freund. X.—C. TORQUATUS, C. AMICTUS & C. LUGENS.—Geoff. Ann.
Mus. XIX.—Kuhl, Beitr.—Desm. Mam.
SIMIA LUGENS (Viudita).—S. TORQUATA, & S. AMICTA.—Humb. Obs.
Zool. p. 357.
Icon. Callithrix amicta (mas.)—Spix, Sim. et Vespert. Bras. pl. 13.

SPECIFIC CHARACTERS.

THE HAIR chestnut-brown; the fore-hands yellowish-white; the hinder-hands and tail black; the neck and breast white.

THE FACE and HANDS brown.

INHABITS the banks of the Solimöens, and the mountains on the right bank of the Orinoco.

The White-throated Squirrel-Monkey is rare and much esteemed. It appears to be extremely mild, timid, and inoffensive; its eye denotes great vivacity, yet it remains for hours motionless, without sleep, and noticing attentively every thing passing around it. Often it refuses to eat, though very hungry; and seems to have a great aversion to be touched on the hands, hiding them under the belly whenever any one attempts to touch them. This mildness and timidity, however, are merely apparent. At the sight of a small bird it becomes furious, springs upon it like a Cat, and devours it in an instant. It is very fond of fresh meat, although it usually lives on fruits; and when it eats, raises both hands to the mouth at once, like the Sagouins. It does not associate with Monkeys of a different species, and the sight of a Varied Squirrel-Monkey puts it into a rage. It runs and leaps with prodigious agility, and, like the Monkey last mentioned, does not thrive on the coasts of South America.

The hair on the body of this Monkey is of a deep chestnut-brown; the hinder-hands, fore-arms, and tail, are of a shining black; the forehead, temples, and circle round the face, of a dusky grey. The throat and breast are white. The fore-hands yellowish-white. In the females and young, the tail is not so black, and the back, instead of being chestnut-brown, is more varied, and tends rather towards a light brown.

4. CALLITHRIX MELANOCHIR.—BLACK-HANDED SQUIRREL-MONKEY.

- Syn.* CALLITHRIX MELANOCHIR.—Pr. Max. Beitr.—Kuhl, Beitr.—Desm. Mam.

- Icon.* CALLITHRIX CINERASCENS, mas. (young).—Spix, Sim. et Vespert. Bras. pl. 14.
CALLITHRIX GIGOT.—Ibid. pl. 16.
Callithrix melanochir.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR ash-grey; bright reddish-brown on the back; the tail spotted with white and yellowish-grey.

THE FACE and HANDS black.

INHABITS Brazil.

This is an agreeable little animal, common to the North of the Rio Doce on all the eastern coast of Brazil, and is even not rarely found in the interior. It is commonly known by the name of *Gigot*, and in its form and mode of life is not far different from the Masked Squirrel-Monkey already described. There is the same peculiarity in its voice. These animals reside on the highest trees of the primitive forests of Brazil in small troops of three to five individuals. When taken young they are easily tamed, and become very mild and confiding. They are sometimes hunted as game.

The bright reddish-brown of the back is peculiar to the adults; the young are entirely grey.

5. CALLITHRIX CUPREA.—COPPER-BREADED SQUIRREL-MONKEY.

- Syn. et Icon.* CALLITHRIX CUPREA.—Spix, Sim. et Vespert. Bras. pl. 17 (fem.)

SPECIFIC CHARACTERS.

THE HAIR brownish-grey above; the head, breast, limbs, and under part of the body, copper-coloured.

THE FACE and HANDS brown.

INHABITS the banks of the Rio Solimöens.

The Copper-breasted Squirrel-Monkey, called *Yapusa* by the natives, is of a brownish-grey above, and copper-colour beneath, as far as the feet. The head is furnished with short and thick hairs, the face and eye-lids are almost naked. The face is surrounded from the temples to the base of the cheeks with copper-coloured hairs directed forwards. The ears are naked behind, very prominent, and covered in front by some red hairs. In general, all the hairs are directed backwards, those of the back, shoulders, and thighs, are tolerably long, black, and intermixed with red. The tail is of a reddish-grey, becoming gradually lighter towards the extremity. The eyes are brown.

6. CALLITHRIX MOLOCH.—MOLOCH SQUIRREL-MONKEY.

- Syn.* CEBUS MOLOCH.—Hoffm. in Mag. Gesell. Naturf. Freund. X.
CALLITHRIX MOLOCH.—Geoff. Ann. Mus. XIX.—Kuhl, Beitr.—Desm. Mam.

Icon.

SPECIFIC CHARACTERS.

THE HAIR ash-coloured, annulated with brown; the temples, cheeks, and belly, bright red; the tip of the tail and hands of a clear grey, almost white.

THE FACE and HANDS dusky and naked.

INHABITS Para.

This elegant little animal has all the upper parts of the body, the neck, and head, as well as the internal surface of all the limbs, covered with hairs, annulated with light grey and pale brown, occasioning these parts of the body to present an agreeable varied appearance. The hairs of the tail, which are very bushy at its base and short elsewhere, are annulated to a considerable extent with dark greyish-brown and dirty white. The inner surface of the limbs is of a clearer grey than the upper part of the body. The backs of the hands, especially the fore ones, are of a clear grey, almost white. The hairs on the top of the head are short and perpendicular. The cheeks, the upper part of the neck, the breast, belly, and the internal surface of the limbs, are of a reddish-yellow, tending rather to a bright red on the limits of the grey tint of the sides, where these colours are separated by a definite line.

7. CALLITHRIX INFULATA.—MITRED SQUIRREL-MONKEY.

- Syn.* CALLITHRIX INFULATUS.—Kuhl, Beitr.—Desm. Mam.
Icon.

SPECIFIC CHARACTERS.

THE HAIR grey above, reddish-yellow beneath, a white spot surrounded with black above the eyes; the base of the tail reddish-yellow, the point black.

INHABITS Brazil.

This animal, first named by Lichtenstein, and described by Kuhl, from a specimen in the Museum of Berlin, is known to us only by the above description.

¹ See Hoffmannsegg's Description of Four Quadrumanous Animals in the Mag. der Gesellsch. Naturforsch. Freund. zu Berlin, for 1809, vol. X. p. 8.

8. CALLITHRIX DONACOPHILA.—D'ORBIGNY'S SQUIRREL-MONKEY.

Syn. et Icon. CALLITHRIX DONACOPHILUS.—D'Orb. Voy. pl. 5 (Mammifères).

SPECIFIC CHARACTERS.

THE HAIR of a uniform greyish-brown, interspersed with white.
THE FACE and HANDS bluish-grey.
INHABITS South America.

A figure of this animal is given in D'Orbigny's Voyage, now in course of publication; but its description has not yet reached us. It appears to be fond of climbing the elevated reeds of those tropical regions.

IMAGINARY SPECIES.

1. C. NIGRIFRONS of Spix, is identical with C. personata.
2. C. CINERASCENS of Spix, is the young of C. melanochir.
3. C. AMICTA, and,
4. C. LUGENS, do not differ specifically from C. torquata.

GENUS VII. PITHECIA.—FOX-TAILS.

Syn. PITHECIA (Schweif Affe).—Illig. Prodr.—Kuhl, Beitr.—(Saki) Desm. Mam.—Geoff. Ann. Mus. XIX.
SIMIA (in part).—Linn. Gmel. I.—Humb. Obs. Zool.
CEBUS (in part).—Erxl.
BRACHYURUS (in part).—Spix, Sim. et Vespert. Bras.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short. THE FACIAL ANGLE about 60°. THE EYES and EARS resembling those of Man.
THE CANINE TEETH powerful, and projecting forwards.
THE BODY and LIMBS medium size. HABITS diurnal or crepuscular.
THE TAIL usually long, and plentifully covered with long hairs.
THE NAILS short and curved.
INHABITS South America.

Several of the Sagoins have the tail long and bushy, for which reason they may be called *Fox-tailed Monkeys* (Singes à queue de renard), or briefly FOX-TAILS, and their teeth project forwards to a greater degree than in the other Monkeys. The above are the Pithecia of Desmarest and Illiger. One species, having the tail less than the body, is separated by Spix from the remainder to form his Genus *Brachyurus*.

The Fox-tails are also designated *Night Monkeys* in Cayenne, but inaccurately, as they are not really nocturnal but rather crepuscular, being busily astir principally in the evenings and at early dawn. They have a general resemblance to the Sapajoes and the remaining Sagoins; but are distinguished from the former in not having the tail prehensile; and from the other genera of Sagoins, by the tail being supplied with long and bushy hair. Another, and very marked essential character, consists in the circumstance of their incisive teeth not preserving their parallelism with the canines, but being crowded together as if forced forwards by the great size of the canines. Their head is round, their muzzle short, and the facial angle ranges from about 60° to 52°. The size of the ear is moderate; the nasal bones are elevated and extended; the tail is somewhat shorter than the body; the hands are pentadactylous, with short and curved claws.

These animals usually reside in the depths of the forest, where they conceal themselves or sleep during the day, so that their manners are not well known. Their usual food is fruit and insects; they collect in small troops; and they are often pursued by some of the larger Monkeys, who seize their supplies, and beat them if they have the temerity to resist.

1. PITHECIA LEUCOCEPHALA.—WHITE-HEADED FOX-TAIL.

Syn. LE YARQUÉ.—Cuv. Reg. Anim. I. 103.
PITHECIA LEUCOCEPHALA.—Geoff. Ann. Mus. XIX.—Desm. Mam. (No. 91).—Kuhl, Beitr.
SIMIA LEUCOCEPHALA (YARQUÉ).—Humb. Obs. Zool. p. 359.
PITHECIA OCHROCEPHALA (var).—Kuhl, Beitr.—Desm. Mam.
Icon. L'YARQUÉ.—Buff. Hist. Nat. XV. pl. 12.—Audeb. Sing.—Schreb. Säugth. pl. 32.

SPECIFIC CHARACTERS.

THE HAIR brownish-black; a broad yellowish-white circle round the face; no beard.
THE FACE and HANDS brown.
INHABITS Guiana.

This species has very generally been confounded with the Red-breasted Fox-tail (*P. rufiventer*), though it clearly differs in its markings, which, according to Audebert, are very uniform. Its face is brown; the sides of the head and neck are covered with a yellowish-white hair, short, and cut, as it were, with scissors; the body generally is brownish-black, covered with bushy hair, about four inches long. This remark applies also to the tail, which is nearly of the same length as the body; on the extremities the hair is short; the colour brown.

This is a rare species, frequenting the thickets of Guiana and Surinam. Its habits require further elucidation. De la Borde states that this animal goes in troops, consisting of from half-a-dozen to a dozen; whilst Stedman notices that it is the only species of Monkey which is not sociable, being always found solitary. He also remarks that it is generally persecuted by its congeners, who never fail to attack, and rob it of its stores. It feeds upon honey, rice, and the other grains used by Man. The female has usually only one at a birth, which for a time it carries on its back. Its cry is said to resemble that of the Weepers.

Sometimes these animals are found with the hair surrounding the face of a bright yellow-ochre tint (*P. Ochrocephala* of Kuhl and others), a variation in all probability belonging to the female or young.

2. PITHECIA HIRSUTA.—URSINE FOX-TAIL.

Syn. LE SAKI GRIS.—Cuv. Reg. Anim. I. 103.
Icon. PITHECIA HIRSUTA (mas).—Spix, Sim. et Vespert. Bras. pl. 9.

SPECIFIC CHARACTERS.

THE HAIR greyish-black, very long and curly; yellowish on the hands; no beard.

THE FACE dusky. THE HANDS yellow.

INHABITS the banks of the Rio Solimões and Rio Negro.

The Ursine Fox-tail was introduced to notice by Spix; and no additional information has hitherto been supplied. This, however, is the less to be regretted, as the statements of the above named Naturalist are both minute and interesting.

The native name of all these well-clad Monkeys is *Paraouâ*. Their coat in a remarkable degree resembles that of the Bear. At morning and evening they issue from the forests, collect in great numbers, and cause the air to resound with their piercing cries. They are ever watchful and alert, so that they cannot be caught without much trouble. On the slightest noise they retreat with the greatest rapidity, and plunge into the depths of the forests. At the same time, when once tamed and domesticated, they become exceedingly fond of their master; they retreat to him when alarmed, and rejoice to become his companion, especially at meal-time.

The fur on the body and tails of these Monkeys is very bushy and even frizzled. The species on which we are now dwelling, and to which the Indians give the name of the *Great Paraoua*, to distinguish it from a smaller, is greyish-black. Its hair is about three inches long, crisp, here and there grizzly, occasionally of a light brown hue. On the back of the head it is peculiarly long, and has been compared to a hood. The hands and feet are nearly devoid of hair, and of a light flesh colour; the neck, too, is nearly naked. The tail is as long as the body. The young ones are of the same colour with the full-grown animals.

3. PITHECIA SATANAS.—BLACK FOX-TAIL.

Syn. LE SAKI NOIR.—Cuv. Reg. Anim. I. 103.
SIMIA SATANAS (COUXIO).—Humb. Obs. Zool. p. 315 and 358.
CEBUS SATANAS.—Hoffm. in Mag. Gesellsch. Naturf. Freund. X.
PITHECIA SATANAS.—Geoff. Ann. Mus. XIX.—Desm. Mam. No. 84.
—Kuhl, Beitr.
Icon. Humb. Obs. Zool. pl. 27.
BRACHYURUS ISRAELITA, mas. (young).—Spix, Sim. et Vespert. Bras. pl. 7.

SPECIFIC CHARACTERS.

THE ADULT.

THE HAIR dusky black; scanty beneath; a very long beard.

THE YOUNG.

THE HAIR yellowish-brown; dusky black on the head and tail; the beard short.

THE FACE and HANDS reddish-grey.

INHABITS Para, Rio Negro, and the Orinoco.

For our acquaintance with this Monkey, we are indebted to the liberality of the Count of Hoffmannsegg, who dispatched the Naturalist Sieber to Brazil, and, among other newly discovered animals, received from him a specimen of this species at Berlin. The face and all the hands are of a reddish-grey colour, and naked; the mouth is large. The whole of the rest of the body is covered with long coarse hair of a deep brownish-black in the male, and of a yellowish-brown in the female.

With this account of the Black Fox-tail we have ventured to combine the description of the *Brachyurus Israelita* of Spix, under the conviction that it is the young of the same species. The external and other characters, as far as they have been noted, correspond; and the comparative shortness of the tail, upon which Spix chiefly insists, and readily explicable upon our supposition, is an insufficient ground for the formation of a new species. The point, however, requires further elucidation; and the more so, as the learned Naturalist assigns the forests of the Yapura, a tributary of the Solimöens, near Peru, as the habitat of his *Brachyurus*.

4. PITHECIA RUFIVENTER.—RED-BREASTED FOX-TAIL.

- Syn.* LE SAKI À VENTRE ROUX.—Cuv. Reg. Anim. I. 103.
 PITHECIA RUFIBARBATA.—Kuhl, Beitr.—Desm. Mam. No. 88.
 SIMIA PITHECIA.—Linn. Gmel. I.
 PITHECIA RUFIVENTER.—Geoff. Ann. Mus. XIX.—Desm. Mam. No. 86.—Kuhl, Beitr.
 SIMIA RUFIVENTER.—Humb. Obs. Zool. p. 358.
Icon. LE SAKI.—Buff. Suppl. VII. pl. 31.—Audeb. Sing.
 PITHECIA CAPILLAMENTOSA (fem.)—Spix, Sim. et Vespert. Bras. pl. 11.

SPECIFIC CHARACTERS.

THE HAIR dark brown above; red beneath in the male, yellow beneath in the female; yellowish-brown on the head; black on the hands.

THE FACE and HANDS dark flesh colour.

INHABITS Guiana.

This animal has been called the *Wigged Monkey*, a name to which it seems justly entitled; and Spix gives a particular description of no fewer than three wigs; the first flowing down the shoulders, the second forming a marked zone around the face, and the third ascending backward from the eyes. Under this profusion of hair, its ears, which are small, are entirely hid. Audebert informs us, that the tints of colouring vary.

The habits of this species are not accurately known. From its having received from Buffon the appellation of the Nocturnal Monkey, it has been inferred that it is taciturn, solitary, feeble, and timid. It lives in thickets; associates in small groups of eight or ten, and is not often met with.

5. PITHECIA BREVICAUDATA.—SHORT FOX-TAIL.

- Syn.* LE COURTE-QUEUE OUAKARY.—Spix, pl. 13.
 CEBUS OUAKARY.—Fisch. Syn. Mam.
Icon. Brachyurus Ouakary (mas.)—Spix, Sim. et Vespert. Bras. pl. 8.

SPECIFIC CHARACTERS.

THE HAIR on the head, arms, and legs, black; on the back yellowish-brown; on the thighs and tail ferruginous; no beard; the hair of the forehead distichous.

THE FACE and HANDS dusky. THE TAIL short.

INHABITS the banks of the Rio Solimöens and Rio Iça.

To these characters, it is scarcely necessary to add any thing descriptive of the animal discovered by Spix. It is of moderate dimensions, and lives in considerable troops, which confine themselves to the woods which skirt the rivers. It is chiefly during the day that these animals make the forests resound with their piercing and savage cries.

6. PITHECIA MELANOCEPHALA.—BLACK-HEADED FOX-TAIL.

- Syn.* SIMIA MELANOCEPHALA (CACAJAO)—Humb. Obs. Zool. p. 316 and 359.
 PITHECIA MELANOCEPHALA.—Geoff. Ann. Mus. XIX.—Desm. Mam. No. 92.—Kuhl, Beitr.
Icon. Humb. Obs. Zool. pl. 29.

SPECIFIC CHARACTERS.

THE HAIR of the head black; of the point of the tail, dark brown, elsewhere brown, varied with yellow.

THE FACE and HANDS dusky.

INHABITS the banks of the Rio Negro and Cassaquiare.

Our acquaintance with this interesting animal we owe to the exertions of the indefatigable Humboldt. Its countenance has a resemblance to that of an infant, while its expression approximates that of an old Negro. The hair of the head is as if all combed forward; and bristles occupy the place of the eye-brows and beard. The ears are quite naked, very large, and more than any of the American Monkeys, like those of Man. The hair is long and shining, and generally copious, except round the neck, where it is nearly wanting.

This animal is very voracious, but dull and heavy, feeble, and extremely gentle. It eats all kinds of fruits, not excepting the sourest lemons. In

seizing an object, it extends its arms, and curves its back in a singular manner. As its fingers are exceedingly long and slender, its attempts at grasping are very awkward, and even its mode of feeding. It has a dread of the other Monkeys, and it trembles in every fibre at the sight of a Crocodile or Serpent. When irritated, a rare circumstance, it opens its mouth in an extraordinary manner, and utters convulsive cries. The little animal, which for a time was the companion of Humboldt, was of a delicate constitution, and died under the effects of a *Coup-de-Soleil*, notwithstanding all the means which were employed for its recovery.

7. PITHECIA MONACHUS.—HOODED FOX-TAIL.

- Syn.* PITHECIA MONACHUS (Moine)—Geoff. Ann. Mus. XIX.—Desm. Mam. No. 90.—Kuhl, Beitr.
 SIMIA MONACHUS.—Humb. Obs. Zool. p. 359.
Icon. Buff. Hist. Nat. Suppl. VII. pl. 30.

SPECIFIC CHARACTERS.

THE HAIR variegated with large spots of brown and bright yellow; forming a cowl or hood on the top of the head.

INHABITS Brazil (probably).

The whole history of this species, noted by so many respectable authorities, is very obscure, and requires revision. It was introduced into the catalogue of Monkeys on the authority of M. Geoffroy-St-Hilaire, from a specimen in the Paris Museum, but of this specimen little was known or determined. Kuhl says it is the least of all the tribe; its habits and habitat are very doubtful, if not wholly unknown.

8. PITHECIA AZARÆ.—AZARA'S FOX-TAIL.

- Syn.* PITHECIA MIRIQUOUINA.—Geoff. Ann. Mus. XIX.—Desm. Mam.—Kuhl, Beitr.
 LE MIRIQUOUINA.—D'Azar. Quadr. Parag. II. p. 213.
 SIMIA AZARÆ.—Humb. Obs. Zool. p. 359.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brownish-grey, cinnamon colour beneath; two white spots beneath the eyes.

INHABITS Paraguay.

As the distinguished and indefatigable Azara is our only authority for this animal, as for many others of Southern America, and as no plate of it has been published, we give in detail the characters he supplies. The head is very small and almost round; the neck is uncommonly short, and seems even thicker than the head. The whole face to the very eyes is covered with hair, the eyelids and nose, which is prominent, being alone naked. The eye is large; the iris of a pale brown. The ear, too, is very large, round, hairy, somewhat elevated at the point. The fur is very soft, bushy, and erect, that of the tail alone lying close. The greater part of the body is of a grizzly colour; the lower parts are of cinnamon hue, and on the face, above the eye, upon the cheek, and under the chin, there is a white marking. The female is of the same colour as the male, and is a trifle less in size, and the young in no respect differs from the markings of its parents.

Azara drew his description from the examination of three females and one male. He had also seen it domesticated, and learned that it was very gentle and quiet.

9. PITHECIA CHIROPOTES.—CAPUCHIN FOX-TAIL.

- Syn.* SIMIA CHIROPOTES (Capuchin de l'Orénoque)—Humb. Obs. Zool. p. 311 and 358.
 PITHECIA CHIROPOTES (CAPUCHIN)—Geoff. Ann. Mus. XIX.—Desm. Mam. No. 85.—Kuhl, Beitr.

Icon.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown; distichous on the head; the beard very long.

THE FACE black and naked.

INHABITS the banks of the High Orinoco.

This Monkey, as stated by Humboldt, is one of the most remarkable of South America, though not mentioned by any preceding Naturalist. It is of a reddish-brown colour; its coat long and shining. Its head is oval shaped; the facial angle about 52°; the face and palms of the hand are black and naked. The forehead and top of the head are covered with thick and very long hair, lying forwards, and dividing itself over the eyes into two large tufts. The eyes are large and deep-set; the canine teeth very formidable, and the deep brown beard venerable, extended down the breast. The head, thighs, and tail, are of a deeper tint than the rest of the body.

Of all the animals of its kind, the Capuchin Fox-tail is that one whose features most resemble those of Man. His eyes have an expression of melancholy, not free from ferocity. As the chin is hid under his bushy beard, the facial line appears larger than it really is. He is a strong animal, agile, ferocious, and scarcely tameable. When irritated, he starts back on his hind feet, grinds his teeth, pulls the end of his beard, and leaps with threatening gestures around his assailant. In the fits of his ire I have often seen him, says Humboldt, fix his teeth deep in a wooden plank. He generally maintains a sullen sadness, which is interrupted only at the sight of some favourite food. He drinks but seldom, and in a way which differs remarkably from the other American Monkeys, who raise the cup presented to them to the lip. The Capuchin, on the contrary, drinks from the hollow of his hand, at the same time turning his head to a side. This is a tedious operation, which he performs with either hand, and only when he imagines he is unobserved. He becomes quite furious when any one wets his beard; and it would appear that it is to avoid this annoyance that he resorts to his peculiar mode of drinking.

These Monkeys do not live in troops, but in pairs only, in the forest. They are found in the vast deserts in the High Orinoco, to the south and east of the Cataracts, and appear to be unknown in most of the neighbouring provinces. The Priest Juan Gonzalis, who was intimately acquainted with the locality they frequent, informed Baron Humboldt that the native Indians devour these animals in great numbers at certain seasons of the year.

DOUBTFUL SPECIES.

1. *PITHECIA INUSTA* (Spix, Sim. et Vespert. Bras. pl. 10) is suspected by Temminck to be identical with *P. hirsuta*. It is about one-third smaller, and the head is wholly ferrugineous.

2. *SIMIA SAGULATA*, THE JACKETED MONKEY (Traill, in the Memoirs of the Wernerian Society, vol. iii.) is conjectured by Fischer to be a *Pithecia Satanas*.

To this Catalogue we have nothing to add, except that our examination inclines us to agree in the justness of the suspicions expressed by Temminck and Fischer.

IMAGINARY SPECIES.

1. *P. OCHROCEPHALA* (Kuhl, Beitr.) is the female or young of *P. leucocephala*.

2. *P. RUFIBARBATA* (Kuhl and Desm.) is absolutely identical with *P. rufiventer*. This is the *Simia Pithecia* of Linnæus.

3. *P. CAPILLAMENTOSA* of Spix is merely a duplicate of *P. rufiventer*.

4. *BRACHYURUS ISRAELITA* of Spix is the young of *P. Satanas*.

GENUS VIII. NYCTIPITHECUS.—NIGHT-MONKEYS.

Syn. LES NOETHORES.—F. Cuv. Hist. Mam.—Cuv. Reg. Anim. I. 104.

AOTUS.—Illig. Prodr.

NYCTIPITHECUS.—Spix, Sim. et Vespert. Bras.

GENERIC CHARACTERS.

THE HEAD round and broad. THE MUZZLE short. THE FACIAL ANGLE about 60°.

THE EYES very large and approximated. THE EARS very small.

THE NAILS short. HABITS nocturnal.

THE TAIL longer than the body.

INHABIT Guiana and Brazil.

To the Night-Monkeys Illiger has very improperly assigned the generic term *Aotus* (Earless). They differ from the other Sagoins, merely by their large nocturnal eyes, and their ears are partly concealed under the hair.

All these animals come from Guiana or Brazil.

It was the Baron Humboldt who proposed the establishment of this genus for the arrangement of the *Douroucouli*, which he discovered in the forests of the Orinoco. He designated it *Aotes* (ἀωτος), earless; but as this was a character which was inapplicable to the animal, Spix substituted the appellation *Nyctipithecus* (Night-Monkey), which, taken from one of its most striking characteristics, has been generally adopted.

The generic characters are distinctly marked. The head is round and very broad; the muzzle is short; the eyes nocturnal, very large, and near each other; the ears are very small; the tail is longer than the body, not prehensile, covered with hair; each foot has five toes, and the nails are flat. In all these particulars, the *Nyctipithecus* have a strong resemblance to the *Loris* of the ancient Continent. For a long time the animal introduced by Humboldt was the only species of the genus; lately, two more have been added by Spix, who thinks it highly probable there are others.

1. NYCTIPITHECUS TRIVIRGATUS.—HUMBOLDT'S NIGHT-MONKEY.

Syn. LE DOUROUCOULI.—Cuv. Reg. Anim. I. 104.

AOTUS HUMBOLDTI.—Illig. Prodr.—Schinz. Thier.

AOTUS TRIVIRGATA.—Geoff. Ann. Mus. XIX.

SIMIA TRIVIRGATA (DOUROUCOULI).—Humb. Obs. Zool. p. 307 and 358.

Icon. Humb. Obs. Zool. pl. 28.

Douroucouli (fem.)—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR grey, mixed with white, a brown band along the back.

THE FACE blackish. HANDS white.

INHABITS Guiana.

The Baron Humboldt, who discovered this animal, observes that it is the most remarkable he had met in Guiana. It differs from its congeners not only in the form of its teeth and ears, but still more in its habits, the size of its eyes, and in the whole of its physiognomy, which very much resembles one of the *Loris* (*Stenops*) of the Old World. It is strikingly characterized by its head being cat-like, by its large yellow eyes, which cannot support the light; by the smallness of the external ear, and by its unrepensible tail being much longer than its body.

This Night-Monkey is generally of a grey colour mixed with white, with a brownish line running along the back; the lower parts of the body have an orange yellow tint. The head, and especially the forehead, is marked with three black streaks which descend to the eye. The face is covered with blackish hair; the beautifully yellow eyes are of an enormous size when compared with the magnitude of the animal. The mouth is surrounded with white and short bristles. The hands and soles of the feet are white. The tail, which exceeds the length of the body by about a half, is of the same colour as the back, and tipped with black. The whole fur is soft and pleasant to the touch, and is used by the natives for tobacco-pouches and such like purposes. M. Geoffroy-St-Hilaire gives the vertebrae as follows: cervical 7; dorsal 14; lumbar 9; sacral 2; coccygeal 18. (Cons. d'Hist. Nat. in loco.)

The Douroucouli sleeps throughout the whole day, and is much annoyed by the light. Hence it retires into some shady corner, or into the hollow of a tree. If roused during the day, it is not only sad, but lethargic. It often sits like a Dog, with its back bent, the four feet collected under it, and its head resting on the fore paws. It is gentle during the day-time, and may be handled with impunity. It is, however, as active during the night, as it is stupid during the day. Its vision now improves, and it preys upon Birds, and especially Insects. When in New Barcelona, I used, says Humboldt, to keep one in my bed-room, and it unceasingly vaulted about, and made a great noise. It also eats vegetables, especially sugar-cane, dates, and almonds, and flies, which it catches with great address. Upon the whole, however, it eats but little, and it has been observed not to drink for twenty or thirty days.

According to Humboldt, it is exceedingly difficult to tame this Monkey. At all events, says the Baron, my companion only snapt at all the caresses bestowed upon him. He puffed like a Cat, and violently struck with his claws. M. F. Cuvier's experience, however, on this point, was different; the individual which he possessed, a female, being very gentle. Its night-cry (*muh, muh*) resembles that of the Jaguar, and its strength is quite extraordinary for so small an animal. It has also other cries, which are very peculiar.

2. NYCTIPITHECUS FELINUS.—CAT-FACED NIGHT-MONKEY.

Syn. NYCTIPITHECUS FELINUS (Le Singe-de-nuit à face-de-chat).—Spix, p. 25.

—Less. in Dict. Class. XV.

CEBUS FELINUS.—Fisch. Syn. Mam.

Icon. Spix, Sim. et Vespert. Bras. pl. 18 (fem.)

SPECIFIC CHARACTERS.

THE HAIR ash-coloured above, reddish beneath.

THE FACE and HANDS white. The Male has a beard. Tail longer than the body.

INHABITS Para.

Our acquaintance with this and the succeeding species, as already stated, we owe to Spix, who has given figures of both. This Night-Monkey is cat-faced; its visage is lean, its mouth large, and its eyes red and very large. The greater part of the face is white. The body is slender. The hair rising from the forehead and cheeks is black, and inclines backwards. The ears are conspicuous, oblong, naked, clad only at their margins. The male has a beard. The fur above is close, ash-coloured; beneath, reddish. The tail is somewhat larger than the body, and chiefly black.

Spix procured this animal in Para, and kept it long in domestication. It fed upon rice.

3. NYCTIPITHECUS VOCIFERANS.—NOISY NIGHT-MONKEY.

Syn. NYCTIPITHECUS VOCIFERANS (LE BABILLARD BRUN).—Spix, p. 25.—Less. in Dict. Class. XV.

CEBUS VOCIFERANS.—Fisch. Syn. Mam.

Icon. Spix, Sim. et Vespert. Bras. pl. 19 (fem.)

SPECIFIC CHARACTERS.

THE HAIR wholly of a brown colour, paler underneath.

THE FACE and HANDS brown. No beard. Tail scarcely longer than the body.

INHABITS the Forests of Solimoëns near Tabatinga.

As already stated, this species is introduced upon the authority of Spix, and adopted by Fischer and Lesson. We are led to understand it is smaller in size, is beardless, and that the tail is scarcely longer than the

body. It has the same slender body, but is almost entirely of a brown colour. The two species have much the same habits, sleeping throughout the day, and being active during the night, chattering loud in small companies. Though not easily caught, yet the Indians, on discovering their retreats, soon capture them, as the strong day-light almost blinds them.

This animal has a white marking both above and below the eye; there are some dark brown streaks on the forehead, and the fur is paler coloured under the belly. The ears are not so large as in the last species, nor is the tail so long. Both species are very timid, retiring, cleanly, and delicate.

The natives speak of another nearly allied species, which they call *Xupara*, and Spix considers it probable there may be several in the forests of Solimoëns.

FAMILY II. HAPALE.—MARMOUSETS.

Syn. LES OUISTITIS.—Cuv. Reg. Anim. I. 104.

SIMIA (in part).—Linn. Gmel. I.

HAPALE (from *ἀπαλος*, soft).—Illig. Prodr. p. 71.

ARCTOPITHECI (ARCTOPITHEQUES).—Geoff. Ann. Mus. XIX. 118.

GENUS HAPALE.—ILLIG.

CHARACTERS OF THE FAMILY AND GENUS.

GENERAL FORM approaching to that of Man.

CLAWS on the thumbs of the fore-hands, and on all the fingers. NAILS only on the hinder thumbs.

THE DENTAL FORMULA $2 \left\{ \frac{2+C+(3 F+2)M}{2+C+(3 F+2)M} = \frac{16}{16} = 32. \right.$

INHABIT the tropical parts of America.

The Marmosets, forming a small group like the Sakis, have long been confounded with the great family of Apes or Monkeys. In fact, they resemble the Apes of America, in having the head round, the face flat, the nostrils lateral, and the buttocks hairy; they have no cheek-pouches, and their tail, like that of the Sakis, is not prehensile. They differ from them, however, in having only twenty molar teeth like the Apes of the Old Continent; all their nails or claws are compressed and pointed, excepting those of the hinder thumbs, while the thumbs of the fore-hands are so slightly separated from the fingers, that one would almost hesitate in applying the term *quadrumanous* to this family.

They are diminutive animals, of an agreeable form, and are easily tamed.

We have now in the foregoing pages taken a survey of the Apes of the Old World, and, latterly, of the majority of those of the other hemisphere. A small group still remains, which M. Geoffroy-St-Hilaire formed into a section of the Apes of the New World. This section, the *Arctopithecques* of the last named Naturalist—the *Hapale* of Illiger, has been subdivided by many Naturalists into the *Jacchus* and *Midas*, while Mikán, in his splendid work on the Fauna of Brazil (*Delectus Floræ et Faunæ Brasiliensis*), has arranged it into three minor divisions. Without doubting the existence of the minor distinctions pointed out by these celebrated writers, we think that the purposes of modern classification will all be satisfied by arranging them in one family; and, with Desmarest, Ranzani, and especially with M. Isidore Geoffroy-St-Hilaire, we shall consider them as forming a single genus.

Of the principal characteristics of the Ape family, namely, four vertical incisors in each jaw, flat nails on the fingers and toes, and a complete ossified case for the lodgment of the eyes, the family of the Marmosets possesses the last alone. Comparing this family, again, with the other Monkeys of the New World, we find, while the latter have 36 teeth, the former have only 32, agreeing herein with the Apes of the Old World. The form of their teeth, moreover, differs from those of both the foregoing groups. The incisors are oblique and prominent, more especially those of the upper jaw, which are also broad; those of the lower jaw are much longer and narrower; the lateral incisors are much shorter. The three false molars have a point at their external edge, and a heel on their internal; the two true molars of the upper jaw are tricuspidate, those of the lower have four tubercles. Not only are these Marmosets destitute of some leading characters of the Apes, but, literally, they do not deserve the name of *Quadrumanus*. Their upper extremities are not true

hands; and this is not owing, as in the Sapajoes and others, to the want or rudimentary state of the thumb, but because it is not sufficiently free, and hence cannot be opposed to the fingers; moreover, it is not armed with a nail but a claw. The tail is always longer than the body, and thickly clad. The fur is generally long, bushy, and very soft to the touch; its colours are usually brilliant and beautiful.

Like most other Monkeys they live among trees; and though destitute of the grasping hands of some, and the prehensile tails of others, the deficiency is made up by their claws, which enable them to climb like Birds, and to the very summits of the loftiest trees, where their more weighty and powerful associates and foes cannot follow them.

Little is known of the habits of these beautiful little creatures in their native haunts; but many of the species have been imported into Europe, and as here they thrive with due care, and even propagate, their manners are not wholly unknown. Interesting notices will appear under many of the species, and we shall here introduce only a few anecdotes illustrative of their mental powers as observed by M. Audouin in the Common Marmoset. Daily experience shows that a Dog placed before a mirror does not recognise his likeness, and is still less capable of receiving any peculiar impression from the most striking picture. M. Audouin, however, assures us from innumerable observations, that it was very different with his Monkeys; and that in a picture they could recognise not only their own likeness, but also that of other animals. Thus the picture of a Cat, and, which is even more remarkable, even that of a Wasp, would put them in terror, whilst if a Beetle or Lady-bird was represented on the canvas, they would dart upon it for their prey. This single fact seems to indicate very considerable intelligence, and it is supported by others. One day one of M. Audouin's pets, in eating a grape, squirted some of the juice into its eye; and never afterwards would it eat grapes but with its eyes shut. Alarmed at the picture of a Wasp, their panic, as will readily be supposed, is much greater for a real one. Thus we are told that one day a Wasp being attracted to their cage by a lump of sugar, the two Monkeys instantly retreated to the most remote corner. On this M. Audouin, having caught the Wasp, approximated it to them, when they violently shut their eyes, and hid their heads between their hands. They were exceeding fond of the smaller insects, which they seized with address; also of sugar, roasted apples, and eggs; they never would eat any kind of nuts, or acid fruits; they also declined meat; but they instantly seized and devoured small living Birds. Their sight was very acute; and their curiosity insatiable; they were very capricious, but became familiar with their keepers. Their cry was various, according to the different emotions which agitated them.

(A.) PROPER MARMOUSETS. (JACCHUS.)

M. Geoffroy distinguishes the *Ouistitis*, properly so called (*Jacchus*), characterized by having their lower incisive teeth pointed, placed in a curved line, and equal to the canines. Their tail is bushy and annulated; their ears are usually ornamented with a bunch of hair. It is rather difficult to establish clear specific differences among these animals, differing from each other only in colour.

1. HAPALE JACCHUS.—COMMON MARMOUSET.

Syn. L'OUISTITI COMMUN.—Cuv. Reg. Anim. I. 105.
JACCHUS VULGARIS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA JACCHUS.—Linn. Gmel. I. 39.—Humb. Obs. Zool. p. 360.
HAPALE JACCHUS.—Kuhl. Beitr.—Pr. Max. Beitr.
STRIATED MONKEY.—Penn. Quadr. No. 142.

Icon. Oustiti mâle adulte—jeune femelle.—F. Cuv. et Geoff. Hist. Mam.
Hapale Jacchus.—Pr. Max. Abbild.
L'Ouistiti.—Buff. Hist. Nat. XV. pl. 14.—Audeb. Sing.—Schreb. Säugth. pl. 33.
THE SAGLIN or CAGUI MINOR.—Edw. Glean. pl. 218.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown; the crupper and tail annulated with black and greyish-brown; a white spot on the forehead; very long whitish hairs on each side of the ears.

INHABITS the tropical parts of America.

The *Common Marmouset* has been long and familiarly known. The head is round, covered with black hair at the crown, and on the temples there are two remarkable tufts of long white hair; the ears resemble the human. The face is flesh-coloured and naked, as also the hands and feet; the eyes are reddish. The upper part of the body is covered with longish hair, in alternate stripes of black and greyish-brown. The ring-like markings are still more conspicuous on the tail, to the number of about twenty of each colour. The under parts of the body, and inside of the limbs, are brown. This beautiful species is about eight inches long, without including the tail, which is somewhat longer than the body. At birth their eyes are open; they are of a greyish colour; and immediately attach themselves to their mother, and hide themselves in her fur. M. F. Cuvier states concerning one in the Paris Ménagerie which had three at a birth, that she destroyed one before suckling the others. Her maternal feelings were any thing but strong; and the male showed generally a greater affection for the young. Though very active and attentive to all that passes, they seem rather stupid, and are very distrustful. They never distinguish persons, even those most familiar with them; and they are very irritable, and apt to snap at all. They have a singular whistling sort of a cry, in which they particularly indulge.

This species is widely spread over both the American Continents; and as it bears the change of climate well, and readily propagates, it is very commonly met with in these countries.

VAR. RUFUS.—There is a variety of this species, with the tail annulated with red and ash colour.

2. HAPALE PENICILLATUS.—PENCILLED MARMOUSET.

Syn. JACCHUS PENICILLATUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA PENICILLATA.—Humb. Obs. Zool. p. 361.
Icon. OUISTITI FEMELLE À PINCEAU.—F. Cuv. et Geoff. Hist. Mam.
Jacchus penicillatus.—Spix, Sim. et Vespert. Bras. pl. 26.
Hapale penicillatus.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR grey; the crupper and tail annulated with dark and light grey; a white spot on the forehead; long dark brown or black pencils of hair in front of each ear; the head and upper parts of the neck black.

INHABITS Brazil.

This singular and graceful-looking animal is distinguished from the previous species principally by those remarkable pencil-formed tufts in front of its ears, from which it has received its specific name. Similar appendages are sometimes likewise found behind the ear, and on the back of the neck. The hair on the head is usually black, with a remarkable white marking on the forehead. The countenance generally is of a dark Ethiopic hue, and is nearly naked; it is surrounded with a tawny-coloured fur, which on the neck is nearly black. The fur of the body is beautifully striped light and dark grey and yellow; the tail is decidedly annulated, black and white; its tip is white. M. Cuvier's specimen was not six inches long. The habits of this species are but little known. Spix

states it is always found in small troops, and that the mother never carries the young either on her back or breast. It is one of the most common Monkeys in Brazil.

3. HAPALE LEUCOCEPHALUS.—WHITE-HEADED MARMOUSET.

Syn. JACCHUS LEUCOCEPHALUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA GEOFFROYI.—Humb. Obs. Zool. p. 360.
Icon. HAPALE LEUCOCEPHALUS.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR black, spotted with dark grey; the tail annulated with black and dark grey; the head and breast white; long black pencils of hair on each side of the ears.

INHABITS Brazil.

This very beautiful little animal has a strong family likeness to the two foregoing species, and like the last it has a broad pencil or rather tuft of black hair at the side of its head. Its other markings, however, completely distinguish it from its congeners. The whole head and front of the neck are white, while the rest of the body is black, spotted with dark grey, the tail annulated, but with very dark colours. This species is somewhat larger than the preceding. It is an inhabitant of Brazil; and Prince Maximilian states that he has witnessed the adult carrying one of its young on its back and another at its breast. Its favourite resorts are the lofty forests, and it is rather abundant. It is so much esteemed for its beauty that it is very often tamed, and made a household ornament.

4. HAPALE HUMERALIFER.—WHITE-ARMED MARMOUSET.

Syn. JACCHUS HUMERALIFER (LE CAMAIL).—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA HUMERALIFERA.—Humb. Obs. Zool. p. 360.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dusky brown; on the shoulders, breast, and arms, white; on the top of the head, dark brown; the tail indistinctly annulated with grey.

INHABITS Brazil?

This species differs somewhat more than the preceding from the *Common Marmouset*. The ring-like markings of the tail are not so distinct, and the back is of a dusky brown colour. The upper part of the head is also very dark, whilst the neck and the lower part of the body are dull white; the hind legs are of a speckled brown colour. It is somewhat smaller than the *Common Marmouset*, and the tail is proportionally larger. Its habitat has not been accurately ascertained, though it is suspected to be from Brazil.

5. HAPALE AURITUS.—BLACK MARMOUSET.

Syn. JACCHUS AURITUS (OREILLARD).—Geoff. Ann. Mus. XIX.—Desm. Mam.
SIMIA AURITA.—Humb. Obs. Zool. p. 360.

Icon.

SPECIFIC CHARACTERS.

THE HAIR black, varied with red above; the tail annulated with dark brown; the upper part of the head and face marked in the middle with yellowish-white; the hands ash-coloured; the ears covered with long white pencils.

INHABITS Brazil.

This animal, of which little is known, is about the size of the *Common Marmouset*.

(B.) TAMARIN MARMOUSETS. (MIDAS.)

M. Geoffroy assigns the term *Midas* to those species having their lower incisors trenchant, placed nearly in a straight line, and equal to the canines. Their tail is more slender, and it is not annulated.

6. HAPALE ŒDIPUS.—RED-TAILED MARMOUSET.

Syn. LE PINCHE.—Cuv. Reg. Anim. I. 105.
MIDAS ŒDIPUS.—Geoff. Ann. Mus. XIV.—JACCHUS ŒDIPUS.—Desm. Mam.

SIMIA ŒDIPUS.—Linn. Gmel. I.—Humb. Obs. Zool. 361.
RED-TAILED MONKEY.—Penn. Quadr. No. 144.

Icon. Pinche mâle.—F. Cuv. et Geoff. Hist. Mam.
Midas Œdipus fem. (var.)—Spix, Sim. et Vespert. Bras. pl. 23.
Le Pinche.—Buff. Hist. Nat. XV. pl. 17.—Audeb. Sing.
LITTLE LION MONKEY.—Edw. Birds, pl. 195.

SPECIFIC CHARACTERS.

THE HAIR grey, mixed with brown; long white hairs on the head, hanging behind the ears; the tail red throughout its first half, black towards the end.

INHABITS the Banks of the River Amazon, Guiana, and Brazil.

This *Red-tailed Marmouset* has many well-marked characteristics, of which none is more striking than its long white crest which falls down about the neck. All the under parts of the body, and the inside and extreme parts of the extremities, are also white. The outer sides of the limbs are of a deep red colour, as is also the tail, which is tipped with black. The face is wholly black and naked, as is also the front of the neck; the eyes, too, are stated to be altogether black. Its size varies from eight to ten inches, and the tail is considerably longer than the body. A variety of the female has been figured by Spix (tab. 23), with the body striped black and dark yellowish-grey.

Though not very common, this species is found in the neighbourhood of Carthageua, at the mouth of the Rio-Sinu, and in Guiana. Humboldt states it is very savage in its temper, and is not tamed without much difficulty; but when once domesticated, lives a long time in its native country. One was brought to him, which he was anxious to preserve, but it obstinately refused all nourishment, and died in great wrath, squaking like a Bat, and biting every one that approached it. This animal has by Edwards been designated the "*Little Lion Monkey*," for which he assigns the following reason:—"When it prances about the room on its all-fours, and plays its tail over its back, it has very much the air of a little Lion."

7. HAPALE RUFIMANUS.—RED-HANDED MARMOUSET.

- Syn.* LE TAMARIN.—Cuv. Reg. Anim. I. 106.
MIDAS RUFIMANUS.—Geoff. Ann. Mus. XIX.—JACCHUS RUFIMANUS.—Desm. Mam.
SIMIA MIDAS.—Linn. Gmel. I.—Humb. Obs. Zool. p. 362.
GREAT-EARED MONKEY.—Penn. Quadr. No. 141.
Icon. TAMARIN À MAINS ROUSSSES.—F. Cuv. et Geoff. Hist. Mam.
Le Tamarin.—Buff. Hist. Nat. XV. pl. 13.—Audeb. Sing.
LITTLE BLACK MONKEY.—Edw. Birds, pl. 196.

SPECIFIC CHARACTERS.

THE HAIR black; on the crupper, variegated with ash colour; on the hands, red.

INHABITS Guiana.

This Red-handed Marmouset was first described by our countryman Edwards. It is one of the least species, usually not exceeding six or seven inches; its tail being twice as much; its bite, owing to its smallness, is not more offensive than the pinch from a Sparrow's bill; it is, however, very lively and full of action. The eyes are of a hazel colour, the face of a dark flesh, the nose scarcely rising at all; the upper lip slit like a hare's lip, the teeth very small, nearly approaching in shape to the human. The ears are large in proportion, of a blackish flesh colour, and thinly beset with short hairs. The hair on the head forms a peak on the forehead, and the face is nearly naked. The head, body, and tail, are covered with soft black hair, rather rough and shaggy; the hair on the lower part of the back stands erect, and is mixed with yellow coloured hairs; the hands are covered with short, sleek, deep orange-coloured hair; the fore-hands are not so human-like as in some other Monkeys, though it can still hold any thing in one hand.

Pennant and Buffon made the *Negro Monkey* a variety of this species; but M. F. Cuvier says they are evidently two distinct species. "I have had seven or eight individuals," he says, "of both, and the *Negro Monkey* has the fore arm invariably black, whilst in the other it is constantly orange-coloured."

The favorite resort of this species is the deep forests. They are bold, and do not flee at the approach of Man. The females have but one at a birth. They remain almost constantly upon the trees in large troops; their cry is a sharp whistle; though very choleric they are easily tamed, and delight in sitting upon their master's shoulders; they are full of pleasantries. Their flesh has a disagreeable taste; and, therefore, they are not used as food by the native tribes of South America.

8. HAPALE URSULUS.—NEGRO MARMOUSET.

- Syn.* LE TAMARIN NÈGRE.—Cuv. Reg. Anim. I. 106.
MIDAS URSULUS.—Geoff. Ann. Mus. XIX.—JACCHUS URSULUS.—Desm. Mam.
SIMIA URSULA.—Humb. Obs. Zool. p. 361.
Icon. Tamarin nègre femelle.—F. Cuv. et Geoff. Hist. Mam.
Buff. Hist. Nat. Suppl. VII. pl. 32.
Le Tamarin nègre.—Audeb. Sing.

SPECIFIC CHARACTERS.

THE HAIR black, slightly undulated on the back with red.

THE HANDS black.

INHABITS Para—South America.

The fur of this species is soft and thick, and is composed of only one kind of hair, which is wholly black upon the head, round the neck, on the extremities, and upon all the lower parts of the body, where it is more sparing than elsewhere. The back and flanks have a waved appearance—black and fawned colour. The face, ears, hands, and feet, are naked, and of an Ethiopic complexion; the colour of the eyes brownish-yellow. The external ear is remarkably large, and appears at its back part as if mutilated, in a way that is seldom witnessed in other animals.

M. F. Cuvier had one of these animals in his custody for some days, and satisfied himself as to the strong general resemblance it bore to the foregoing species. Its character was remarkable only for its extraordinary irritability. On the slightest movement being made, it showed its teeth, and bit with violence as soon as it was touched. Fortunately, however, its jaws were so weak, that it could not even penetrate the skin. Desmarest informs us that this species is found in Para, where it is very common.

9. HAPALE LABIATUS.—WHITE-LIPPED MARMOUSET.

- Syn.* LE TAMARIN À LÈVRES BLANCHES.—Cuv. Reg. Anim. I. 106.
MIDAS LABIATUS.—Geoff. Ann. Mus. XIX.—JACCHUS LABIATUS.—Desm. Mam.
SIMIA LABIATA.—Humb. Obs. Zool. p. 361.
Icon. MIDAS FUSCICOLLIS.—Spix, Sim. et Vespert. Bras. pl. 20.
MIDAS NIGRICOLLIS.—Ibid. pl. 21 (var.)
MIDAS MYSTAX (fem.)—Ibid. pl. 22 (var.)

SPECIFIC CHARACTERS.

THE HAIR dusky-brown; beneath red; on the head black; on the nose and margins of the lips, white.

INHABITS Brazil.

This species, as noted above, was arranged by Spix in his genus *Midas*; and two others were added—the *M. fuscicollis*, and *M. Mystax*. Temminck, however, considers them only as varieties, a view which most Naturalists adopt. It is somewhat singular, however, that according to this view, the female (*M. Mystax*, Spix) should be furnished with great white moustaches, an ornament denied to the male.

The White-lipped Marmouset is very striking in its markings. The back, and outer parts of the arms and legs, are of a dusky-brown colour, speckled with rosy-white; the head, tail, hands, and feet, are black; and the inside of the extremities, and the under parts of the body and tail, are of a beautiful red colour. Finally, the neck is of a reddish-fawn colour, and the mouth is surrounded with a circle of white hair which forms a striking contrast with the neighbouring dark parts. It is of smaller dimensions than the *Rufimanus*.

This animal was found at Ollivenza, near a dark-coloured river, in the country of the Tocnos, between the Solimöens and the Iça.

10. HAPALE ROSALIA.—SILKY MARMOUSET.

- Syn.* LE MARIKINA.—Cuv. Reg. Anim. I. 106.
MIDAS ROSALIA.—Geoff. Ann. Mus. XIX.—JACCHUS ROSALIA.—Desm. Mam.
SIMIA ROSALIA.—Humb. Obs. Zool. p. 361.
SILKY MONKEY.—Penn. Quadr. No. 143.
Icon. Marikina mâle.—F. Cuv. et Geoff. Hist. Mam.
Le Marikina.—Buff. Hist. Nat. XV. pl. 16.—Audeb. Sing.

SPECIFIC CHARACTERS.

THE HAIR clear yellow, deeper about the neck; a long mane.

INHABITS Guiana and Brazil.

The history of this beautiful little animal has scarcely been investigated in its native haunts, the forests of Brazil. The deficiency, however, has, to a certain extent, been supplied by the indefatigable F. Cuvier, who had frequent opportunities of becoming acquainted with it in Paris. Its elegant form, and easy and graceful movements, the intelligent expression which animates its look, its sweet voice, and especially its attachment to those about it, have always made it a favorite. Without the petulance, it has all the vivacity of its congeners. When imported into these cold regions, it must be protected with care from the inclemencies of weather; it must also be kept with a minute attention to cleanliness, for without this it speedily pines and dies. Accustomed to live in families, solitude appears intolerable; and, therefore, it is most desirable that two or more should be in company. The food they most affect is Insects and sweet fruits, but they may be habituated to live on biscuits and milk. The individual whose habits were studied by M. Cuvier, sought to hide itself on the least alarm, and expressed its fear by a continued whistle. It de-

lighted in caresses, and testified affection, though not complete confidence; it came at the call of those it knew, and retreated from strangers, displaying its teeth, its only, though far from formidable weapons. Like many Birds it delighted to resort to the highest parts of its cage, descending but seldom, and eating but little.

This animal is generally of a beautiful clear yellow colour, somewhat more golden about its neck; its face is naked, and of a deep flesh colour, so are the paws, and in fact the whole skin over the body. The fur is all of one kind, composed of fine silky hair (hence Pennant's name, the *Silky Monkey*), much longer on the head and neck than in the other parts of the body. This supplies it with a great mane, and from this single print of resemblance it has received from many travellers the name of the *Little Lion Monkey*, and *Léoncito*. Its tail is also covered on all sides with long hair. M. Isidore Geoffroy remarks, that soon after these animals arrive in the colder regions, their bright coat fades, and before death they are usually very pale, leading to the supposition that in extreme age they may become white.

VAR. GUYANENSIS.—There is a variety from Guiana, having the tail variegated with red and black.

VAR. BRASILIENSIS.—And another from Brazil, of a deeper red, but having the tail of a uniform colour.

11. HAPALE CHRYSOMELAS.—RED-HEADED MARMOUSET.

Syn. LE MARIKINA NOIR.—Cuv. Reg. Anim. I. 106.

JACCHUS CHRYSOMELAS.—Desm. Mam.

MIDAS CHRYSOMELAS.—Kuhl Beitr.

Icon. HAPALE CHRYSOMELAS (Der Schwarze Lowen-Sabui), Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR black; on the arms and round the face, bright red; on the forehead and the upper part of the tail, light yellow.

INHABITS Brazil.

Although there are obscure notices of this very remarkable and beautiful animal in the writings of Desmarest and Kuhl, yet we believe it is chiefly to Prince Maximilian of Neuwied that we are indebted for accurate information regarding it. In his work on the Natural History of the Brazils, he remarks, "This exquisite *Sabui* (the Brazilian name) is one of the most beautiful ornaments of the great primordial forests of the Illeus and the Rio Pardo. The traveller must proceed for four or five days' journey from the coast before he encounters them, but after this they will be often seen. These small animals, notwithstanding their insignificant dimensions, which amount to only six inches and a half for the body, and fifteen for the tail, have often contributed to our support when we were ranging these vast deserts."

The face, body, lower limbs, and greater part of the tail, is of a beautiful black colour. The hair which surrounds the face and that of the neck is extraordinarily long, and its general colour is of a fiery red, more or less mixed with yellow; such, too, is the colour of the fore-arm, of the tail, and, though darker, of the upper part of the foot. Near the ear the hue is chestnut colour, and a mixture of this shade pervades the chest. The Prince truly remarks, that could they be domesticated in this country, they would be regarded as beautiful pets.

12. HAPALE LEONINUS.—LEONINE MARMOUSET.

Syn. MIDAS LEONINUS.—Geoff. Ann. Mus. XIX.—JACCHUS LEONINUS.—Desm. Mam.

SMIA LEONINA.—Humb. Obs. Zool. p. 36.

Icon. Humb. Obs. Zool. pl. 5.

SPECIFIC CHARACTERS.

THE HAIR olive-brown; on the back striped with yellowish-white; a thick mane of olive-brown.

THE FACE black; whitish on the nose and lips.

INHABITS the eastern plains of the Andes.

This species, which was discovered by Baron Humboldt, has been described by him as of the size of the Red-headed Marmouset; the upper part of the face is black, the lower, including a part of the nose, whitish. The fur, generally, is of an olive-brown, with a heavy mane of the same colour; the back is striped with yellowish-white. The tail, which is of the same length with the body, is black on its upper, and brown on its under side. The hands, feet, and nails, are deep black.

In its native district this little animal has received the appellation of *Leoncito de Mocoa*, and hence, probably, its specific name as given by Humboldt. It is a very rare species. It inhabits the plains of the eastern slope of the Cordilleras of the Andes, especially the fertile banks of the Putumays and Coqueta; it never mounts even to the elevation of tem-

perate regions. It is one of the smallest and most elegant of the Monkeys; it is gay and playful; but like many of its congeners, very irascible. When provoked, it bristles up its mane, so acquiring some kind of resemblance to the African Lion. Our traveller only saw two; they were kept in a cage, and their movements were so rapid and constant, that he could scarcely take a sketch of them. The Mocoa Indians breed them extensively in a domestic state. Their whistle is not unlike the singing of some small birds.

13. HAPALE CHRYSOPYGUS.—NATTERER'S MARMOUSET.

Syn. MIDAS CHRYSOPYGUS.—Natterer.

Icon. JACCHUS CHRYSOPYGUS.—Mikan, Delect. Flor. et Faun. Bras.

SPECIFIC CHARACTERS.

THE HAIR black; on the buttocks, thighs, and inner surface of the legs, golden yellow.

INHABITS St Paolo, Brazil.

For our acquaintance with this very striking and elegant little animal, we are indebted to the active Naturalist Natterer, who has sent several specimens to Vienna. In that city it fell under the examination of M. Mikan, who has furnished a most beautiful drawing of it in his superb work on the Flora and Fauna of Brazil. Its size is between ten and eleven inches from the crown of the head to the origin of the tail, which is fourteen inches long. Its face, of a light olive hue, is nearly free from hair; its forehead is a bright orange. Its long flowing locks divide on the head, and descend gracefully over the back and shoulders. Its body and upper extremities are thickly clad with a shining black vestment; and its feet and tail are of the same colour: its trowsers, the only remaining part of its covering, are of a bright golden colour, and have conferred upon it the above specific name.

Of its peculiar habits M. Natterer has sent no accounts, and they are hence unknown.

14. HAPALE MELANURUS.—BLACK-TAILED MARMOUSET.

Syn. JACCHUS MELANURUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.

SMIA MELANURUS.—Humb. Obs. Zool. p. 360.

Icon.

SPECIFIC CHARACTERS.

THE HAIR yellowish-brown above, greyish-yellow beneath; on the tail, black.

INHABITS Brazil.

This animal, of whose habits nothing is yet known, is of a yellowish-brown above, becoming deeper on the lumbar region, and also on the head. The face is brown; beneath the neck, breast, and belly, the hair is of a greyish-yellow; the limbs are still browner than the head; and the anterior surface of the thighs is of a yellowish colour, which reaches to the haunches, and is divided off from the brown of the hinder parts by an oblique line; the tail is of a uniform brownish-black.

According to M. Kuhl, this species serves to connect the Proper Marmosets with the Tamarins.

DOUBTFUL SPECIES.

1. THE FAIR MONKEY (Penn. Quadr. No. 145), which is identical with *Le Mico*, illustrated by Buffon, Hist. Nat. XV. pl. 18, and by Audeb. Sing.,—the *Jacchus argentatus* of Geoffroy and Desmarest, and the *SMIA ARGENTATA* of Linnæus and Humboldt—is very plausibly conjectured by Isidore Geoffroy-St-Hilaire to be an albino variety of the Black-tailed Marmouset just described. It is of a uniform silvery white; the tail black; the face and hands reddish. Kuhl notices a specimen with the tail also white.

2. *JACCHUS ALBICOLLIS* (Spix, Sim. et Vespert. Bras. pl. 25) is conjectured by some writers to be a variety of the Common Marmouset. The auricular pencils of the hinder part of the head, neck, and throat, are white; the fore-part of the head is brown, mixed with white hairs.

3. *MIDAS PYGMEUS* (Spix, Ibid. pl. 24, fig. 2), of a diminutive size, variegated with yellow and grey above, reddish beneath; the tail, which is longer than the body, is annulated with black and yellow. Found on the banks of the Solimoëns.

4. *MIDAS BICOLOR* (Spix, Ibid. pl. 24, fig. 1), with the head, neck, breast, and fore limbs, white, the remainder brown; the tail ferruginous. Found near the Rio Negro.

IMAGINARY SPECIES.

1. *MIDAS FUSCICOLLIS* (Spix, Ibid. pl. 20), a male.

2. *MIDAS NIGRICOLLIS* (Ibid. pl. 28), a male.

3. *MIDAS MYSTAX* (Ibid. pl. 29), a female.

These are varieties of *Hapale labiatus* already described.

FAMILY III. PROSIMIA.—MAKIS.

SYNONYMS.

LES MAKIS.—Cuv. Reg. Anim. I. 106.

LEMUR.—Linn. Gmel. I. 41.

PROSIMIA.—Briss. Reg. Anim. p. 220.—PROSIMI (Affer) et MACROTARSI (Langfüsser).—Illig. Prodr. p. 73.

CHARACTERS OF THE FAMILY.

GENERAL FORM approaching to that of the Quadrupeds.

CLAWS always on the first finger of the hinder hands, and sometimes also on the second finger. NAILS flat on all the other fingers, and on the thumbs.

The Makis, according to Linnæus, comprise all those Quadrumanous animals, which have their incisors either more or less than four in number, or at least otherwise directed than in the Apes or Monkeys. This negative character cannot fail to include animals differing rather considerably in their characters, while it does not even unite all that ought to be comprised in one division. M. Geoffroy has, however, established in this family several divisions, which are more distinctly characterized.

These animals have their four thumbs well developed and opposable, and the first finger of the hinder hands is always armed with a pointed and elevated claw; all the other fingers are [usually] covered with flat nails. The fur is woolly, and their teeth begin to exhibit sharp tubercles, locking into each other, as we find in the insectivorous quadrupeds.

GENUS I. LEMUR.—LEMURS.

Syn. LES MAKIS PROPHEMENT DITS.—Cuv. Reg. Anim. I. 107.

LEMUR.—Geoff. Ann. Mus. XIX. 158.

GENERIC CHARACTERS.

THE HEAD long and triangular. THE NOSTRILS terminal. THE EYES medium size. THE EARS short and hairy.

$$\text{THE DENTAL FORMULA } \begin{array}{l} 2 + C + (3 F + S) M = 18 \\ 3 + C + (2 F + 3) M = 18 \end{array} = 36.$$

THE TARSUS shorter than the tibia. THE TAIL longer than the body, and covered with thick hair.

THE MAMMÆ TWO. HABITS diurnal.

THE FIRST FINGER only of the hinder hand with a claw.

INHABIT Madagascar and adjacent Islands.

The Lemurs, or Proper Makis, have six incisors below, compressed, and sloping forwards, but only four above, placed straight, and the first incisors being separated from each other. The canines are trechant; and there are six molars on each side above and six below.

These animals are very active, and have been termed FOX-NOSED MONKEYS (Singes à museau de Renard), on account of their pointed faces. Their ears are not very large. The species of Lemurs are numerous; they live on fruits, and inhabit the Island of Madagascar, where they appear to occupy the place of the Monkeys, which, it is reported, are not to be found in that island. They differ from each other chiefly in their colours.

To these characters a few general remarks may be added. Their lower incisive teeth differ remarkably from those of the Monkeys both in form and position, being very long and slender, but directed horizontally, and not vertically, as usual. The first incisor of the lower jaw is of a different shape from those placed more internally, and is also larger; a fact the more important as, according to some authors, this last incisor should be regarded as the true canine, and the next would thus be the first molar. According to this view, many of the Lemurian animals would have precisely the same dental formula as the American Monkeys, and the anomaly which presents itself in these genera would be explained,—the superior canine being placed anterior to the lower one, an arrangement which is but seldom seen. Be this as it may, the so-called inferior canine is small, triangular, and very like a false molar. There are three true molars in each jaw.

The limbs of the Lemurs, especially the hinder ones, are long, and the thumbs are widely separated from the fingers, so that they are excellent instruments for grasping. No use has yet been discovered for the remark-

able claw on the index toe. The tail is longer than the body, and contributes to the gracefulness of the animal. The general form of the Lemur is slender; and their head being long and their snout projecting, they have certainly some resemblance to the Fox. Their fur is generally woolly, very bushy, and abundant; their ears are short and clothed; their nostrils terminal and sinous; and their eyes are placed not anteriorly, as in Man, nor laterally, as in most animals, but in an intermediate position. The mammae, two in number, are pectoral.

As their organization thus approximates them to the Apes, so also do their habits. They live upon trees, and vault with agility. M. F. Cuvier tells us of one which would spring to a branch ten feet from the ground, while its gait was at the same time constrained. They are not so petulant and impudent as the Monkeys, especially those of the Old World; and they never advance upon a stranger with threatening gestures and grimaces, or attempt to seize or bite hard. Though their manners have scarcely been at all studied in their native country,—Madagascar and the neighbouring isles,—yet, being often domesticated in Europe, we are by no means strangers to their dispositions. Many curious traits will be found in the accounts of the species; and we may here subjoin a few of the original remarks of M. F. Cuvier. He thinks, that however inoffensive and timid, they are not remarkable for their intelligence; and though frequently tamed, they but rarely form strong attachments. They are partly nocturnal, and spend much of the day rolled up in the form of a ball. They feed themselves with their hands, and, notwithstanding the length of their snout, drink by suction; when at ease, their cry is a feeble grunt, but when alarmed, it becomes deep and strong, and as they sing out in concert, the noise becomes insupportable. The different species fight furiously among themselves, biting savagely, and tearing off each other's hair with their hands. Two pair, M. Cuvier remarks, "which I possessed, could never regard each other with complacency. If I raised the partition which separated them, they were roused to fury, uttering acute, interrupted, and rapid cries. Unless the wires of the cage had separated them, they would certainly have injured each other; and the females were not more amicable than the males." These animals were fed with boiled roots and fruits, bread and milk, and they were preserved at a uniform and warm temperature. Provided they were kept clean, they enjoyed excellent health; they seemed less annoyed with their captivity, and the inclemency of the climate, than the Apes. The history of an individual, as afterwards detailed, was traced for nineteen years.

1. LEMUR CATTÀ.—RING-TAILED LEMUR.

Syn. LE MOCOCO.—Cuv. Reg. Anim. I. 107.

LEMUR CATTÀ.—Linn. Gmel. I. 43.—Geoff. Ann. Mus. XIX. 162.—Desm. Mam. 98.

RING-TAILED LEMUR.—Shaw, Gen. Zool. I.—RING-TAILED MAUCAUCO.—Penn. Quadr. I. No. 150.

Icon. Le Mococo.—Audeb. Sing.—Ménag. du Mus.—Buff. Hist. Nat. XIII. pl. 22.

Mococo mâle.—F. Cuv. et Geoff. Hist. Mam.

Maucauco.—Edw. Birds, pl. 197.—Copied in Schreb. pl. 41.

SPECIFIC CHARACTERS.

THE HAIR grey, reddish above, whitish beneath; on the tail annulated with black.

This Ring-tailed Lemur is the one of all others with which we are most familiar in Europe, and is remarkable for the beauty of its fur, the elegance of its form, and its familiarity. It is fourteen inches long from the snout to the origin of the tail. All the upper parts of its body are of a beautiful grey colour, which has a rosy hue on the back and shoulders; the summit of the head, and back of the neck, are black; as are the margin of the eyes and the snout; all the other parts of the body are white; and the tail is ringed throughout, alternately black and white,

to the number of about thirty. It almost invariably bears its tail elevated. The fur is always clear and shining.

It is of this animal that our countryman Edwards says, in his interesting description, "I kept one in my house for some time: it was a very innocent, harmless creature, having none of the cunning or malice of the Monkey kind, though it has much of its shape and manner of sitting." M. Geoffroy informs us that he had traced the history of one of these animals for the period of nineteen years; hence we may conclude that it can be brought to support the temperature of these northern climates. At the same time this individual was always much annoyed by the cold; hence he often rolled himself into the shape of a ball, and covered his back with his tail. In winter time his favourite resort was the fire, putting on his paws to warm them. So much did he enjoy the warmth, that he permitted his whiskers and face to be singed before he would retire; and often he did no more than turn his face aside. He also delighted to bask in the sun. He was allowed a certain degree of liberty, and made one of the workshops of the museum his home. Here he indulged in the liveliest curiosity; unceasingly in motion, he examined, pawed, overturned every thing. A shelf above the door of his chamber was his bed; before retiring to rest, he regularly amused himself with exercise, and for half an hour jumped and danced with heart and heel; this feat accomplished, he was asleep in a moment. He fed on bread, carrots, and fruit, of which he was exceedingly fond. He also ate eggs, and from his birth had a partiality for roast beef and brandy. He was gentleness itself, sensible of caresses, familiar with every one, though somewhat taciturn in his declining days; at the same time he had no partialities, and jumped on the knees or shoulders indifferently of every visitor.

M. F. Cuvier also studied the manners of this favourite animal; and he has recorded a few facts which we must not omit. The palm of the hand extends, so to speak, in a straight line, hid under the hair, to the middle of the fore-arm, where it reappears naked; a somewhat singular occurrence. Again, when the arm of this Lemur is stretched out, its fingers are necessarily closed; accounting for the facility with which these animals hang from the branches. Many Naturalists have fallen into the mistake that the tongue is rough like the *Felina*, whereas it is smooth. It is to be added, that these animals, though they never use their teeth to bite or to cut, yet have the sociable instinct of using them to dress the vestments of their fellows; in fact, they use them as a kind of comb; and, finally, says M. F. Cuvier, I have been able to verify the observation of Linnæus, that, when at their ease and happy, they purr like the Cat.

Though thus well known in Europe, it would appear to be very different in their native haunts. At all events, no information of their native manners has been recorded. All we know on this point is the remark of Flaccourt, that they live upon trees, and congregate in troops to the number of thirty or forty.

2. LEMUR MACACO.—RUFFED LEMUR.

- Syn.* LE VARI.—Cuv. Reg. Anim. I. 107.
 LEMUR MACACO.—Linn. Gmel.—Geoff. Ann. Mus.—Desm. Mam.
 RUFFED LEMUR.—Shaw, Gen. Zool. I.—RUFFED MAUCAUCO.—Penn. Quadr. I. No. 151.
Icon. Maki Vari.—F. Cuv. et Geoff. Hist. Mam.
 Le Vari.—Audeb. Sing.—Le Vari (Var. A.)—Ibid.—Buff. Hist. Nat. XIII. pl. 27.
 BLACK MAUCAUCO.—Edw. Birds, pl. 217.

SPECIFIC CHARACTERS.

THE HAIR longest on the cheeks; varied with large black and white spots; on the tail entirely black.

Though this Ruffed Lemur has a specific name (*Macaco*), very much resembling a common appellation (*Mococo*) of the one preceding, yet there seems to be the widest difference in their natural disposition,—much greater, indeed, than in their external appearance. In its natural haunts this animal appears to be quite ferocious, and Flaccourt says they are furious like Tigers, and that two of them will make a noise which might pass for a hundred. They are also, he says, very difficult to tame, if not captured when quite young. This character is borne out by what is reported by M. F. Cuvier of one whose dispositions he had watched in a state of confinement. One of these Macacos was put into a cage with one of its congeners, where for a time they lived without hostility, if not with much cordiality. Ere long, however, they were removed into another cage, and in a different locality, upon which the Macaco murdered his companion during the night, and devoured him all but the skin.

The only specific characters which have been supplied of this animal

relate to the markings of the fur, which, after all, are by no means uniform. They differ somewhat in the sexes, though confined to black and white. The black prevails on the face, body, feet, and tail; but it is strikingly contrasted with the white of the back of the head, of a band, ribbon-shaped, thrown across the body, and of the four limbs, mounting behind over the lower part of the crupper; the lower jaw, too, is white, and there is a white band on the snout. The males alone are white headed, the females superiorly being all black. The fur is remarkable for its beauty; it is very long and bushy, and remarkably soft to the touch. The Ruffed Lemur is about seventeen inches long, from the snout to the origin of the tail; its tail has the same dimensions. At Malmaison, where Madame Bonaparte amused herself by collecting a number of objects of Natural History, this species bred occasionally. The eyes of the young were open at birth.

Audebert gives a variety, founded upon trifling differences of the markings; sometimes the upper part of the body is all white.

3. LEMUR RUBER.—RED LEMUR.

- Syn.* LE MAKI ROUGE.—Cuv. Reg. Anim. I. 107.
 LEMUR RUBER.—Geoff. Ann. Mus. XIX.—Desm. Mam.—Péron et Lésueur.
Icon. Maki roux femelle.—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR of a bright reddish marroue; the face, hands, tail, belly, and the inner surfaces of the limbs, black; a white spot on the back of the neck.

This, the most beautiful perhaps of all the Lemurs, was first noticed by the able and unfortunate Commerçon during his sojourn at Madagascar. He took a drawing of it, which lay long neglected among his papers. The interesting and indefatigable Péron, again, in his short visit to the same island, was struck with the appearance of the animal, and sent its fur to Paris, where it was preserved. France had the good fortune to receive the third specimen, which has been noticed in the *Annales des Sciences*, which animal was brought home alive in a merchant ship, and in the *Jardin des Plantes* fell under the observation of F. Cuvier, who gave a drawing and description of it in his *Mammifères*. This individual was a female, and probably the markings of the male are different; they are, however, unknown.

This individual is the most beautiful of the Lemurs hitherto described, both from its size and shape, and also from its brilliant colouring. In its general organization it resembles the other Lemurs. The upper parts of the body, including the back, the sides of the body and neck, the outer sides of the extremities, and the summit and sides of the head, are of a beautiful chestnut-red colour; whilst the face, hands, and feet, together with the inner sides of the limbs, and the under parts of the neck, chest, and belly, and the whole of the tail, are of the deepest black colour; there is besides a broad white marking on the back of the neck, and a band of the same colour over the instep and back of the head; and the reddish tint is somewhat paler round the ears. The eyes are fawn-coloured. M. Cuvier remarks, that there are very few animals in which the colouring of the under parts of the body is of a deeper shade than that of the upper; and the Grison alone had previously been supposed to exhibit this anomaly.

This Red Lemur was very gentle and tame; and though very agile, it was usually sad and somnolent; it spent its days rolled up in the shape of a ball, and waked up only to eat. It never emitted any cry. It was seventeen inches long from the snout to the origin of the tail, which extended to eighteen inches.

4. LEMUR ALBIMANUS.—WHITE-HANDED LEMUR.

- Syn.* LEMUR ALBIMANUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
 LEMUR COLLARIS.—Geoff. et Desm. ubi supra.
Icon. Le Mongouz.—Audeb. Sing.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown above; reddish marrone on the cheeks; belly white; all the hands white.

This animal is far from being well known; although it has been described by Brisson, from a specimen in the Museum of Réaumur, and also by Audebert, under what would now be regarded the inaccurate name of *Mongouz* (Buffon). From snout to tail it measures about sixteen inches. Its snout is black; its ears round; the hair of the face is short, and of a yellowish-grey colour, that of the temple and throat ferruginous. The top of the head, neck, shoulders, back, and outer sides of the limbs, are clothed with a deep brown-grey fur somewhat speckled; that of the

chest, belly, and insides of the limbs, is of a lighter colour. The hands and feet are covered with whitish hair to the very nails, and hence its specific name. The tail, which is longer than the body, is covered with long hair, grey and grizzly.

5. LEMUR ALBIFRONS.—WHITE-FRONTED LEMUR.

Syn. LE MONGOUS À FRONT BLANC.—Cuv. Reg. Anim. I. 107.
LEMUR ALBIFRONS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
Icon. LE MAKI À FRONT BLANC, mâle, femelle, et son petit.—F. Cuv. et Geoff. Hist. Mam.—Audeb. Sing.

SPECIFIC CHARACTERS.

MALE.

THE HAIR chestnut-brown above; olive-grey beneath; the face, from the eyes to the muzzle, black; a white band round the head; the hands yellowish.

FEMALE.

THE HAIR paler than in the male; no white band on the head.

The White-fronted Lemur was catalogued among the species by M. Geoffroy-St-Hilaire, and described and depicted by Audebert. Little, however, was known concerning it until the year 1816, when M. F. Cuvier obtained two pairs.

The male *L. albifrons* has the hair on the upper parts of the body, the outer sides of its limbs, and a third of its tail, of a golden chestnut-brown colour, when in a strong light; the inferior parts of the body, and inner sides of the limbs, are olive-grey-brown. The tail towards the tip is black. The front part of the head, and as far back as the ears, the cheeks, and under part of the lower jaw, are white. The face, palms, and soles, are of the hue of an Ethiopian black; and the iris is orange coloured. The only difference of colour in the female is, that those parts which are white in the male are of a dark grey colour, and that the rest of the fur is somewhat paler.

The animals under M. Cuvier's observation bred in Paris, and the period of gestation was about $3\frac{1}{2}$ months. The young had the same markings, and was of the same colour as its dam; its hair, at birth, was very short; its eyes were open, and it was about the size of a small Rat. No sooner did the young one make its appearance, than it hid itself in its mother's bosom, and soon began to feed itself. For a long while it was scarcely possible to get a sight of it, so hid was it in its mother's fur, and she, on her part, always turned her back on all intruders, even those with whom she was most familiar. Previous to the birth of her young one, she had been extremely gentle and familiar; she courted caresses, and licked the hand; but the moment she had her little one, she became suspicious, retreated as far as possible from every one, and threatened those who approached. When her care of the young one became unnecessary, in the third month, her natural demeanour returned; but throughout the nursing her care was most assiduous. When five and six weeks old, the young one began to eat the aliment presented to it, but it continued to suck for six months. Whenever in the slightest degree alarmed, it rapidly retreated to its mother's arms.

6. LEMUR MONGOZ.—MONGOOZ LEMUR.

Syn. LE MONGOUS.—Cuv. Reg. Anim. I. 107.
LEMUR MONGOZ.—Linn. Gmel. I.—Geoff. Ann. Mus. XIX.—Desm. Mam.
WOOLLY MAUCAUCO.—Penn. Quadr. I. No. 149.
Icon. Mongous mâle, et tête de sa femelle.—F. Cuv. et Geoff. Hist. Mam.
MONGOUZ.—Edw. Glean. pl. 216.
Mongous.—Buff. Hist. Nat. XIII. pl. 26.

SPECIFIC CHARACTERS.

MALE.

THE HAIR brown fawn colour, with an olive or yellow shade; the end of the tail black; the face grey; the top of the head black; the cheeks bright brown.

FEMALE.

THE HAIR on the top of the head grey, otherwise resembling the male.

This name (Mongous), originally applied by Edwards and other early writers to nearly all the Lemurs, is now confined to a single species. The general colour of the fur, which is remarkably fine and thick, is of a brown fawn colour, with an olive or yellow shade, and this colour is nearly uniform both on the upper and lower parts of the body; the tail is black at its extremity, and the summit of the head is entirely so in the male, while it is grey in the female. The lower parts of the cheeks are supplied with a ruff of a beautiful orange colour, and the face, ears, and

palms of the hands, are of a violet hue; the iris is orange. The form of the head of the male is not precisely similar to that of the female, and generally she is smaller and of a lighter hue than her mate.

When taken young, the Mongooz Lemur is easily tamed; though it is not so gentle as its ring-tailed congener. Buffon, who of course speaks of an imprisoned specimen, describes it as a filthy animal, which gnawed its tail. The individual mentioned by him required to be chained; it escaped into the neighbouring shops and houses, helping itself to all the fruits and sugar it could find; and was recaptured only with difficulty. It bit cruelly, making no exception, even of those who had the charge of it. It had a habitual insignificant grunt; and when tired, it uttered a stronger cry, not unlike the croaking of Frogs. It was invariably chilly, and delighted in the warmth of a fire.

7. LEMUR NIGRIFRONS.—DARK-FRONTED LEMUR.

Syn. SIMIA SCIURUS.—Petiv. Gazophyl. p. 26.
LEMUR NIGRIFRONS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
Icon. MAKI À FRONT NOIR (mâle).—F. Cuv. et Geoff. Hist. Mam.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown above, ash-grey beneath. THE FOREHEAD and FACE blackish-brown.

This species was first described and represented by our countryman Petiver (*Gazophylacium*, p. 26, tab. 17, fig. 5), under the name of *Simia Sciurus*, and in this he was followed by Schreber. Some uncertainty, however, prevailing, and new opportunities of examination occurring in Paris, it was there re-examined, and described by M. Geoffroy-St-Hilaire, under the specific name of *nigrifrons*, which it is now likely to retain. It is about the size of the Ring-tailed Lemur, and in external appearance differs but little from the *Mongoz*. Its ears are rather shorter than those of its congeners. Its forehead and cheeks are of a blackish-brown colour, gradually becoming lighter towards the snout, which is light grey. The upper part of the head and neck, the shoulders, and outer sides of the fore-legs, are of a greyish-brown colour, somewhat variegated with white and black. The back, flanks, and outer parts of the hind legs, are of a uniform brownish-grey; the tail becomes darker as it approaches its tip; the fur in front of the neck and chest is whitish; the hands and feet are covered with short ash-coloured hair.

8. LEMUR FULVUS.—FULVOUS LEMUR.

Syn. LEMUR FULVUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
Icon. LE MAKI BRUN.—Ménag. du Mus.
GRAND MANGOUS.—Buff. Hist. Nat. Suppl. VII. pl. 33.

SPECIFIC CHARACTERS.

THE HAIR brown above, grey beneath. THE FOREHEAD elevated and prominent.

The Fulvous Lemur has not been long catalogued in any of our systems, and was first described by M. Geoffroy-St-Hilaire (Ménag. du Mus.) Care should be taken not to confound it with the Mongooz, than which it is about a third larger; its head also is rounder, and its trunk more delicate; its tail likewise is not so bushy or woolly, and becomes more slender towards its extremity. It is brown above, and ash-coloured below. The croup and hind-legs are of an olive tinge, and the hairs are here reddish at their points. The iris is of a faint orange hue; the hair is entirely black, and the forehead is elevated and prominent. This animal has been exhibited in Paris as the *Pig-lemur* (*Cochon*).

9. LEMUR RUFUS.—RUFIOUS LEMUR.

Syn. LEMUR RUFUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
Icon. LE MAKI ROUX.—Audeb. Sing.—Copied in Schreb. pl. 39, C.

SPECIFIC CHARACTERS.

THE HAIR yellowish-red above, dull white beneath; a white circle round the head; a black line from the face to the hinder part of the head; the tail black near the tip.

Care should be taken not to confound this *Reddish*, or rust-coloured Lemur, with the *ruber* or Red Lemur of M. F. Cuvier, which is of a far brighter colour. This species has been established only upon some stuffed specimens which exist in the Paris Museum, and therefore requires further elucidation. Audebert is not quite convinced that it differs from the *Macaco*, though he inclines to this belief. M. Geoffroy-St-Hilaire, on the other hand, is satisfied upon this point, though it may still be allied to some other species.

The Reddish Lemur is of the same dimensions as the *Macaco*; its snout

is black; its ears short and round; the summit of its head, temples, cheeks, and under part of the neck, are of a dull white; a black line runs from the face, and extends to the crown of the head. All the body is of a yellowish-red colour, and the tail, much more slender than that of the Macaco, is black at its extremity.

10. LEMUR CINEREUS.—GREY LEMUR.

Syn. LEMUR CINEREUS.—Geoff. Mag. Encyc. I. p. 20.—Desm. Mam.

Icon. LE GRISET.—Audeb. Sing.—Copied in Schreb. pl. 40, C.

PETIT MAKI.—Buff. Hist. Nat. Suppl. VII. pl. 84.

SPECIFIC CHARACTERS.

THE HAIR grey, tipped with yellow above; whitish beneath; the point of the tail yellowish.

Some degree of doubt for some time hung over this last species, but it is now considered as unquestionably distinct. Stuffed specimens, we believe, are common in Paris; and Buffon described it from an individual discovered by Sonnerat; Audebert has also given us a description.

The Grey Lemur is a very pretty little animal, only ten inches long from the tip of the snout to the origin of the tail, which is somewhat longer. Its hair is mouse-grey towards its root, yellowish at its extremity, and frizzled like the wool of the Merino Sheep. Though its snout is not so prominent as that of the other Lemurs, its physiognomy is more delicate, and its movements lighter. The whole of the body is covered with this grey fur tipped with yellow; the under parts are almost white; the tail is yellow at its point.

DOUBTFUL SPECIES.

1. LEMUR ANJUANENSIS (Geoff. Ann. Mus. XIX.) was considered by M. Fred. Cuvier to be the female of the White-fronted Lemur. However, a pair of specimens of this latter animal, exhibited in London, resembled each other precisely (see Linn. Trans. XIII. p. 624), so that the question of their identity still remains doubtful.

2. LEMUR NIGER (Geoff. Ann. Mus. XIX.), entirely black, with long hairs hanging from the neck, is not very distinctly established. It is figured by Edwards (Gleanings, pl. 217) under the name of the BLACK MACAUCCO.

3. LE MAKI À GORGE BLANCHE (F. Cuv. et Geoff. Hist. Mam.)

In the year 1834, M. F. Cuvier published a beautiful representation and a good description of a Lemur, of whose species he still remained doubtful. This animal was a female; and though satisfied it was not a *Mococo*, a *Vari*, an *albifrons*, *Mongoz*, nor *Red Lemur*, yet still it might be the mate of some other of the previously described species. This animal possessed the size, proportions, and general physiognomy of the *Mongoz*; its snout was grey, with the exception of the muzzle, which was violet-coloured; round the eyes it was black. The head, as far as the ears, the neck, shoulders, and upper extremity, were grey; the lower part of the under jaw, the sides of the head as far back as the ears, and the under part of the neck and chest, were white. The ears were of a dark flesh colour; the back to the tail, the sides of the body, the belly, thighs, and legs, were fawn-coloured; the hands and feet were greyish; the first half of the tail was of a dull fawn grey, and the other half was blackish. All the naked parts of the body had a violet hue. We have been the more particular in tracing these external colourings, that others may assist in determining the species.

Like many of the female Lemurs, this individual was of an extremely sweet disposition. It was strongly attached to its owner—a lady, who was very fond of it, but obliged, however, to part with it, to their mutual regret, and so much did this affect the poor animal, that it sank under grief, but retaining its accustomed amiability to the last. This regret was manifested by its inactivity. It sat still with arms crossed, neglecting wanton amusement, and hanging the head on its breast. At first it ate a little, as in brighter days, but gradually its strength and appetite declined, cough supervened, and in a few days it died.

IMAGINARY SPECIES.

1. LEMUR COLLARIS (Le Maki à fraise) is a duplicate of Lemur albi-manus described above.

It should be mentioned here, that many of the differences noted above as specific are, in all probability in some instances, only sexual. It is still more probable that many species still remain undescribed and unknown.

GENUS II. LICHANOTUS.—INDRI.

Syn. LES INDRIS.—Cuv. Reg. Anim. I. 108.

LICHANOTUS.—Illig. Prodr. 72.

INDRI.—Geoff. Ann. Mus. XIX.—Desm. Mam.

LEMUR (in part).—Linn. Gmel. I.

GENERIC CHARACTERS.

THE HEAD triangular. THE MUZZLE pointed.

THE EARS short and rounded. THE EYES directed forwards.

THE DENTAL FORMULA $\frac{2+C+(2F\dots)M}{2+C+(F\dots)M}$ imperfectly known.

THE TARSUS shorter than the tibia.

THE FIRST FINGER only of the hinder hand with a claw.

THE MAMMÆ two.

INHABIT Madagascar.

The Indris, in respect to their dentition, coincide [as far as known] with the Lemurs, excepting that they have only four [incisors] in the lower jaw.

This genus is very readily distinguished from the neighbouring ones of the Lemurian family, by its having only four incisors in each jaw. Those of the upper jaw form pairs, the centre ones having their edge concave, whilst in the two lateral they are convex. The lower incisors are contiguous, and are especially remarkable as regards their direction, being almost quite horizontal; the side ones are somewhat larger, and are rounded externally. The canines are slightly separated from the incisors.

1. LICHANOTUS BREVICAUDATUS.—SHORT-TAILED INDRI.

Syn. LEMUR INDRI.—Linn. Gmel.

INDRI BREVICAUDATUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.

INDRI NIGER.—Lacépède.

INDRI MACAUCCO.—Penn. Quadr. No. 147.

Icon. L'INDRI.—Audeb. Sing.—Sonner.² Voy. II. pl. 88.

SPECIFIC CHARACTERS.

THE HAIR brownish-black; a large spot on each side, reddish above, and yellowish below; the crupper and tail white.

THE TAIL very short.

This species, the only one distinctly known, [almost] without a tail, is three feet high, black, with a grey face, and white buttocks. The inhabitants of Madagascar tame the short-tailed Indri, and even train it, like a Dog, for the chase.

The name *Indri*, in the language of Madagascar, denotes Man-of-the-Woods, and notwithstanding its inferior size, it possesses many claims to the appellation. M. Audebert, indeed, remarks, that the Indri, of all known animals, bears altogether the closest resemblance to Man; and this not only in its general contour, but also in its several proportions. We must, however, add, that the differences are most conspicuous; the head is shaped somewhat like that of a Fox; there is a tail, though it is very short; and the hind feet are truly hands, making it completely quadrumanous.

It has been stated above, that this Maki is tamed and reared to the chase. This circumstance is the more worthy of observation, because most of the animals which Man has domesticated and taught to assist him in hunting, are themselves of predatory habits, as, for example, the Dogs, the Weasels, the Chetah, and the Falcons. The Indri, on the other hand, feeds wholly on vegetables, and is, moreover, a harmless creature, delighting in fruits, and having no thirst for blood.

This animal is three feet and a half high; and the lower limbs are very nearly equal in length to the body; its snout is long, and the ears are short and round; the tail is remarkably short. All the nails on the extremities are flat (with the exception of that of the first finger of the hinder hand, which is a strong claw), and terminate in a very acute point, in which respect they possibly differ from those of Mau. In colour it is almost black; its fur is silky and abundant. The muzzle, the arm-pits, and lower part of the abdomen, are grey, and the buttocks are white, where also the hair is woolly, and curled as in the Sheep. Its eye is white and very lively; its cry like that of a weeping child.

¹ Lichanotus.—From λικανος, the first finger.

² SONNER. VOY.—Voyage aux Indes Orientales et à la Chine fait par ordre du Roi, depuis 1774 à 1781, par M. Sonnerat. Paris, 1782.

DOUBTFUL SPECIES.

1. L'INDRI à LONGUE QUEUE is described and figured by Sonnerat (Voy. II. pl. 89) under the name of Maquis à bourres (Flocky Lemur). This is the Lemur laniger of Linn. Gmel., the Maki fauve of Buffon, and Indris longicaudatus of most other authors. It is said to be yellow, with a very long tail; but the species itself requires revision, being probably identical with some of the Lemurs already described.

GENUS III. STENOPS.—LORISES.

Syn. LES LORIS.—Cuv. Reg. Anim. I. 108.
STENOPS.¹—Illig. Prodr. I. 73.
LORIS and NYCTICEBUS.—Geoff. Ann. Mus. XIX. 162.—Desm. Mam.
LEMUR (in part).—Linn. Gmel. I.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short. THE EYES very large, approximated, and directed forwards. THE EARS short and hairy.

THE DENTAL FORMULA as in the genus Lemur (see page 189).

THE TARSUS and METATARSUS of equal length.

THE MAMMÆ four. HABITS nocturnal.

The first finger only of the hinder hand with a claw.

INHABIT the East Indies and Africa.

The Lorises, otherwise called Slow-paced Lemurs (Singes Paresseux), have the same dentition as the Lemurs, only the points of their molars are sharper. They have the abrupt muzzle of a Mastiff; the body slender; the tail wanting [or medium size]; large approximated eyes; and a rough tongue.

They feed on Insects, sometimes also on small Birds or Quadrupeds; they walk at an excessively slow pace; and their habits are nocturnal. Sir A. Carlisle has noticed that the arteries of their limbs are subdivided at the base into small branches, in the same manner as in the true Sloths.²

Two species are noticed from the East Indies [and one from Africa].

To this genus we assign, with Temminck, the Potto of Bosman. It thus comprises three species; but there are two others, the reality of whose existence requires further proof. The dentition appears to undergo some important changes during its progress to maturity.

1. STENOPS TARDIGRADUS.—SLOTH-LORIS.

Syn. LE LORIS PARESSEUX ou le PARESSEUX DE BENGALE.—Cuv. Reg. Anim. I. 108.

LEMUR TARDIGRADUS.—Linn. Gmel. I.—Raffles, in Linn. Trans. XIII. 247.

NYCTICEBUS BENGALENSIS.—Geoff. Ann. Mus. XIX. 164.—Desm. Mam.

SLOW-FACED LEMUR.—Shaw, Gen. Zool. I.

Icon. LE LORIS PARESSEUX.—Audeb. Sing.

LORIS DE BENGALE.—Buff. Hist. Nat. Suppl. VII. pl. 36.—Vosm.³

DESCR. Pares. (Amsterdam, 1770).

POUKAN.—F. Cuv. et Geoff. Hist. Mam.

TAIL-LESS MACCAUCO.—Penn. Quadr. I. pl. 48.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown, a dark brown line along the back; the tail apparently wanting; a white spot on the forehead.

INHABITS Bengal.

The Sloth-Loris has been long and pretty accurately known to Naturalists. Linnæus described it; as did Vosmaër, the celebrated Dutch Zoologist. D'Obsonville examined it in its native haunts, and Audebert furnished an account from the Paris Museum. Our distinguished countryman, Sir William Jones, supplied a truly classical description in the Asiatic Researches, Vol. IV., while Dr Shaw, and Sir A. Carlisle, the celebrated anatomist, have both examined it with care.

The following detailed account of the Sloth-Loris is from the pen of the learned and accomplished Sir William Jones:—"This male animal had four hands, each five-fingered; palms naked; nails round, except those in the indices behind, which were long, curved, pointed; hair very thick, especially on the haunches, extremely soft, mostly dark-grey, varied with brown, and a tinge of russet; darker on the back, paler about the face, and under the throat, reddish toward the rump; no tail; a dorsal stripe, broad, chestnut-coloured, narrower towards the neck; a head al-

most spherical; a countenance expressive and interesting; eyes round, large, approximated, weak in the day-time, glaring and animated at night; a white vertical stripe between them; eye-lashes black, short, ears dark, rounded, concave; great acuteness at night, both in seeing and hearing; a face hairy, flattish; a nose pointed, not much elongated, the upper lip cleft; canine teeth comparatively long, very sharp.

"In his manners he was for the most part gentle, except in the cold season, when his temper seemed wholly changed; and his Creator, who made him so sensible of cold, to which he must often have been exposed even in his native forests, gave him, probably for that reason, his thick fur, which we rarely see in animals in these tropical climates. To me, who not only constantly fed him, but bathed him twice a-week in water accommodated to the seasons, and whom he clearly distinguished from others, he was at all times grateful; but when I disturbed him in winter, he was usually indignant, and seemed to reproach me with the uneasiness which he felt, though no possible precautions had been omitted to keep him in a proper degree of warmth. At all times he was pleased with being stroked on the head and throat, and frequently suffered me to touch his extremely sharp teeth; but at all times his temper was quick, and, when he was unseasonably disturbed, he expressed a little resentment by an obscure murmur, like that of a Squirrel, or a greater degree of displeasure by a peevish cry, especially in winter, when he was often as fierce, on being much importuned, as any beast of the woods. From half an hour after sun-rise, to half an hour before sun-set, he slept without intermission, rolled up like a Hedgehog; and, as soon as he awoke, he began to prepare himself for the labours of his approaching day; licking and dressing himself like a Cat, an operation which the flexibility of his neck and limbs enabled him to perform very completely: he was then ready for a slight breakfast, after which he commonly took a short nap; but when the sun was quite set, he recovered all his vivacity. His ordinary food was the sweet fruit of the country; plantains always and mangos during the season; but he refused peaches, and was not fond of mulberries, or even of guaiavas: milk he lapped eagerly, but was contented with plain water. In general he was not voracious, but never appeared satisfied with Grasshoppers; and passed the whole night, while the hot season lasted, in prowling for them. When a Grasshopper, or any Insect, alighted within his reach, his eyes, which he fixed on his prey, glowed with uncommon fire; and, having drawn himself back to spring on it with greater force, he seized the prey with both his fore-paws, but held it in one of them, while he devoured it. For other purposes, and sometimes even for that of holding his food, he used all his paws indifferently as hands, and frequently grasped with one of them the higher part of his ample cage, while his three others were severally engaged at the bottom of it; but the posture of which he seemed fondest was to cling with all four of them to the upper wires, his body being inverted; and in the evening he usually stood erect for many minutes, playing on the wires with his fingers, and rapidly moving his body from side to side, as if he had found the utility of exercise in his unnatural state of confinement. A little before day-break, when very early hours gave me frequent opportunities of observing him, he seemed to solicit my attention; and if I presented my finger to him, he licked it with great gentleness, but eagerly took fruit when I offered it; though he seldom ate much at his morning repast: when the day brought back his night, his eyes lost their lustre and strength, and he composed himself for a slumber of ten or eleven hours.

"My little friend was, on the whole, very engaging; and, when he was found lifeless, in the same posture in which he would naturally have slept, I consoled myself with believing that he died without pain, and lived with as much pleasure as he could have enjoyed in a state of captivity.

"In India it is found in the Garrow mountains, in the woods on the Coast of Coromandel, and has likewise been transmitted from the Eastern Islands."

Little requires to be added to this truly graphic description. M. F. Cuvier remarks, that the length of the body of this Loris is about 14 or 16 inches, equal to the size of a small Cat; and when standing erect upon its paws, its shoulders are nearly six inches high. *Sprawling*, however, may be said to be the favourite gait of this animal; its extremities being wide asunder, and its chest and abdomen almost touching the ground; so that it has a very uncommon appearance. Regarding the dental system of this species, M. F. Cuvier remarks, that the crest, on the inner side of the true molars, projects more at the anterior than the posterior part; that the upper incisors are regularly placed at the side, not before each other, and that the inferior canine is round, and not flattened externally. D'Obsonville informs us he could readily distinguish the peculiar cries of this Loris, when it was happy and sad, when it was hungry or impatient; it is a kind of soft whistle. It appears susceptible of some education, ceasing to bite

¹ Stenops, from στενος, narrow, and ὤψ, visage.

² The remarkably slow pace of these Lorises has led travellers to suppose them true Sloths, and hence some authors have asserted, contrary to Buffon and to the fact, that the genus of Sloths exists also in Asia.—Note of the Baron Cuvier.

³ Vosm. DESCR.—Description de differens Animaux de la Ménagerie du Prince d'Orange, par P. Vosmaër. Amsterd. 1766--1787.

and snap, and becoming attached to its master. Its odour is far from being agreeable.

To this already somewhat extended account, we cannot omit a valuable contribution made to our knowledge, of the anatomical structure of this animal, by Sir Anthony Carlisle, and communicated by him to Dr Shaw. Becoming possessed of the body of a *tardigradus*, he injected the arterial system, and discovered an unusual appearance in the great arterial trunks proceeding to all the limbs. "Immediately," he remarks, "after the great artery from the body (subclavian) has penetrated the armpit, it is divided into twenty-three equal-sized cylinders, which closely surround the principal trunk of the artery, now diminished in size to an inconsiderable vessel. The cylindrical arteries accompany each other, and divide with the two principal branches of the fore-arm (the radial and ulnar), being distributed in their routes upon the muscles, each of which has one of these cylinders. The other branches, for example, the radial and ulnar, proceed like the arteries in general; disposing themselves upon the skin, membranes, bones, &c., in an arborescent form. The great artery of the inferior extremity, the iliac, in the same way divides itself on the margin of the pelvis into upwards of twenty equal-sized cylinders, also surrounding the main trunk; these vessels are also finally distributed as in the upper extremity; the cylinders wholly upon the muscles, and the arborescent branches on all the other parts. It would be of some importance," adds Sir Anthony, "to ascertain whether the other slow-moving quadrupeds have any peculiar arrangement of the arteries of their limbs. This solitary fact is hardly sufficient for the foundation of any theoretical explanation of the slow movement of these muscles; if, however, it should be corroborated by similar circumstances in other animals, a new light may be thrown upon muscular action by tracing a connection between the kind of action produced in a muscle, and the condition of its vascularity or supply of blood."—(*Shaw's Gen. Zoology*, Vol. I. p. 91.)

These animals are sometimes found with two of the upper incisors wanting.

VAR. GRISEUS.—GREY SLOTH LORIS.

There is a larger variety, found in Bengal, called *Bru samundi* by the natives. It is grey, with the dorsal stripe entirely black.

2. STENOPS GRACILIS.—SLENDER LORIS.

Syn. LE LORIS GRÈLE.—Cuv. Reg. Anim. I. 108.

LORIS GRACILIS.—Geoff. Ann. Mus. XIX. 164.—Desm. Mam.

LORIS CEYLONICUS.—Fisch.¹ Anat. Mak., pl. 7 (skeleton).

LORIS.—Shaw, Gen. Zool. I.

Icon. LE LORIS GRÈLE.—Audeb. Sing.

LORIS.—Buff. Hist. Nat. XIII., pl. 30.—Seb.² Thes. I., pl. 35, fig. 1 (male), fig. 2 (fem.)

LEMUR TARDIGRADUS.—Schreb. Säugth., pl. 38.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown above, whitish beneath; a white spot on the forehead; circle round the eyes red. THE TAIL wanting.

INHABITS Ceylon.

This animal is smaller than the preceding, and has its nose more elevated, owing chiefly to the projection of the intermaxillary bones. From this difference, M. Geoffroy was led to form his genus *Nycticebus* of the former species, and his genus *Loris* of the latter.

The information we possess concerning this Slender Loris is but scanty, more especially respecting its habits and mode of life. Seba remarks, that it has an acute sense of smell; lives upon the seeds of lofty trees, which the male always tastes before offering to his mate.

Audebert counted four mammæ upon the female, although there were two glands only. The dimensions of the animal were small, the head and trunk extending only to five inches. The head is flat, but when garnished with hair, appears capacious and round. The eyes are very large and prominent, and the eye-lashes conspicuous. The muzzle is about half an inch long; the snout prominent, projecting over the mouth, whose upper lip is somewhat cleft. The ears are large, round, very concave, and almost naked. The arms are very long and slender; the hands are only an inch long, and the fingers are armed with short and flat nails. The legs are as slender as the arms, and somewhat longer; the feet being twice as long as the hands. The great toe is very strong; and has a striking tubercle between it and the next, as may be also seen on the hand. This Loris has neither tail nor tubercle answering to it. The fur covering the head, neck, back, and external portions of the extremities, is

of a reddish-brown colour, and this colour surrounds the eyes; there is a grey spot in the middle of the forehead, extending to the temples and cheeks; the muzzle is naked and flesh-coloured. The fur upon the extremities is very thin; and the whole of the under part of the body of a light yellowish-grey colour.

3. STENOPS POTTO.—BOSMAN'S LORIS.

Syn. LEMUR POTTO.—Linn. Gmel. I. 42.

NYCTICEBUS POTTO.—Geoff. Ann. Mus. XIX. 165.

GALAGO GUINEENSIS.—Desm. Mam. No. 127.

Icon. POTTO.—Bosm.³ Guin. II. pl. 4.

SPECIFIC CHARACTERS.

THE HAIR reddish in the adult; grey in the young. THE TAIL of medium length.

INHABITS Guinea.

To this genus we may refer the Potto of Bosman—an animal having the same remarkably slow movements as the Sloths and Lorises. [Cuvier considers it to be a Galago, and Temminck a Loris.]

This species seems very obscure, known only by Bosman's description and figure in his account of Guinea. He mentions that the animal is called Potto by the natives, and Sloth by Europeans, on account of the extreme slowness of its movements. He tells us it is scarcely able to walk ten paces a day; that it eats up all the fruit and leaves of a tree, thus becoming fat, after which it grows lean, and is in danger of starving, before it climbs a second tree. All this he narrates not from personal knowledge, but from the testimony of the Negroes. Its figure bears some resemblance to the *S. tardigradus*, but it is represented with a tail of some length. He adds, "This animal is so ugly and hideous, that I scarcely believe its match can be found in any part of the world. On the ground it crawls like a Reptile. Its hands bear a close resemblance to those of Man; its head is very large in proportion to its body. The robe of the young is of the same colour as that of the Rat, through which its smooth and glistening skin is seen; that of the old is red and tufted like wool."

DOUBTFUL SPECIES.

1. NYCTICEBUS JAVANICUS of Geoffroy (Ann. Mus. XIX.) and others, was found in Java by Leschenault de la Tour. It differs from the Sloth Loris merely in having the dorsal line deeper, and the muzzle more pointed. Probably it is only a variety of *Stenops tardigradus*.

2. NYCTICEBUS CEYLONICUS of Geoffroy (loc. cit.), figured in Seba's Thesaurus, I., pl. 47, under the name of *Cercopithecus Zeylonicus, seu tardigradus dictus major*,—is said to be dark brown approaching to black; the back entirely black; the tail very short. As its specific name denotes, it inhabits Ceylon.

GENUS IV. OTOLICNUS.—GALAGOS.

Syn. LES GALAGO (in part).—Cuv. Reg. Anim. I. 109.

OTOLICNUS.—Illig. Prodr. 74.

GALAGO (in part).—Geoff. Ann. Mus. XIX. 165.—Desm. Mam.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short. THE EYES very large, approximated, and directed forwards. THE EARS long, naked, and membranous.

THE DENTAL FORMULA, as in the Genus Lemur (see page 189), sometimes, by abortion, $\frac{2}{3} \frac{1+C+(3F+3)M}{1+C+(2F+3)M} = \frac{16}{18} = 34$.

THE TARSUS three times the length of the metatarsus.

THE TAIL long and bushy.

THE MAMMÆ two. HABITS nocturnal.

THE FIRST FINGER only of the hinder hand with a claw.

INHABIT the African continent and Madagascar.

These animals have the teeth and the insectivorous diet of the Lorises; but their elongated tarsi give to their hinder limbs a disproportionate length. Their tail is long and bushy, their ears expanded and membranous, while their large eyes indicate that their habits are strictly nocturnal. Several species are known, all from Africa.

In every part of their frame the Galagoes bear a close resemblance to

¹ FISCH. ANAT. MAK.—Gottlieb Fischer's Anatomie der Maki, und der ihnen verwandten Thiere. Frankfurt am Main, 1804.

² SEB., THES.—A. Sebae locupletissimi rerum naturalium Thesauri accurata descriptio. Amsterdam, 1734-1765.

³ BOSM. GUIN.—Reise nach Guinea durch W. Bosman. Hamburg, 1708.

the Lemurs properly so called; a remark which requires particular application to the teeth, as it was long supposed there was a subgenus having only two incisors in the upper jaw. The truth is this: The incisors are very small, the upper canines again are particularly large, and the excessive development of these latter frequently displaces the neighbouring teeth. The most remarkable feature in the organization of this genus is the great length of the posterior extremities, approximating them to the Kangaroos. In the *Quadrupedia* an essential character, as is well known, consists in the multiplication, the separation, and the distinct specification, so to speak, of all the parts of the foot. Now, the elongation of the hinder limb is, in the case before us, effected without in the slightest degree deranging the type of the order, and solely by a change in the volume of some of its parts. Of the seven bones which form the tarsus, two only, namely, the *Scaphoid* and *Calcaneum*, are lengthened; and notwithstanding the marked change thus produced, the common forms and use of the bones themselves are modified but to a trifling extent.

The great length of these limbs, and the size of the eyes and external ears, all harmonize with the fact that the Galagoes are nocturnal and insectivorous. By means of the large auricle, whose folds it actually expands, it is advertised of the slightest noise, even to the flitting of an insect through the air; and on perceiving one, darts upon it like a Hawk. This it does in two ways; seated in ambush, and hid beneath the foliage, it sometimes starts up only on its hind feet, without quitting the branch, in a moment it darts upon its victim, and clenches it: more frequently, however, like the Bat, it seizes its prey in the air, vaulting surprisingly, flying from branch to branch, and scarcely ever missing the object of pursuit.

Like most of the Bats, the Galagoes, during repose, escape from the annoyance which the extreme acuteness of their hearing might produce; for they have the remarkable power of closing their ears when asleep. These appendages contracting and folding at their base, retract to that extent that they even become invisible. When roused from sleep by any sudden noise, the animal unfolds, and we may almost say expands, every part of its ear, extending it in the direction whence the sound emanates. This appendage, then, it is interesting to observe, subserves a double purpose; expanded, it is an admirable acoustic instrument; and contracted, it completely plugs up the auditory foramen. The animal can thus at will make itself deaf, or nearly so; a most happy faculty during its hours of repose, when the animated and busy scenes around it are all active and noisy under the light of day. It has thus a kind of eye-lid to the ear, rendered the more necessary from the exquisite sensibility and great perfection of the sense.

The habits of the Galagoes resemble those of Monkeys and Squirrels. Generally quite gentle, they live perched upon trees, and cling to the branches almost like Birds. Their agility in pursuit of their living prey quite astonishes an observer; their motions are so rapid that the eye cannot follow them, and they are almost as quick in devouring their prey as in seizing it. They make a most comfortable bed for their young. The Negroes hunt them as an article of food.

1. OTOLICNUS CRASSICAUDATUS.—GREAT GALAGO.

- Syn.* GALAGO CRASSICAUDATUS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
GALAGO À QUEUE TOUFFUE.—Desm. Mam.
Icon. LE GRAND GALAGO.—Cuv. Reg. Anim. III. pl. 1, fig. 1.—Nouv.
Dict. d'Hist. Nat. XIII. pl. E. 31.

SPECIFIC CHARACTERS.

THE HAIR reddish-grey. THE EARS two-thirds of the length of the head.

INHABITS Africa.

Of this Galago, distinguished as *Le Grand* by Cuvier, and catalogued by nearly all systematic writers, exceedingly little is known. It is of about the size of a Rabbit; the ears are oval, and equal two-thirds of the body in length; the fur is thick and silky, and of a reddish-grey colour; the tail is throughout bushy. Its habits are supposed to correspond with those of its congeners, and its precise locality has not been ascertained.

2. OTOLICNUS SENEGALENSIS.—SENEGAL GALAGO.

- Syn.* LE MOYEN (GALAGO).—Cuv. Reg. Anim. I. 109.
GALAGO SENEGALENSIS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
GALAGO GEOFFROYI.—G. Fischer, in Act. Soc. Mosc. I. p. 25.
LEMUR GALAGO.—Shaw, Gen. Zool. I.
Icon. LE GALAGO.—Audeb. Sing.
GALAGO DU SENEGAL.—F. Cuv. et Geoff. Hist. Mam.—Schreb. Säugeth.
pl. 38, B.
GALAGO MOHOLI.—Smith, Zool. S. Afr. pl. 8. (Mamm.)

SPECIFIC CHARACTERS.

THE HAIR yellowish-grey above; yellowish-white beneath; tending to reddish on the tail.

THE EARS as long as the head.

INHABITS Western and Southern Africa.

The most striking characters of this interesting-looking animal are its ears, equal in dimensions to its whole head; its posterior limbs greater in length than the body and head together, and the tail longer than both. The fur is rather long, bushy, and very soft; it is longest on the body; somewhat less so on the head, rather unequal on the lower part of the body, very short on the hands, and under the tarsus. This Galago is yellowish-white beneath, and yellowish-grey above, tending to reddish on the tail; the points only of the hairs have the grey cast, the basal portion being of a blueish ash colour; the yellow commences on the extremities, whilst the head is wholly grey. A yellowish-white band pervades the whole chauffru.

This, and probably the other species, are very common in Western Africa. The Moors, who frequently bring them to the coast, sell them to the Europeans under the name of *Gum animals*—a circumstance which has induced some to believe that they eat this article. It is owing merely, however, to the gum trees attracting Insects, and of course their devourers.

In captivity these creatures must be kept with all the care exercised towards Birds; for they are exceedingly apt to escape, and it is almost impossible again to catch them. Their vivacity, their extreme petulance, and the extent of their leaps, are truly surprising, and not less so the extensive motion of their ears.

Although the reasons assigned by Dr Smith do not appear to us sufficient for the establishment of the new species he proposes (*Galago Moholi*, which we anticipate further inquiry will assign to the present), yet we are happy to quote his excellent description of the animal so frequently seen in Southern Africa. "The first specimens we observed were upon two trees close to the Limpopo River, in about latitude 25° S., and from that parallel we continued to observe others as far as we travelled. During their movements they evince great activity; they spring from branch to branch, and even from tree to tree, with extraordinary facility, and always seize with one of their fore-feet the branch upon which they intend to rest. In their manners they manifest considerable resemblance to Monkeys, particularly in their propensity to the practice of ridiculous grimaces, gesticulations, &c. According to the natives it is a nocturnal animal, and is rarely to be seen during the day. The latter it spends in its nest; where the female rears her young, generally two at a birth. Its food consists principally of pulpy fruits, though there is reason to believe it also consumes Insects, as the remains of the latter were discovered in the stomachs of several individuals we examined."

3. OTOLICNUS MADAGASCARIENSIS.—MADAGASCAR GALAGO.

- Syn.* LE PETIT (Galago).—Cuv. Reg. Anim. I. 109.
GALAGO MADAGASCARIENSIS.—Geoff. Ann. Mus. XIX.—Desm. Mam.
OTOLICNUS MADAGASCARIENSIS.—Schinz Thier. I. 147.
MURINE LEMUR.—Penn. Quadr. I. 232.
MICROCEBUS RUFUS.—Geoff. Cours. Lec. 11, p. 24.
LEMUR MURINUS.—Linn. Gmel. I. 44.
Icon. MAKI NAIN.—F. Cuv. et Geoff. Hist. Mam.
LEMUR PUSILLUS (Le Maki nain).—Audeb. Sing.
RAT DE MADAGASCAR.—Buff. Hist. Nat. Suppl. III. pl. 20.

SPECIFIC CHARACTERS.

THE HAIR dark-grey above; whitish beneath. THE EARS much less than the head.

INHABITS Madagascar.

This Galago, though of dimensions and general appearance such as very naturally procured for it the appellation of the Madagascar Rat, yet possesses a structure which removes it far from the order Rodentia, and places it in that one on which we are now dwelling. Its organs of motion, even to the crooked nail on the index fingers of the posterior extremity, agree precisely with those of its congeners. Its tail has been remarked to be somewhat less bushy; its ears are proportionally very decidedly smaller than the previous species; they are also rounder, but are membranaceous and naked; the eyes are of the same great size, and the pupil is round. The tongue is smooth. The whole of its body, except the muzzle and the extremity of its members, is covered with a thick fur, composed of wavy silk-looking hairs, soft and light. The forehead, back of the head, upper part of the neck, the shoulders, and superior portion of the arms, as well as the back and upper parts of the body, and the whole of the tail, are

¹ SMITH, ZOOLOG. S. AFR.—Illustrations of the Zoology of South Africa, consisting chiefly of Figures and Descriptions of the objects of Natural History, collected during an Expedition into the Interior of South Africa in the years 1834 to 1836, fitted out by the Cape of Good Hope Association for exploring Central Africa. By Andrew Smith, M.D. London, 1838, et seq.

of a uniform fawn-grey colour; while the under part of the lower jaw, the throat, lower part of the neck, the chest, the inner side of the arms, the belly, and external aspect of the hinder limbs, are white. The face and hands are flesh colour, with a white longitudinal spot between the eyes. There is no very manifest difference between the sexes.

The habits of this animal are very similar to those previously detailed. In confinement, he passes the entire day hid in a comfortable nest, rolled up into a ball, and sound asleep; but with the twilight he leaves his retreat, and is active throughout the night. It is now that he eats and amuses himself; exceedingly lively and active, he runs round his cage as if flying, and will leap six feet vertically. He lives upon fruit, bread, and biscuits.

DOUBTFUL SPECIES.

1. THE LITTLE MAUCAUCO (Penn. Quadr. I. 233), figured in Brown,¹ Illustr. pl. 44, is either the young of the Senegal Galago, or the type of a new species. It differs from the Madagascar Galago in having the ears nearly as long as the head, and the tail reddish.

2. GALAGO DEMIDOFFII (G. Fisch. in Act. Soc. Mosc. I. p. 24, fig. 1) is said to have its fur reddish-brown; the muzzle blackish, and the ears half as long as the head; the tail is longer than the body, and ends in a tuft. This animal is thought to have come from Senegal. M. Geoffroy considers it to be the young of some other species.

GENUS V. TARSIIUS.—TARSIIERS.

Syn. LES TARSIIERS.—Cuv. Reg. Anim. I. 109.

TARSIIUS.—Storr,² Prodr.—Geoff. Ann. Mus. XIX. 167.—Illig. Prodr. 74.—Desm. Mam.

DIDELPHIS (in part).—Linn. Gmel. I. 109.

GENERIC CHARACTERS.

THE HEAD round. THE MUZZLE short and pointed. THE EYES very large and approximated. THE EARS large, naked, and membraneous.

THE DENTAL FORMULA $\frac{2+C+(3F+3)M}{1+C+(3F+3)M} = \frac{18}{16} = 34$.

THE TARSUS three times the length of the metatarsus.

THE TAIL very long, tufted at the end.

THE MAMMÆ two, ventral. HABITS nocturnal.

THE INDEX and MIDDLE FINGERS of the hinder hands armed each with a pointed nail.

INHABIT the East Indian Archipelago.

The Tarsiers have the elongated tarsi of the Galagoes, and resemble them in most of the details of their structure; but the interval between their true molars and incisors is occupied by several smaller teeth, and the first or middle incisors of the upper jaw are elongated and resemble the canines. Their muzzle is very short, and their eyes are still larger than any of the preceding.

These animals are of nocturnal habits, and live on Insects. They come to us from the Moluccas [and other islands of the East Indian Archipelago].

1. TARSIIUS SPECTRUM.—PODJE TARSIER.

Syn. LEMUR SPECTRUM.—Pall.³ Glir. p. 275.

TARSIIUS SPECTRUM.—Geoff. Ann. Mus. XIX.—Desm. Mam.

MACROTARSUS INDICUS.—Lacep.

DIDELPHIS MACROTARSUS.—Linn. Gmel. I. 109.

TARSIER MAUCAUCO.—Penn. Quadr. I. 231.

Icon. LE TARSIER.—Buff. Hist. Nat. XIII. pl. 9.—Copied in Schreb. Säugth. pl. 155.

TARSIIUS FUSCUS s. FUSCOMANUS.—G. Fisch. Anat. Mak. pl. 3, 4.

TARSIIUS DAUBENTONII.—Audeb. Sing.

TARSIIUS BANCANUS (young).—Horsf. Jav.

The Podje, the only well-ascertained species of this genus, is of the size of a Rat, measuring about six inches from the muzzle to the origin of the tail; this appendage is considerably longer. The head is round, the ears are transparent and naked, and half the length of the head. The snout is short and pointed, the eyes are remarkably large, and the posterior extremities as long as the body and head taken together; the extremities almost naked, the nails short and flat, with the exception of those on the

index and middle fingers of the hinder hands, which are hooked. The tail is clothed with hair only at its base and tip. The fur, which lies close, is of a dark reddish-brown colour.

Of the habits of this animal but few particulars have been stated. It lives upon trees, and pursues Insects. The name *Podje* is applied to it by the natives of the island of Macassar, where it abounds.

IMAGINARY SPECIES.

1. T. BANCANUS of Dr Horsfield, figured in his work on Java, is the young of the Podje Tarsier according to Temminck.

2. T. DAUBENTONII; and,

3. T. FUSCOMANUS of G. Fischer (Anat. Mak.), are identical with T. Spectrum.

DOUBTFUL GENUS.—CHIROGALEUS.

Travellers should search for some animals, drawn by Commerçon [the originals are deposited in the Museum d'Histoire Naturelle], and engraved by Geoffroy (Ann. Mus. XIX. pl. 10) under the name of Cheirogaleus. These figures seem to indicate a new genus or sub-genus of Quadrumanous animals.

M. Geoffroy has the fullest conviction that these animals will turn out to belong to a distinct genus. The accurate Commerçon had carefully sketched them of their natural size; and this after having prepared a history of the Lemurs, and examined all their minute and distinguishing characteristics. These animals, like the Felinæ, have the head round, the nose and muzzle short, the lips armed with moustaches, the eyes large, prominent, and approximated, and the ears short and oval. Their tail is long, very bushy, regularly cylindrical, and generally curling forward, sometimes upon itself, and sometimes round the animal's body. All these traits correspond with those belonging to the Cat family. But to these we have to add, that the phalanges of the extremities, widely separated, and formed for grasping, like those of the Lemurs and the Chirolei, have the four thumbs completely opposable, and apt for all their peculiar movements. They are, moreover, supplied with broad nails, which are short and flat. The nails, again, on all the other phalanges are straight, slender, acute, surpassing considerably the fleshy extremity. These nails, however, are very different from the claws of Bears, Cats, &c., and in their form and position much resemble the awl-shaped nail which in the Lemurs is attached to the index finger of the hinder hand.

The respective dimensions of the three species which the celebrated traveller has sketched, supply the specific names which M. Geoffroy has provisionally supplied to them. They are—

1. CHIROGALEUS MAJOR.—Geoff., whose length is about twelve inches. It is of a dark brown colour, particularly about the chanfrin.

2. CHIROGALEUS MEDIUS.—Geoff. Length nine inches. The colour is not so deep; a black circle surrounds the eyes, and the chanfrin is much lighter.

3. CHIROGALEUS MINOR.—Geoff. Little more than seven inches long. The colour generally is much lighter, especially about the eyes and chanfrin, which are both surrounded with a black circle.

Are not these different ages of the same animal?

Note.—Mr Waterhouse, in the Annals of Natural History, Vol. 11. p. 468, has described the skins of several Quadrumanous animals, brought to the Zoological Society's Museum from Fernando Po. Not having had an opportunity of examining the skins themselves, or of procuring drawings, we have abstained from noticing them in the text.

1. COLOBUS PENNANTII, Waterh., seems not to differ specifically from the Bay Monkey of Pennant.

2. COLOBUS SATANAS, Waterh., greatly resembles the Colobus Guerezi of Ruppell, if it be not absolutely identical therewith.

3. CERCOPITHECUS MARTINI, Waterh., founded upon two skins, of which the *face and hands were wanting*, resembles the Vaulting Guenon (*C. nictitans*).

4. CERCOPITHECUS ERYTHROTIS, Waterh., *wanting the face and hands*, seems to resemble the Moustache Guenon (*C. Cephus*).

5. 6. Two others, Colobus leucomeros and *C. ursinus*, are mentioned from the same locality.

¹ BROWN, ILLUSTR.—New Illustrations of Zoology, by Peter Brown. London, 1776.

² STORR, PRODR.—Prodromus Methodi Mammalium. Auctore Theophilo C. C. Storr. Tab. 1780.

³ PALL. GLIR.—Nova Species Quadrupedum e Glirum ordine. Auctore Petro Sim. Pallas. Erlang. 1778.

LIST OF THE PLATES

OF THE

ANIMALS REPRESENTED IN VOLUME I. OF THIS WORK.

DIVISION I. VERTEBRATA.—CLASS I. MAMMALIA.

Plate.	Genus.	Figures.	Plate.	Genus.	Figures.
✓ A.		Head, skeleton, and teeth, of	✓ XII.	MUSTELA,	Weasels,
		Orang-outang, &c.	✓ XIV.*	CANIS,	Dogs,
✓ I.	{ PITHECUS,	Orang-outang,	✓ XIV.**	do.	do.
	{ TROGLODYTES,	Chimpansee,	✓ XV.	do.	Wolves and Foxes,
	{ HYLOBATES,	Gibbons,	✓ XV.*	do.	Dogs,
✓ II.	CERCOPITHECUS,	Guenons,	✓ XVI.	VIVERRA,	Civets,
✓ II. C.	{ NASALIS,	Proboscis Apes,	✓ XIX.	FELIS,	Cats,
	{ SEMNOPITHECUS,	Solemn Apes,	✓ XIX. B.	do.	do.
✓ II. D.	MACACUS,	Macacos,	✓ XIX. C.	do.	do.
✓ III.	CYNOCEPHALUS,	Baboons,	✓ XXX.	SCIURUS,	Squirrels,
✓ III. B.	do.	do.	✓ XXXIX.	ELEPHAS,	Elephants,
✓ IV.	MYCETES,	Howlers,		SUS,	Hogs,
✓ IV. D.	CEBUS,	Weepers,	✓ XLII.	{ PHACOCHEERUS,	Ethiopian do.
✓ V.	HAPALE,	Marmousets,		{ DICOTYLES,	Peccaries,
✓ VI.	LEMUR,	Makis,	✓ XLIII.	RHINOCEROS,	Rhinoceroses,
	{ LICIANOTUS,	Indris,	✓ XLVII.	CAMELUS,	Camels,
✓ VI. B.	{ STENOPS,	Lorises,	✓ L.	CERVUS,	Deer,
	{ OTOLICNUS,	Galagoes,	✓ L. B.	do.	do.
	{ TARSUS,	Tarsiers,	✓ LI.	do.	do.
✓ VI. C.	GALEOPITHECUS,	Flying-Cats, male, female,	✓ LII.	CAMELOPARDALIS,	Giraffe,
		and young,	✓ LIII.	ANTELOPE,	Antelopes,
✓ VII. G.	{ VESPERTILIO,	True Bats,	✓ LVII.	BOS,	Oxen,
	{ NYCTICEIUS,	Roquet-Dog Bats,			
✓ X.	URSUS,	Bears,	35 Plates.		
	{ AILURUS,	Pandas,			
✓ XI.	{ ICTIDES,	Benturongs,			
	{ NASUA,	Coatis,			
					Total, 230

DIVISION I. VERTEBRATA.—CLASS II. AVES.

Plate.	Genus.	Figures.	Plate.	Genus.	Figures.
✓ I. B.	VULTUR,	Vultures,	✓ L.	HIRUNDO,	Swallows,
✓ III.	AQUILA,	Eagles,	✓ LV.	PARUS,	Titmice,
✓ IV.	HALIAETUS,	Fisher-Eagles,	LVII.	EMBERIZA,	Buntings,
✓ VI.	{ CIRCUS,	Harriers,		do.	do.
	{ SERPENTARIUS,	Snake-Eaters,	✓ LVIII.	{ FRINGILLA,	Finches,
✓ VII.	STRIX,	Owls,	✓ LXII.	LOXIA,	Crossbills,
✓ VIII.	do.	do.	✓ LXXV.	GARRULUS,	Jays,
✓ X.	LANIUS,	Shrikes,	✓ LXXXV.*	CINNYRIS,	Soui-Mangas,
✓ X. B.	{ do.	do.	✓ LXXXVIII.	TROCHILUS,	Humming-Birds,
✓ X. C.	{ LANIARIUS,	Thrush-Shrikes,	✓ LXXXVIII. B.	do.	do.
	do.	do.	✓ LXXXVIII. C.	do.	do.
✓ XVIII.	TANAGRA,	Tanagers,	✓ LXXXVIII. D.	do.	do.
✓ XXIII.*	SETOPHAGA,	Gnat-Catchers,	✓ LXXXIX.	do.	do.
✓ XXIII.	VIREO,	Chats,		{ URUPA,	Hoopoes,
✓ XXX.	MERULA,	Thrushes,	✓ XCII.	{ EPIMACHUS,	Promerops,
✓ XXXII.	PITTA,	Breves,	✓ XCII. B.	do.	do.
✓ XXXIV.	ORIOLES,	Orioles,	✓ XCIV.	MEROPS,	Bee-Eaters,
✓ XLII.	SYLVIA,	Warblers,	✓ XCIX.	BUCEROS,	Hornbills,
✓ XLVI.	REGULUS,	Kinglets,	✓ XCIX. B.	do.	do.
✓ XLVII.	TROGLODYTES,	Wrens,	✓ CI.	PICUS,	Woodpeckers,
✓ XLIX.	EUCRYLAIMUS,	Eurylaimes,	CIX.	TROGON,	Couroucous,

LIST OF THE PLATES.

Plate.	Genus.		Figures.	Plate.	Genus.		Figures.
✓ CXII.	{ CALYPTORHYNCHUS,	Muffed-Cockatoos,	5	CXXVII.	ORTYX,	Quails,	6
	{ PSITTACUS,	Parrots,	4	CXXIX.	COLUMBA,	Pigeons,	9
✓ CXIII.	{ LORIUS,	Lories,	1 y	CXXIX. B.	do.	do.	5 x
	{ PSITTACULA,	Parrakeets,	5	CXXIX. C.	do.	do.	6
CXXIII.	TETRAO,	Grouse,	5	CXXXIII.	STRUTHIO,	Ostriches,	2 >
✓ CXXIII.*	do.	do.	5				
✓ CXXIV.	LAGOPUS,	Ptarmigan,	5				
				48 Plates.			Total, 302

DIVISION II. INVERTEBRATA.—SECTION I. MOLLUSCA.

CLASS GASTEROPODA.—ORDER TRACHELIPODA.

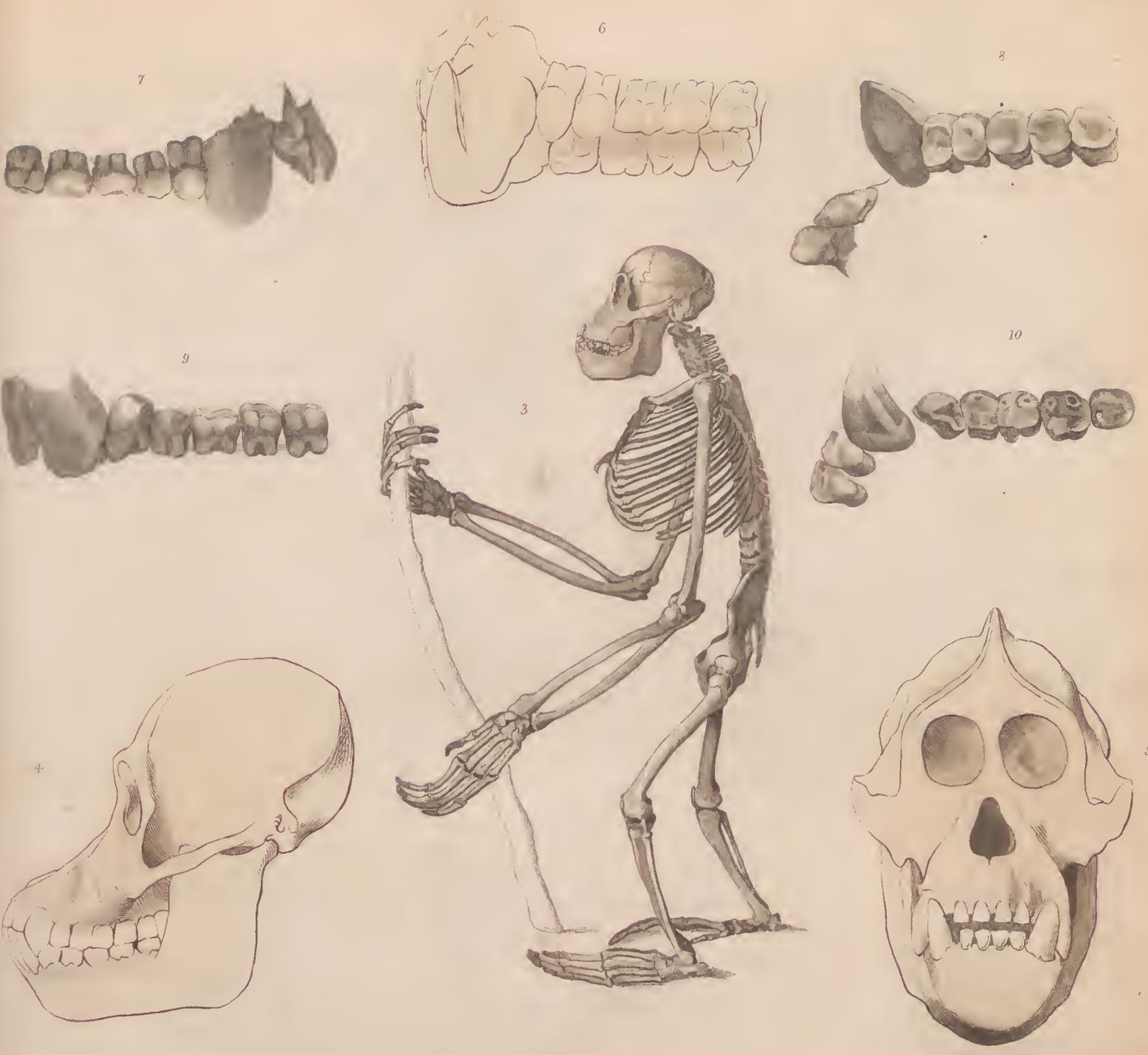
Plates.	Genus.		Figures.
III.	CONUS,	Cones,	25
XLVI.	ACHATINA,	Agates,	10
			<hr/> Total, 35

DIVISION II. INVERTEBRATA.—SECTION II. ARTICULATA.

CLASS INSECTA.

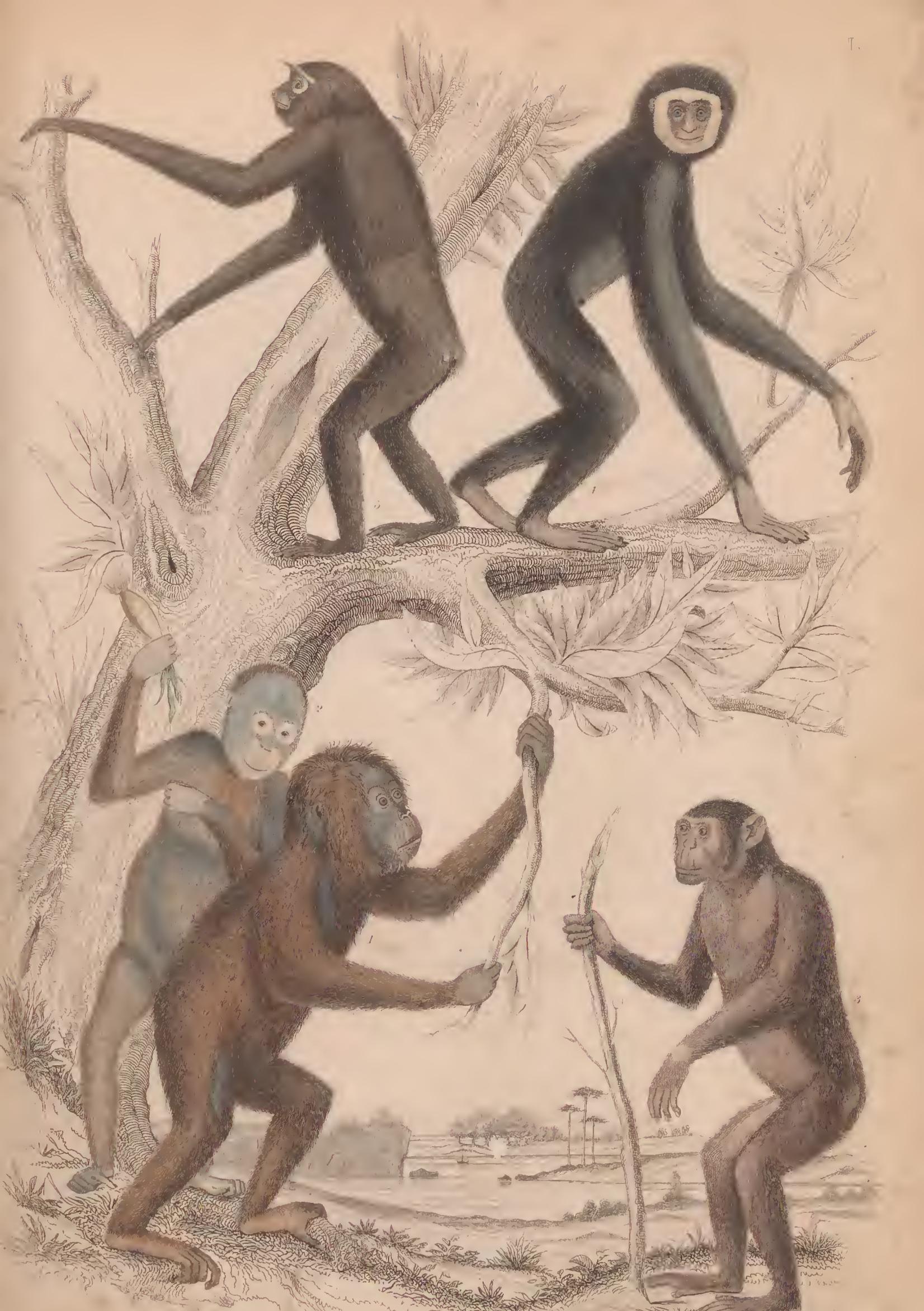
Plates.	Order.		Figures.
IV.	COLEOPTERA,	Beetles,	15
XII.	LEPIDOPTERA,	Butterflies,	17
			<hr/> Total, 32

	Figures.	Plates.
Total of the Mammalia represented,	230	35
of the Birds represented,	302	48
of the Mollusca represented,	35	2
of the Insecta represented,	32	2
	<hr/> In all, 597	<hr/> 87



1 2 *Orang Outang* adult
 3 fem
 4, 5 skull
 6 both jaws
 7, 8 upper
 9, 10 lower

11 Nostrils of the Ape of the Old Continent
 12 New
 13 *Erudus hemidactylus*



PITHIQUES, MEN OF THE WOODS
 P. Salvus. Orang Outang
 P. m.
 PROWIDDYTES, CHIMPANZES.
 P. m.
 HYLOBATES, GIBBONS.
 P. m.
 P. m.



NISALIS, PROBOSCTS APES.
 1. *N. larvatus* Kaliau
 2. *S. comatus* Dote
 3. *N. cristatus* Entellus
 4. *N. melalophus* Cincapay
 5. *N. comatus* Crested
 6. *N. murus* Ichmeou



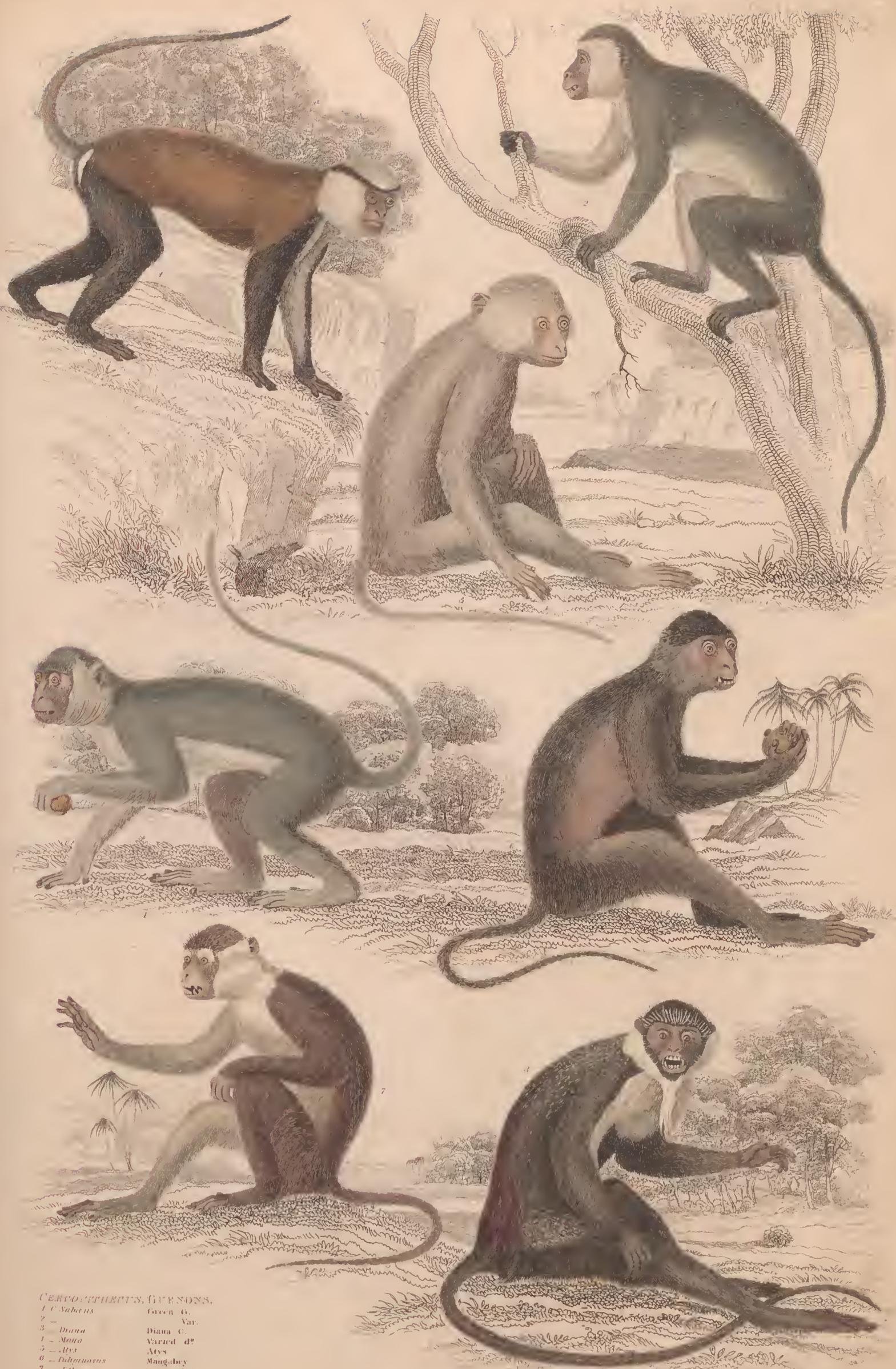
MACAQUES, OR CAUDS
 1 *Silenus* Ouamle-rou M
 2 *Sinensis* Chinese-cappul
 3 *Cynomolgus* Bare-lipped
 4 *Rhesus* Rhesus
 5 *acrosternus* Pig-tailed
 INDIAN JUNGLES.
 6 *Barbatus* Barbary M.



W. G. Sc. del. & sculp.

CYNOPHILIA'S BABOONS.
 1. C. Sphinx Guinea
 2. Young Female
 3. Baboon Little
 4. porcarius Chacma
 5. Hamadryas Dog faced
 6. Female

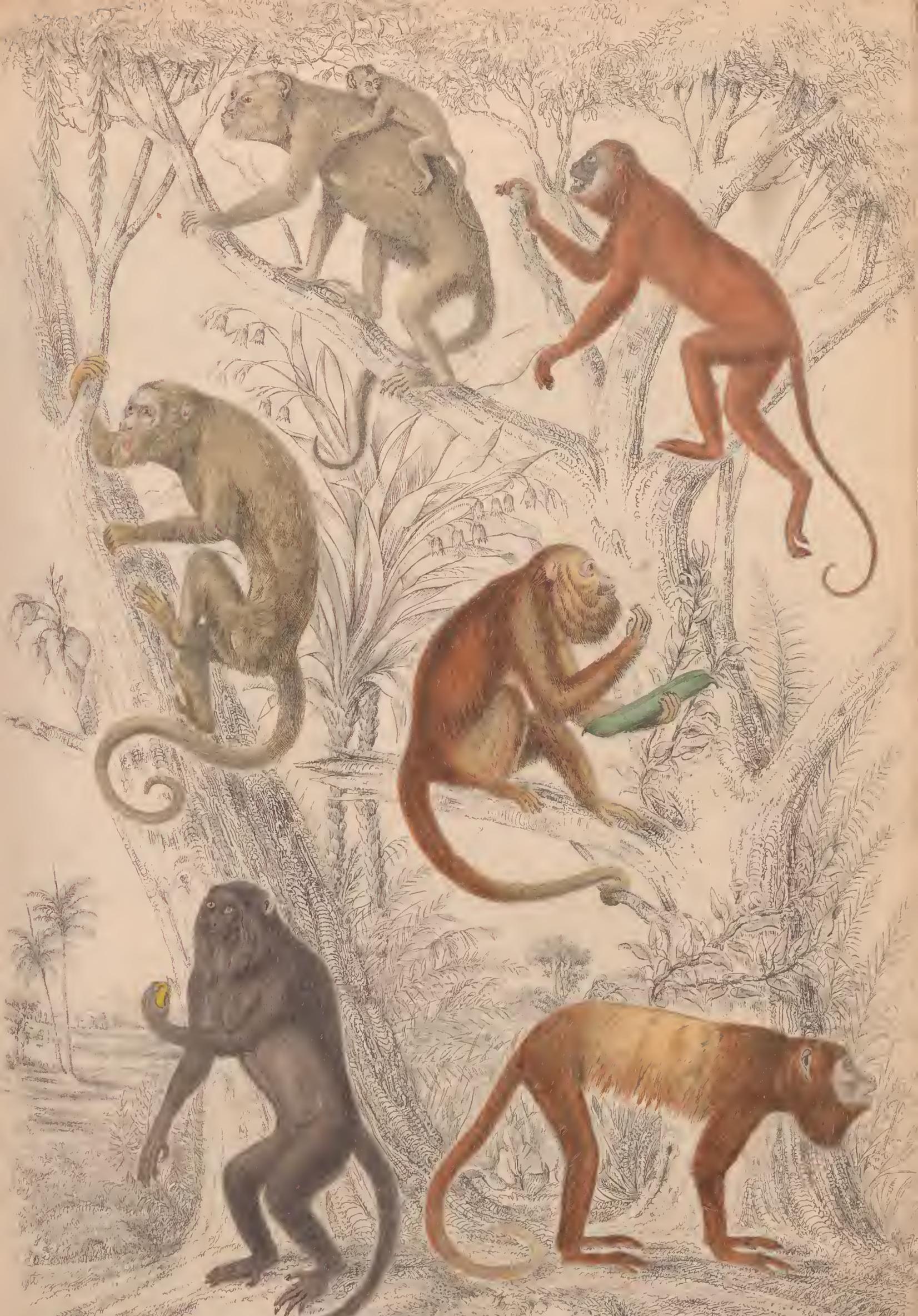




CERCOPILEPTES, GÜENON'S.
 1 - *C. Sabaeus* Green G.
 2 - " " Var.
 3 - *Diana* Diana G.
 4 - *Mona* Varied d?
 5 - *Alys* Alys
 6 - *Dobsonius* Mang-bey
 7 - *Ethiops* Collared d?

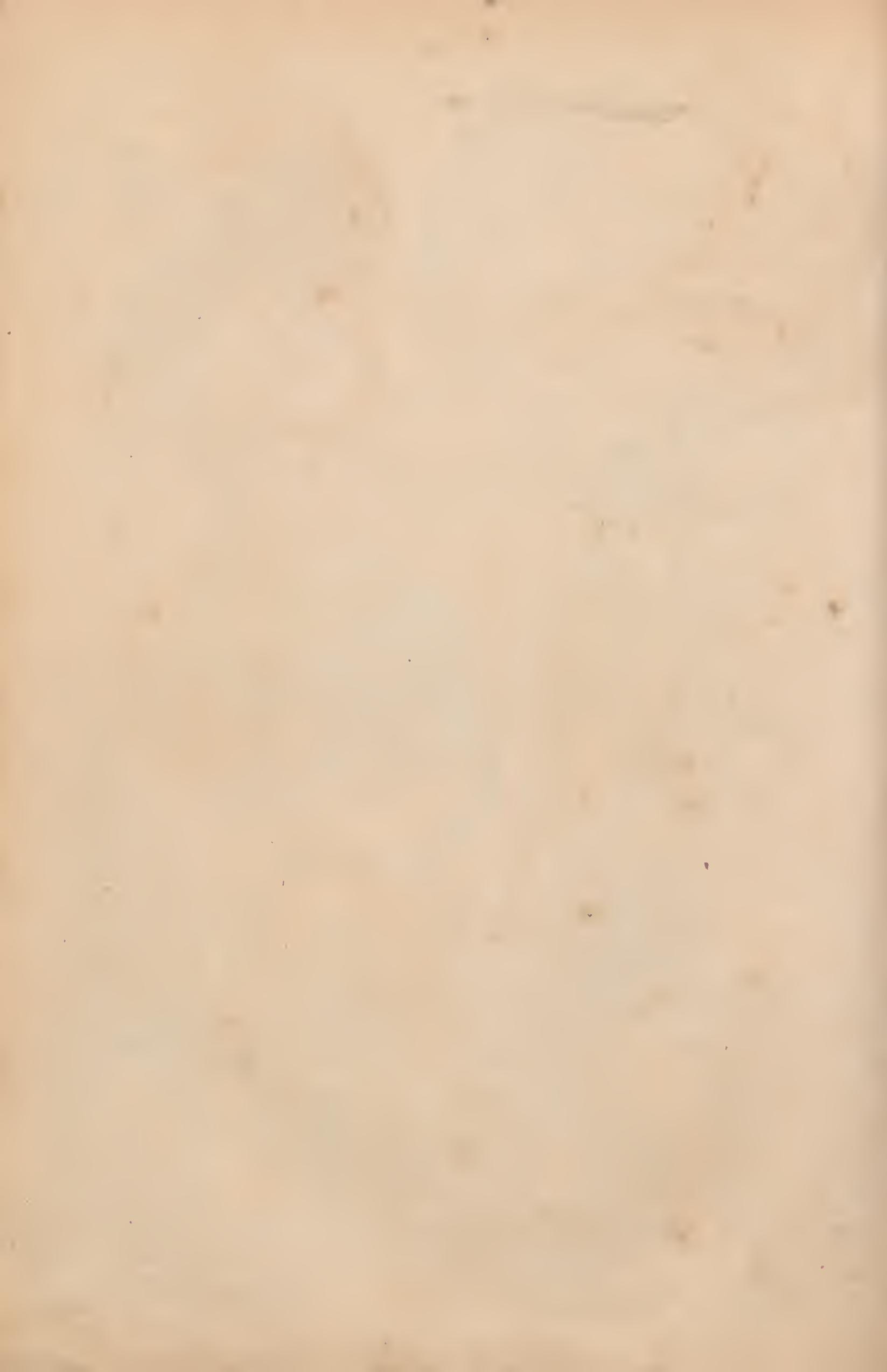


PYNOCERPHILUS BARBONS.
 1. Chabonin. Gr. Anabus. Little B.
 2. FLETO, MANDRILLUS.
 3. Wainon. Gr. at
 young
 4. leucopneus. Drill
 Female
 young



MYCETES, HOWLERS.

- | | |
|-----------------------------|---------------|
| 1. <i>M. venustus</i> | Royal H. |
| 2. <i>- ursinus</i> | Princ |
| 3. <i>- chrysurus</i> | Golden-tailed |
| 4. <i>- niger</i> | Black |
| 5. <i>-</i> | Imm & young |
| 6. <i>- var. strimlicus</i> | |





C. L. L. S.	WEETERS.
1. C. Apella	Common W.
2. C. Var. trepobus	Fearful
3. C. Capucinus	Capuchin
4. C. Var. hypoleucus	White-throated
5. C. barbatus	Bearded
6. C. Fatuellus	Horned



JACCHUS, MARMOSETS.
 1. *J. vulpina* Common M.
 2. *J. m. m.* TAMPINS.
 3. *M. rubicinnus* Great-eared T.
 4. *A. dipus* Red-tailed
 5. *U. argentatus* Fair
 6. *B. sulcia* Silky
 7. *U. sulcia* Negro

1810



- 1. Mamma
- 2. Rufus
- 3. albifrons
- 4. Macaca
- 5. ...
- 6. ...
- 7. ...

- Woolly M.
- Red
- White-fronted
- Ruffed
- Var
- Gray
- Ring-tailed



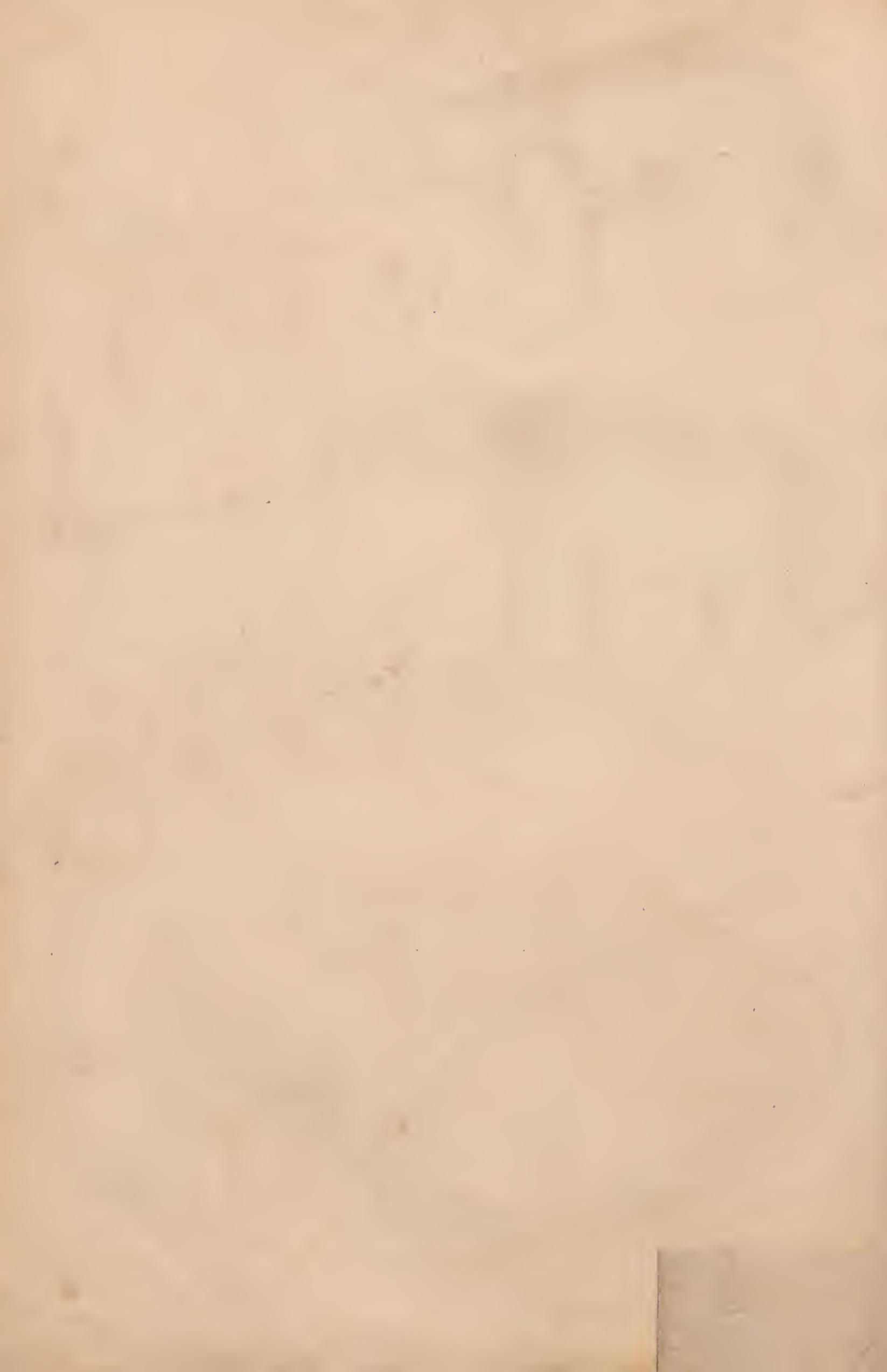
<i>LITHANOTIS</i> .	INDRIS.
1. <i>L. brevicaudatus</i>	Short-tailed I.
<i>STENOTIS</i> .	TODD'S.
2. <i>S. indusculus</i>	Slow I.
3. <i>S. gracilis</i>	Slender
<i>OTOLIPONIS</i> .	PALEO.
1. <i>O. senegalensis</i>	Senegal G.
5. <i>M. Madagascarensis</i>	Little
<i>TARSIS</i> .	TARSIER.
6. <i>T. spectrum</i>	Podje I.



PLECOPTERUS, LONG EARED BATS.
 1 *P. anellus* Common Long eared B.
 2 *P. d'*
 3 *Barbastellus* Barbastelle
 4 *Timoriensis* Timor
 5 *MYIOTERIS, DWARF EARED BATS.*
 6 *Noveboracensis* New York B.
 7 *Bourbonica* Bourbon
 8 *Castroica* Cayenne



URSUS, BEARS.
 12. *U. maritimus*. Polar B.
 3. *U. arctos*. Brown B. of Europe
 4. young
 5. *U. americanus*. Black B. of America





THE SLOTH BEARS,
 1. *U. arctoides*. Sluggish
 2. *U. ursinus*. BENT-BROWED.
 3. *U. schlegelii*. White-fronted
 4. *U. thibetanus*. Black
 5. *U. thibetanus*. Brown
 6. *U. arctoides*. Red

Fig. 1. *Melanos*

Lands: R. Scott sc.





MUSTELA. WEASELS

1	M (Putorius) Furo	Perce	(Albino)
2			
3	Belette	Common W	
4	Ermine	Ermine	(Summer)
5			(Winter)
6			



CANIS. DOGS.

Canis Familiaris

- 1 Blood Hound
- 2 Stag Hound
- 3 Fox Hound
- 4 Harrier
- 5 Beagle
- 6 English Terrier
- 7 Scotch D'
- 8 Isle of Skye D'

Painted by Gilpin, Edwards & Cap^m Brown Engraved by W^m Borsick

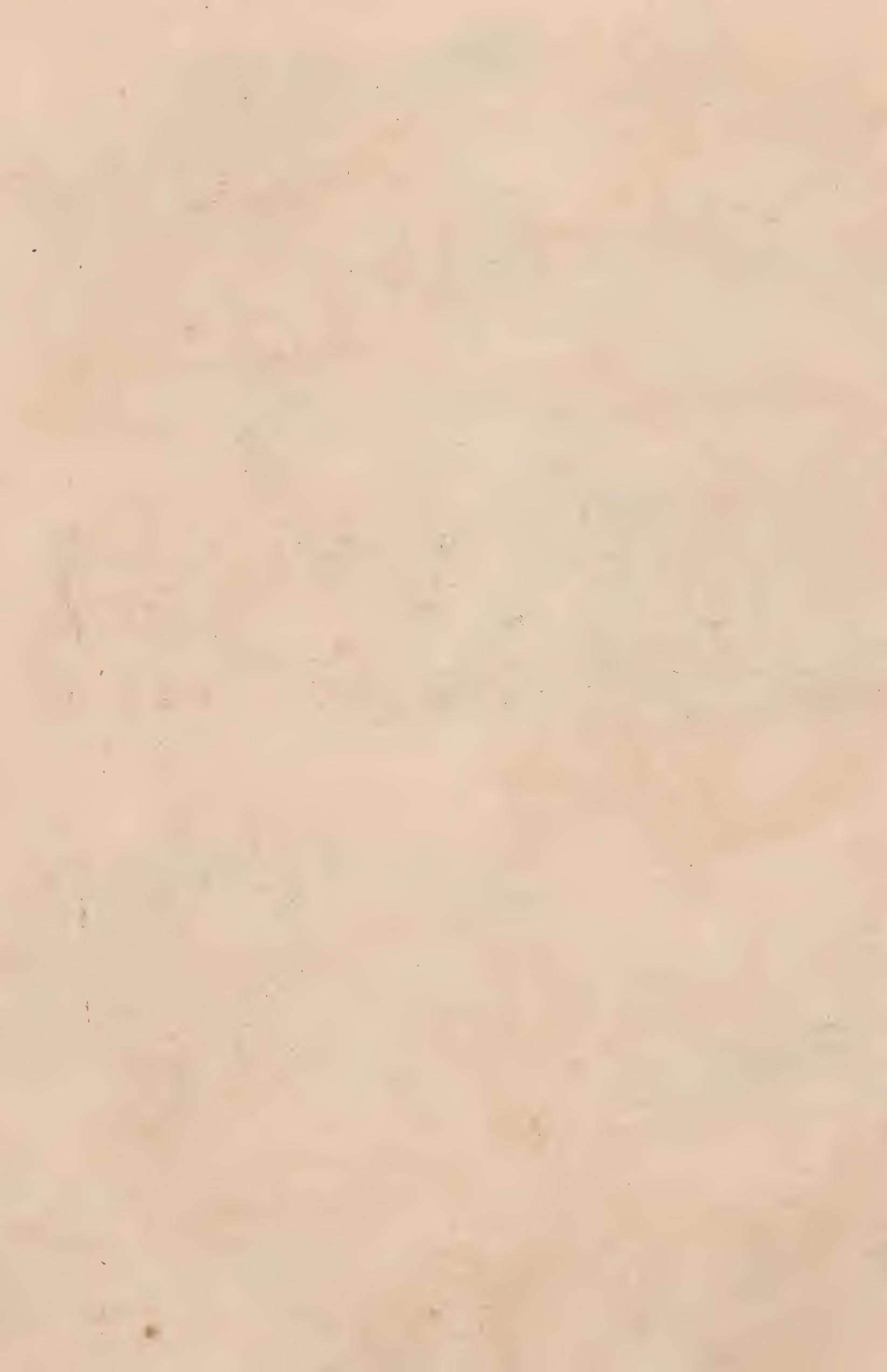




PLATE. WOLVES & FOXES.
 1. Dusky Wolf. *C. mibulus* Var. 3.
 2. Prairie D^g. - *Lutrans* - 4.
 3. Common D^g. - *Lupus*.
 4. European Fox. - *Vulpes*.
 5. Cross. D^g. - *Lutvus* Var. 1.
 6. Silver D^g. - D^g. - 2.
 7. Red D^g. - D^g. - 3.



CANIS, DOGS.
 1 Gray Wolf - *C. occidentalis*
 2 Arctic Fox - *Lagopus*
 3 Corsac - *Corsac*
 4 Jac kal - *auratus*
 5 Cape D^o - *mesomelas*
 LYNX, CATS.
 6 Burche's Lynx - *L. baileyi*
 7 Bruce's Lynx - *M. b. baileyi*
 8 Smiles' do - *smithii*
 9 Island's do - *islandii*

Engr'd by W^m Warwick

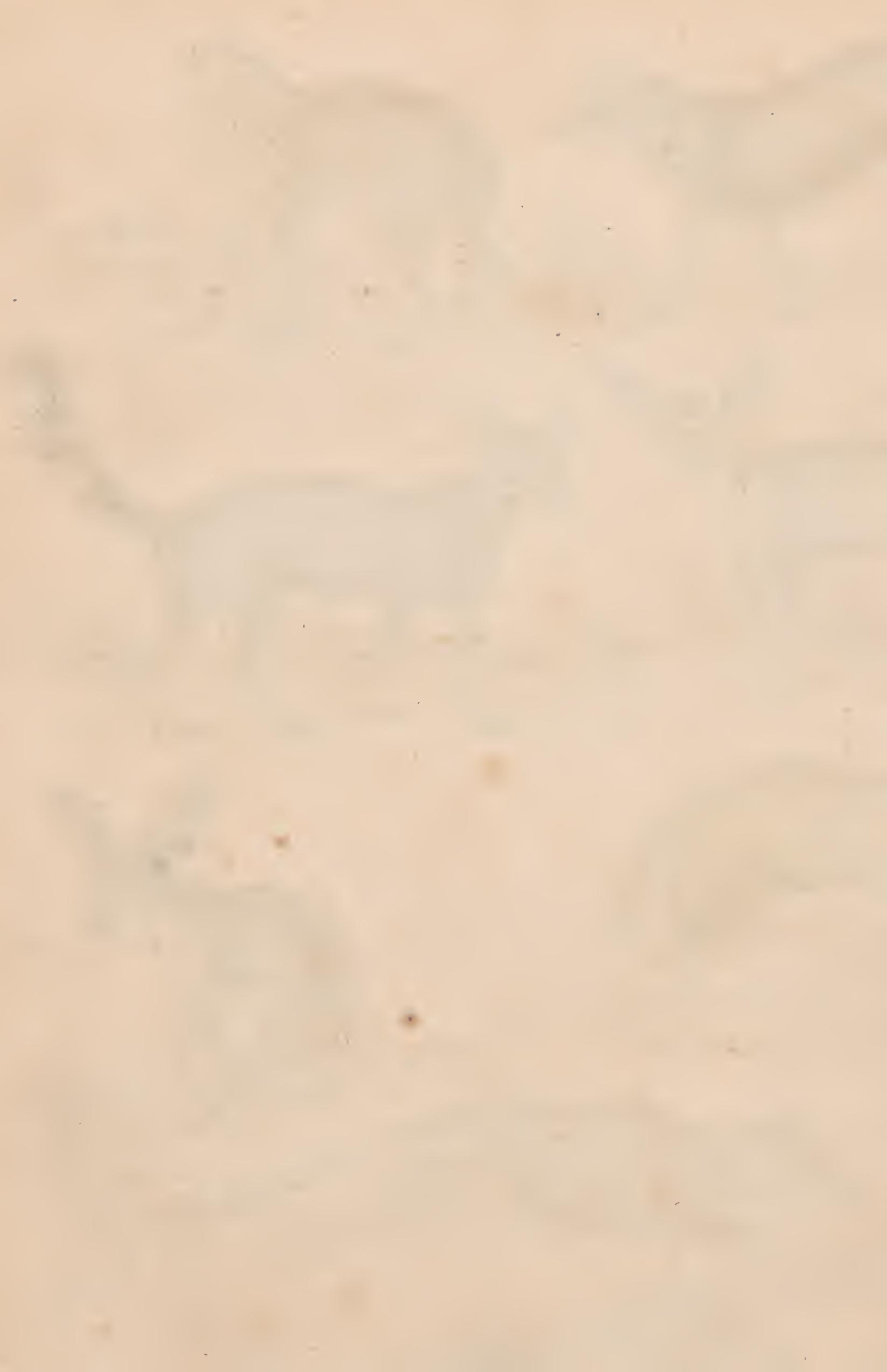




PLATE.	DOGS.
1 C. lupus occidentalis	grey American Wolf
2 auratus	Jackal
3 Mesomelas	fox Jackal
4 pictus	Spotted Dog
5 Zerisk	Barren Fox
6 Lalandu	Lulus of Fenice



1 Civet
 2 Gray-headed
 3 Zibet
 4 Laysan
 5 Laysan se
 6 Genet
 7 Malabar
 8 Fissure
 9 Banded
 10 Slender

11 Civet
 12 Zibet
 13 Musang
 14 Rasse
 15 Genet
 16 Malabar
 17 Fissure
 18 Banded
 19 Slender

20 Fissure
 21 Banded
 22 Slender

23 Fissure
 24 Banded
 25 Slender

26 Fissure
 27 Banded
 28 Slender

29 Fissure
 30 Banded
 31 Slender

32 Fissure
 33 Banded
 34 Slender

35 Fissure
 36 Banded
 37 Slender

38 Fissure
 39 Banded
 40 Slender

41 Fissure
 42 Banded
 43 Slender

44 Fissure
 45 Banded
 46 Slender

47 Fissure
 48 Banded
 49 Slender

50 Fissure
 51 Banded
 52 Slender

53 Fissure
 54 Banded
 55 Slender

56 Fissure
 57 Banded
 58 Slender

59 Fissure
 60 Banded
 61 Slender

62 Fissure
 63 Banded
 64 Slender

65 Fissure
 66 Banded
 67 Slender

68 Fissure
 69 Banded
 70 Slender

71 Fissure
 72 Banded
 73 Slender

74 Fissure
 75 Banded
 76 Slender

77 Fissure
 78 Banded
 79 Slender

80 Fissure
 81 Banded
 82 Slender

83 Fissure
 84 Banded
 85 Slender

86 Fissure
 87 Banded
 88 Slender

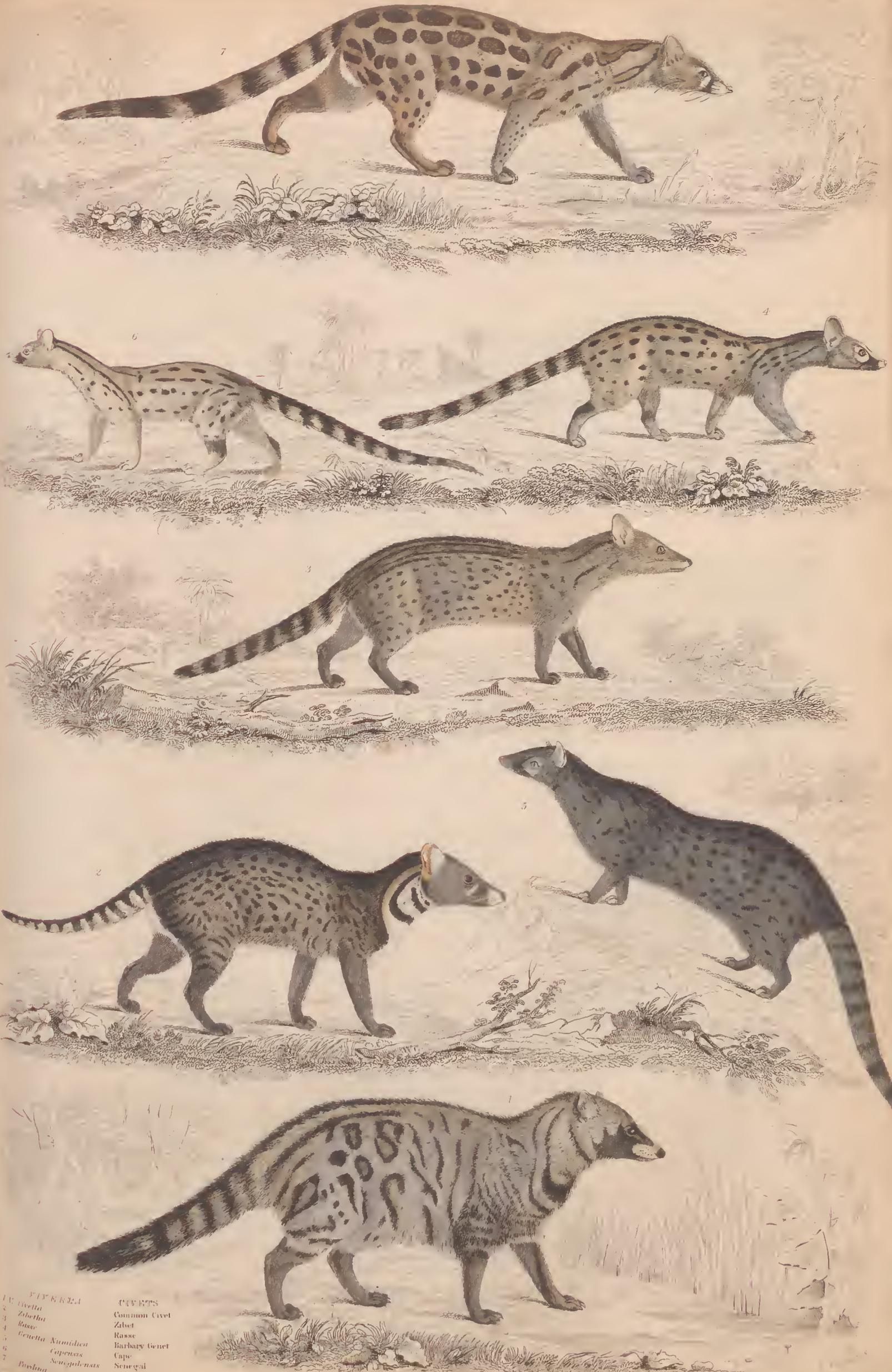
89 Fissure
 90 Banded
 91 Slender

92 Fissure
 93 Banded
 94 Slender

95 Fissure
 96 Banded
 97 Slender

98 Fissure
 99 Banded
 100 Slender

Drawn by Capt. Brown. Eng'd by John Mills.



1	<i>Civetta</i>	CIVETS
2	<i>Zibetha</i>	Common Civet
3	<i>Rasse</i>	Zibet
4	<i>Genetta Namulica</i>	Rasse
5	<i>Capensis</i>	Barbary Genet
6	<i>Songolensis</i>	Cape
7	<i>Prodon</i>	Senegal
		Pantherine



- | | | |
|---|-------------------|--------------------|
| 1 | Asian Lion | <i>P. leo</i> |
| 2 | Javanese and Cebu | — |
| 3 | Puma | <i>Cougar</i> |
| 4 | Tiger | <i>Tigris</i> |
| 5 | Clouded Tiger | <i>T. tigris</i> |
| 6 | Leopard | <i>Leopardus</i> |
| 7 | Ocelot | <i>Pardalis</i> |
| 8 | Sumatra Cat | <i>Protonotris</i> |
| 9 | Newcaid DP | <i>Macrotis</i> |



- FELIS* *CATIS*
- 1 *tigris* fem. Tiger
 - 2 *pardus* Margay
 - 3 *maculata* fem. Ruppel's
 - 4 *lynx* Bay Lynx
 - 5 *maculata var. servalina* Servaline

4

Fig. Milne sc. Louise Durva del & sc.

5



2



3



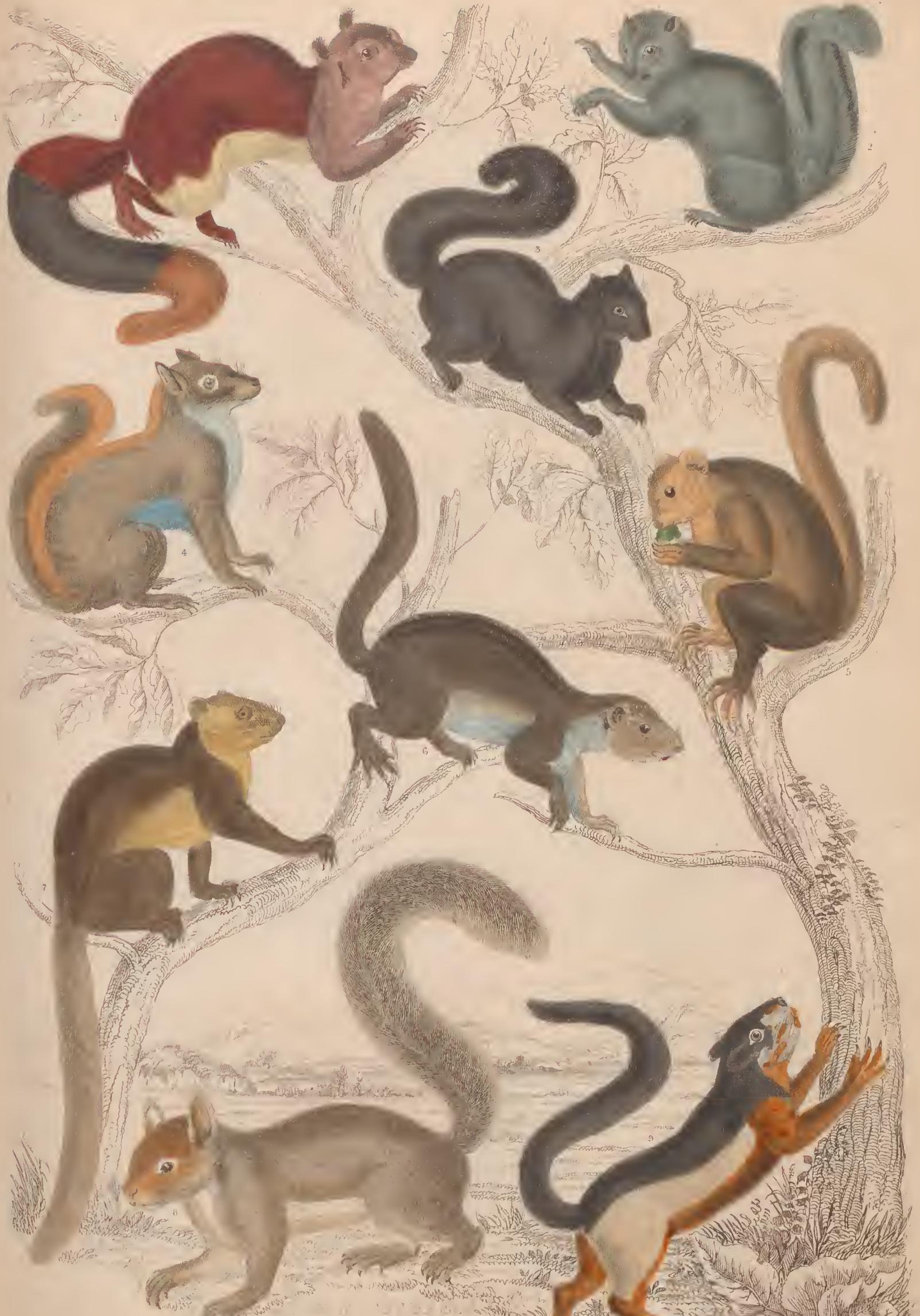
1

FELIS CATS.
 1. *F. uncia* Jaguar.
 2. *F. tigris* Tiger.
 3. *F. caracal* Persian Lynx.
 4. *F. colocola* Colocolo.



P. 1818. CATS.
 1. Leopardus car. melan. Black leopard
 2. jubata Maned Hunting Leopard
 3. cinnam. Red faced Lynx
 4. Serv. al. Serval
 5. torquati N. paul. Cat
 6. armillata Collared

G. H. G.
 Turrey sc. - John et



- 1 Malabar
- 2 Gray
- 3 American Black
- 4 Chickaree
- 5 Plantain
- 6 Laysan
- 7 Two Coloured
- 8 White Faced
- 9 Ruffles

- Marmota*
- amurensis*
- dyer*
- hobsonii*
- charboni*
- insularis*
- pacolor*
- leucotis*
- fulvica*

Drawn by J. P. Brown Engraved by W. Wood



SCIRIUS SOPHICUS.
 1. *color* Grey S.
 2. *novor* Black American
 3. *Andsonis* Chickaree
 4. *mont* Japanese



Marchal Det'



ELEPHANTS. ELEPHANTS.
 1st Indian - *E. Indicus*.
 2nd African - *Africanus* Fem



1 *Sus scrofa* var. *Seneensis* Feni-Chinese P.
 2 *Sus scrofa* var. *Capensis* Cape P.
 3 *Sus scrofa* var. *Indicus* M. Balyrussa P.
 4 *Sus scrofa* var. *Indicus* F.
 5 *Sus scrofa* var. *Ethiopi* ETHIOPIAN PIGS.
 6 *Sus scrofa* var. *Ethiopi* Ethian's P.
 7 *Sus scrofa* var. *Indicus* P. ETIOP. P.
 8 *Sus scrofa* var. *Indicus* Collared P.
 9 *Sus scrofa* var. *Indicus* White-tipped

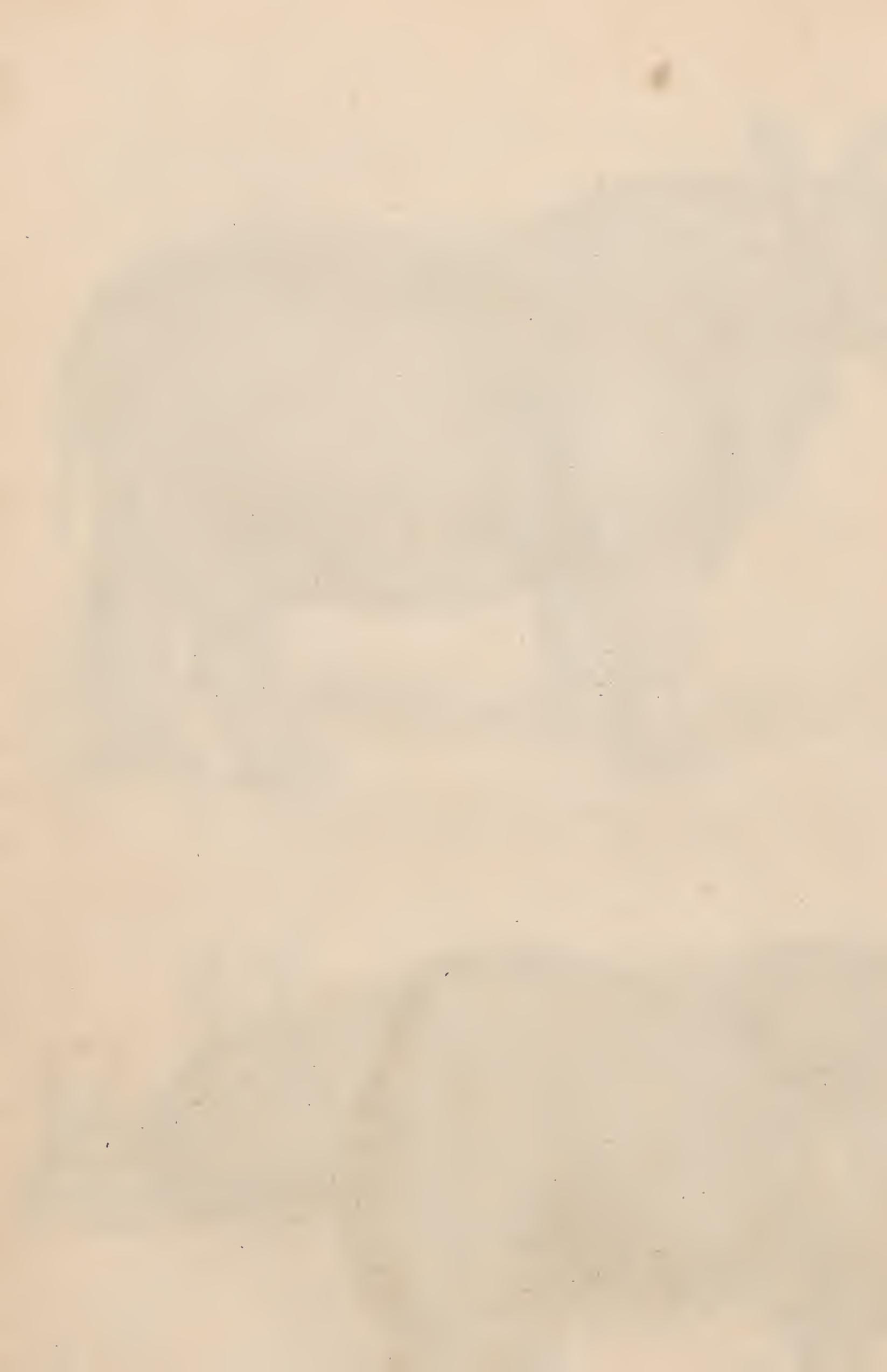
Taken by Mr. Milne etc



Drawn by G. S. Sower

Engraved by W. Wood

RHINOCEROS
 Indian Rhinoceros *R. Indicus*
 Lesser Twohorned *R. Serratus*







1 Bactrian Camel *C. Bactrianus.* 2 Dromedary *Dromedarius.*



1. Bactrian Camel *C. Bactrianus* 2 Dromedary *Dromedarius*.



10 does
 2 fawns
 1 doe
 6
 7

Moose D Winter
 Summer
 2nd year
 Rest
 Fem.
 Fallow
 Black var.
 Fem
 Young



CERVIS. DEER.
 1. *Canadensis* Wapiti D.
 2. *Elaphus* Red
 3. *Bengalensis* Bengal
 4. *porcinus* Porcine
 5. *Timorensis* Timor



1 Fallow Deer
 2 Virginian D^r
 3 Longtailed Deer
 4 AXIS
 5 Malayan Rust
 6 Guizipico Deer
 7 Nepaul Stag

8 Dama
 9 Siamensis
 10 Macrotis
 11 LEE
 12 Equatus
 13 Macrotis
 14 Wallachi

Painted by Miss Brown

Engraved by W. Wood



6



5



3

1 *Cervus (Platycerus) Dama* Fallow D Sammer

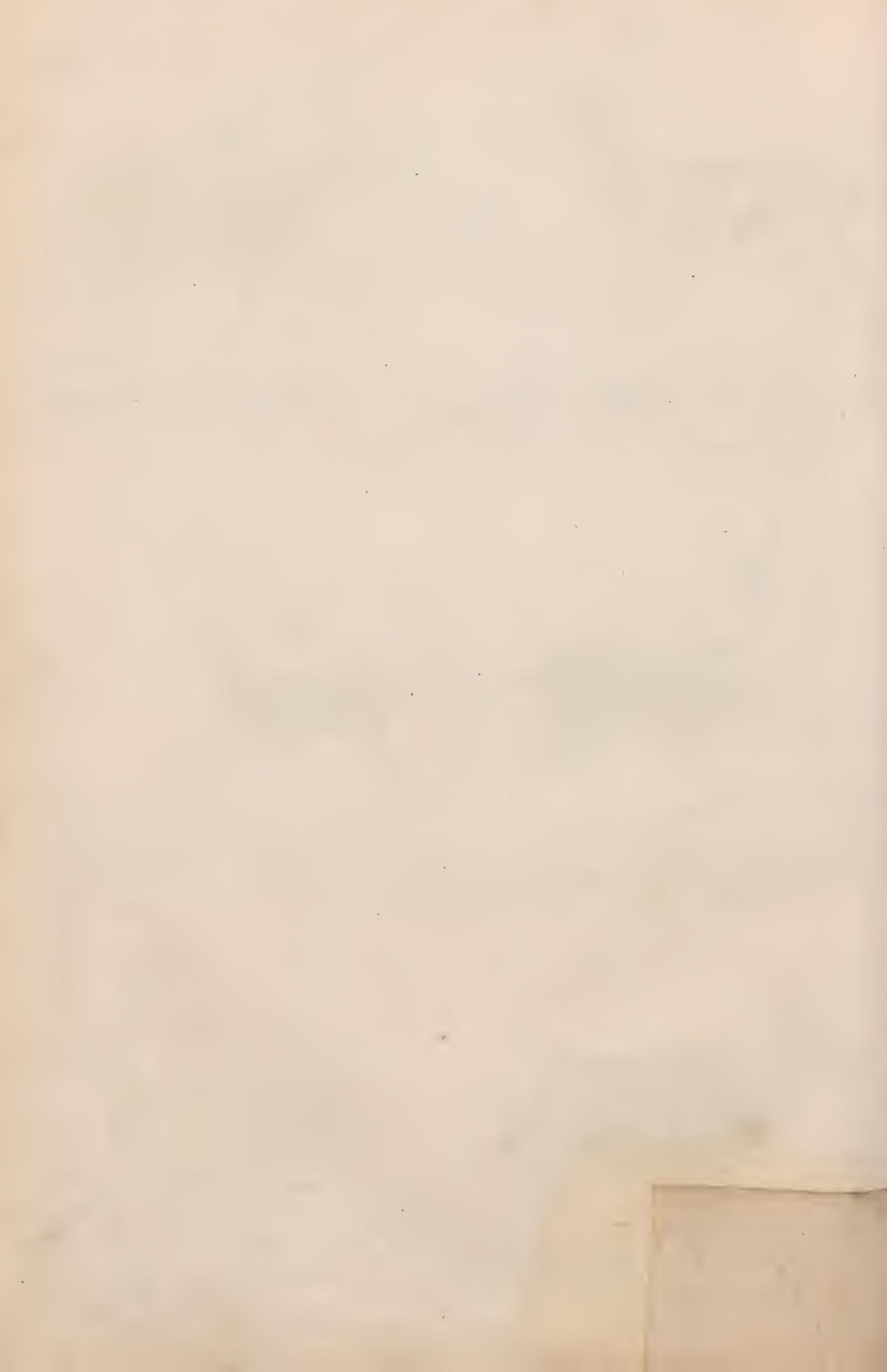
2 *Elaphus Wallichii* Nepal Stag **CERVUS, DEER,**

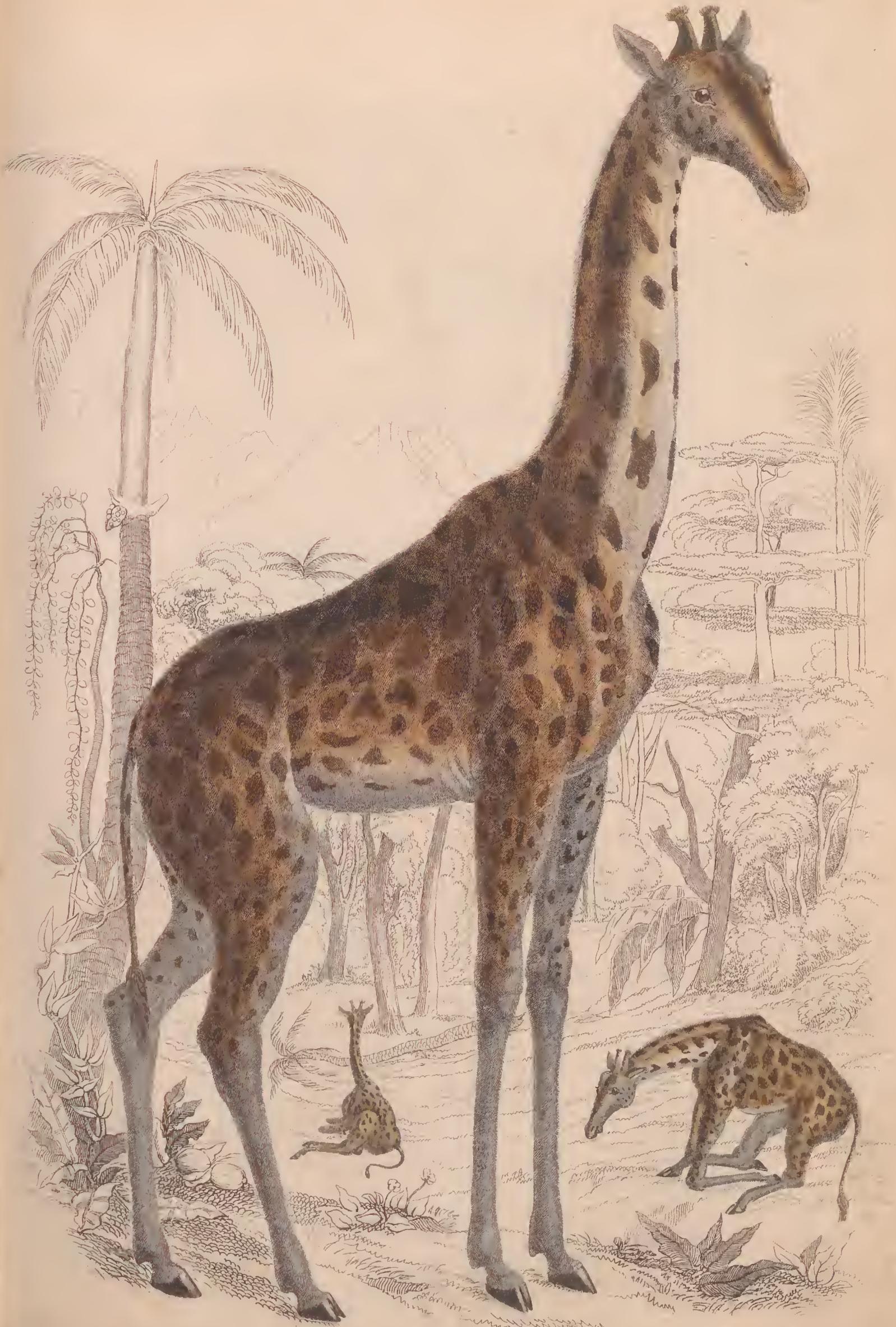
4 *Axis Moluccensis*

Capreolus Caprea Common Roebuck

3 *Alces alces* Greater Auroch

5 *Cervus (Platycerus) Dama* Fallow D Sammer





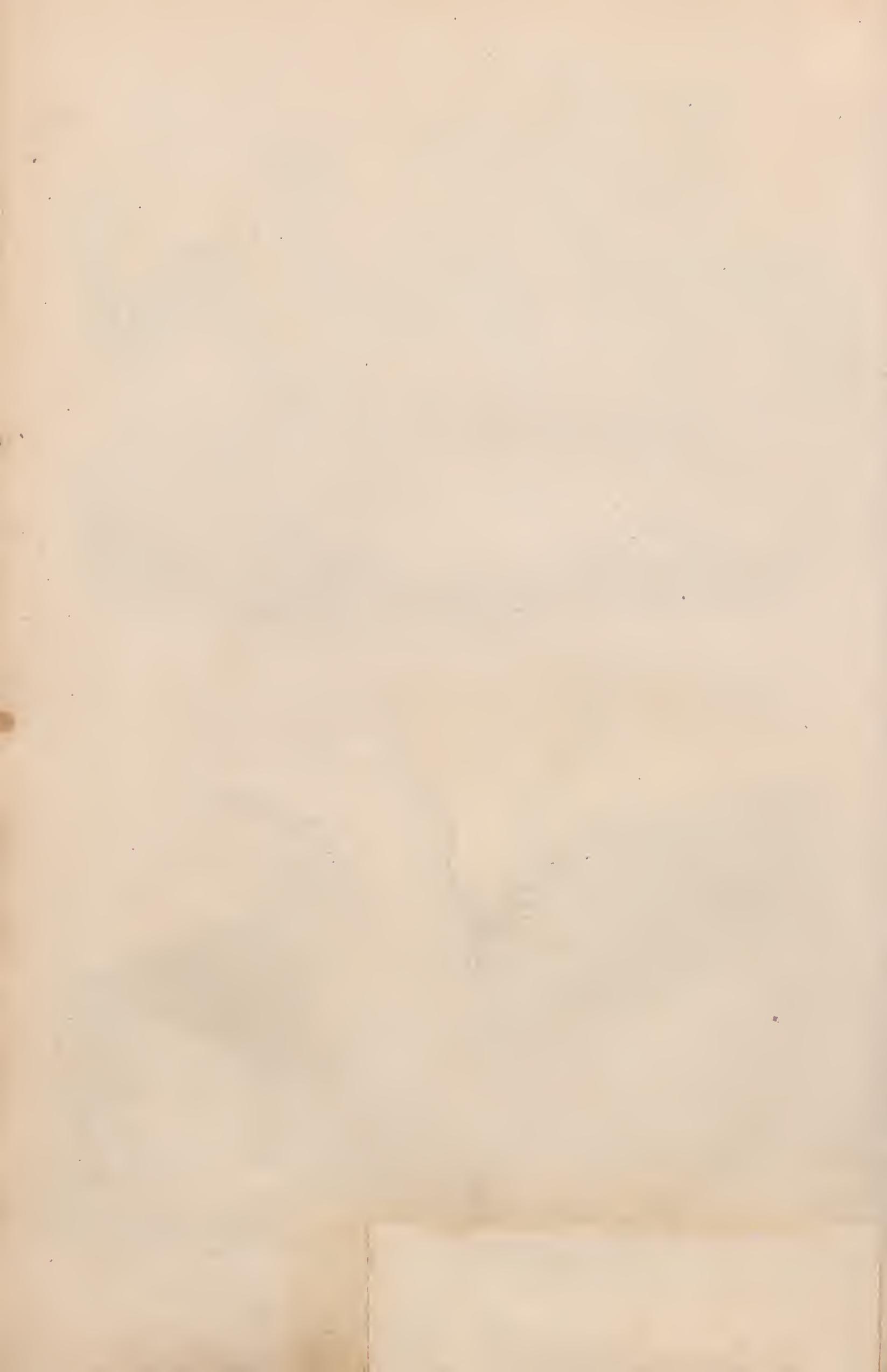
Drawn by Captain Brown.

CAMELDIPLODONTIS GORRETTI.
THE GIRAFFE.

Engraved by W^o Warwick.



ANTLOPE.		ANTLOPES.
1. A. Gazella	Dorcus	Barbary Gazelle
2. 3.		Fem & Young
4.	Kevella	Kerel Doubtful Sp
5. Oryx	Addax	Addax
6. & quercus	niger	Sable





ANTILOPE & ANTELOPES.
 1. Chamois Antelope. — *Budiacra*.
 2. Duvanc el's — *Duvancell*.
 3. Low-tailed — *Quadriscopa*.
 4. Cambling Oetan — *Sumatrensis*.
 5. Prong-horned — *Lucifer*.
 6. Blackie Sienelock — *Unguis*.
 7. Four-horned — *Quadrirornis*.
 8. Bontelock — *Personata*.
 919





BOS. OXEN.
 Indian Ox. — *B. taurus* Var. Indicus
 Zebu — " "
 Little Ox — " "
 Hornless Ox — " "
 American Bison. — *Americanus*

Drawn by Capt. Brown Engd. by Wm Warwick.



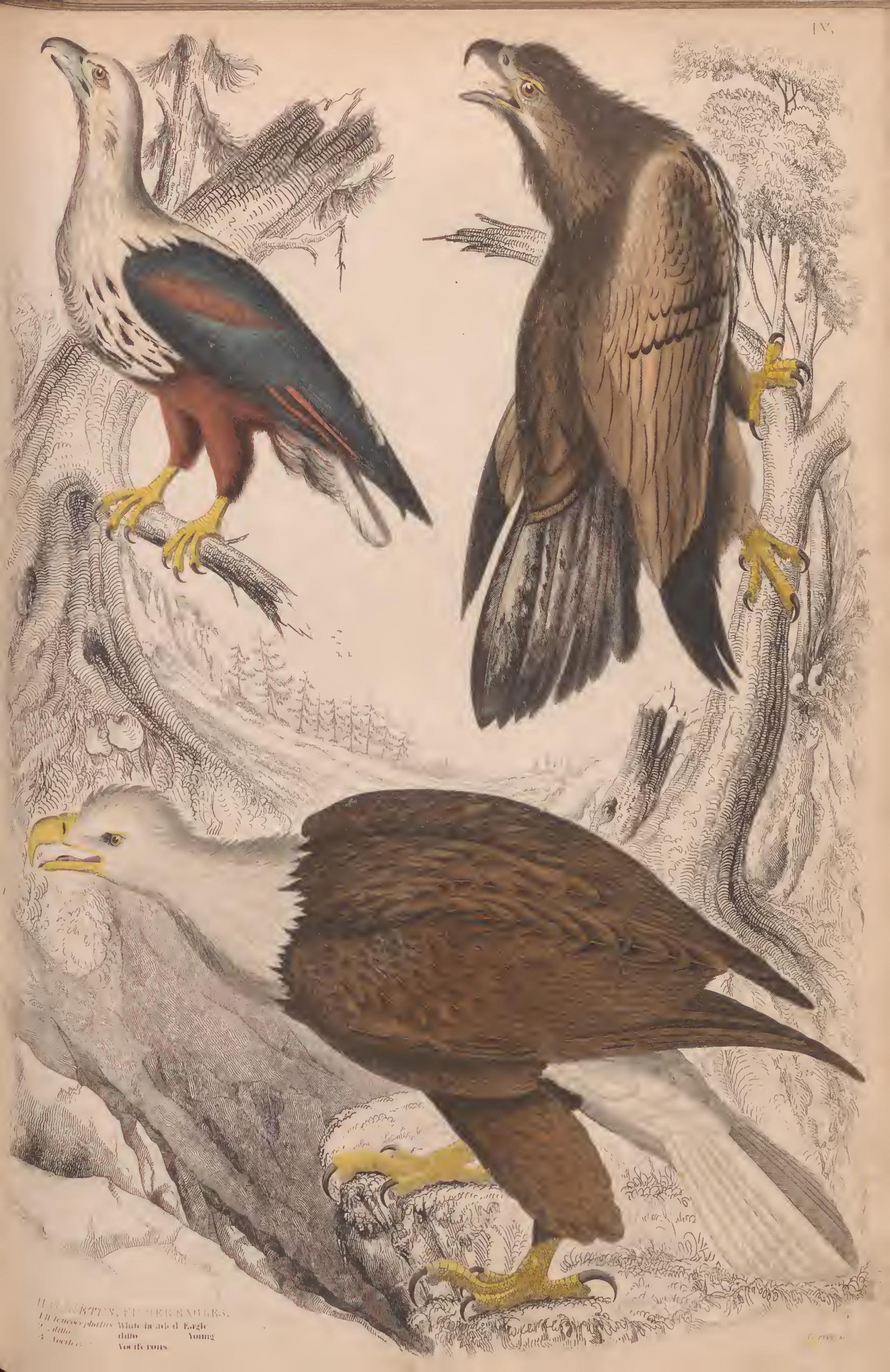
Bovus, Bovulus.

- 1 B. Indicus var. Indicus orientalis Common Ox
- 2 minor Small Ox
- 1 Americanus Bison

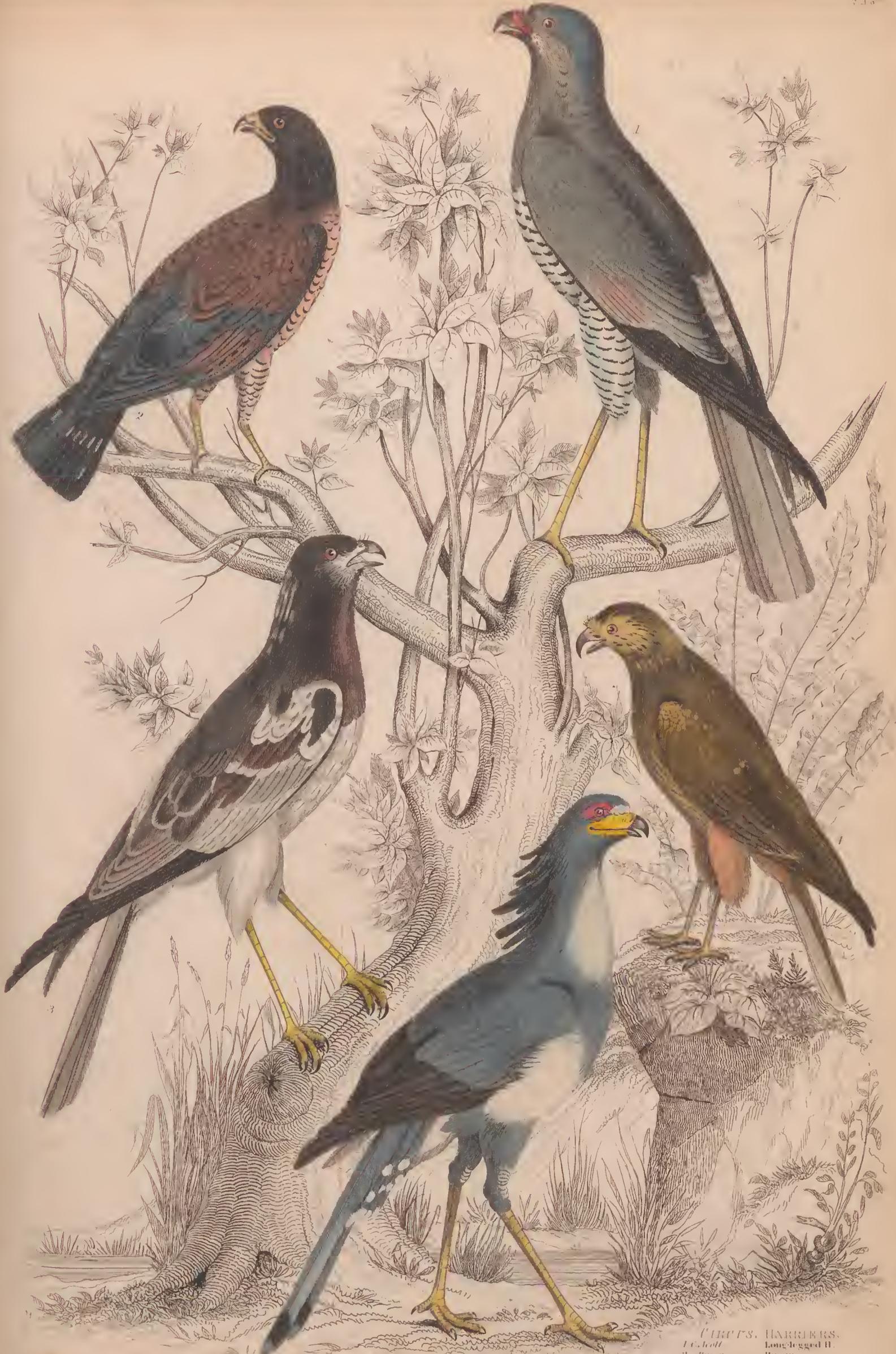


1. Egyptian Vulture
 2. *galeocephalus* Crested
 3. *Pondicherry*
 4. *Indus* Indian

Wm. Sc. — Turvey etc.



H. J. WOODS, F. R. S. W. W. & A. S. P. S.
 1. *Haliaeetus phasianus* White-headed Eagle
 2. ditto ditto Young
 3. *Accipiter* Youth rous



CIRCUS, HARRIERS.
 1. C. holl. Long-legged H.
 2. Buson Buson
 3. islandicus Indian
 4. cyaneus (Bon Harrier
 young female
 SERPENTARIUS, SNAKE EATERS.
 5. Serpentinus Secretary S.

W. G. sc.



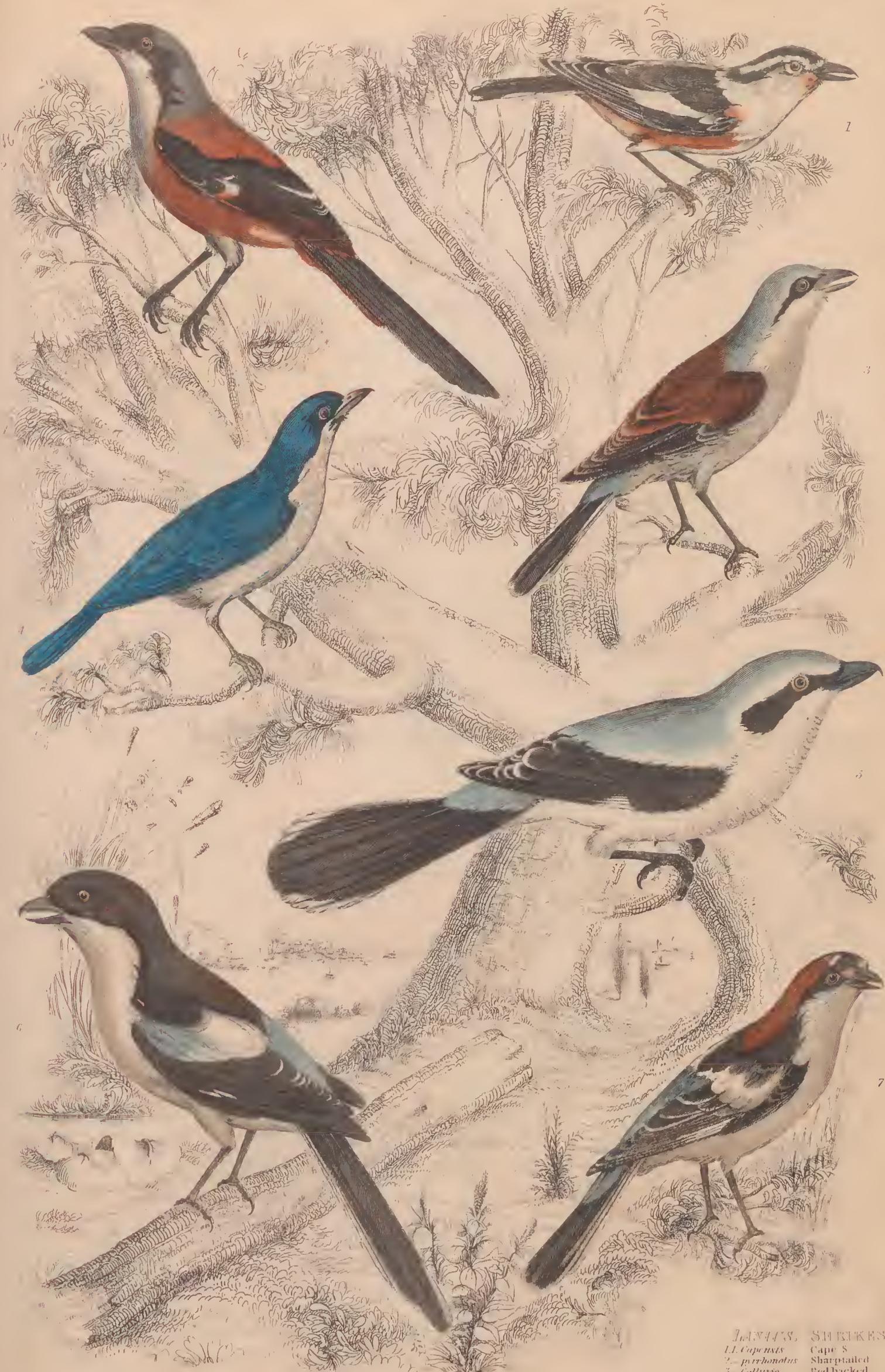
SPERDIN, OWLS.
 1. Virginia Horned Owl S. Virginia
 2. Long-eared Owl - Ohio
 3. Screech Owl - America N
 4. Great Horned Owl - America N



STRIPED OWLS.
 1. Tengmalm's Owl. *S. Tengmalmi*
 2. Great Chiroseous. *C. cinerea.*
 3. Dalhousie's. *Dalhousiet.*
 4. Little. *P. passerina.*

A Wilson & Capt. Brown Del.

S. Melne Sc.



Turvey sc & etc

INDIAN.	SHRIKES.
1. <i>Copivix</i>	Cape S
2. <i>pyrrhonotus</i>	Sharptailed
3. <i>Collurio</i>	Red backed
4. <i>bicolor</i>	Blue
5. <i>Excubitor</i>	Great cinereous
6. <i>collaris</i>	Collared
7. <i>rufus</i>	Rufous



LANTIS. SHRIKES.
 1. *ulrus*. Buff breasted S.
 2. *pendens*. Cruel
 3. *supercilliosus*. Supercillious
 4. *myiacteus*. Whiskered
 5. *Ethiopicus*. Bourbon
 LANTIS. TERUSH SHRIKES.
 6. *olivaceus*. Fem Olive T.



Milne sc. Turvey del.

LANTARIN'S, TURKEY-SHRIKES.
 1. *B. babakii* Babakii T.
 2. Fem.
 3. *viridis* Green
 4. *albicollis* White-throated
 5. *olivaceus* Olive
 6. *Barbary* Barbary



TANAGERS. TANAGERS.
 1 Summer Redbird - *T. Eschsch.* M.
 2 " " " - *Idem*.
 3 Scarlet Tanager - *T. Rubra*. M.
 4 " " " - *Idem*.
 5 Louisiana - *T. Columbiana*



VIREO, CHATS.

- | | | |
|-----------------------|----------------|-------------------|
| 1 Yellowthroated Chat | D ^o | — Flavifrons. |
| 2 Solitary | D ^o | — Solitaria Male. |
| 3 | | — Female. |
| 4 Pine-swamp | D ^o | — Sphaenosa. |
| 5 Yellow-breasted | D ^o | — Polyglotta. |
| 6 Red-eyed | D ^o | — Olivacea. |
| 7 White-eyed | D ^o | — Novboracensis. |
| 8 Warbling | D ^o | — Melodina. |



MEXICAN THRUSHES.
 1 Little Tawny Thrush. *M. Minor*.
 2 Golden-crowned D^o. *- Auricapilla*.
 3 Richardson's D^o. *- Richardsoni*.
 4 Audubon's D^o. *- Ludoviciana*.
 5 Tawny D^o. *- Wilsoni*.
 6 Water D^o. *- Aquatica*.



PIPITA, BREYES,
 1. *cyanoptera*. Giant
 2. *Mackloti*. Macklot's
 3. *streptans*. Noisy
 4. *granatina*. Grenadine
 5. *erythrogastrus*. Red breasted



DEGERS'S ORIOLES.
 1. Javanese - *O. leucogaster* Male
 2. Golden - *Galbula* Male
 3. D^o - *Galbula* Female
 4. Black - *Sinensis*
 5. Black-headed - *melanocephalus*
 6. Two-colored - *bicolor*.

Drawn by Cap^m Brown & Engr^d by J. Turvey



SYLVIA, WARBLERS.
 1. Palm Warbler. *S. palmarum.*
 2. Blue Mountain. *— tigrina.*
 3. Hemlock. *— parus.*
 4. Autumnal. *— autumnalis.*
 5. Black-throated Green. *— arvensis.*
 6. Maryland Yellow-throat. *Marylandica* *Mulz.*
 7. D? *—* *Fem.*
 8. Kentucky. *— formosa.*
 9. Yellow-throat. *— flavicollis.*



REGULUS KINGLETS.

- | | |
|------------------|--------------------------|
| 1 Ruby crowned | <i>R. calendula</i> Male |
| 2 D ^c | " Female |
| 3 Curvica | <i>C. turci</i> |
| 4 American | <i>Americana</i> M. |
| 5 D ^c | " F. |
| 6 Byronic | <i>Byronensis</i> |
| 7 All coloured | <i>Omnicolor</i> |
| 8 European | <i>Crataegus</i> |



TROGLODYTES. WRENS.

- | | |
|------------------|---------------------|
| 1 Winter Wren | <i>T. Hyemalis</i> |
| 2 European | <i>Europaeus</i> |
| 3 House | <i>Oedon</i> |
| 4 Bewicks | <i>Bewickii</i> |
| 5 Marsh | <i>Palustris</i> |
| 6 Brown | <i>Fusca</i> |
| 7 Great Carolina | <i>Lincolnianus</i> |
| 8 Long-Billed | <i>Longirostris</i> |



ERYTHRALLIA,
ETRYTHRALLIAES.
 1. E. Corydon. Corydon
 2. _ nasutus Great-billed
 3. Horsfieldii Horsfield's
 4. _ female
 5. _ cucullatus Hooded



HIRUNDO.
 SWALLOW. H. rufa. Male.
 1 Barn Swallow. H. rufa. Male.
 2 " " " " " " " "
 3 Bank " " " " " "
 4 White-bellied " " " "
 5 Cliff " " " "
 6 White-collared " " " "



TITMICE.
 1 Blackcap Titmouse. *P. atricapillus.*
 2 Canadian " *Hudsonicus.*
 3. Cole. *Aler.*
 4 Crested " *bicolor.*
 5 Azure " *Cyanus.*
 6 Smith's " *Smithi.*
 7 Penduline " *Pendulinus M.*
 8 " *D.* Fem.
 9 African " *Afr.*



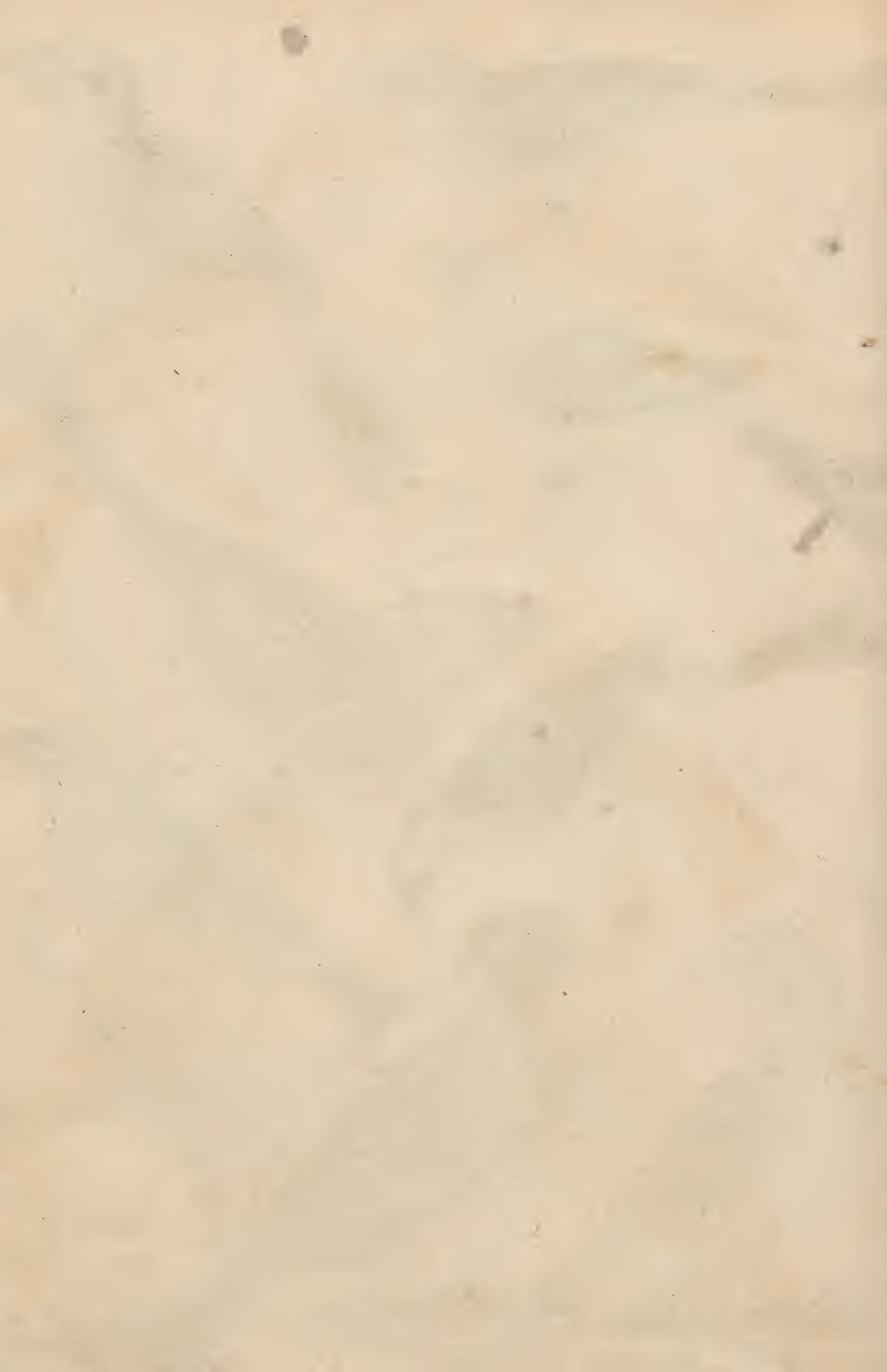
AMERIZA, PARADISEA
 WHIDAH BUNTING, Male.
 1. State of Plumage 10th Nov^r
 2. " " " 1st Oct^r
 3. " " " 11th Sept^r
 4. " " " 19th Jan^r
 5. " " " 20th June
 6. Female

Drawn by J. G. Brown

Engraved by J. Turley



- FRINGILLA, FINCHES.*
 1 Field-sparrow. *F. pusilla*
 2 Swamp — *Palustris*
 3 Tree — *Arborca.*
 4 Song — *Melodia*
 5 Chipping — *Socialis*
FRINGILLA, FINCHES.
 6 Henslow's *E. Henslowi*
 7 Lapland long-spurred — *Laponica* M.
 8 *ps.*





White Jay - Parus di

GARRULUS, JAY'S.
 1. glandarius European
 2. Floridanus Florida
 3. cristatus Blue
 4. Stelleri Steller's
 5. Canadensis Canadian



CINNYRIA
SOUTH MANOAS.

- | | | | |
|------------------|---|----------------|------|
| 1 Cardinal | ♂ | Cardinalis | Male |
| 2 D ^o | ♀ | ♀ | ♀ |
| 3 Orange | ♂ | Orange | ♀ |
| 4 D ^o | ♀ | ♀ | ♀ |
| 5 Red | ♂ | Red | ♀ |
| 6 D ^o | ♀ | ♀ | ♀ |
| 7 Shrike | ♂ | Shrike | ♀ |
| 8 Black-breasted | ♂ | Black-breasted | ♀ |
| 9 Flycatcher | ♂ | Flycatcher | ♀ |

Engraved by W^m Davis



TROCHILUS.
HUMMING BIRDS.

- 1 Tufted necked *T. ornatus* Male
- 2 " " *"* Female
- 3 Azure-Blue *Leucurus*
- 4 Harlequin *Multicolor*
- 5 Ruby crested *Moschinos*
- 6 Goulds *Gouldii*
- 7 Gigante *bigas*
- 8 Least *Alpinus* Male
- 9 " " *"* Female
- 10 White Striped *Messoleucus*
- 11 Evesons *vesper*
- 12 Tricoloured *tricolor*



TROCHILUS.
 HUMMINGS-BIRDS.
 1 Modest T modestus, Lin.
 2 Mango - Mango M.
 3 D^o Young M.
 4 D^o D^o First moult.
 5 White throated D^o - Luciter.
 6 Blue throated - Luciter.
 7 Swainson's - Swainsonii.

Engraved by S. Albee



HUMMINGBIRDS.
 AMERICAN BIRDS.
 1. Azure-crowned *T. cyanocephalus* M.
 2. Do - - - - - Young.
 3. Blue-throated - *glaucoptis* F.
 4. Tomminck's - *tomminckii* M.
 5. Supplis & Emerald *biolor* M.
 6. Do - - - - - Young.
 7. Clarence's - *clarencei* F.



1. *Topaz throated* ♀
 2. *do* ♂
 3. *do* ♀
 4. *Violet-cared* ♀
 5. *do* ♂
 6. *Sapphirine* ♀



TROCHILUS.
 HUMMING-BIRDS.
 1 Rivoli
 2 Violet-crowned Staphanoides
 3 Stokes
 4 Northern Colubris Male
 5 Do Fem
 6 Nest of Do
 7 Crested - crestatus M
 8 Do - 1
 9 Purple - calycus
 10 Warbler - Warbler

a Horned T. cornutus M
 b Half-tailed T. naucens

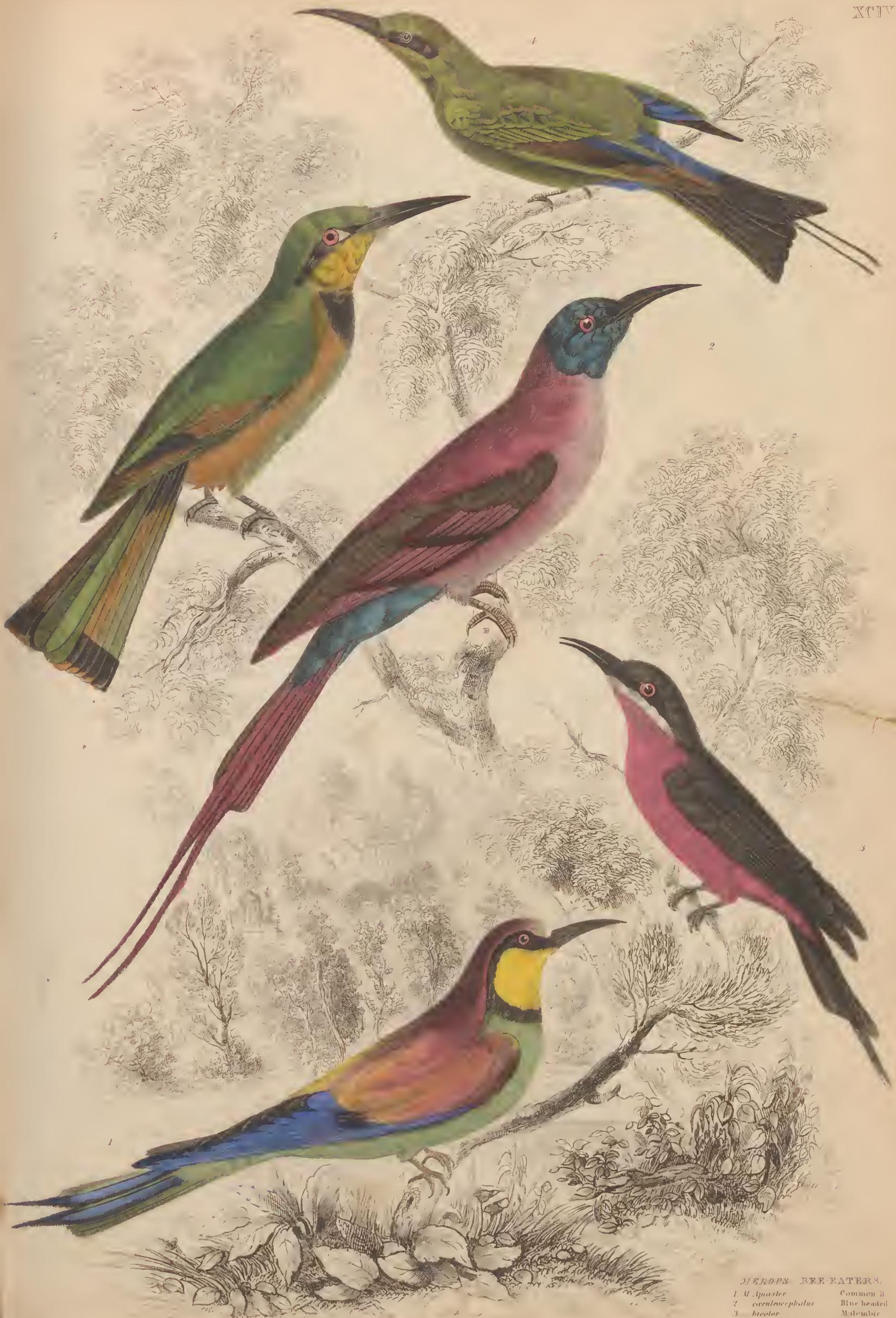
Engraved by N. M. Chase



<i>UPPA</i>	HODGKINS.
<i>U. lappi</i>	Common B.
<i>U. minor</i>	Lesser "
<i>U. capensis</i>	Madagascar "
<i>REPKACH</i>	S. PROMEROP.
<i>U. fuscus</i>	Striped P.

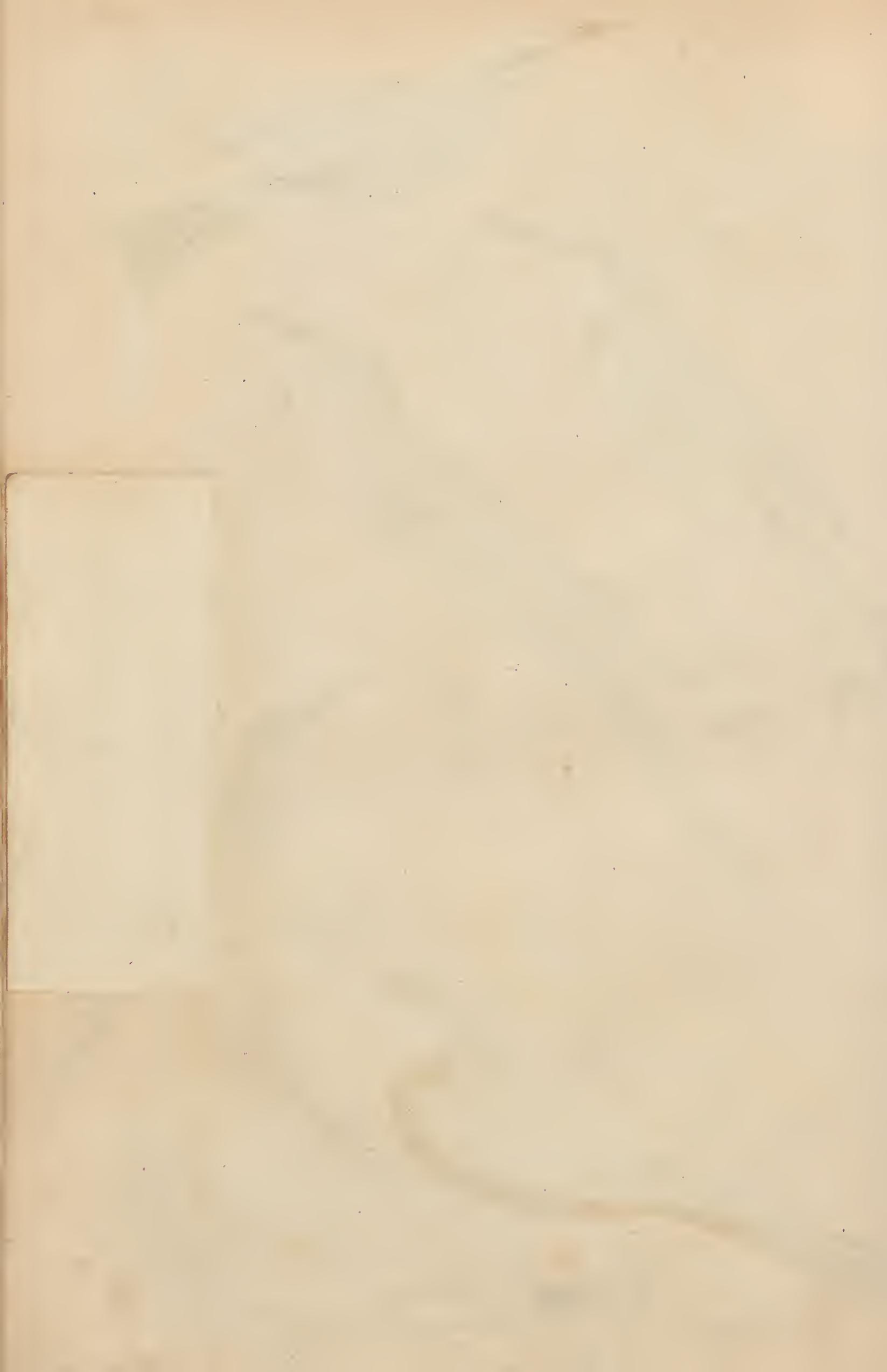


Ptilinopus, PRONEROPUS.
 1. *erythrogastrus*. Red-billed P.
 2. *superbus*. Superb —
 3. *caeruleus*. Blue —



MENOPS BEE EATERS.

1. <i>M. apuaster</i>	Common B
2. <i>cornicephalus</i>	Blue headed
3. <i>bicolor</i>	Moluccic
4. <i>viridis</i>	Indian
5. <i>erythropterus</i>	Red winged





- MEXICAN HONEYCREEPERS**
- 1. Japanese Bee-eater *Melanerpes*
 - 2. Superb *Superbia*
 - 3. Red-headed *Pyrhrocephalus*
 - 4. Indian *Vireo*
 - 5. Red-winged *Am. leucophaea*
 - 6. Blue-headed *Cyanocorypha*

Drawn by Capt. Brown

Engraved by S. Milne



1. Black-crested
 2. Grooved-bill
 3. Trumpet
 4. Bontan
 5. Double-billed
 6. Caribbeed
 7. Black-crested



PICTS. WOODPECKERS.
 1 Red-headed *P. erythrocephalus*
 2 Yellow-bellied *Varius*
 3 Downy *pubescens*
 4 Bengal *benigolensis*
 5 Red-bellied *carolinus*
 6 Lewis's *torquatus*
 7 Black-breasted *multicolor*
 8 Red-cockaded *quercinus*
 9 Hairy *villosus*



CHALYPTORHYNCHUS.
 MITTLED LUGKATDS.
 1. - *Rose*
PSITTACUS. PARROTS.
 2. - *scutatus* Bucket-tailed P.
 3. - *hueti* Huet's
 4. - *pretti* Prett's
 5. - *mitredus* Mitred



LORIKEETS. LORIKEETS.
 1. *L. scintillatus* Sparkling L.
 PSITTACIDAE. PARAKEETS.
 2. *P. plumbea* Thrush P.
 3. *P. plumbea* Coquette
 4. *P. plumbea* Fern.
 5. *P. plumbea* Slender
 6. *P. plumbea* Iris



TETRAID. GROUSE.
 1 Pinnated Grouse. T. Cupido M.
 2 Spotted " " " Canadensis M.
 3 Sharp-tailed " " Phasianus.

Drawn by Captⁿ Brown & A. Ruler

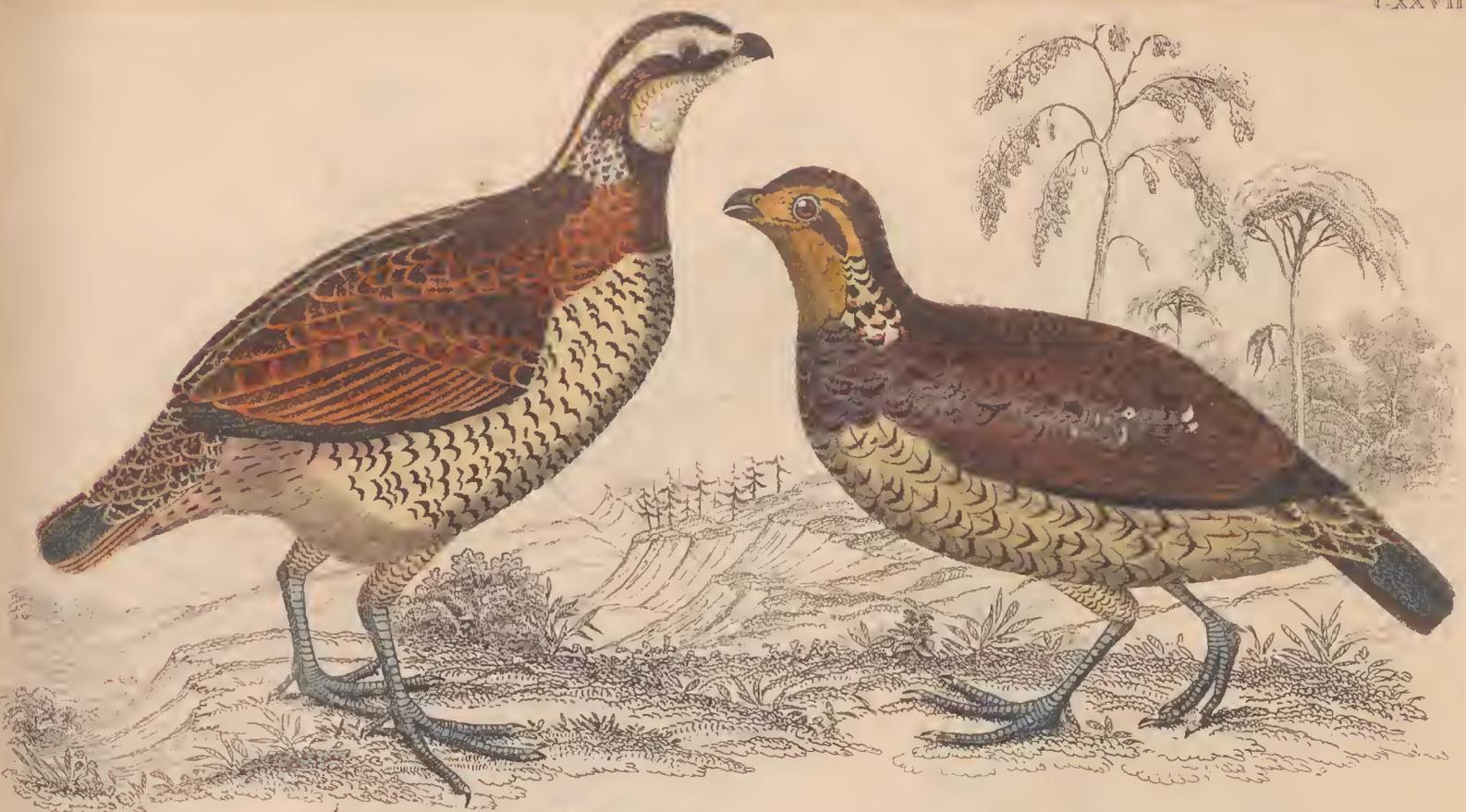
Engr^d by S. Mitre



LAGOPUS PTARMIGAN.
 1. Willow Ptarmigan. 2. Saticet's Mole Spring.
 3. 10th — Summer.
 4. 10th — Fem. Winter.
 5. Ptarmigan — Males Summer.
 6. 10th — Winter.

Drawn by Capt^l Brown

Engr^d by J. Astor



OREOXYL. QUAILS.
 1. Virginian Quail. *O. Virginiana* W.
 2. ———— " ———— *Fem.*
 3. Californian " ———— *Californica* M.
 4. ———— " ———— *F.*
 5. Long-tailed " ———— *Macroura*.
 6. Montezuma's " ———— *Montezuma*.

Drawn by A. Wilson & Capt. Bewick

Engd. by S. Mearns





COLUMBA PIGEONS.

- 1. Blue-headed Ground P. *C. Cyanocephalus*
- 2. Zenaida *Zenaida*
- 3. Purple-crowned *Purpurata*
- 4. Passenger *Mitroclora*
- 5. Blue & Green *Cyano-virens*
- 6. African *Afra*
- 7. Ground *Passerina*
- 8. Black-capped *Melanoccephala*
- 9. Great crowned *Coronata*





COLUMBAE. PIEDRS 8.
 1. *scrpta* Speckled P.
 2. *laemulata* Mantled
 3. *capistrata* Grey-headed
 4. *ditropa* Double-crested
 5. *humeralis* Red-collared



(1841) PLATE 38.
 1. *nana* Dwarf P
 2. *perlata* Pearly
 3. *ruticeps* Red-headed
 4. *leptogramma* Banded
 5. *incra* Fem. Ash-coloured
 6. *diademata* Fem. Diadem

Museo Civico di Storia Nat. Torino



STRUTHIO, OSTRICHUS,
IS Camelus. The Ostrich.
2. Fem.

Taylor sc. & c.



CONUS, CONES.

- | | |
|-------------------|---------------------------|
| 1 Matchless Cone | <i>C. Gleditsii</i> |
| 2 1 st | <i>D^o</i> |
| 3 Tufts | <i>Tuftensis</i> |
| 4 Dymers | <i>Angur</i> |
| 5 Fumigated | <i>Fumigatus</i> |
| 6 D ^o | <i>D^o</i> |
| 7 Ornamented | <i>Stouile</i> |
| 8 D ^o | <i>D^o</i> |
| 9 Hebrew | <i>Hebrewus</i> |
| 10 D ^o | <i>D^o Var.</i> |
| 11 Tessellated | <i>Tesselatus</i> |
| 12 Marbled | <i>Marmoreus</i> |
| 13 Jasper | <i>Retulimus</i> |
| 14 General | <i>Generalis</i> |
| 15 Fl. or spot | <i>Pulcherrimus</i> |
| 16 Franciscan | <i>Franciscanus</i> |
| 17 Stone cutter | <i>Lithoglyphus</i> |
| 18 D ^o | <i>D^o</i> |
| 19 Musci | <i>Musci</i> |
| 20 Ceylon | <i>cent. novis</i> |
| 21 Flat d | <i>Lamellatus</i> |
| 22 Bird d | <i>Sponsalis</i> |
| 23 Plumbeus | <i>Plumbeus</i> |
| 24 Geographic | <i>Geographicus</i> |
| 25 Striated | <i>Striatus</i> |

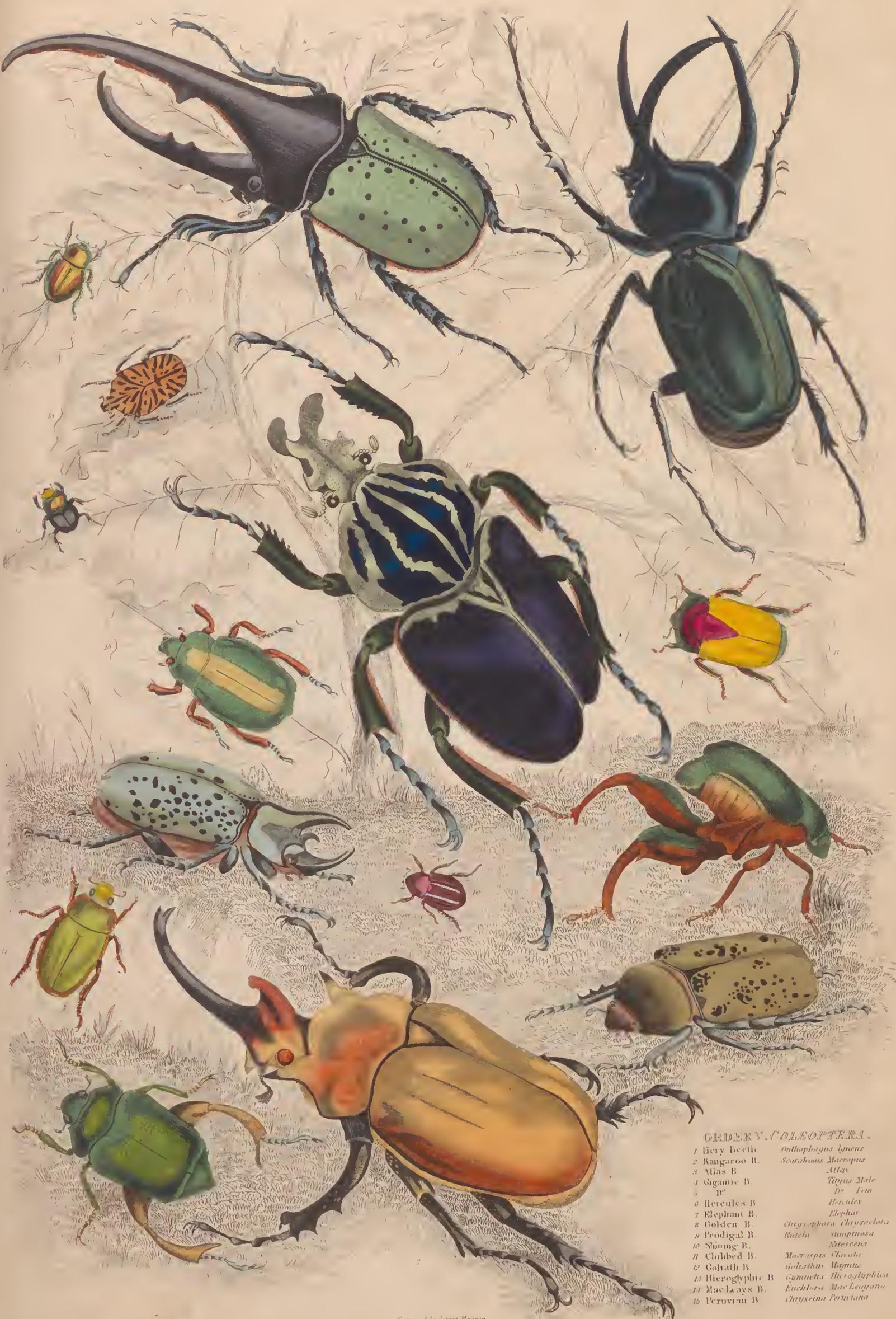




MILITARIA, AGATE-SHELLS.

- 1 Zebra Agate shell
- 2 White lined
- 3 Acute
- 4 Purple mouth'd
- 5 D^r Var.
- 6 Zebra
- 7 Albo lineata
- 8 Acuta
- 9 Papirata
- 10 D^r

- 1 Chestnut
- 2 Fiery
- 3 Variegated
- 4 Virgia
- 5 Austriaca
- 6 Filumina
- 7 Variegata
- 8 Virginia



ORDER V. COLEOPTERA.

- 1 Hery Beetle *Onthophagus lyncus*
- 2 Kangaroo B. *Scarabaeus Macropus*
- 3 Atlas B. *Atlas*
- 4 Gigantic B. *Titus Mole*
- 5 " " *De Fem*
- 6 Hercules B. *Herodes*
- 7 Elephant B. *Elephas*
- 8 Golden B. *Chrysophora Chrysochlora*
- 9 Prodigal B. *Ritela sumptuosa*
- 10 Shining B. *Nitescens*
- 11 Clubbed B. *Macraspis Navata*
- 12 Goliath B. *Goliathus Magnus*
- 13 Hieroglyphic B. *Gymnetus Hieroglyphica*
- 14 Mac Leays B. *Euchlora Mac Leayana*
- 15 Peruvian B. *Chryseina Peruviana*



ORDER X. LEPIDOPTERA BUTTERFLIES.

1 Royal Butterfly *Euglynis Regalis*

2 D^r

3.1 Azure blue *Polyommatus Argiolus* Male

5 D^r Female

6 Mazarine blue *Ictis*

7 Silver Streak *Argynnis Raphia*

8 Nieppe *Pieris Nieppe*

9 D^r

10 Imperial Trojan *Papilio Prionus*

11 Merry *Acontia Lubentina*

12 D^r

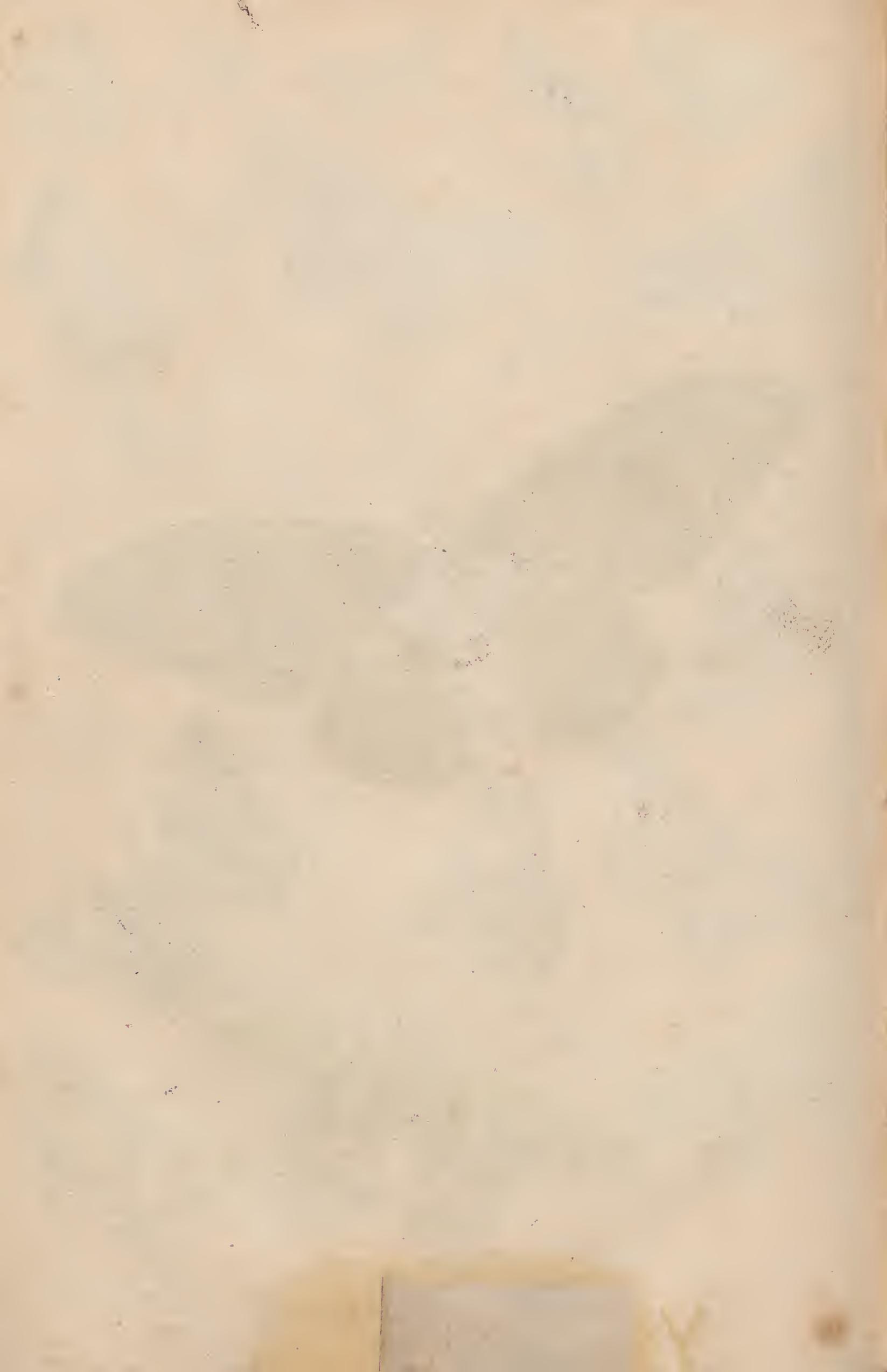
13 Painted lady *Gynthis Carthus*

14 Amphinome

15 D^r

16 Elm *Vanessa Polychloris*

17 Oriental Emperor *Nymphalis Ropheus*



THE
ANIMAL KINGDOM.

THE FIRST CLASS OF THE VERTEBRATED ANIMALS.

MAMMALIA—MAN AND BEASTS—CONTINUED.

THE CARNASSIERS OF CUVIER.

SYNONYMS.

LES CARNASSIERS.—Cuv. Reg. Anim. I. 110.

CARNASSIERS.—Ham. Smith, Syn. p. 53.

FERÆ, (Raubthiere.)—Voigt. Thierr. I. 105.

CARNIVORA, (Fleischfressende Thiere.)—Schinz Thierr. I. 150.

THE Carnassiers form a large and varied group of unguiculated Mammalia, possessing three kinds of teeth, like Man and the Quadrumana, but having no opposable thumbs on the fore extremities. They (all) feed on animal substances, and more exclusively in proportion as their molars are more trenchant. Those which have their molar teeth partly tuberculous feed more or less also upon vegetable substances, and those having them studded with conical points derive their subsistence chiefly from Insects. The articulation of the lower jaw, directed crosswise, and compressed like a hinge, admits of no horizontal movement, and confines the motion of the jaw to opening and shutting.

The cerebrum, still rather furrowed, has no third lobe, and, as in the succeeding divisions, does not cover the cerebellum. Their orbits are not separated in the skeleton from the temporal fossæ. The cranium is narrowed, and the zygomatic arches are remote

and elevated, to give more volume and strength to the muscles of the jaw. The sense of smelling is most perfectly developed in them, and their pituitary membrane is generally extended over very numerous bony laminae. The fore-arm can still rotate in most of them, although with less facility than in the Quadrumana, and they never have thumbs on the fore-limbs capable of opposing the fingers. Their intestines are not capacious, on account of the substantial nature of their food, and to avoid the putrefaction which flesh would undergo from remaining too long in an elongated canal.

In other respects, their forms, and the details of their organization, vary much, and draw along with them corresponding variations in their modes of life, to such an extent that it becomes impossible to arrange the genera in one group. It becomes necessary to form several families, which are differently related to each other, according to these multiplied variations.

M. Cuvier accordingly divides his Carnassiers into the families of Chiropteres, Insectivores, Carnivores, &c.; but as there are many and strong objections to this arrangement, as he himself was aware, we prefer adopting the views of other first rate authorities, and consider the Chiroptera as a distinct order.

ORDER III.—CHIROPTERA.

MAMMALIA WITH FOUR DISTINCT UNGUICULATED LIMBS ; THREE KINDS OF TEETH ; NO MARSUPIAL BONES ; THE LIMBS UNITED ON EACH SIDE BY A MEMBRANE.

SYNONYMS.

CHIROPTÈRES OU ALIPÈDES.—Dum. Zool. Anal. p. 11.

LES CHEIROPTÈRES.—Cuv. Reg. Anim. I. 111.—Desm. Mam. p. 107.

CHIROPTERA and Galeopithecus.—Fisch. Syn. Mam.—Temm. Mon. Mam. I. pref.

PRIMATES, (in part.)—Linn. Gmel. I.

VOLITANTIA, (Flatterfüsser.)—Illig. Prodr. 116.

CHARACTERS OF THE ORDER.

GENERAL FORM adapted for flight or vaulting.

MEMBRANES extending between the four limbs and the fingers of the anterior pair.

THE MAMMÆ pectoral, *cole libero pendulo*.

THE CLAVICLES very strong. THE SHOULDER-BLADES broad.

THE FORE-ARM incapable of rotation.

The Chiroptera have still some affinities to the *Quadrupana*, *parleur verge pendante*, and in their mammæ being placed upon the breast. Their distinguishing feature consists in a fold of skin arising from the sides of the neck, extending along their four feet and their fingers, which sustains them in the air, and even permits such of them to fly as have their hands sufficiently developed for that purpose. This arrangement requires strong clavicles and scapulæ, in order that their shoulder may have the requisite solidity; but it is

incompatible with the rotation of the fore-arm, which would have enfeebled the force of the jirk necessary for flying.

These animals have four large canines, but the number of their incisors [and molars] varies. For a long time they have composed two genera, [through the progress of science now become two tribes,] according to the extent of their organs of flight; but the second requires many additional subdivisions.

TRIBE I. GALEOPITHECUS.—VAULTING CATS.

The Galeopitheci differ from the other tribe with which they are associated in this respect, that the fingers of their anterior extremities, which are all supplied with sharp claws, are not lengthened out, but are like those of their posterior extremities; so that the membrane, filling up the interval between them, and extending to the sides of the tail, can do little more than discharge the office of a parachute. Their canines are indented and short, like their molars. Above they have two incisors, which are also indented, and widely separated from each other; in the lower jaw they have six, deeply grooved or pectinated, a structure which is quite peculiar to themselves. These animals live upon trees, in the Indian Archipelago, and pursue Insects, and perhaps Birds: were we to judge from the wasting which their teeth undergo through age, we should infer that they also lived upon fruits. Their cœcum is large.

The Flying, or, more properly, Vaulting Cat or Lemur, forms the solitary genus of this tribe, which in many respects constitutes a connecting link between the Lemurs we have left, and the Bats. It has not the hands of the *Quadrupana*, and differs in other striking particulars. It is distinguished, again, from the Bats, in that in these latter there is not a fold of skin between the toes, whilst the hind-feet of the Galeopitheci are palmated, as are their fore-feet. Besides, the alar membranes of the Bats do not commence before the shoulders, whilst those of the Vaulting Lemurs proceed from the neck, at the angle of the jaw. Lastly, the toes of the anterior extremity, in the Galeopitheci, are not much larger than those of the posterior, whilst in the Bats the fingers are prolonged to five or six times the length of their toes. The Vaulting Lemur uses its hind-legs a good deal like other Quadrupeds, and its fingers and toes are nearly of the same relative length as in the Monkeys. The flying membrane of the Galeopithecus is not naked, as is common in Bats, but covered on both sides with fine and soft hair like that of the Mole. The females have two prominent mammæ, which are pectoral. The dental apparatus clearly manifests that these animals are frugivorous, though it is also alleged they can eat flesh and insects, like the *Hedgelog*.

GENUS I. GALEOPITHECUS.—VAULTING LEMURS.

GENERIC CHARACTERS.

THE HANDS and FEET moderately developed, also the TOES; all supplied with strong and crooked NAILS.

$$\text{THE DENTAL FORMULA} \quad \frac{2+C+(1F+4)M}{3+C+(1F+4)M} = \frac{16}{18} = 34.$$

THE VAULTING MEMBRANE covered with hair both above and beneath.

THE MAMMÆ two. Pectoral.

HABITAT, the Indian Archipelago.

GALEOPITHECUS RUFUS.—THE RED VAULTING LEMUR.

Syn. GALEOPITHECUS VOLANS.—Shaw, Gen. Zool.

LEMUR VOLANS.—Linn. Gmel. I. 44.

FELIS VOLANS TERNATEA.—Seb. Thes.

COLUGO and OLECK.—Native names.

LEMUR VOLANS.—Pallas, Act. Ac. Sc. Pet. 1780.

Icon. GALEOPITHECUS RUFUS.—Audeb. des Galeop. pl. 1.

GALEOPITHECUS RUFUS.—Griffith's Cuvier, II. 158.

GALEOPITHECUS VARIEGATUS, (GEOFFROY).—Audeb. des Galeop. pl. 2.

LEMUR VOLANS.—Schreb. XLIII.

FELIS VOLANS TERNATEA.—Seb. Mus. tab. 58.

SPECIFIC CHARACTERS.

THE FUR is reddish-grey above, reddish below, and variegated and spotted with different coloured greys when the animal is young.

INHABITS the Moluccas and Indian Archipelago.

The Red Vaulting Lemur is about the size of a Cat. Its head resembles that of the Lemurs, but the muzzle is more arched; its eyes are large, and at a considerable distance from each other; the ears are small, naked, oval, and black; the nose also is black. The anterior extremities are long, and very slender; the fore-arm is more clothed with hair than the arm; the sole of the foot is naked and black; the toes are about an inch long, flattened on the sides, and united by a membrane; the nails are curved into a half circle, and are strong, much compressed, and pointed. They somewhat resemble those of the Cat, and, as in this animal, appear to be habitually concealed. In the posterior extremities the thigh is more clothed than the leg; the toes and nails are like those already described. The tail is not so long as the body and head taken together. The membrane rises from under the chin, proceeds to the nails of the anterior extremity, then to those of the posterior, and unites at the extremity of the tail. The robe which covers the head, back, and upper part of the membrane, is smooth, and of a deep and lively red colour; that of the chest, abdomen, and arm, is brighter and rough. The teeth are said to be anomalous, and are variously described by authors. We subjoin that of M. Desmoulins:—There are six incisors in the lower jaw, the intermediate four of which are much sloped; the two central have eight pectinated furrows, the next nine, and the third five; the external are both less sloped and less indented. The next tooth resembles a molar on its posterior surface; it has also two distinct roots, but has a triangular point in front. To this succeeds another, which before its principal projection has one small heel, and behind it three, disposed triangularly. Four molars succeed, the first of which is twice the length of the others. In the upper jaw there are also five molars, the four last of which very much resemble each other; the one anterior to these has two principal points in a series, and is very strong at its base; the tooth before this (answering to the canine) is very long, triangular, and has three distinct indentations. In the intermaxillary bone there are two teeth, the posterior of which resembles the canine which succeeds it. These incisors are early and frequently lost.

These animals almost constantly reside on trees, where they hang during the day, suspended by their hind-legs from the branches; they move with difficulty on the earth's surface; but climb trees with surprising facility, and spring from one to the other, supported, as by a parachute, in their passage by the membrane spread round their body. They are crepuscular, and active only during the twilight.

The Colugo was first described by Bontius in his History of Java. He informs us it is found in Guzerat, is gregarious, and feeds chiefly on fruits. Camelli, in his enumeration of the animals of the Philippine Islands, published by Petiver in the Philosophic Transactions, says, its length is three spans, and that the young adhere to the teats of the parent, even in flying, by their mouth and claws. Their flesh is said to have a disagreeable odour, but, notwithstanding, it is eaten by many of the islanders with much relish.

DOUBTFUL SPECIES.

1. GALEOPITHECUS VARIEGATUS (Audeb. des Galeop. pl. 2.—Geoffroy, in Mag. Encycl. Desm. No. 134) appears to be nothing more than the young of the preceding.

2. GALEOPITHECUS TERNATENSIS, (Seba, Mus. tab. 58, Geoffroy.) This species was introduced into our catalogues by M. Geoffroy, upon the imperfect description of Seba. It was observed in Ternate, one of the Moluccas.

TRIBE II. VESPERTILIONIDÆ, GRAY, LESSON.—GEN. VESPERTILIO, LINN.—BATS.

The tribe of the Bats comprehends various and numerous families, all closely associated. Throughout the whole the fingers of the anterior extremity are much prolonged, and enveloped in a membrane usually naked, forming true wings; the thumb is considerably apart, but not opposable, and is armed with a claw; the posterior extremities are weak, furnished with five equal toes; there are three sorts of well characterized teeth.

A striking peculiarity has lately been pointed out in the osteology of the superior extremity, so remarkably employed in this

tribe, which must not be omitted. We allude to the existence of a particular bone, placed behind the articulation of the arm with the fore-arm, and presenting in this joint an arrangement altogether parallel to that of the patella in the knee-joint. This bone, analogous to the olecranon process, and which may be designated the patella of the anterior extremity, is not, we believe, found in any other of the Mammalia, not even in the Galeopithecii; whereas it exists in the Insectivorous as well as in the Frugivorous Bats, although in some of the former it is rudimentary.

FAMILY I. FRUGIVORA.—FRUGIVOROUS BATS.

Syn. MEGANYCTERES.—Latreille, Reg. Anim.

CHARACTERS OF THE FAMILY.

THE MOLAR TEETH with flat and slightly crested crowns.

THE INDEX with three phalanges, and usually with a nail.

INHABIT the East Indies, the East Indian Archipelago, New Holland, Isle of France, Africa.

These Bats, as implied in M. Latreille's designation, are usually of larger dimensions. In the present state of the science they form a considerable number of genera, upon which we shall make a few remarks.

Being frugivorous, their dental apparatus differs somewhat from that of the other Bats. Their molars, instead of being studded with tubercles and acute points, exhibit an elongated crown, smooth, or limited to its possessing a small crest on the edges, especially the exterior one. This character is remarkable, inasmuch as it is intermediate between those of the Carnivora and Herbivora, properly so called, and is found in this group alone, where it undergoes some modifications. As to the canines and incisors, they very much correspond in their arrangement, direction, form, and usual number, to those of the Monkeys, with one striking exception. The wings of these Bats are usually neither so broad nor so long as those of the Insectivora; and generally they arise more from the back than the flanks. Another striking peculiarity is, that the fore-finger is always provided with all its phalanges, and (with only one exception, we believe) is terminated by a small nail; whilst in the Insectivora it wants, as in the other three fingers, both the nail and its phalanx. As to the interfemoral membrane, it is always but slightly developed, and usually completely rudimentary.

The membranes, then, in the Frugivora, do not possess the same extent of development as in the succeeding family. No more do we find in their avenues to sensation those membranous prolongations which are destined at one time to augment their sensibility, and at another time to diminish it; in other words, those oral and nasal coverings, whose presence produces so grotesque and striking an appearance.

This family is essentially frugivorous; though, as a Dog may eat bread, so the species belonging to it may accustom themselves to devour small Birds, perhaps, and other animal matters. Their gape is usually small. They live chiefly on mellow fruits; they also consume flowers. Most of them are nocturnal, and impatient of the light of day, while others, again, are all alive and active even under the direct rays of the sun. They produce but one at a birth. Finally, they live in numerous troops, some upon trees, others among rocks, and others in old ruined buildings. It was in the great pyramid that Geoffroy-St-Hilaire discovered in Egypt the species which bears his name.

The Frugivora are unknown in America and Europe. They abound on the Continent of India, in its Archipelago, in Egypt, Senegal, the Cape, and even in New Holland.

(A.) TAIL-LESS ROUSSETTES, (ROUSSETTES SANS QUEUE.)

GENUS I. PTEROPUS.—ROUSSETTE BATS.

Syn. LES ROUSSETTES.—Cuv. Reg. Anim. I. 113.

PTEROPUS.—Briss. Reg. Anim.—Illiger Prodr.—Geoffroy-St-Hilaire, Ann. du Mus. tome XV. 86.

GENERIC CHARACTERS.

HEAD prolonged, straight, conical. MUZZLE slender. INCISORS vertical. INTERFEMORAL MEMBRANE slightly developed. FORE-FINGER generally with a claw.

THE DENTAL FORMULA $\frac{2+2+C+(1F+4\text{ or }5)M}{2+C+(1F+5)M} = \frac{16\text{ or }18}{18} = 34\text{ or }36$

The Roussettes have trenchant incisors in each jaw, and molars with flat crowns. These grinding teeth have generally two longitudinal and parallel furrows, which are worn down by detrition. Hence, these Bats live chiefly on fruits, of which they destroy large quantities; yet they do not miss an opportunity of pursuing Birds and small Quadrupeds. These are the largest known Bats, and their flesh is eaten. They inhabit the East Indies.

Their membrane is widely sloped off between the thighs, and they have no tail, or a very small one. Their index finger is one half shorter than the middle one, and bears a third phalanx, and usually a small nail, which is wanting in the other Bats. The other fingers have only two phalanges. Their muzzle is simple, their nostrils separate, the ears middle-sized, without opercula, and their tongue papillate, the papillæ being curved backwards. Their stomach consists of an extremely elongated and unequally bulging sac. They are found only in Southern Asia, the East Indian Archipelago, Bourbon, and Isle of France, New Holland, Van Diemen's Land, and Africa.

I. PTEROPUS EDULIS.—EDIBLE ROUSSETTE.

Syn. LA ROUSSETTE NOIR.—Cuv. Reg. Anim. I. 113.

PTEROPUS EDULIS.—Geoff. Ann. Mus. XV. p. 90.—Desm. Mam. No. 137.

VESPERTILIO VAMPIRUS, (in part.)—Linn. Gmel. I.

ROUSSETTE EDULE, ou KALONG.—Temm.

Icon. TEMM. MON. MAM. II. pl. 35, fig. 1, (head.)—I. pl. 15, fig. 1, 2, (cranium,) 3, (teeth,) 4, 5, 6, (of the young.)

PTEROPUS JAVANICUS.—Horsf. Zool. Jav.

Ternate Bat.—Penn. Quadr. II. pl. 103.

SPECIFIC CHARACTERS.

THE HAIR on the muzzle, cheeks, and throat, dark brown; on the sides of the neck and upper part of the head bright red; a transverse reddish band, and a black band, between the shoulders.

INHABITS the Sonda Islands, Java, the Moluccas.

The Edible Roussettes remain during the day suspended in large numbers from the trees. The inhabitants are obliged to protect their fruits with nets, on account of the devastations of these Bats. Their cry is loud, and resembling that of a Goose. They are taken by means of a bag, hung for that purpose at the end of a pole. The natives find the flesh delicate, but Europeans dislike it, on account of its strong odour of musk.

The Edible Bat is the largest known species, and taking the lead of the others, we shall be somewhat more ample in the details. Its forms are

slender; its body prolonged; its muzzle long; and the membranes used in flying broad and extended. The robe on the upper part of the body is close, from the hairs throughout a part of their course adhering to the skin; it is always very short, and the skin may be seen beneath. In the young the fur is longer, and quite free, a difference depending upon the age of the individuals. The lower parts of the body are most clad, and the hair is here somewhat curled. The ears are long and pointed. The inter-femoral membrane unites the limbs to the coccygial region; it is broad at the knee, and forms a large angle: that of the wing, besides being broad, is also very long; the whole is perfectly black in the adult, and of a brown colour in the young. The incisors in the upper jaw are uniform, and regularly placed, which is scarcely the case in the inferior maxilla: there is no small anomalous tooth in the upper jaw, and four molar spaces; below there is an anomalous tooth, and five molar spaces. As to colour, the muzzle, cheeks, and throat, are of a deep chestnut, while the side and back of the neck are of a bright red; a reddish band, accompanied with another of a blackish hue, extends between the shoulders; and forms the limit of the red marking of the neck, a peculiarity which distinguishes this from all the other species. The back is of a dark chestnut colour, or greyish-black, as are also the posterior extremities; the chest is chestnut coloured, the abdomen dark-brown, or, more generally in the adult, perfectly black. Of the sixty specimens which enrich the Leyden Museum, only three, according to Memminck, extend from the tip of one wing to that of the other as much as four feet ten inches, (French,) and two to nearly five feet. This nearly corresponds with the dimensions reported by Dr Horsfield of those in the Museum of the Honourable the East India Company. "In adult subjects, the extent of the expanded wings is full five feet, and the length of the body one foot. In the specimen I have before me, the extent of the wings is five feet, two inches. The smallest specimen in the Museum has an expansion of three feet and ten inches across the wings: all the others measure nearly five feet. The length of the arm and fore-arm together is fourteen inches; the naked thumb projecting beyond the membrane measures two inches; and the claw, which is strong and sharp, has an extent of nearly an inch long in its curvature."

Though inclined to agree with Messrs Geoffroy and Temminck, that Horsfield's *Javanicus* is a mere variety of the present, yet the Doctor's account of the habits of this animal is so excellent that we shall borrow freely from it. It is extremely abundant in the lower parts of Java, and uniformly lives in society. The more elevated districts are not visited by it. Numerous individuals select a large tree for their resort, and suspending themselves with the claws of their posterior extremities to the naked branches, often in companies of several hundreds, afford to a stranger a very singular spectacle. A species of Fig-tree, resembling the *Ficus religiosa* of India, which is often found near the villages of the natives, affords them a favourite retreat, and the extended branches of one of these are sometimes covered by them. They pass the greater portion of the day in sleep, hanging motionless: ranged in succession, with the head downwards, the membrane contracted about the body, and often in close contact, they have little resemblance to living beings, and, by a person not accustomed to their economy, are readily mistaken for a part of the tree, or for a fruit of uncommon size suspended from its branches. In general, these societies preserve a perfect silence during the day; but if they are disturbed, or they contend among themselves, they emit sharp piercing shrieks, and their awkward attempts to extricate themselves, when oppressed by the light of the sun, exhibit a ludicrous spectacle. In consequence of the sharpness of their claws, their attachment is so strong, that they cannot readily leave their hold, without the assistance of the expanded membrane; and if suddenly killed in the natural attitude during the day, they continue suspended after death. It is necessary, therefore, to oblige them to take wing, if it be desired to obtain them during the day. Soon after sunset they gradually quit their hold, and pursue their nocturnal flights in quest of food. They direct their course, by an unerring instinct, to the forests, villages, and plantations, occasioning incalculable mischief, attacking and devouring indiscriminately every kind of fruit, from the abundant Cocoa-nut of the meanest peasantry, to the most delicate productions cultivated by the chiefs. By the latter, as well as by the European colonists, various methods are employed to protect the orchards and gardens. Delicate fruits, such as Mangoes, &c., as they approach to maturity, are ingeniously secured by means of a loose net or basket, skilfully constructed of split bamboo. Without this precaution, little valuable fruit would escape the ravages of the Kalong.

There are few situations in the lower parts of Java, in which this night

wanderer is not constantly observed. As soon as the light of the sun has retired, one animal is seen to follow the other at a small but regular distance, and this succession continues uninterrupted till darkness obstructs the view. The flight of the Kalong is slow and steady, pursued in a straight line, and capable of long continuance. Its chase forms occasionally an amusement to the colonists and inhabitants, during the moonlight nights, which at Java are uncommonly serene. He is watched in his descent to the fruit trees, and a discharge of small shot readily brings him to the ground. The natives of many of the Islands often employ for their capture a net at the end of a long pole. They eat it; and consider the flesh, which is white, delicate, and very tender, as delicious, whilst its peculiar flavour disgusts most Europeans: for it has a very strong smell of musk, produite par leur urine, qu'ils répandent lorsqu'on les inquiète. When wounded or irritated, they utter a sharp cry like that of the Goose.

2. PTEROPUS JUBATUS.—MANED ROUSSETTE.

Syn. et Icon. PTEROPUS PYRRHOCEPHALUS.—Meyen, in Nov. Act. Acad. Cur. vol. XVI. pl. 45 and 46, (eranium.)

ROUSSETTE À CRINIÈRE.—Temm. Mon. Mam. II. 59.

PTEROPUS JUBATUS.—Esch. Zool. Atl. pl. 16.

SPECIFIC CHARACTERS.

THE HAIR uniform deep reddish-brown; on the face black.

INHABITS the Island of Luzon.

This species, bearing a considerable resemblance to the previous one, may properly be characterized as new, not having hitherto found its way into the catalogues, native or foreign, of our most recent systematic works. M. Temminck, in his second volume, has recently given an account of it, deriving his materials from the memoirs of Messrs Eschscholtz and Meyen, quoted below.²

The Maned Bat has the chest, belly, and the whole back, of a very deep brown colour, and this colour is not limited between the shoulders by a transverse band, as in the former species: all the neck, however, is covered with a broad reddish-brown collar, which runs to a point upon the upper part of the back. The whole face is black, and covered with short hair; the crown of the head and occiput are of a shining orange-yellow colour, whilst there is a bright brown spot beneath the ear; the ears are almost naked, about an inch long, with the apex roundish. The breadth of the inter-femoral membrane is an inch, and decidedly keel-shaped, though the descriptions do not indicate whether the membrane surrounds the coccygial region, or leaves this bone free from the membrane. The eyes are of a pale red colour. In this Roussette the molars are stronger, wider, and more approximated, than in any other species. The upper jaw has no vestige of a false molar; there is a very small one in the lower.

These large Bats are found in the Island of Luzon, the principal of the Philippines, where they cover the trees with their numerous troops, and have been compared to nests suspended from the branches. They are sometimes seen to fly during the day, but more frequently they are habitually hid under the foliage during sunshine. They are frugivorous. Their flesh is tender, and much esteemed, having a great resemblance to that of Frogs. It is esteemed by the Spaniards as well as the islanders, a remark which Temminck extends to all the Bats he describes.

3. PTEROPUS EDWARDSII.—EDWARDS' ROUSSETTE.

Syn. PTEROPUS EDWARDSII.—Geoff. Ann. du Mus. XV. 92.—Desm. Mam. No. 138.

ROUSSETTE D'EDWARDS.—Temm. Mon. Mam. II. 61.

PTEROPUS MEDIUS, (Roussette intermédiaire).—Temm. Mon. Mam. I. 176.

Icon. GREAT BAT from Madagascar.—Edw. Birds, pl. 180.

SPECIFIC CHARACTERS.

EARS broad and long. MEMBRANES attached near the spine. No transversal markings. COAT bright red. BACK chestnut. ABDOMEN light brown.

INHABITS Madagascar, India, Ceylon.

Edwards' Roussette is of smaller dimensions than that of our first named species, a remark which applies to all the features of the face; the ears, however, are both broader and longer. The side membranes are attached nearer to the spine than in the edulis, which, of course, makes the back narrower; the transversal bands are here likewise wanting. Whatever variety occurs in the coats of these Bats generally, the face is always

¹ ESCH. ZOOLOG. ATL.—Zoologischer Atlas enthaltend Abbildungen und Beschreibungen neuer Thierarten während des Floreaplanes von Kotzebue's zweiter Reise um die Welt, in den Jahren 1823—1826, von Dr. Friedr. Eschscholtz. Berlin, 1829—1833.

² L'Atlas Zoologique, par M. Eschscholtz, 4^e, cachet avec une figure. Memoire par M. Meyen, Nov. Acta Phys.-Med. Acad. Cas. Leop. Nat. Curios. tome XVI. p. 604.

darker than the neck, so as often to be quite black, though usually it is of a very deep chestnut hue; whilst black or dark brown pervades the extremities.

Temminck informs us, that this is the only one of the larger species, in which *the old males* have a bunch of unctuous hairs, proceeding from a common centre, at the side of the neck; though it is not so apparent as in the smaller kinds, since the bushy hairs do not differ in colour from the others, and they are all of the same length. He also remarks, that those from Madagascar differ from those obtained in the Indian Peninsula and Ceylon only in having the face blacker, and the orange hue upon the neck more conspicuous.

Edwards, to whom these immense sized Bats were more a novelty than they now are, seems to have been shocked at the appearance of this "Great One;" and, after insisting on the accuracy of his drawing, tells us, that from it "an idea of this Fiend may be formed." He adds, that when wounded by a gun they are very fierce, snapping at, and biting those who offer to take them. He was also informed that they dipped into the sea for fish. Major Sykes, in his very recent work, "Catalogue of the Animals of the Deccan," (*Dukhun*), remarks, that there the animals of the same troop differ remarkably in their external markings. "The native Portuguese," he continues, "are the only individuals who eat this Roussette, but I can certify that its flesh is delicate, and free from all disagreeable flavour."

4. PTEROPUS FUNEREUS.—FUNEREAL ROUSSETTE.

Syn. ROUSSETTE FUNÈBRE.—PTEROPUS FUNEREUS.—Temm. Mon. Mam. II. 63.

Icon. Temm. Mon. Mam. II. pl. 35, fig. 4, (head.)

SPECIFIC CHARACTERS.

THE HEAD small. THE EARS large. THE INTERFEMORAL MEMBRANE deeply divided, and of equal breadth at the coccyx and feet.

THE HAIR varying in colour from dark brown and grey to black.

INHABITS the East Indian Archipelago.

The dimensions of the Funereal Roussette are smaller than those of the *Edulis*, and the head is proportionally much less, whilst the ears are larger; the interfemoral membrane is very deeply divided, and of equal breadth at the coccyx and feet; this membrane is covered with hair above, and at its base only below. There is no anomalous molar in the upper jaw, where the incisors are broad and uniform, whilst they are small and in pairs beneath. The robe is very dark, short, rough, and somewhat frizzled and shining on the back; the alar membranes are well clad above, as is the interfemoral, which is, however, bare near the foot, and also near the coccyx underneath. The following markings, varying probably according to age, and the season of the year, have been enumerated by Temminck: 1. Quite black, except at the back of the neck, where there is a slight deep chestnut marking. 2. Shining black on the lower parts of the head; dull black on the back, with a meagre coat; bright red on the occiput and nape of the neck; and dark chestnut on the sides of the neck. 3. Face, neck, and chest, quite black, belly dark brown; nape dull brown; back olive brown. 4. Under portions quite black; sides of the neck chestnut; nape very bright golden red; back, ash-grey. In the young, whose covering is more copious, it is of a uniform dark brown, except at the nape and neck, which are of a dull brown. This species has never been previously characterized or precisely distinguished from the two preceding, with which it may easily be confounded. Hence the necessity for details.

The habits of this animal do not differ from those of the other larger kinds. The superb Leyden Museum possesses twelve specimens derived from four islands of the Indian Archipelago, namely, Timor, Amboyna, Borneo, and Sumatra. Those of Timor and Borneo are, in their markings, precisely similar.

5. PTEROPUS PHÆOPS.—BLACK-FACED ROUSSETTE.

Syn. ROUSSETTE À FACE NOIR.—PTEROPUS PHÆOPS.—Temm. Mon. Mam. I. 178, II. 65.

Icon. Temm. Mon. Mam. II. pl. 35, fig. 3, (head), pl. 36, fig. 1, 2, (cranium,) and 3, (teeth.)

SPECIFIC CHARACTERS.

THE BODY stout and short. THE MUZZLE long. THE EARS short and pointed. THE INTERFEMORAL MEMBRANE broad on the tibia, rudimentary along the coccyx.

THE HAIR varying from brown to bright yellow and red.

INHABITS Macassar and Amboyna.

The Black-faced Roussette is of the same dimensions as Edwards'; its body is stout and short; the muzzle long; the eyes further removed from

the nostrils than from the ears, which are short and pointed; the interfemoral membrane is broad on the tibia, but narrow along the coccyx, and, reduced to a rudimentary state, is scarcely seen, hid by the long hair. There is no anomalous molar in the upper jaw; in the under it is isolated, and flat on the crown; the incisors above are small and regularly placed, but in the inferior maxillary are crowded and compressed by the canines. The face is of a deep black colour; the rest of the head, the neck, and shoulders, a pale yellow; the cheek, a bright golden-red; and the hairs in every other part of the body have a twofold colour, being brown at their base, and bright yellow at their points. The wings approximate to each other on the back to within half an inch; and in the old of both sexes the back is quite naked; in the young it is clad with black and shining hair.

It inhabits Macassar in the Island of Celebes; also Amboyna.

6. PTEROPUS POLIOCEPHALUS.—GREY-HEADED ROUSSETTE.

Syn. ROUSSETTE À TÊTE CENDRÉE.—PTEROPUS POLIOCEPHALUS.—Temm. Mon. Mam. I. 179, II. 66.

Icon.

SPECIFIC CHARACTERS.

THE HAIR on the head dark grey; on the shoulders rosy chestnut; elsewhere grey above; yellowish beneath.

THE INTERFEMORAL MEMBRANE rudimentary. THE COCCYX free, hairy. THE EARS pointed and naked.

INHABITS New Holland and Van Diemen's Land.

The size of this Roussette is somewhat less than that of our first species, the *Edulis*, and its body is shorter and stouter. The interfemoral membranes are reduced to a mere rudiment; the coccyx is free, and covered with long hair; the robe is abundant over the whole body, and over the extremities; the incisors of the lower jaw are somewhat separated from each other; the ears, of moderate dimensions, are pointed and quite naked. All the upper parts of the head, the cheeks, and throat, are of a dark ash-colour, mixed with some black hairs; the ash-colour shades off into grey towards the crown of the head, and a longitudinal band of this tint appears on the chanfrin. The whole of the nape, shoulders, and a part of the front of the neck, are of a beautiful rosy chestnut hue; this colour is separated by a dark ash-coloured band, which extends over the rest of the body; all the back and chest present a mixture of ash-coloured and black hairs, somewhat lighter on the crupper and outer sides of the hind-feet, and approximating to yellow, which colour, of a deeper tint, pervades the abdomen, and the inner side of the feet; the fore-arm and adhering part of the membrane are clad with brown hair. The markings of the female agree with those of the male; her dimensions being somewhat less.

The habitat of the Ash-headed Roussette is New Holland and Van Diemen's Land; its habits exactly correspond with those already related.

7. PTEROPUS CHRYSOPROCTUS.—GOLDEN-NECKED ROUSSETTE.

Syn. ROUSSETTE À CROUPION DORÉ.—PTEROPUS CHRYSOPROCTUS.—Temm. Mon. Mam. II. pl. 67.

Icon. Temm. Mon. Mam. II. pl. 35, fig. 2, (head.)

SPECIFIC CHARACTERS.

THE HAIR on the head bright golden-red; on the back chestnut; blackish beneath.

THE INTERFEMORAL MEMBRANE broad at the heel; rudimentary at the coccyx.

INHABITS the Moluccas and New Guinea.

This species was introduced to the notice of Naturalists in the year 1838, by M. Temminck, from four specimens obtained by Messrs Macklot and Müller, in their voyage to the Moluccas and New Guinea. Its *native country* is Amboyna, where it feeds upon mellow and succulent fruits, whose fibrous portions are rejected, so that it taps and enjoys the fruit, without swallowing the pulp, or devouring the harder parts.

Its dimensions are somewhat less than No. 4, the Funereal. The interfemoral membrane, somewhat broad at the heel, slopes away, and is nearly rudimentary, so that at the coccyx it is hid under the fur; the ears are straight and pointed; the upper incisors are broad and free, the under are small, and in pairs; there is no false molar in the upper jaw; that of the lower one is short and obtuse. The robe generally is long, rough, and frizzly; upon the back it is silky, smooth, and shining; the muzzle is covered with a few transparent hairs. The *adult male* is chestnut-coloured round the eyes and on the chin; the head, all the neck, and the chest and shoulders, are of a very lively golden-red colour; the back, as far as the loins, of a shining dark chestnut; the lumbar region, the coccyx, and

femur, are chestnut, passing into blackish on the abdomen, and near the humerus; the membranes are black. The *female* differs from the male in having the back of a shining black colour, the loins of a lively chestnut, and the inferior parts dark chestnut.

8. PTEROPUS MACKLOTTII.—MACKLOT'S ROUSSETTE.

Syn. ROUSSETTE DE MACKLOT.—PTEROPUS MACKLOTTII.—Temm. Mon. Mam. II. pl. 69.

Icon. Temm. Mon. Mam. II. pl. 35, fig. 5.

SPECIFIC CHARACTERS.

THE HAIR on the back brick red; elsewhere yellow or brown.

THE EARS large and naked.

AN ODORIFEROUS GLAND, covered by a bunch of coarse hairs on each side of the neck, in the male only.

INHABITS the Moluccas and New Guinea.

This species, like the former, has not hitherto been introduced to the notice of the English reader. It rests upon the same respectable authority as the preceding, the late M. Macklot having published an account of it.

The expanse across the wings is less, in proportion to the length of the body, than in Edwards' Roussette, (No. 3,) though it is not so short and stout as in some which have been enumerated. The interfemoral membrane is of medium breadth, extending along the tibia and femur, and uniting round the coccyx, the membrane only being partially hid by the fur. The ears are large and naked. In the male there is a great bunch of coarse oily hairs upon the side of the neck, covering an odoriferous gland beneath; the upper incisors are uniform and well set, the lower are small and crowded; there is no false molar in the upper jaw, but a large obtuse one in the lower. The robe is long and silky, supplied with woolly hairs at the inferior parts, whilst those of the back and extremities are short and shining; the lower side of the membrane, from the flanks to the extremity of the fore-arm, is clad with a thick woolly covering.

In the *adult male* the crown of the head and the nape are pale yellow; the cheeks and throat, brown; the chest, golden-brown; abdomen, chestnut; sides of the neck and shoulder, golden-yellow; all the back and the extremities are covered with shining brick-red hair; the membranes possess the colour of a faded leaf. The *adult female* differs much from the male. It wants the oily apparatus; the crown of the head and nape are of a dull pale yellow, and this colour, shaded with a little brown, pervades the neck, cheeks, and throat; the chest is in a great degree bare; all the inferior parts of the body are of a dull yellowish-brown, whilst the back is of a beautiful pale and shining yellow. The females are often larger than the males.

9. PTEROPUS DASYMALLUS.—THE WOOLLY ROUSSETTE.

Syn. ROUSSETTE LAINEUSE.—PTEROPUS DASYMALLUS.—Temm. Mam. I. 180. P. RUBRICOLLIS.—Sieb.¹ Spicil. Japon. p. 13.

Icon. ROUSSETTE LAINEUSE.—Temm. Mon. Mam. I. pl. 10.

SPECIFIC CHARACTERS.

THE HAIR brownish or yellowish; very long and woolly.

THE INTERFEMORAL MEMBRANE rudimentary. THE COCCYX free. THE EARS small, pointed, and naked. THE MEMBRANES covered with hair, except the metatarsal.

INHABITS Japan.

The general dimensions of this Roussette are smaller than Edwards'; and the wings smaller, in proportion to the body, than the rest of the genus. The interfemoral membrane is rudimentary along the posterior extremities, and wanting round the coccyx, being only visible at the heel, and hid elsewhere under the thick fur; the ears, too, are small, pointed, and very much concealed; the upper incisors are large, uniformly and regularly set; the lower are small and in pairs, having no anomalous tooth behind the upper canine, but a broad and bilobed false molar behind the lower one; in all, there are four molars above, and six below. The coat is very woolly, and long throughout; the side membranes are clad both above and below; all the extremities are covered with long hair, leaving the metatarsal bones alone covered with a naked membrane; those on the region of the coccyx are long.

The face and summit of the head, the cheeks, and regions of the ear, are brown, mixed with grey; the front and side of the neck, the nape, and all the posterior portion of the neck and shoulders, are of a dull yellowish-

white; all the other parts of the body are of a deep brown, the points of the hairs being ochrous. The ears are naked, the points alone being visible. The membranes are dark brown.

The habitat of this species is Japan, where, according to M. Siebold, it bears the name of *Sabaosiki*.

10. PTEROPUS URSINUS.—URSINE ROUSSETTE.

Syn. PTEROPUS URSINUS.—Kittlitz.

ROUSSETTE À PIEDS VELUS OU URSINE.—Temm. Mon. Mam. II. p. 70.

PTEROPUS PSELAPHON.—G. Tridascant Lay, Zool. Journ. IV. 457.

Icon. ROUSSETTE À PIEDS VELUS OU URSINE.—Temm. Mon. Mam. II. pl. 37.

SPECIFIC CHARACTERS.

THE HAIR grizzly black, long and bushy.

THE INTERFEMORAL MEMBRANE rudimentary. THE EARS very short and pointed. THE MEMBRANES and FINGERS covered with hair.

INHABITS the Bonin Islands, near Japan.

The first account of this animal was supplied by Mr Tridascant Lay. It was noticed by him in the Island of Bonin, at the time that the Blossom Frigate, commanded by Lord Byron, lay in that station. He was greatly struck with the very great contraction of the pupil under the influence of the solar ray. We extract the following particulars from his interesting account:—"In this blind condition it climbs trees, groping its way up to the topmost branches, where, after extending its claws to learn whether there be another sprig within reach, still higher than its present situation, it quietly drops its weight upon the hind claws, and there composes itself to rest, apparently with as much felicity as a traveller feels after descending some perilous height. When captured it was often observed to sneeze. When thirsty, it descends a tree on the margin of the rill, and after sipping a little refreshment, re-ascends the trunk, and takes its departure from the branches. It is not a bad swimmer. Those which were taken on board the frigate and confined did not discover any sign of fear, and ate, without repining, the fruit that was given them; and on their being set at liberty, they climbed to the highest part of the rigging, and there found a convenient place for repose."

The great intolerance of light is a character which is common nearly to all Bats; and hence the name *pselaphon*, (alluding to its powers of touch being superior to those of sight,) proposed by Mr Lay, is very far from being specific. The name *Ursinus* was given by M. Kittlitz, who circumnavigated the globe in a Russian vessel. Mr Lay mentions that this species sucks the juice without devouring the pulp of fruits.

This species has a close resemblance to the preceding. The most characteristic differences are to be found in the form of the cranium, in the fingers being covered with hair, and in the length and colour of the robe. The dimensions are somewhat larger in this species, but this is a character not to be depended on. As in the Woolly Roussette, the ears are very short, pointed, and scarcely appear beyond the thick fur with which the whole body, the membranes, and even the feet, are clad. This last character is the more remarkable, as it not only serves, at first glance, to distinguish the two species, but also as a special characterizing this one from all others; none besides possessing hair upon the metatarsal region nor upon the fingers. The interfemoral membrane surrounds, in a very rudimentary state, the whole of the coccygeal region; it is totally hid by the long fur, and is only visible at the heel. The cranium is large, bulging, much contracted between the zygomatic arches, which are much stronger and wider than in the preceding species, and the superciliary ridges are more perfect; the muzzle is shorter and broader; the teeth are the same.

The fur is longer than in the Woolly Roussette, and consists of two kinds, one very bushy, like cotton, and the other very long and silky; the inner part of the membranes, as well as the feet, are abundantly supplied with these hairs. The whole of the cottony fur is of a sooty-black colour; the pubic region and the fingers are deep chestnut; the whole of the silky hairs have their points greyish, which gives to the whole robe a grizzly black appearance; the head is quite black, as are all the extremities.

11. PTEROPUS VULGARIS.—COMMON ROUSSETTE.

Syn. LA ROUSSETTE VULGAIRE.—Cuv. Reg. Anim. I. 114.

PTEROPUS VULGARIS.—Geoff. Ann. Mus. XV. 92.—Temm. Mon. Mam. I. 182, II. 74.

VESPERTILIO VAMPYRUS.—Linn. Gmel. I.

Icon. LA ROUSSETTE.—Buffon, Hist. Nat. X. pl. 14, copied in Schreb. Saügh. pl. 44.

ROUSSETTE VULGAIRE, (Jeune de l'année.)—Temm. Mon. Mam. II. pl. 38.

¹ SIEB. SPICIL. JAPON.—A. Siebold, Dissertatio de Historia Naturalis in Japonia statu, etc., cui accedunt Spicilegia Faunæ Japonicæ. Batav. 1824.

SPECIFIC CHARACTERS.

THE HAIR brown, varying to red and yellow, thick and coarse.

THE EARS small and pointed. THE INTERFEMORAL MEMBRANE short, concealed.

INHABITS Isle of France and Bourbon.

The Common Roussette is about the size of the European Squirrels, and the expanse across the wing somewhat less than in the smaller specimens of Edwards' Bat. The ear is small and pointed. The appearance of the teeth very much corresponds to that described of the Macklotii, (our No. 8,) although the canines are not quite so strong, more acute and approximated, and the incisors are smaller. The interfemoral membrane is short, and entirely hid under the hair of the coccygeal region. The fur is thick and coarse. In the *old males* the great dark brown space which covers the shoulders runs down the spine to an obtuse point, the rest of the back is brownish-yellow; the abdomen and chest are of a dark reddish-brown; the pubic region and the arms of a lighter hue. In the *aged females* there is a broad black band runs down the centre of the back, which strikingly contrasts with the pale colour of the sides; the head is a pale brown; the throat, chest, and abdomen, a deep chestnut; the extremities, yellowish-brown. The young, of a year old, have the body and members well covered with long and downy fur, generally smooth, but somewhat curled round the neck; the head is yellowish-grey, mixed with silky hairs of a deep brown; the nape, sides of the neck, and chest, are covered with a downy fur, more or less curled, and of a rust-red colour, livelier at the chest than the shoulders; the chest, a part of the abdomen, and the back, are sooty-black, mixed with grey silky hair.

As to its habitat, Temminck gives the Isles of France and Bourbon as certain. It is also *said* to be found in Madagascar, and *perhaps* in Africa. Its flesh is eaten freely, and is generally considered very agreeable, the young being preferred. Its habits are like those of its congeners.

12. PTEROPUS RUBRICOLLIS.—RED-NECKED ROUSSETTE.

Syn. LA ROUGETTE.—*Chv. Reg. Anim.* I. p. 114.

ROUSSETTE À COU ROUGE.—*PTEROPUS RUBRICOLLIS.*—*Geoff. Ann. Mus.* XV. 93.

ROUSSETTE ROUGETTE.—*P. RUBRICOLLIS.*—*Temm. Mon. Mam.* I. p. 183.

Icon. LA ROUGETTE.—*Buff. Hist. Nat.* X. pl. 17.

SPECIFIC CHARACTERS.

THE HAIR very copious; red on the neck; yellowish on the head; dark brown on the chest.

THE EARS small and concealed. THE INTERFEMORAL MEMBRANE rudimentary and concealed.

INHABITS Islands of Bourbon and Madagascar.

The name, Red-necked Roussette, is unfortunately chosen, inasmuch as the great majority of the genus have this character. A broad golden-red collar, however, is in this one sufficiently conspicuous; the head, and all the upper parts of the body, are of a yellowish-brown, mixed with silky hairs of bright yellow; chest, dark brown: the inferior parts are more grey than the back, but varied in the same manner. The dimensions of this species are half those of our first species. The incisors are more approximated, the middle ones being contiguous; in the lower jaw, again, they are in pairs. The ears are small, and hid under the fur; the interfemoral membrane is rudimentary, and also hid. The robe is downy, very curly, long, rough, and very abundant.

This species is usually stated to inhabit the Islands of Bourbon and Madagascar. It must be distinguished from the *P. rubricollis* of Siebold. (See our species 9.)

13. PTEROPUS ALECTO.—THE GREAT-WINGED ROUSSETTE.

Syn. ROUSSETTE ALECTO.—*PTEROPUS ALECTO.*—*Temm. Mon. Mam.* II. 75.

Icon.

SPECIFIC CHARACTERS.

THE BODY stout and short. THE ALAR MEMBRANES comparatively very large. THE INTERFEMORAL MEMBRANE rudimentary. THE EARS naked, short, and pointed.

THE HAIR mostly black, mixed with chestnut.

INHABITS Celebes.

This species, observed by Temminck in the Leyden Museum, has very recently been described. It is remarkable for its stout short

body; for the very great extent of the wings in proportion to the size of the trunk; and, finally, for nearly the total want of the coccygeal membrane, where only a fold of the skin is to be found. The alar membrane rises from the sides, so making the clad portion of the back the broader. The upper incisors are in pairs; the lower are crowded together. The robe is short, coarse, and downy. The head, front of the neck, and lower parts of the body, together with the shoulders and back, are perfectly black; the eyes and circumference of the face are very deep chestnut; the nape and sides of the neck, bright chestnut; the ears are naked, short, and pointed. The regions of the arm and fore-arm are clad beneath with a fine black fur.

The individual which supplied this description was taken in the Island Celebes.

14. PTEROPUS PALLIDUS.—THE PALE ROUSSETTE.

Syn. ROUSSETTE PALE, ou FEUILLE MORTE.—*PTEROPUS PALLIDUS.*—*Temm. Mon. Mam.* I. p. 184, II. 77.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brownish, varied with grey and white.

THE EARS short and round. THE MUZZLE short and obtuse. THE MEMBRANES clear brown. THE INTERFEMORAL MEMBRANE united to the coccyx, and concealed.

INHABITS Island of Bonda, also Sumatra and Malacca.

This Roussette is of medium size, being equal in dimensions to an *Eduis* a year old. The muzzle is short, and somewhat obtuse; the eyes more distant from the ears than from the point of the nose; the ears are short and round; the interfemoral membrane united to the base of the coccyx by a rudiment half a line broad, and entirely hid under the fur; all the membranes of a clear brown colour. The upper incisors are separated; the lower are crowded, the lateral ones being larger than the others. There is no anomalous molar in the upper jaw, but four true ones; in the lower there is an anomalous tooth and five molars, the last very small and contiguous. Its coat is very short, and composed of brown, grey, and white hairs; the nape, shoulders, and collar, are of a bright rust-colour in adults, and of a paler red in the young; the whole of the back is covered with close, smooth hair, of a pale brown colour, produced by a mixture of brown and white hairs. The head, throat, sides, and abdomen, are of the colour of a decayed leaf. There is no difference in the markings of the sexes, but the young are paler. This species, then, is distinguished by having no small false molar in the upper jaw, but three large and one small one; by its brown hue, like that of a dead leaf, and its small ears, rounded at the point. No varieties of marking have been discovered on the whole number that have been examined: it is also remarkable for the small extent of the cutaneous membrane that adheres, the membrane of the back being connected with the muscles to the extent of only three or four lines.

The Pale Roussette inhabits the Island of Bonda, where it is very common; also Sumatra and Malacca.

15. PTEROPUS KERAUDRENIUS.—KERAUDREN'S ROUSSETTE.

Syn. ROUSSETTE KÉRAUDREN.—*PTEROPUS KERAUDRENIUS.*—*Quoy et Gaim. Zool. de l'Uran.*¹—*Temm. Mon. Mam.* I. 186.

Icon. ROUSSETTE KÉRAUDREN.—*Quoy et Gaim. Zool. de l'Uran.* pl. 3.

SPECIFIC CHARACTERS.

THE HAIR on the back close, brown, and black; on the nape frizzly, reddish-yellow.

THE MEMBRANES deep black. THE ALAR commencing near the median line. THE EARS and INTERFEMORAL MEMBRANE small.

INHABITS Marian Islands.

We owe the discovery of this Roussette to the Naturalists of Captain Freycinet's expedition, who named it from M. Kéraudren, Inspector General of the French Marine. Messrs Quoy and Gaimard report that they fly about in bright day, and suspend themselves in the trees where they build their nests, in holes, and even among rocks. They have but one young at a time, which clings to the mother even when flying. The total length of this Bat is from seven to nine or ten inches; the expanse from wing to wing reaching to about twenty-five. The interfemoral membrane of this Roussette is rudimentary at the coccyx, where it is completely covered with hair; the ears are short, and roundish; the wing arises at a small distance from the median line of the

¹ Zool. de l'URAN.—Voyage autour du Monde sur la Corvette l'Uranie, et la Physicienne par M. Freycinet. Zoologie par MM. Quoy et Gaimard. Paris, 1824.

back; the thumb is very long. All the membranes are of a deep black colour. The incisors are equal, and symmetrically arranged; there is a small anormal tooth in the upper jaw, and a larger one in the lower, with four molars above, and five below. The fur lies close on the back, and is brown; it is more copious, and somewhat more curled, on the nape of the neck and inferior parts. The hairs on the middle of the back are nearly black, but mixed with a few ash-coloured, whilst on the sides of the back, towards the limit of the portion covered with hair, there is a long band in form of a cross, the ash-colour of which predominates over the black. The whole of the nape, as well as the shoulders, are covered with a frizzly fur of a pale reddish-yellow, which half collar terminates in a point at the sides of the chest. The head and throat are a very deep fawn brown; the chest has a russet tinge, and all the other inferior parts are black, mixed with grey hairs. The ears are very small, and somewhat rounded; the long coccygeal hairs hide the rudimentary membrane with which it is surrounded. Temminck states that he has seen individuals in which the yellow collar is of a lighter colour, and others in which it is ash-coloured.

This species has been found only in the Marian Islands.

16. PTEROPUS DUSSUMIERI.—DUSSUMIER'S ROUSSETTE.

Syn. ROUSSETTE DUSSUMIER.—PTEROPUS DUSSUMIER.—Isid. Geoff. in Belanger, Voy. aux Indes Orient. p. 98.—Temm. Mon. Mam. II. 76.

Icon.

SPECIFIC CHARACTERS.

THE HAIR of the face and nape brown; on the chest russet brown; on the back and abdomen a mixture of brown and white.

INHABITS Amboyna and the Indian Continent.

M. Isidore Geoffroy-St-Hilaire has supplied a description of this Roussette discovered in the Continent of India by the distinguished Naturalist whose name it bears. The face and throat are brown; the abdomen and back with a mixture of brown and white hairs; those on the back lie close. The upper part of the chest is russet brown; and the sides of the neck, and all the space on the posterior aspect of the body, from the ears to the insertion of the wings, are of a reddish fawn colour. The reddish marking of its throat, and anterior part of the neck, distinguish it from the previous species, (Kéraudren's.)

Amboyna and the Indian Continent are considered its native regions.

17. PTEROPUS VANIKORENSIS.—THE VANIKORO ROUSSETTE.

Syn. ROUSSETTE DE VANIKORO.—PTEROPUS VANIKORENSIS.—Quoy et Gaim. Zool. de l'Astr. p. 77.—Temm. Mon. Mam. II. 78.

Icon. ROUSSETTE DE TONGA.—Quoy et Gaim. Zool. de l'Astr. pl. 9, Male.

SPECIFIC CHARACTERS.

THE HAIR, on the neck and shoulders, yellowish-red; on the back grey.

THE MEMBRANES dark brown. INTERFEMORAL MEMBRANE narrow and much sloped. THE HEAD large. THE MUZZLE short and cylindrical. THE EARS long, black, and pointed.

INHABITS Vanikoro.

The Roussette of the Vanikoro Island, according to Quoy and Gaimard, is about the size of Kéraudren's, (No. 15.) It differs from it, however, in having a shorter muzzle, which is most conspicuous in the crania. Its robe is lighter in colour and less silky; its head less black; and its collar or cloak, fawn-red, descends further on the back. The head is large, the forehead rounded; the muzzle large and cylindrical; the nostrils well separated, the ears long, black, and pointed. The muzzle and cheeks are of a reddish-brown colour, which becomes darker on the crown. The occiput and sides of the neck, as well as the shoulders, are of a yellowish-red, and all the back brown mixed with grey. The under part of the neck is reddish-brown; the abdomen is brown, with some hairs longer than others and whitish; those of the nrm are long and sleek; on part of the fore-arm there is a scanty wool of a deep red colour. The membranes are of a brown, almost black; the interfemoral is narrow, and much sloped. The nails of the feet appear smaller than usual.

In Vanikoro, where it is called *Lequébé*, it does not appear to be very abundant.

18. PTEROPUS TONGANUS.—THE TONGA ROUSSETTE.

Syn. ROUSSETTE DE TONGA.—PTEROPUS TONGANUS.—Quoy et Gaim. Zool. de l'Astr. p. 74.—Temm. Mon. Mam. II. p. 79.

Icon. ROUSSETTE DE TONGA.—Zool. de l'Astr. pl. 8.—Female and white variety, cranium and teeth, &c.

SPECIFIC CHARACTERS.

THE HAIR, on the abdomen, brown; on the shoulders bright red; on the back black.

THE MUZZLE black. THE EARS black and pointed. THE INTERFEMORAL MEMBRANE sloping towards the heel. THE MEMBRANES brown.

INHABITS Tonga-tabou, one of the Friendly Islands.

Quoy and Gaimard are again our only authorities for this Roussette. They report it to be of medium size between Kéraudren's and Dussumier's. Its collar does not quite meet in front as in the former of these. The abdomen is brown, somewhat red, and without any mixture of white hairs. The wings are lighter; the muzzle, differently coloured, is more pointed, which imparts a fierce look to the animal. The back of the head, and as far down as the shoulders, is of a bright red; the cheeks and muzzle are sombre red, becoming still darker upon the middle of the head; the back is almost black; the throat and abdomen of a deep brown, with a few reddish markings. The hair on the posterior part of the body is long, thick, and abundant; that of the nape is somewhat shaggy, whilst that of the back is silky and lies close; that on the abdomen is coarser and more woolly. The muzzle is black, as are the nostrils. The ears are black, of medium size, and rather pointed. The long hairs about the mouth and eyes are also black. The arms and thighs are thinly clad with short hair. The superbrachial membrane is covered in front with a few soft hairs; the interfemoral, acutely sloping, extends to the heel; the thumb and its claw are proportionally larger, and that of the fore-finger is also strong; all the claws and membranes are brown.

The individual from which the above description was taken was a young one, as was also another characterized as a white variety. In this latter there is a close general similarity, extending even to the character of the fur. The chief differences are in the colour. That of the abdomen is light red; the ears, nails, and membranes, are of a pale yellowish-white. The teeth are as in Kéraudren's.

These Roussettes were found in great abundance upon the Island of Tonga-tabou, one of the Friendly Islands group. They peculiarly delight in the Casuarina tree, where they assemble in hundreds. They fly about in bright day, and in spite of the intensity of the light, as has already been remarked of several other species.

19. PTEROPUS GRISEUS.—THE GREY ROUSSETTE.

Syn. LA ROUSSETTE GRISE.—PTEROPUS GRISEUS.—Geoff. Ann. Mus. XV. 94.—Temm. Mon. Mam. I. 187, II. 81.

Icon. LA ROUSSETTE GRISE.—Geoff. Ann. Mus. T. XV. pl. 6.

ROUSSETTE GRISE.—Temm. Mon. Mam. I. pl. 11, II. pl. 35, fig. 6, (head.)

SPECIFIC CHARACTERS.

THE ALAR MEMBRANES commencing very near the mesial line. THE INTERFEMORAL MEMBRANE small in the members, and partly concealed at the coccyx. THE EARS very short and pointed.

THE HAIR brown, varied with red and grey.

INHABITS the Island of Timor.

The Grey Roussette is about seven or eight inches long, and measures two feet across the wings; the ears are very short and pointed; the side membrane rises from very nearly the mesial line of the back; the interfemoral membrane is small on the members, and rudimentary and partly hid at the coccyx. The upper incisors are small, and regularly arranged; the inferior in pairs, and at a considerable distance from each other; the superior molars exhibit the fine point of a false one, though scarcely visible to the naked eye; there is a small false molar below, which is obtuse; the false molars, after shedding, leave no traces behind. In the *old male* the markings are as follow: Middle of the abdomen brown, the end of hairs being tipped with grey; flanks greyish; head grey, shaded with light brown; nape, sides, and front of the neck, beautiful chestnut, passing on the shoulders to a golden hue; the rest of the upper parts being light grey, from the points being white; there is no vestige of a bushy tuft for the oily secretion in the neck. The *old female* is nearly wholly white; the abdomen preserving a slight grey, and the back and sides of the neck a reddish hue. The common livery, however, of the *adult* is the head, nape, and part of the shoulders, reddish white or bright red; descending from the shoulders all the other superior parts are of a greyish brown; the fur having the brown tint of wine-lees, and the shining hairs being whitish grey; it is somewhat crisp at the coccyx; the cheeks and chin are of a dark greyish-brown; front of the neck a very light red; the other inferior parts have an isabella hue, the middle of the abdomen russet. Such are the markings of the greatest number of adult and old females.

This species was discovered by Peron at Timor.

20. PTEROPUS PERSONATUS.—THE MASKED ROUSSETTE.

Syn. ROUSSETTE MASQUÉE.—PTEROPUS PERSONATUS.—Temm. Mon. Mam. I. 189.

Icon.

SPECIFIC CHARACTERS.

THE HAIR, on the head, pure white and brown; on the neck, pale yellow; on the shoulders, white; and on the back, grey.

THE MEMBRANES brown above, white beneath. THE INTERFEMORAL hid by the fur.

INHABITS Island of Ternate.

The Masked Roussette is of the same dimensions as the Grey. The ears are of medium length, somewhat rounded at the point; the interfemoral membranes are rudimentary; the upper portion being quite hid by the fur; all the membranes are brown above and whitish beneath. The upper incisors are well arranged, and in pairs; the lower are separate, very slender, short, and obtuse; there is a small anormal tooth in both jaws, the upper scarcely visible. The head of this species is strikingly marked with pure white and brown. Pure white covers the whole chanfrin, extends beyond the eye, and forms a spot behind it; the cheeks, margin of the lips and chin, are of the same colour; a broad brown zone covers the throat; the extremities of this zone surround the cheeks and extend to the nostrils. The crown, occiput, neck, and cheek, are of a pale yellow hue; the shoulders and hairs of the arm are white, those of the back are grey, mixed with brown; the chest, abdomen, and sides, have downy hair, brown at their base, and of an isabelle hue at the point.

We owe the discovery of this beautiful species to Professor Reinwardt, who described it in his *Voyages aux Moluques*. Its habits have not been observed.

21. PTEROPUS LABIATUS.—LONG-LIPPED ROUSSETTE.

Syn. ROUSSETTE LABIAIRE.—PTEROPUS LABIATUS.—Temm. Mon. Mam. II. p. 83.

Icon. ROUSSETTE LABIAIRE.—Temm. Mon. Mam. II. pl. 39, fig. 1, 2, (male,) 3, (femelle.)

SPECIFIC CHARACTERS.

THE HAIR, on the chest and sides, light red; on the abdomen, white; a white tuft on each side of the neck, in the male only.

THE LIPS greatly elongated in the male only.

THE MEMBRANES brown. THE INTERFEMORAL rudimentary. THE ALAR commencing from the sides. THE EARS very long and pointed.

INHABITS Abyssinia.

This beautiful Roussette, the male of which is remarkable for the extreme length of its bunch of oily hair, and the elongation of the two lips, is of the size of the Common Bat of English writers, *V. Murinus*. The muzzle is long; the incisors slender and in contact; a narrow membranous appendix supplies the place of the interfemoral, which is throughout hid, and nearly clad by the fur; the alar membrane proceeds directly from the sides; the ears are long and pointed. There is a downy fur over the whole body, particularly on the back. The lips of the male project several lines beyond the teeth, and as completely hide the gape of the mouth as in some large mastiffs, producing a singular physiognomy. The downy fur clothes all the humeral region, and the margin of the alar membrane adhering to the sides; this, and that of the head, short, and not very abundant, is of a reddish isabelle hue, redder upon the back and erupper; the root of the ears, and their posterior margins, are covered with white hairs. From each side of the neck, of a reddish-brown colour, there arises a large pure white tuft of long hair; these large tufts, probably covering as usual an unctuous apparatus, form two bunches, the hairs of which diverge as from a common centre. The chest, humeral region, sides, and coccygeal region, are of a light red; the middle of the abdomen, where the hair is short and smooth, is of a dull white. All the membranes have the colour of a decayed leaf.

The female is destitute of the cervical tuft, and labial peculiarity, but is nearly the same in regard to the markings.

M. Botta presented to the Paris Museum two individuals of this new and beautiful species, discovered in his Abyssinian travels. The Leyden specimens were derived, one, without label, from London, and the other from M. Botta's collection.

(B.) TAILED ROUSSETTES. (ROUSSETTES AVEC UNE PETITE QUEUE.)

M. Geoffroy was the first to describe the species of this subdivision. One of them (*Pteropus Ægyptiacus*) is found in Egypt in the cavities of the Pyramids, and another, with a tail not quite so

long, and engaged to about the extent of a half in the membrane, (*Pter. amplexicaudatus*), comes from the Indian Archipelago.

The section of the TAILED ROUSSETTES is distinguished from the previous one by other characteristics than that expressed by their name; for in them we find that the one half of the thumb is engaged in the alar membrane, and the mammæ are placed higher up than the insertion of the arms; while in the *Tailless Roussettes*, the whole of the thumb is free, and the mammæ are placed underneath the insertion of the humerus. All the species comprehended in this section are likewise small, or of medium size. M. Isidore Geoffroy informs us that he has examined the crania of the majority of them, and found some interesting characters which seem to be common to them all. In the species without a tail, the cerebral cavity is separated from the face by a considerable contraction, corresponding in situation to the posterior part of the orbit, whilst in those which have this appendage, there is no appearance of the contraction, as M. Geoffroy had previously remarked in the *Pteropus marginatus*. In these last, moreover, the cranium is somewhat more developed, and the muzzle is not so slender. The dental system presents no particular character. The small false molar is usually found in the upper jaw, but very insignificant and almost useless, whilst it is often quite wanting in other species. These distinctions are more conspicuous in the smaller species than in the larger.

22. PTEROPUS STRAMINEUS.—STRAW-COLOURED ROUSSETTE.

Syn. LA ROUSSETTE PAILLÉE.—PTEROPUS STRAMINEUS.—Geoff. Ann. Mus. XV. 95.—Temm. Mon. Mam. I. 195, II. 84.—Isid. Geoff. in Dict. Class. d'Hist. Nat. (art. Roussette.)

Icon. Temm. Mon. Mam. pl. 15, fig. 12 and 13, (teeth and cranium.)

SPECIFIC CHARACTERS.

THE HAIR dull yellow above, greyish beneath; a demi-collar of golden-red hairs on the sides and front of the neck in the males only.

THE TAIL very short.

INHABITS Sennaar and Sencgal.

For a long time this Bat was thought to be an inhabitant of the island of Timor, and it is still generally described as derived from that locality. There would appear, however, to be a mistake in this; and its residence is now ascertained to be Africa, in the neighbourhood of Sennaar and Senegal.

Though the total length is about eight inches, that of the tail does not extend beyond two lines. In the *adult male* the fur is smooth, very short, and thin. The region of the sides and front of the neck is adorned with a demi-collar of golden-red hairs, which are diverging and unctuous, and confined to the males. In the female these parts are of a dull yellow colour, more or less clouded with light brown. The rest of the fur is the same in both sexes. Above it is yellowish, or of a dull white, the points of the hairs being brown or ash-coloured; yellow prevails about the ears; the middle part of the chest and of the belly is grey, clouded with brown; the remainder of the inferior parts, and the under parts of the legs and wings, are of a dull pale yellow.

23. PTEROPUS ÆGYPTIACUS.—EGYPTIAN ROUSSETTE.

Syn. PTEROPUS ÆGYPTIACUS.—Geoff. Ann. Mus. XV. 95.
ROUSSETTE GEOFFROY.—PTEROPUS GEOFFROYI.—Temm. Mon. Mam. I. 197.—Isid. Geoff. in Dict. Class.

Icon. Geoff. Descr. d'Egypt. I. pl. 3, fig. 2.

SPECIFIC CHARACTERS.

THE HAIR short and woolly, dull grey, deeper above. THE MEMBRANES brownish-grey. THE INTERFEMORAL broad. THE TAIL very short, one half surrounded by the membrane.

INHABITS Northern Africa and Senegal.

M. Temminck, as appears in the synonyma, has proposed a name for this species, different from that originally bestowed by M. Geoffroy, its first describer, at the same time paying him a well-merited compliment. The motive which influenced him was, that this Roussette was not confined to Egypt, but extended widely throughout Africa. Now, though this consideration, had it been known at the time, might have induced M. Geoffroy to avoid the appellation, yet, having been once fairly affixed, it should be preserved. The reasons for this are numerous and urgent, and quite sufficient, we apprehend, to vindicate us for not following even the high au-

¹ GEOFF. DESCR. D'EGYPT.—Description de l'Égypte, ou Recueil des Observations et des Recherches faites pendant l'expédition de l'armée Française.—Paris, 1809, et seq.

thority of M. Temminck. M. Geoffroy informs us that he himself detached many individuals of the species from the ceiling of one of the chambers of the Great Pyramid, and hence he could have no doubt of one of its habitats. Subsequent investigation, however, has shown that it is found at Senegal, and is now supposed to be common to the whole of Northern Africa.

The muzzle of this Roussette is short, and the eyes equidistant between the nostrils and ears. The interfemoral membrane is broad, surrounding the coccyx, and enveloping half of the very short tail, the upper portion of which member is covered both above and below with long and frizzly hair. The incisors are small, narrow, and symmetrically arranged; the inferior are detached, and, like the upper, placed in pairs; the false molars are very small. The fur is short, woolly, and close, except in the front of the neck, where the hairs are long and fewer. A dull grey forms the prevailing hue, which is deeper above than below; the membranes are brownish-grey. The thumb is proportionally not so long as in the other species.

24. PTEROPUS LESCHENAULTII.—SPOTTED ROUSSETTE.

Syn. LA ROUSSETTE LESCHENAULT.—Isid. Geoff. in Dict. Class. d'Hist. Nat. XIV. 702.—Temm. Mon. Mam. II. 86.—Desm. Mam. sp. 142.

Icon.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown above, light fawn beneath; the neck with a fawn-coloured collar. THE ALAR MEMBRANE spotted with white in parallel lines.

THE TAIL very short, nearly free from the interfemoral membrane.

INHABITS the East Indies.

Specimens of this species have for a considerable time existed in the Paris Museum, and, more lately, three have been introduced into the collection at Brussels. It was originally discovered by the Naturalist whose name it bears, in the neighbourhood of Pondicherry, and M. Roux found specimens at Calcutta. The tail is almost entirely free from the interfemoral membrane, and about six lines long. The Spotted Roussette is of a light fawn colour on the abdomen, and greyish-brown on the back; the back of the neck has a fawn-coloured collar upon it, and the head is dark brown. The ears are short and round. The superior and anterior portion of the membrane is marked with a number of whitish spots, ranged in parallel lines, more distinct in the young than in the aged. It is by mistake that M. Desmarest and Hamilton Smith have placed this species among the Tailless Bats.

25. PTEROPUS AMPLEXICAUDATUS.—LONG-TAILED ROUSSETTE.

Syn. LA ROUSSETTE AMPLEXICAUDE, (P. AMPLEXICAUDATUS.)—Geoff. Ann. Mus. XV. 96.—Temm. Mon. Mam. I. 200.

Icon. Ann. Mus. XV. pl. 4, copied in Temm. Mon. Mam. I. pl. 13,—II. pl. 36, fig. 18 and 19, (cranium and teeth.)

SPECIFIC CHARACTERS.

THE HAIR russet brown above, red brownish-grey beneath.

THE TAIL as long as the femur, partly surrounded by the interfemoral membrane.

INHABITS Timor, Amboyna, Sumatra, and the adjacent parts of Asia.

This species is about the size of the Common Bat of Europe, (*Vespertilio murinus*;) its eyes are equidistant between the eye and the nostril; the alar membranes approximate on the medium line of the back; the interfemoral is quite naked, and involves the upper part of the tail, which equals in length a line drawn from the anterior margin of the eye to the point of the nose. The incisors are small and symmetrically arranged; the muzzle rather long. The fur is fine, smooth, and very short, though close; it covers the extremities very imperfectly, and is quite wanting on the membranes of the side. The back, too, is but partially covered. Russet brown is the marking of the head and upper parts of the body, whilst a red brownish-grey, somewhat tinged with the colour of wine lees, is the tint of the under: in the male the red predominates, in the female the brown. All the members are of russet brown, and the fingers of yellow-brown, which is also the colour of the naked tail. In the young the body is very sparingly covered with soft, fine, and sleek hairs.

The discovery of this species is due to Messrs Lesson and Lesueur, during their voyage to Southern Australia. Messrs Diard and Duvaucel also mention, it has been captured in the neighbourhood of Bencoolen, and Temminck has examined specimens sent from Siam.

26. PTEROPUS HOTTENTOTTUS.—HOTTENTOT ROUSSETTE.

Syn. ROUSSETTE HOTTENTOT, (P. HOTTENTOTTUS.)—Temm. Mon. Mam. II. 87.—Smuts¹ Mam. Cap. p. 3.

Icon. Temm. Mon. Mam. II. pl. 36, fig. 16 and 17, (cranium and teeth.)

SPECIFIC CHARACTERS.

THE HAIR light grey and brown above; dull brown beneath. THE MEMBRANES covered with hair beneath only.

THE TAIL short, free at the base.

INHABITS Southern Africa.

The size of the Hottentot Roussette is somewhat larger than that of the *Amplexicaudatus*; the alar membranes are similar in their connection and form, but better furnished with hair on their inner side; the same remark applies to the interfemoral membrane, which has the appearance of the letter V reversed. The tail commences at this point; it is quite free, but does not extend beyond the margin of the membrane; its length only equals one half of the distance from the anterior margin of the eye to the point of the nose, or the half only of that of the *Amplexicaudatus*. The incisors are very small, symmetrically arranged, and contiguous; there is a space between the molars. The ears are short and rounded; the muzzle long and compressed. The very short fur is fine, smooth, and close; possessing two colours above, and only one underneath; above, the hairs are light grey at their base, and brown at the point, inclined to a russet shade in the male, and to dull brown in the female; all the inferior parts, in both sexes, are mouse-coloured.

This species, therefore, presents the following distinguishing characters; the shape of the interfemoral membrane at the coccyx, the shortness of the tail, which is free in the groove, and the length of the muzzle; these, together with its greater size, readily distinguish it from the *Amplexicaudatus*, with which it might most easily be confounded. The Hottentot Roussette has no indication of a siphon or of odoriferous glands. It is found in the neighbourhood of Cape Town, and also in the interior.

27. PTEROPUS LEACHII.—LEACH'S ROUSSETTE.

Syn. PTEROPUS LEACHII.—Dr Smith, in Zool. Jour. IV. 443.—Temm. Mon. Mam. II. 88.—Smuts Mam. Cap. p. 5.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brownish-grey above; dull grey beneath. THE MEMBRANES blackish.

THE TAIL short and free.

INHABITS Southern Africa.

Leach's Roussette received its name and first description from the well known Naturalist, Dr A. Smith. It has the same locality with the last named, and Dr S. informs us that it is found abundantly in the gardens about Cape Town, during the fruit season, and often proves very destructive to vineyards in the night. The colour above is a sort of brownish-grey, beneath a dull pale smoke grey. The incisors are short, strong, regular, and rounded at the tips; the head long; ears of moderate length, and rounded at the apices; the membranes are blackish, the interfemoral one only edging the inner side of each hinder extremity; the tail is free.

28. PTEROPUS MARGINATUS.—BORDERED ROUSSETTE.

Syn. LA ROUSSETTE À OREILLES BONDÉES, (P. MARGINATUS.)—Geoff. Ann. Mus. XV. 97.—Temm. Mon. Mam. I. 202.

Icon. Ann. Mus. XV. pl. 5, copied in Temm. Mon. Mam. I. pl. 14.

SPECIFIC CHARACTERS.

THE HAIR olive brown; a white border round the ears.

THE TAIL very short, almost free.

INHABITS Bengal.

The incisors of this species are very slender, and symmetrically arranged, though almost crowded between the canines; the eyes are equidistant between the nostrils and ears; these appendages are of medium size, and bordered with a very distinct margin; the tail is exceedingly short, and connected at its root with the interfemoral membrane; the upper part of the humerus and alar membrane are well clad. The fur generally is spare, short, of an olive brown colour; the chanfrin is somewhat full.

A single individual of this species was sent to Paris from Bengal by the late M. Macé, and from this M. Geoffroy's original description (which has served for all the subsequent ones) was taken; a re-examination is desirable, though its specific characters are sufficiently distinct.

¹ SMUTS MAM. CAP.—Dissertatio Zoologica, Enumerationem Mammalium Capensium continens. Auctore Johanne Smuts. Leidæ, 1832.

To this place we are inclined to refer certain Bats from Western Africa, described by Messrs Bennett and Gray under the name of *EPOMOPHORUS*.

29. PTEROPUS WHITII.—WHITE'S ROUSSETTE.

Syn. *EPOMOPHORUS WHITII*.—Gray, in Mag. Zool. and Bot. II. 504.

PTEROPUS WHITII.—Benn. in Trans. Zool. Soc.

Icon. *PTEROPUS WHITII*.—Benn. in Traos. Zool. Soc. II. pl. 6.

SPECIFIC CHARACTERS.

THE HAIR pale brown above, whitish beneath.

AN ODORIFEROUS GLAND on each side of the neck, covered by bunches of white hair—in the male only?

INHABITS Western Africa.

At the first glance of White's Roussette, the attention is arrested by a singular projecting patch of long white hairs placed on each side of the neck in front of the shoulders, and looking almost like a mass of white feathers. As we have no where seen this singular ornament of a considerable number of Bats, so minutely described as by the late Mr Bennett, we shall here transcribe his words. "The oval patch on either side of the neck, occupied by the white and peculiar tufts, measures about an inch in its longest diameter, which is from before backwards. The skin in this part has no other covering than that which is peculiar to the spot itself. This consists of straight, soft hairs, which diverge in all directions as from a common centre. Those that are situated towards the middle of the patch are longer than the others, and are partly directed forwards and partly backwards, having generally a dorsal inclination: their length is twice as great as that of the longer hairs of the body. The mode of their insertion into the skin is unlike that of the ordinary fur: in the latter, the hairs are implanted either singly, or a few only near each other, so that the covering of these becomes nearly uniform; in the patches on the sides of the neck, the hairs are gathered together into bundles, and are inserted in fascicles into the skin, leaving between the several minor tufts interspaces altogether naked. Each of the separate fascicles contains probably from fifty to sixty hairs: and the approximation of these at their base, and their divergence towards their tips, might almost be regarded as bearing a distant analogical resemblance to the quill and dilatation of the feather of a Bird." Considerable obscurity still hangs over the precise use of this apparatus. M. Temminck is of opinion, as already stated, that the diverging hairs cover a glandular structure which secretes an odorous substance, "which may probably afford indication to these animals in the season of their amours;" and Mr Bennett suggests, that the secretion poured forth may serve to sheath and protect a projecting part of the animal from the friction to which it must be subjected during its passage through the air.

The incisors are small and regular; the canines of intermediate size: the first false molar in the lower jaw is small, and of the normal form, but the second in this jaw, and the first in the upper, are of the same forms as the canines, and very little inferior to them in size, so that when the mouth is opened there appear to be four canines in each jaw; next follows in either jaw a tooth with a large lobe upon the outer edge, and a small one within, which is of the intermediate form between the true and false molars; after which come two normal molars in the lower and one in the upper jaw. The molars are separated from each other by a vacant space.

The fur of the body is closely set and soft, and consists of slightly wavy hairs of moderate length. It extends along the anterior extremities nearly as far as the wrist, densely covering the limbs; and is equally furnished on the hinder limbs as far as the ankle. The interfemoral membrane is entirely invested with fur. On the alar membrane there are a few hairs in small distant tufts. The colour is dark brown above, somewhat lighter beneath.

The only ascertained habitat of this species is Western Africa.

30. PTEROPUS MACROCEPHALUS.—GREAT-HEADED ROUSSETTE.

Syn. *EPOMOPHORUS MACROCEPHALUS*.—Gray, in Mag. Zool. and Bot. II. 504.

PTEROPUS MACROCEPHALUS.—Ogilby, in Proc. Zool. Soc. III. 100.

P. MEGACEPHALUS.—Swainson, in Lard. Cab. Cyc. LXXII. 92, 356.

SPECIFIC CHARACTERS.

THE HAIR pale dull fawn above, paler beneath; fascicled and diverging on the sides of the neck.

INHABITS Western Africa.

This Roussette has been procured in the same locality as the former, and possesses, it would appear, precisely the same dentition. These circumstances would apparently indicate the necessity of distinguishing them as a separate group; but we agree with Mr Bennett in thinking, "that the dentary character of the Bats seems to vary so irregularly, that it would be hazardous to rely on them alone for generic distinctions."

The Great-headed, like White's Roussette, has tufts upon the neck, but so little conspicuous that they would be overlooked if the attention were not specially directed to the ascertaining their existence. The hairs of the sides of the neck, of a pale dull fawn colour, are generally slightly larger than the adjoining ones, and pass insensibly into those of the under surface, which resemble them in all respects except in being paler. On separating the fur so as to allow an inspection of its mode of insertion, a part will be found in which the hairs are implanted in bundles, and have a tendency to diverge as from a common centre. The coat above is generally of a deep fawn colour; beneath paler; and there is a conspicuous white spot on the bore of the ear.

DOUBTFUL SPECIES.

1. *P. GAMBIANUS*, (Ogilby, in Proceed. Zool. Soc. III. 100,) from Western Africa, is said to have the head moderately long, and a tuft of white hairs at the front base of the wing.

Mr Ogilby describes the dental system of this species as precisely similar to that of Nos. 29 and 30; and it is upon this circumstance that Mr Gray forms these three species into his genus *Epomophorus*. We fear, however, that this is a hasty classification; and agree with Mr Bennett, that it is "more advisable to abstain from regarding this genus as constituted."

IMAGINARY SPECIES.

1. *PTEROPUS JAVANICUS* (Horsf. Zool. Jav.) does not differ specifically from *P. edulis*.

2. *P. PALLIATUS* (Geoff. Ann. Mus. XV. and Desm. Mam.) is the young of *Cephalotes Peronii*.

3. *P. MEDIUS* is identical with *P. Edwardsii*.

Note.—*Pteropus minimus* (Geoff. Ann. Mus.) is now transferred to the Genus *Macroglossus*; *Pteropus melanocephalus* and *P. tithæcheilus* belong to the modern Genus *Pachysoma*.

M. Isidore Geoffroy-St-Hilaire has given a monograph of this family in the Diet. Class. d'Hist. Nat., art. Roussette. He has formed the genus *PACHYSOMA* with the *Pteropus tithæcheilus* of Temminck, and some allied species, on account of their having four molars less, while the zygomatic arches are more prominent than in the others. Of the *Pteropus minimus* or *rostratus*, he has composed the genus *MACROGLOSSUS*; its muzzle is longer and more slender; some vacant intervals appear between the molars, and its tongue is believed to be extensible. Finally, he has separated the *CEPHALOTES* of Pallas from that of Peron, to the latter of which he has assigned the term *HYPODERMA*, on account of the insertion of its membranes and wings being wholly dorsal.

GENUS II. PACHYSOMA.—STOUT-BODIED ROUSSETTES.

Syn. *PACHYSOMA*.—Isid. Geoff. in Diet. Class. XIV. 703.—Temm. Mon. Mam. II. 91.

PTEROPUS, (in part.)—Temm. Mon. Mam. I. 198.

GENERIC CHARACTERS.

THE HEAD spheroidal, large. THE MUZZLE large. THE ZYGOMATIC ARCHES prominent.

THE THUMB inserted for one half of its length in the membrane.

THE MAMMÆ placed before the arm-pit.

THE DENTAL FORMULA $\frac{2+2+C+(F+3)M}{2+C+(F+4)M} = \frac{14}{16} = 30$

This genus, instituted by M. Isid. Geoffroy, comprehends several species of a small size, which have hitherto been classed with the previous one, (*Pteropus*), and from which they are distinguished by the following peculiarities: Their form is generally heavy and stout,—whence their name; their head is large and short, principally in front, necessarily leading to corresponding modifications in the dental system. In the *Pachysoma*, accordingly, we find but 30 teeth, instead of 34, there being a molar less on each side of each jaw, and that the last, and not the second one, as might be supposed. The form of the cranium is also remarkable; the muzzle is large, and the cerebral cavity very voluminous and spheroidal; whilst between them there is a marked compression, though not equal to that found in the great Roussettes. The space between the cranium and the zygomatic arch is, however, much larger than in the ordinary Roussettes; and the muscles which go to the lower jaw are correspondingly large. Lastly, the mammæ are placed anterior to the insertion of the humerus.

Their habits, moreover, are nocturnal, and they never issue from their

retreat except at the twilight, or after dark. Holes and crevices of trees are their habitual residences; their flight is rapid but irregular; their cry strong, and very piercing; and their bite painful. A penetrating and peculiar odour extends widely around them.

1. PACHYSOMA TITTHÆCHEILUM.—WART-LIPPED STOUT-BODIED ROUSSETTE.

Syn. PTEROPUS TITTHÆCHEILUS, (ROUSSETTE MAMMILÈVRE.)—Temm. Mon. Mam. I. 198.

PACHYSOME MAMMILÈVRE.—Isid. Geoff. in Dict. Class. d'Hist. Nat. (art. Roussette.)

Icon. Temm. Mon. Mam. II. pl. 35, fig. 8, (head.)—I. pl. 15, fig. 17 to 24, (crania and teeth.)

SPECIFIC CHARACTERS.

THE HAIR russet-brown above, grey beneath; on the neck, nape, and sides of the chest, bright rose colour, in the males only.

THE UPPER LIP with two large warts separated by a furrow.

THE TAIL short, enveloped, the point free.

THE INTERFEMORAL MEMBRANE deeply sloped, naked beneath only.

INHABITS Java, Sumatra, Cochinchina, and probably India.

This Stout-bodied Roussette is about the size of the *Pteropus Ægyptiacus*, (No. 23,) or a trifle larger. A small portion of the front of the neck is naked; the muzzle is short, the eye nearer the nostrils than the ear; this appendage is small, keel-shaped towards the point of the posterior margin, marked with transverse ridges towards its base, and fringed with a white border. The nostrils are widely separated, somewhat tubular; on the upper-lip there are two large warts, separated by a furrow, and the lining membrane of both are dotted with small papillæ. The tail is short, nearly wholly enveloped in the interfemoral membrane, its slender termination being alone free. The interfemoral membrane, deeply sloped, is clad above; whilst its other surface, together with the four extremities, are naked. The incisors are slender and contiguous, the lower ones somewhat crowded; there is a small anormal molar in both jaws; the canines have a strong internal heel. The fur is fine, sleek, and very short, with the exception of that on the sides of the neck, and longer in the male than the female. The former has a tuft of diverging hair proceeding from a common centre, on each side of the neck, placed over odoriferous glands.

In the *male*, the front of the neck, the tufts, the nape, and the sides of the chest, are of a beautiful rosy tint, more or less lively, and verging to orange in the old; the superior parts of the body are russet-brown, the abdomen grey. The *female*, which is always larger than the male, has the superior parts of a greyish-brown, inclining to olive; the under are olive-grey; the front of the neck and upper part of the chest are naked, and the fringe round the ear is less distinct than in the male. The *young* of a year old are throughout of a very light brownish-grey, and the tufts are whitish. The secretion from this glandular apparatus has a strong odour, which is more offensive at particular seasons of the year.

2. PACHYSOMA MELANOCEPHALUM.—BLACK-HEADED STOUT-BODIED ROUSSETTE.

Syn. PTEROPUS MELANOCEPHALUS, (ROUSSETTE MÉLANOCÉPHALE.)—Temm. Mon. Mam. I. 190.

PACHYSOME MÉLANOCÉPHALE.—Isid. Geoff. in Dict. Class. d'Hist. Nat. (art. Roussette.)—Bélang. Voy. p. 97.

Icon. Temm. Mon. Mam. I. pl. 12.—II. pl. 36, fig. 10, (head.)

SPECIFIC CHARACTERS.

THE HAIR yellowish-white, tipped with grey above; dull pale yellow beneath; the head black.

THE TAIL wanting. THE INTERFEMORAL MEMBRANE rudimentary, and nearly concealed.

INHABITS Java.

We owe the discovery of this very small species, scarcely three inches long, to M. Von Hasselt, who first became acquainted with it during a journey in the least frequented parts of the Island of Java; the district was mountainous, but he found a small family of them suspended upon a tree. It is quite destitute of a caudal appendage; its ears are small, short, and round; the interfemoral membrane rudimentary, and nearly hid by the hair. The muzzle is very short; the incisors contiguous and symmetrically arranged, the anormal tooth in both jaws is well marked. The fur is long and abundant, except on the front of the neck; even the fore-arms and the legs are well clad. The hair upon the back is yellowish-white, tipped with dark grey; the nape, crown, and muzzle, are black; there is a tuft on each side of the neck; all the under parts of the body are of a dull pale yellow; the skin itself is of a deep brown colour.

3. PACHYSOMA BREVICAUDATUM.—SHORT-TAILED STOUT-BODIED ROUSSETTE.

Syn. PACHYSOME À COURTE QUEUE, (P. brevicaudatum.)—Temm. Mon. Mam. II. 92.—Isid. Geoff. in Dict. Class. d'Hist. Nat. (art. Roussette.)

Icon. Temm. Mon. Mam. II. pl. 35, fig. 9, (head.)

SPECIFIC CHARACTERS.

THE HAIR reddish-olive above; grey beneath; the neck bright red; the head ash-grey.

THE TAIL very short.

INHABITS Sumatra and the Continent of India.

This species might readily be confounded with our No. 1, (*P. titthæcheilum*), as far as regards its markings and the tufts on the neck; but it is at once distinguished by the extreme shortness of the tail, which does not extend beyond the interfemoral membrane more than half a line. The head is small, the muzzle very short and obtuse, the margin of the ear is fringed as in No. 1. The incisors are small, and symmetrically arranged; the canines are large and obtuse. The fur on the sides of the neck is long and strong, hiding the secreting apparatus; the under parts are furnished with silky hairs; in the adult, frequently the chin and front of the neck are almost naked. In the adult *male* the head is an ash-grey; the sides of the neck bright red, the chest and abdomen grey, the flanks russet, the superior parts of an olive tint, more or less verging to red. In the *female* there are the following differences; the long hair of the neck is reddish-grey, and the under parts are ash-coloured, whilst olive-brown prevails above. This species was first particularly described by M. Isidore Geoffroy, and was captured by Messrs Diard and Duvaucel in the Island of Sumatra. It has also been procured from India.

4. PACHYSOMA ECAUDATUM.—BLUNT-NOSED STOUT-BODIED ROUSSETTE.

Syn. PACHYSOME ÉCAUDÉ, (P. ecaudatum.)—Temm. Mon. Mam. II. 94.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dark brown above, ash-grey beneath.

THE MUZZLE obtuse. NOSTRILS projecting. THE TAIL wanting.

INHABITS Sumatra.

The name applied by M. Temminck to this newly introduced species will not be regarded fortunate, when it is considered that the *Melanocephalum*, which has long been known, is likewise destitute of the tail. This species is, however, remarkable for the shortness of its alar membranes, the great obtuseness of its muzzle, its projecting nostrils, and for having no fringe on the margin of the ear. Only one individual has been examined, and this an old female. Its fur was very short, of a pale grey colour at the nape and the sides of the neck, and sooty-brown on the head, and over the rest of the superior parts; the ears are black, and without margins. The under parts of the body were of an ash-grey colour. The membranes are brown, and so are the fingers which support them.

This specimen came from Sumatra.

5. PACHYSOMA DIARDII.—DIARD'S STOUT-BODIED ROUSSETTE.

Syn. PACHYSOME DE DIARD, (PACHYSOMA DIARDII.)—Isid. Geoff. in Dict. Class. d'Hist. Nat., art. Roussette.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brown above; whitish or yellowish beneath; the fore part of the neck naked.

THE FACE very obtuse. THE TAIL long; free for two-thirds of its length.

INHABITS Sumatra.

This species was discovered by Messrs Diard and Duvaucel in Sumatra, and first described by M. Geoffroy. Its fur is very short; brown on the head, back, and arms, grey round the neck, and on the middle of the abdomen, and greyish-brown on the flanks. Its tail is rather long, and extends seven or eight lines beyond the interfemoral membrane. Its face is very obtuse, and there is a naked spot on the front of the neck.

DOUBTFUL SPECIES.

I. PACHYSOMA DUVAUCELII, (Isid. Geoff. in Dict. Class. d'Hist. Nat., art. Roussette.) This species has very slender claims to be considered as real; and Temminck, from actual examination, thought it belonged to *P. titthæcheilum*, our No. 1.

GENUS III. MACROGLOSSUS.—GREAT-TONGUED ROUSSETTES.

Syn. PTEROPUS, (in part.)—Temm. Mon. I. 191.—MACROGLOSSUS.—F. Cuv. in Dents des Mamm. p. 40.—MACROGLOSSUS.—Isid. Geoff. in Dict. Class. XIV. 705.—MACROGLOSSA.—Less. Mam. p. 115.—Gray, in Mag. Zool. et Bot. p. 504.

GENERIC CHARACTERS.

THE HEAD elongated. THE MUZZLE slender, almost cylindrical.

THE TONGUE long, slender, and exsertile.

THE ALAR MEMBRANES arising from the sides of the back.

THE DENTAL FORMULA $\frac{2+C+(F+4)}{2+C+(F+5)} \frac{M=16}{M=18} = 34$

INHABITS the East Indian Archipelago.

The Genus *Macroglossus* constitutes the third of the Frugivorous Chiroptera. The generic distinction consists not solely in the prolongation of the muzzle, or maxillary bones, but also in the peculiar form of the intermaxillary, which is not in them, as in most animals, a part of a circle more or less prominent, and projecting no farther than the canines, as in the *Pachysoma* and the *Harpies*, but in this genus forms an obtuse cone, for the support of the muzzle, contributing to its prolonged form. This prolongation varies not so much among individuals of different ages, as according to the localities in which the animals have lived. Thus, those from Sumatra have an exceedingly long snout; and those from Java have a somewhat shorter one than those from Timor; that of the Amboyna animals is remarkably short, compared with those from Sumatra; whilst, in specimens from Celebes, the muzzle is much more slender, and a little longer than those from Amboyna. The local difference is great, but seems to depend solely upon the different lengths of the muzzle.

1. MACROGLOSSUS MINIMUS.—KIODOTE OR GREAT-TONGUED ROUSSETTE.

Syn. PTEROPUS MINIMUS, (LA ROUSSETTE KIODOTE.)—Geoff. Ann. Mus. XV. 97.—Temm. Mon. Mam. I. 191.—Desm. Mam. Suppl.

MACROGLOSSUS MINIMUS.—F. Cuv. in Dents Mamm.—Isid. Geoff. in Dict. Class.

MACROGLOSSA KIODOTES et M. HORSFIELDII.—Less. Mam. 115.

Icon. KIODOTE.—F. Cuv. et Geoff. Hist. Mam.

PTEROPUS ROSTRATUS.—Horsf. Jav.

Temm. Mon. Mam. I. pl. 15, fig. 25 to 30, (crania and teeth,) pl. 16, fig. 1, 2, (skeleton.)

SPECIFIC CHARACTERS.

THE HAIR light red, tinted with yellow above; light russet beneath.

THE INTERFEMORAL MEMBRANE very narrow, covered with hair above.

THE TAIL rudimentary.

INHABITS the East Indian Archipelago.

This long-muzzled Bat was first discovered by M. Leschenault, in Java, who called it *Kiodote*, supposing this to be the name applied to it by the natives. From M. Leschenault's notes, M. Geoffroy published a description in the year 1810, and Dr Horsfield gave another from the examination of several specimens, in his Zoological Researches, in 1824. He seems to have regarded it an undescribed species; and states that by the Javanese it is called *Louvo-Assu*, literally *Dog-Bat*. It was M. F. Cuvier who proposed to arrange it in a distinct genus, and for the following reasons, which appear perfectly satisfactory.

It may be distinguished at first glance, not only from the Roussettes, but from every other kind of Bats, by its very prolonged and slender muzzle, which is also cylindrical and pointed, somewhat like that of the Ant-eaters. The tongue also is cylindrical, long, and extensible, conforming to the shape of the snout. Finally, the teeth exhibit equally remarkable characters; for, notwithstanding the elongation of the muzzle, their number is not augmented, and, what is remarkable, they are likewise of smaller dimensions. The whole of the jaw, moreover, is not supplied with teeth, especially the lower one, where a wide interval exists between the incisors of the right and left sides; another is found behind the first and second molar, and a third behind the last molar.

To these more specific characters we have still to add, that the interfemoral membrane is very narrow, extending, however, from the feet to the coccyx, where it encounters the slender rudiments of a tail. The lower jaw is placed at an acute angle, and projects beyond the upper one: it is more slender than in any other species. The fur is short, close, and somewhat woolly. All the upper parts of the body are of a light red, somewhat tinted with yellow towards the root of the hairs. The under parts are of a light russet hue. The interfemoral membrane is clad above, and the hairs extend beyond the membrane; the whole cutaneous system is of reddish hue.

Dr Horsfield supplies the following information concerning the habits of the *Louvo-Assu*: "It is far less abundant than the *Kalong*—(The Edible Roussette, No. I.;) but it still exists in sufficient numbers to commit serious injury among the plantations and fruit trees. Like other species of *Pteropus*, it feeds on fruits of every description, but particularly infests the various species of *Eugenia* or *Jambu*, which are cultivated in gardens. During the day it remains suspended under branches of trees, or retires under roofs of old houses and sheds. At night it sallies forth, like the species *Pteropus*."

It inhabits Java, Timor, and the surrounding islands. Its existence on the Continent of India has not yet been proved.

GENUS IV. HARPYIA.—TUBE-NOSED ROUSSETTES.

Syn. CEPHALOTES, (in part.)—Geoff. Ann. Mus. XV. 104.

VESPERTILIO, (in part.)—Linn. Gmel. I.

HARPYIA.—Illig. Prodr. p. 118.—Temm. Mon. Mam. II. 98.

GENERIC CHARACTERS.

THE HEAD large and broad. THE MUZZLE thick and very short. THE NOSE prolonged into two diverging tubes, round, cleft externally, and terminated with a projecting margin.

THE ALAR MEMBRANE arising from the sides of the back.

THE THUMB partly covered by the membranes. THE INDEX with a third phalanx and claw.

THE DENTAL FORMULA—

In the Old, $\frac{2+C+(F+3)}{\dots C+(F+4)} \frac{M=12}{M=12} = 24$

In the Middle Age, $\frac{2+C+(F+3)}{1+C+(F+4)} \frac{M=12}{M=14} = 26$

Not well known in the Young.

INHABITS Amboyna.

This genus is founded upon a single species, the *Vespertilio Cephalotes* of Pallas, well described and delineated in all its details by the eminent German Naturalist. Illiger, in his *Prodromus*, first constituted it into the genus *Harpysia*. M. Geoffroy associated it with another of the Chiroptera, described by Péron, classifying them under the genus *Cephalotes*. M. Isidore Geoffroy, in his monograph of the Frugivorous Bats, in 1828, so often quoted above, demonstrated the necessity of separating the so-named *Cephalotes* of Pallas from that of Péron, herein agreeing with Illiger in an arrangement which is now very generally adopted. M. Isidore Geoffroy applies the generic term *Cephalotes* to Pallas' species, and proposes the name *Hypoderma* for that of Péron. We agree with Temminck in thinking this innovation unnecessary, and therefore follow Illiger as to Pallas' species, and apply the term *Cephalotes* to another group.

The osseous cerebral covering of the Harpy Roussette is spheroidal and very large; the zygomatic arches are strong and much detached; the lower jaw is long, much rounded, very slender, and terminated by canines curved forward, completely inclosing the small upper incisors of the intermaxillary bone. The fore-finger of this Bat has a claw upon it, exhibiting in this particular a striking difference to the genus *Cephalotes*, which, although it has the terminal phalanx, is destitute of the nail. It has also thirteen pair of ribs, and not fourteen, as in this last named genus. The tail is partly concealed in the interfemoral membrane, as in the succeeding genus; but not to the same extent as in the preceding. The alar membrane rises from the sides, and covers the whole of the metatarsal bones, extending to the middle finger, into which it is fixed, covering the two internal ones. The incisors, as they have been called, in the lower jaw, have given rise to controversial remarks. In adopting the common nomenclature, we follow the example of most Naturalists; although M. Geoffroy contends they are true canines, as Pallas had pointed out before. It is quite true, that these teeth in this animal have the same direction and form; and M. Isidore Geoffroy has, moreover, remarked, that were we to extract the so designated incisor of the *Harpysia*, and the canine of the *Pachysoma*, the most experienced eye could not determine any difference between them.

1. HARPYIA PALLASII.—PALLAS' TUBE-NOSED ROUSSETTE.

Syn. VESPERTILIO CEPHALOTES.—Linn. Gmel. I. p. 50.

CEPHALOTES PALLASII.—Geoff. Ann. Mus. XV. 107.—Desm. Mam.

HARPYIA PALLASII.—Temm. Mon. Mam. II. 101.

MOLUCCA BAT.—Penn. Quadr. II. No. 503.—Shaw, Gen. Zool. I. 134.

Icon. VESPERTILIO CEPHALOTES.—Pall. Spicil. Zool. III. pl. 1, (skeleton &c.,) pl. 2.—Copied in Schreb. Säugth. pl. 61.

HARPYIE DE PALLAS.—Temm. Mon. Mam. II. pl. 40, fig. 1 and 2,—(cranium and teeth,) fig. 3, 4, and 5.

CEPHALOTE.—Buff. Hist. Nat. Suppl. III. pl. 25.

SPECIFIC CHARACTERS.

THE HAIR clear ash-brown above, whitish beneath; on the tubes of the nose, ears, and tail, bright yellowish-brown.

THE MEMBRANES yellowish-red, marked with irregular whitish spots. THE INTERFEMORAL cleft in the middle, partly covering the tail. THE TAIL short.

INHABITS Amboyna.

Pallas' Tube-nosed Roussette possesses the same dimensions with the Common Bat of Europe, *Vespertilio murinus*. Its head is nearly oval; its muzzle short and broad; its nostrils prolonged into two diverging tubes, which are round, cleft in the outer side, and terminated by a projecting border. The upper lip also is cleft, and supplied with a double row of small whiskers; there is also a short tuft of hairs above the eyes. The ears are wide apart, naked, round, and short; there is a hooked nail upon the fore-finger, as well as upon the thumb, of which the half is enveloped in the alar membrane; the tail is covered above, and half concealed by the interfemoral membrane, which is broad, and supported by the cartilages of the tarsi, which are short. The membranes of the wings arise from the sides; they are very large, and completely cover the metatarsal bones, attaching themselves to the middle finger, differing in this particular from all the known Chiroptera. The Anatomical details perfectly agree with those of the Roussettes, and, especially as regards the cranium, with the Pachysomata.

The fur is somewhat long, and frizzled above; short and smooth below; the upper part of the fore-arm, the larger half of the arm, and the flank membranes are clad. In the male the superior parts are of a clear brownish-grey, whilst a deep brown line runs from the coccyx to the nape; at this point it divaricates to the shoulders. In the female the whole of the upper part of the fur is of a greyish-brown, more or less deep, and the dorsal line does not divide as in the male. In both the sexes the cheeks, chest, and the middle of the abdomen, are of an ash-white colour; the lower part of the arms and sides ash-coloured, tinted as with wine lees. The nasal tubes, ears, and tail, are of a clear yellowish-brown; the membranes are of a yellowish-red, irregularly marked with whitish spots; the iris is bright brown.

The habits of this Roussette are wholly unknown. The elder Naturalists describe it as coming from the Moluccas; MM. Macklot and Müller sent it from Amboyna.

DOUBTFUL SPECIES.

M. Rafinesque-Smaltz, in his *Prodrome de Somnologie*, has described a remarkable species of Bat from the Island of Sicily, under the name of CEPHALOTES TÆNIOTIS. It has two incisors in the upper jaw, and none in the lower; the canines and molars are pointed; there is no projecting crest upon the nose, and the tail is free for one half of its length. The fur is entirely of a greyish-brown, and a wart appears between the two incisors of the upper jaw. At present it remains doubtful whether this Bat should be referred to Harpyia or Cephalotes, or even whether it may not form the type of a distinct genus.

GENUS V. CEPHALOTES.—CEPHALOTES.

Syn. CEPHALOTES.—Geoff. Ann. Mus. XV. 101.—Temm. Mon. Mam. II. 103.

Icon. HYPODERMA.—Isid. Geoff. in Dict. Class. XIV. (art. Roussette.)

GENERIC CHARACTERS.

THE HEAD very thick. THE MUZZLE short and truncated. THE NOSTRILS slightly tubular, large. THE UPPER LIP cleft by a deep furrow.

THE ALAR MEMBRANE enveloping the entire body in a single piece, and adhering to the spine only by a transparent membrane.

THE THUMB NAIL partly covered by the membrane.

THE INDEX having the third phalanx, but without a CLAW.

THE DENTAL FORMULA varying according to the age.—

$$\text{In the Young } \frac{2 \cdot 2 + C + 4 \cdot M}{2 + C + (F+5) \cdot M} = \frac{14}{18} = 32$$

$$\text{In the Adult } \frac{2 \cdot 1 + C + 4 \cdot M}{1 + C + (F+5) \cdot M} = \frac{12}{16} = 28$$

$$\text{In the Old } \frac{2 \cdot 1 + C + 4 \cdot M}{\dots C + (F+5) \cdot M} = \frac{12}{14} = 26$$

INHABITS the East Indian Archipelago.

In accordance with the observations of M. Geoffroy, we again separate the Cephalotes from the Roussettes, with which they agree in having the same kind of molar teeth, but the index, although having three phalanges, like the preceding, wants the claw. The alar

membranes, instead of arising from the sides, unite together in the central axis of the back, to which they adhere by a vertical and longitudinal hinge. Their incisors [being variable according to age] are often only two in number.

The general form of the cranium of the Cephalotes resembles that of the Roussettes, but differs from them, as well as in Pachysoma, Harpyia, and all the other known Chiroptera, in possessing a very remarkable apparatus which takes the place of the intermaxillary bones, and which, with the Rhinolophus, to be afterwards noticed, exhibits an anomaly which is altogether peculiar. In this animal the intermaxillary bone is represented by two ossicula, detached from the maxillaries, and each supporting a small tooth; these little bones are shaped somewhat like an S, are three lines long, depressed, and united to the extremity of the nasal bones by a cartilage close to the origin of the teeth. The muscular attachments confer on these bones, and consequently upon the teeth, the power of moving backwards and forwards, whilst in the other genus alluded to, the motion is upwards and downwards; both, however, being remarkable examples of moveable incisors in the class Mammalia. Besides this anomalous peculiarity, and wanting the nail of the fore-finger, the Cephalotes is also destitute of the fibular bone, and has fourteen pair of ribs. The remarkably strong and disagreeable odour which this animal exhales is probably produced by the secretions of the two considerable glands of the cheek, the upper part of which, covered by the skin, is of a beautiful red colour.

The external forms present another peculiarity of this genus which is not less striking. The wings do not spring from the sides as in the majority of the Chiroptera, or even from a small distance from the spinal ridge, as is the case with a few species of the Roussette, but the skin extends continuously over the whole body of the animal, thus completely enveloping it as with a cloak; it is confined solely by a diaphanous integument, adhering to the skin of the trunk along the dorsal ridge, and about a line in breadth. Only half of the thumb is enveloped in the membrane, a character which, along with Pachysoma and Harpyia, distinguishes it from the Roussettes. The alar membrane takes its inferior attachment as high up as the metatarsal bones, and does not cover any of these bones, as in the Harpyia; the toes are totally free as in the Roussettes.

I. CEPHALOTES PERONII.—PERON'S CEPHALOTE.

Syn. LA CEPHALOTE DE PÉRON.—Geoff. Ann. Mus. XV. 104.—Cuv. Reg. Anim. I. 114.

HYPODERMA PERONII.—Isid. Geoff. in Dict. Class. XIV. 708.

PTEROPUS PALLIATUS, (young).—Geoff. Ann. Mus. XV. 99.

Icon. HYPODERME DES MOLLUQUES, (femelle).—Quoy et Gaim. Voy. de l'Astr. pl. 11.

Temm. Mon. Mam. pl. 35, fig. 7, (head.)

CEPHALOTES PERONII.—Geoff. Ann. Mus. XV. pl. 7.

SPECIFIC CHARACTERS.

THE HAIR brownish or reddish. THE TAIL partly engaged in the interfemoral membrane.

THE EARS broad and pointed.

INHABITS Timor, Amboyna, Banda, &c.

The size of Péron's Cephalote is about that of the American Vampire, and it has no nail on the fore-finger. Its muzzle is obtuse, its ears straight and pointed. The alar member, different from any thing we have previously seen, envelopes the whole body, adhering to the spinal ridge by a transparent integument; about half of the tail is concealed by the interfemoral membrane; a few longish hairs are scattered around the mouth and eyes. In the young there are four incisors of the upper jaw, small and pointed, arranged in pairs, and fixed on either side into the rudiments of the moveable laminae; those below are symmetrically arranged, though somewhat crowded. In the adult, the two incisors of the upper jaw remain moveable, and the two below are much approximated by the canines.

The fur of the adult is short, rough, and not very abundant; somewhat frizzly upon the shoulders, the hairs of the side of the neck converge to a point in the medial line of the neck; on the coccyx they are transparent. The whole of the body proper is well clad, whilst the membrane that covers the back is quite naked; the internal membranes in the upper part of the wing, and of the thighs, are covered with frizzly hairs. In the young, the fur is short and cottony, and the membrane which covers the back is covered with down, or semi-transparent hair; the inferior parts of the body are almost bare. A reddish colour predominates in the young, olivaceous grey in the adult and old; a yellowish tint pervades the male, and a greyish the female. There is but little fur on the chin, cheeks, and front of the neck, and in the old these parts are quite naked.

The whole of the membrane is diaphanous, and of a bright brown colour.

The entire length of this Bat, including the tail, (half an inch,) is about six and a half inches, and the extreme breadth two feet and a half, sometimes a trifle more. These dimensions do not depend always on age, but also on locality; those of Amboyna being larger than those of Banda, and those of Timor less than these last. This great animal retires and conceals itself during the day in caverns and among the clefts of the rocks; from which inaccessible hiding-places it usually issues only at the twilight. It flies with rapidity, is not very social with the allied genera, bites very cruelly, and occasions an abominable odour, although

destitute of the unctuous apparatus possessed by some of the previously described species.

It inhabits Banda, Samao, Timor, and Amboyna, in large numbers; but has not hitherto been seen in Java.

IMAGINARY SPECIES.

1. *CEPHALOTES MOLLUCCENSIS* of MM. Quoy and Gaimard (Voy. de l'Astrolabe, P. Zool. vol. I. p. 86) is distinguished only by trifling individual peculiarities.

Note.—*Cephalotes Pallasii* is now transferred to the Genus *Harpyia*.

FAMILY II. INSECTIVORA.—INSECTIVOROUS BATS.

Syn. LES VRAIES CHAUVES—SOURIS.—Cuv. Reg. Anim. I. 114.

CHARACTERS OF THE FAMILY.

THE MOLAR TEETH studded with conical points.

THE INDEX with one or two phalanges only, always without a nail.

INHABIT the tropical or temperate parts of the whole globe.

Having fully discussed the characters of the Frugivorous Bats, we now arrive at the Proper Bats, which are all Insectivorous. Their molar teeth, three in number on either side of each jaw, and studded with conical points, are preceded by a variable number of false molars. The index finger is always deprived of the nail, and with the exception of one sub-genus, the membrane extends between the thighs.

We have already had occasion (p. 3) to notice the recent and interesting discovery of M. Isidore Geoffroy in the osteology of the Bats, namely, that they have a bone connected with the elbow-joint in all respects answering to the knee-pan. This interesting structure is most marked in the Frugivorous Bats, but continues sufficiently striking in most of the Insectivorous; the genus *Vespertilio* supplying the only partial exception, being in them entirely hid in the tendon of the triceps muscle. M. Temminck enumerates the following as the functions to which this peculiar apparatus is subservient. Most of the Bats, he remarks, possess the power of using their wings, or membranes, in the capacity of hands, the wing being moveable in all directions, and susceptible of prehension. The structure of the wing accordingly corresponds to these functions, as they supply hands to seize, feet to walk, and wings to fly, the *Elbow-pan*, as we may term it, being used in their crawling gait, and in affording support on the ground, in the same way as the knee-pan in the other classes of the Mammalia. M. Brehm has made the same remark, and adds that in this respect the Bats differ from Birds, which never employ their wings in seizing or retaining an object, or in supporting their body, except when flying.

In the *Insectivorous Chiroptera* the thumb is always very short, being composed of a single articulation, and of a claw with its phalanx; the fore-finger always wants the nail and the ungual phalanx. The intermembral membrane, with one exception, is very ample, most frequently enveloping the whole of the tail by means of strong tendons and of a tendinous prolongation from the heel. This apparatus, directed towards the abdomen, is employed in retaining the young as in a sac during flight.

From M. Temminck we learn that a fact hitherto inexplicable, has received an explanation from recent observations made upon these winged Mammifera. We allude to a curious circumstance noticed in the capture of these animals. In the haunts where they have been found in numbers, at one time, only males have invariably been obtained, at another only females, and, finally, at others a heap of young only, without a single adult of either sex. The habits of the animals, as lately observed, afford an explanation of these isolated unions. For it would appear that the two sexes never resort to the same retreat; but immediately when their amours are ended, the females retire, always in company, and often in great flocks, into narrow chinks far from the company of the males, who in their turn associate in bands; the sexes remain thus separated till the young are in a state to fly about and take care of themselves; after which they quit the society of their mothers, and choose a new retreat, where individuals of the same age assemble, and which sepa-

rate into their several sexes about the time of their love season. M. Brehm has verified a part of these observations upon several of the European species of *Vespertilio*; and testimonies to the same effect have been communicated by the Dutch Naturalists in the East Indies. Facts speak quite as distinctly to the point, for M. Temminck assures us that parcels of these Bats, coming from all parts of the world, when obtained in their native haunts are invariably composed of males, or females, or their young exclusively. Up to the present time, he adds, we have obtained females only of some species belonging to the Great Asiatic Archipelago, and probably from the resorts of the males not having as yet been discovered by Naturalists.

Two of the reflections of the eminent conservator of the Leyden Museum, after his review of the whole order, are so important that we must not omit them. 1st, He states that his researches lead him to conclude that in some species the function of reproduction goes on chiefly, if not solely, not when the animals appear to have attained their full maturity, but apparently at an earlier period. The sutures of the cranium in the class thus signalized indicate that they have not reached their full growth, and their length of body and span across the wings are *strikingly smaller* than in their fellows, whose strong occipital and coronal crests, and every other sign, indicate that they have attained the maximum of their developments. Some species of the genera *Molossus*, *Pachysoma* and *Pteropus*, have supplied the matter for this remark, which M. Temminck considers, in the present state of our knowledge, very inexplicable. 2d, His concluding observation respects the markings of the Chiroptera. In some of the species, and more especially of the Insectivorous family, he has observed that there is a perfect resemblance in the colouring of the fur of the two sexes; and when there is a difference, it is always a reddish colour more or less pure, which distinguishes the livery of the female whilst the male is marked with brown or grey. When, however, the males, and sometimes those of the other sex also, are provided with unctuous bunches at the sides of the neck, and generally with all the frugivorous family, it is the male which is adorned with red, and when there is a difference in colouring, the female wears the dull and more obscure livery. His study of the colours of the Chiroptera also lead to the conjecture that, as in Birds, they are probably subject to a double moult, and thus have one dress for summer and another for winter.

The Insectivorous Bats may be subdivided into two principal tribes. The first has the middle finger of the membrane, with three ossified phalanges, but the other fingers, as well as the index, have only two. The second tribe has only one ossified phalanx for the index, and the other fingers have two [or three.]

M. Spix subdivides the Insectivorous Bats into *ISTIOPHORI*, or Leaf-nosed Bats, and into *ANISTIOPHORI*, which have the nose simple, and wholly destitute of that singular nasal appendage. By combining his arrangement, with the preceding, we form four tribes corresponding nearly with those indicated by M. Lesson, and in our own country by Mr Gray, under the names of *NOCTILIONINA*, *PHYLOSTOMINA*, *RHINOLOPHINA*, and *VEPERTILIONINA*.

TRIBE I. DIPHALANGIA ANISTIOPHORA.

Syn. ANISTIOPHORI, (in part.)—Spix, Sim. et Vespert. Bras.

NOCTILIONINA.—Less. Mam.—Gray, in Mag. Zool. and Bot. II. 498.

CHARACTERS OF THE TRIBE.

THE INDEX with two ossified phalanges.

THE NOSE simple, without a leafy appendage.

GENUS VI. DYSOPE.¹—BULL-DOG BATS.

- Syn.* MOLOSSUS.—Geoff. Ann. Mus. VI. 150.—Desm. Mam. p. 113.
 DYSOPE.—Illig. Prodr. p. 122.—Temm Mon. Mam. I. 205.
 DINOPS.—Savi, in Nuov. Giorn. di Letter. No. 21, p. 230.
 NYCTINOMUS.—Geoff. Descr. d'Egypte, II. 28.—Desm. Mam. p. 116.
 —Horsf. Jav.
 CHEIROMELES.—Horsf. Jav.
 THYROPTERA?—Spix, Sim. et Vespert. Bras. p. 61.
 VESPERTILIO, (in part.)—Linn. Gmel. I. 49.

GENERIC CHARACTERS.

THE HEAD thick. THE MUZZLE broad and flat.

THE EARS very large, mostly approximated, recumbent over the eyes, and arising from the commissure of the lips. THE UPPER LIP large and wrinkled.

THE AURICULAR OPERCULUM round, thick, placed in front. THE TONGUE smooth.

THE DENTAL FORMULA varying according to the age; as under—

First Age,	$\frac{2+2+C+(F+3)M}{3+C+(2F+3)M} = \frac{14}{18} = 32$
Very young,	$\frac{2+1+C+(F+3)M}{3+C+(2F+3)M} = \frac{12}{18} = 30$
Young,	$\frac{2+1+C+(F+3)M}{2+C+(2F+3)M} = \frac{12}{16} = 28$
Adult,	$\frac{2+1+C+(F+3)M}{1+C+(2F+3)M} = \frac{12}{14} = 26$
Old,	$\frac{2+1+C+(F+3)M}{C+(2F+3)M} = \frac{12}{12} = 24$

THE TOES covered with bristles. THE THUMBS of the hinder feet free, and sometimes opposable.

THE ALAR MEMBRANES narrow. THE TAIL long, partly engaged in the INTERFEMORAL MEMBRANE.

INHABIT the tropical parts of the entire globe, and the warmest portions of the temperate zones.

The Bull-Dog Bats have the muzzle simple, their ears broad and short, arising from the angle of the lips, and uniting together upon the muzzle, the auricular operculum short, and not surrounded by the auricle. The tail occupies the entire length of the interfemoral membrane, and often extends beyond it. [In the adult state only two incisive teeth appear in each jaw; according to M. Temminck, in their extreme youth, their incisors are as many as six in the lower, and four in the upper jaw; these are gradually reduced with age to two in the upper jaw only.]²

The following admirable description of the characters of this genus is supplied by M. Geoffroy. The Bats belonging to the genus *Dysopes* may be easily recognised by their fierce-looking physiognomy, and the peculiarity of their whole figure: their large head and broad muzzle has led to their being compared to the Bull-Dog, and to their being designated by his name. The head is remarkably full across the ears, which approximate and are festooned over the eyes, so that they are calculated quite as much to protect these organs, as to favour the power of hearing: they arise very near the commissure of the lips, and after passing behind the auditory foramen, sweep upwards and forwards to unite upon the brow. Most of the Chiroptera have the tragus placed in the auditory cavity, where it forms a kind of second external ear, and then receives the name of *auricular operculum*; but in the *Dysopes* there is a

difference, because this second ear is situated in front and exteriorly; it is, moreover, round and thick. Lastly, the species of this genus are recognised by their tail, which is long, and generally more or less engaged in the interfemoral membrane. The tongue is smooth, and the muzzle unfurnished with hairs; the nose is destitute of membranes and cavities; the nostrils are but slightly prominent, open in front, and margined with a small hood.

To these indications M. Temminck adds the following:—In all the species of this genus the posterior members are very short, the fibula is perfect, often as large as the tibia, and the wide separation of these bones supplies large space for the strong muscles of the feet. They have all bristles on their toes, and the outer or inner one is usually freer than the others, and sometimes opposable. The thumb is short, strong, and bulky; the upper lip is ample, and wrinkled; the snout more prominent than the lips. Their most striking characteristic, however, is the apparent insufficiency of their wings, seemingly quite disproportioned to the size of their bodies, which are big and heavy. To such an extent is this narrowness of their wings, that in some species we should be led to conclude they could not serve them in a long continued flight, and must be useful only as a parachute. Forced to subsist in subterranean and deep caverns, it would appear that it was chiefly by scaling the walls of buildings and the trunks of trees, or by crawling by means of their prehensile organs, that they provided for their wants. Insects and larvæ are probably the food of these creatures; whose manners and appetites are, however, as yet but little known.

All Naturalists agree that this group of animals is very distinctly and accurately defined and circumscribed, and yet it was for a long time separated into two, or more. This circumstance was owing to the reputed differences in the number of their incisive teeth, arising from changes produced by age, and which it is now ascertained occur alike in them all. The *Molossus* was said to be characterized by two incisors above and two below, and the other section, the *Nyctinomus*, by two above and four below; the latter being, moreover, supposed to belong exclusively to the old world, whilst the former alone were found in the new. All this, however, was the result of hasty inference. It would appear that the maximum number of the incisors is not less than six above and four below. To these succeed the canines, which on their mesial side are supplied with prominent heels. These appear as the animal advances in age, and before them the incisors, one by one, drop out till there is only one pair left above, and sometimes none below. In the words of Temminck, a part of the canines takes the place of the incisors which fall out, and the heels of the lower canines discharge, along with the upper incisors, the functions of mastication.

The Genus *DINOPS* of M. Savi is formed of one of these Bull-Dog Bats (*Dysopes Cestonii*) which [being examined in its first age] was found to have six incisors in the lower jaw.

Again, M. Geoffroy has formed those with four incisors only in the lower jaw, into the Genus *NYCTINOMUS*. [These are the young.]

At first, the Bull-Dog Bats were found only in America; at present they have been discovered in both Continents, [and more recently in New Holland.] Many of them have the thumbs of the hinder feet more separated than the fingers, and distinctly moveable, a character which has led Dr Horsfield to form a new Genus *CHEIROMELES*, with a single species in which this character is very distinctly marked.

It is probably to this genus that we should refer the *THYROPTERA* of M. Spix, which have been but imperfectly described by him. They appear to have many of the characters of the Bull-Dog Bats, and their thumb has a concave dilatation, peculiar to them, and enabling them to cling with greater security.

¹ *Dysopes*, from *δυωπειω*, to frighten with excessive ugliness.

² The precise words of the Baron Cuvier are, "One seldom finds more than two incisors in each jaw; but, according to M. Temminck, many have at first six incisors below, of which they successively lose four,"—a remark not strictly accurate, as an examination of the dental formulæ noted above will serve to explain.

(A.) BULL-DOG BATS OF AMERICA.

1. DYSOPEs RUFUS.—RUFous BULL-DOG BAT.

Syn. MOLOSSUS RUFUS.—Geoff. Ann. Mus. VI. 155.—Desm. Mam. DYSOPEs RUFUS, (Molosse Marron ou Doguin.)—Temm. Mon. Mam. I. 230.

Icon. DYSOPEs FEROTIS.—Pr. Max. Abbild. Temm. Mon. Mam. pl. 23, fig. 17, 18, 19, (cranium and teeth.)

SPECIFIC CHARACTERS.

THE HAIR dark reddish-brown above, light reddish-brown beneath.
THE MEMBRANES and EARS dark brown.
THE MUZZLE very broad and short. THE TAIL robust.
INHABITS Surinam and Brazil.

The size of the Rufous Bull-Dog Bat is considerably larger than that of the Common Bat of English authors, the length of the body being upwards of three inches, of the tail two, and across, from tip of the one wing to that of the other, sixteen inches. Its muzzle is of enormous size, very full and short, and somewhat resembling that of the Bull-Dog; the gape of the mouth is also very large, and the external ear exceedingly developed; the interfemoral membrane is connected, angle-shaped, to the middle of the tail, enveloping the upper portion, and leaving the other half free, and without any membranous edging; the lips are surrounded with hairs, but have no verrucae or warts about them; the inner parts of the ears, and the base of the outer surface, are clad with hair. The fur of the upper parts of the animal is of a deep reddish chestnut colour, of the lower of a lighter reddish chestnut; the ears and membranes dusky brown.

M. Geoffroy first described this animal; and M. Temminck, who, in the Low Countries, in the year 1827, examined a specimen preserved in spirits of wine, states that its habitat is unknown. The individual which supplied Prince Maximilian's description and plate was procured in the Brazils.

2. DYSOPEs ALECTO.—BLACK BULL-DOG BAT.

Syn. DYSOPEs ALECTO, (MOLOSSE ALECTO.)—Temm. Mon. Mam. I. 231. MOLOSSUS ALECTO.—Less. Mam. 101.

Icon. Temm. Mon. Mam. pl. 20, (old.)—pl. 23, fig. 23 to 26, (cranium and teeth.)

SPECIFIC CHARACTERS.

THE HAIR deep and shining black. THE MEMBRANES small and very narrow. THE TAIL free for the greater part of its length.
INHABITS Brazil.

The length of the body of the Black Bull-Dog Bat is very much the same as that of the one last described, whilst its extreme breadth is not more than a foot. The wings are hence somewhat disproportioned to the size of the body, being very narrow, as if clipped; the tail is free for about two-thirds of its dimensions. The ears are much broader than they are elevated; they are united in front, and are prolonged, riband-like, towards the nostrils, which are almost united. The head is short, and surmounted by a very elevated coronal crest, which runs down the chanfrin. The canines, having each a strong heel, are contiguous, and two fine bilobed incisors project in front of them. Some long hairs appear on the lower part of the back, but the rest of the fur appears like very fine silk velvet, having a beautiful lustre; the membrane which connects the arm with the fore-arm is clothed with close and short hairs, which extend along the arm, and between the origin of the two last fingers. The colour, above and below, is a brilliant and shining black; the membranes and face are also black. The additional aural appendage is broad, and the common one, which is not high, is in the shape of a semi-circle.

This new species was introduced by Temminck, who justly remarks, that its hideous physiognomy, short feet, and sombre colouring, make the name he has bestowed peculiarly appropriate.

Its habits are quite unknown.

3. DYSOPEs ABRASUS.—SHORN BULL-DOG BAT.

Syn. DYSOPEs ABRASUS, (MOLOSSE À POILS RAS.)—Temm. Mon. Mam. I. 232. MOLOSSUS ABRASUS.—Less. Mam. 102.

Icon. Temm. Mon. Mam. pl. 21, (young.)

SPECIFIC CHARACTERS.

THE HAIR very short but thick, very bright reddish-brown above; lighter and more dingy beneath. THE MEMBRANES black.
INHABITS Brazil.

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The Shorn Bull-Dog Bat has much the same forms, but is somewhat less than the preceding. The lesser half of the tail is free of the interfemoral membrane; the ears are nearly as broad as they are high; they are distinct, and not united upon the chanfrin; the muzzle terminates in the nostrils, which are far apart. The head is short and obtuse. The canines have a large heel, and are continuous, whilst two delicate bilobed incisors project in front of them. In the young, the canines are somewhat separated, and between them four bilobed incisors are found, somewhat crowded together.

The fur is very spare, but close; and the hairs appear more or less to adhere throughout their course. On the forehead, and the membrane which unites the arm and fore-arm, also on a stripe along the latter part, and at the base of the little finger, the skin is covered with short and close hair; but all these parts are naked beneath. The upper parts are of a very bright and shining chestnut colour, somewhat duller and paler beneath; the membranes are black. This species was first described by Temminck. Its habits are unknown.

4. DYSOPEs NASUTUS.—LONG-NOSED BULL-DOG BAT.

Syn. DYSOPEs NASUTUS, (MOLOSSE VELOX.)—Temm. Mon. Mam. I. 233.

NYCTINOMUS NASUTUS.—Gray, in Mag. Zool. and Bot. II. 501.

Icon. NYCTINOMUS BRASILIENSIS.—Isid. Geoff. in Ann. des Sc. Nat. I. pl. 22. —Copied in Zool. Journ. I. pl. 11.

MOLOSSUS NASUTUS.—Spix, Sim. et Vesp. Bras., pl. 35, fig. 7, (indifferent.)

Temm. Mon. Mam. pl. 24, fig. 2, 3, (skeleton.)

SPECIFIC CHARACTERS.

THE HAIR yellowish-brown above; greyish-brown beneath; a band detached from the rest of the hair, on the internal surface of the membranes; the long hairs of the hinder feet silvery white. THE MEMBRANES brown.

THE NOSTRILS prolonged.

INHABITS Brazil.

The Long-nosed Bull-Dog Bat is one which has long been known as very common, and widely spread over the Brazils. It has been mentioned by M. Natterer of Vienna, by the Prince de Neuwied, and many other travellers, and specimens have long been preserved in the museums of the Low Countries, of Berlin, Munich, &c. By a fortunate mistake, however, eleven specimens having been transmitted from South America by M. Augustus-St-Hilaire, they fell, many years ago, into the hands of M. Isidore-St-Hilaire, who, apparently ignorant that they were pretty well known, made his *début* in the Science by publishing a long account of them in the Ann. des Sciences Naturelles. He takes occasion, from the subject, to discuss the dogma laid down by the celebrated Buffon, that the animals of the one Continent are wanting in the other, and shows that, although this is very extensively, it is not universally true. At the time he wrote, (1824,) he could say, "That, of all the genera of Simia, Lemures, Chiroptera, and Insectivora, now known, there is not one, I may venture to affirm, whose existence in both Continents is unquestionable. The first instance that we find of this simultaneous existence in the two worlds, is in the Carnivora, where we come to the Ursi, Felis, &c." He then goes on to prove, at length, that this Dysopes is unequivocally of the same genus with that section which is more common in the Old World, and concludes the interesting discussion in these words:—"We must not forget, that the truth of the idea (Buffon's) which I have just proved erroneous, seemed demonstrated by the experience of ages, and consequently that the exceptions to the rule are very rare. Difference of country neither can nor will any longer be a proof of difference of organization, but it can and must always be an indication of it: it can no longer prove it; but it ought always to make us suspect it; in a word, it can no longer command, but it will always counsel; and thus the Naturalist, without blindly following the route it points out, ought carefully to collect its indications, that he may advance with firmer and truer step in the path he has thought fit to pursue."

The whole length of this Bat is about four inches, and its breadth across the wings between eleven and twelve. The snout is slender, the nostrils prominent, the muzzle short, and the lips marked with transverse wrinkles. The ears are broad, roundish, not united; the tail is long, and the upper and longest portion engaged in the interfemoral membrane, the rest being free. The fur is short, very soft, and somewhat shining. All the superior parts, and the head, are of a dull or fawn brown; beneath, greyish-brown prevails; a stripe, distinguished from the rest of the coat, extends along the flanks on the internal side of the membrane; long hairs cover the toes, and these are of a silvery whiteness. The membranes are brown.

Of its habits we have seen no account.

5. DYSOPE VELOX.—LONG-WINGED BULL-DOG BAT.

Syn. DYSOPE VELOX, (MOLOSSE VÉLOCE).—Natterer.—Temm. Mon. Mam. I. 234.

MOLOSSUS VELOX.—Less. Mam. 102.

Icon. Temm. Mon. Mam. pl. 22, fig. 1.—pl. 23, fig. 22, (teeth.)

SPECIFIC CHARACTERS.

THE HAIR deep reddish-brown above; lighter beneath. THE MEMBRANES long and narrow.

THE NECK with a glandular sac.

INHABITS Brazil.

This Bat was discovered and named in the Brazils, was sent thence by M. Natterer of Vienna, and has since been examined by other Naturalists. Its dimensions are a trifle less than those of the preceding species; the wings are rather narrow, but are far from being short; and the shorter half of the tail is alone left free. The ears are broader than they are elevated, and conjoined in front, but destitute of any fold of skin on the echanfrin. The syphon of a small glandular bag may be seen in the front of the neck, if examined when the specimen is fresh or moist, but not when dry. The fur is very short and smooth, and the hairs every where are of one colour; the side membranes are clad both above and below, and transparent hairs run along the arm and fore-arm. The colour in the superior parts is of a very deep and shining chestnut colour; beneath, the tint is somewhat duller and paler.

Its habits have not been described.

6. DYSOPE OBSCURUS.—SOOTY BULL-DOG BAT.

Syn. MOLOSSUS OBSCURUS.—Geoff. Ann. Mus. VI. 155.—Desm. Mam.

MOLOSSUS FULIGINOSUS?—Gray, in Mag. Zool. and Bot. II. 501.

DYSOPE OBSCURUS, (MOLOSSE OSCUR.)—Temm. Mon. Mam. I. 236.

Icon. Temm. Mon. Mam. pl. 22, fig. 2.—Pl. 23, fig. 20, (teeth.)

MOLOSSUS FUMARIUS?—Spix, Sim. et Vespert. Bras. pl. 35, fig. 6.

SPECIFIC CHARACTERS.

THE HAIR of two colours; above blackish-brown at the points, beneath greyish-brown; the base of the hairs white.

THE EARS united by a band of skin, passing to the nostrils.

INHABITS Brazil and Surinam.

The Sooty Bull-Dog Bat is three inches three lines long; its alar membranes are somewhat broader, in proportion to the size of the body, than in its congeners; the ears, not so high as they are broad, are united at their base by a fold of skin which reaches the nostrils; the larger half of the tail is engaged in the interfemoral membrane, and the rest is quite free; the tibia and fibula are proportionably longer than in the other species. The individual hairs exhibit two colours; in the upper parts of the body they are blackish-brown at the tip, and white at the base; in the lower parts, with a white base, they have ash-brown tips. There are minute hairs at the margin of the lips, which are smooth.

M. Temminck states that he has seen individuals of this species which were sent from Brazil; but he took his description from individuals transmitted from Surinam.

7. DYSOPE MOXENSIS.—NOTCH-EARED BULL-DOG BAT.

Syn. et Icon. MOLOSSUS MOXENSIS.—D'Orb. Voy. (Mammifères,) pl. 11.

SPECIFIC CHARACTERS.

THE HAIR brown above, lighter beneath; the membranes grey.

THE EARS uniting over the forehead with a transverse notch.

INHABITS South America.

To D'Orbigny, the celebrated Naturalist, who has travelled to such good purpose in South America, we owe the (as yet slight) intimations we possess of this species, as well as the following. The description of these Bats will appear in the splendid work of the French Government, "Voyage dans L'Amérique Meridionale;" but the portion relating to the Mammalia not having been published, we possess only the beautiful coloured engravings without the letter-press. Compelled, therefore, to postpone the minute description, we observe that the Moxensis, in its general appearance, closely resembles its congeners. It is stout bodied and compact, and the breadth of the membranes is moderate throughout; this is especially true of the interfemoral, which scarcely comes down to the end of the fibula, and does not include the half of the tail; the ears are broader than they are high, and the anterior bands hanging over the eyes, all but meet over the nose, having a marked notch between them. The

fur over the body seems copious, and is universally of a rich brown; the colour of the membranes and ears is of a brownish-black.

8. DYSOPE RUGOSUS.—WRINKLED BULL-DOG BAT.

Syn. et Icon. MOLOSSUS RUGOSUS.—D'Orb. Voy. (Mammifères,) pl. 10.

SPECIFIC CHARACTERS.

THE HAIR and MEMBRANES grey-brown. THE EARS and UPPER LIP deeply wrinkled.

INHABITS South America.

From the same reasons as those assigned in the notice of the last species, our acquaintance with this one is likewise very limited. In size it appears to be somewhat less, and the interfemoral membrane extends two-thirds down the tail, which, however, is shorter. The uniform tint both of the body and membranes is a greyish-brown. The ears are remarkably large and broad; and a very distinguishing character, whence the animal has derived its name, consists in a number of marked rugæ extended along both the aural membrane and the upper lip.

9. DYSOPE AMPLEXICAUDATUS.—GUIANA BULL-DOG BAT.

Syn. MOLOSSUS AMPLEXICAUDATUS.—Geoff. Ann. Mus. VI. 156.—Desm. Mam. No. 159.

VESPERTILIO BARBIPES.—Act. Soc. Hist. Nat. Par. I. 115.

Icon. LA CHAUVÉ-SOURIS DE LA GUYANE.—Buff. Hist. Nat. Suppl. VII. pl. 75.

SPECIFIC CHARACTERS.

THE HAIR black; lighter beneath; grey on the sides of the abdomen.

THE TAIL entirely enveloped in the interfemoral membrane.

INHABITS Cayenne.

The fur of this Guiana Bull-Dog Bat is blackish, darker above than below, the flanks ash-coloured; the ear is wrinkled, and extends over the cheeks; the tail is wholly enveloped in the interfemoral membrane, which is much more ample than in the other species. It is said to be of the size of the Serotine Bat, and to be very common in Cayenne, where it flies about in large troops.

10. DYSOPE CASTANEUS.—CHESTNUT BULL-DOG BAT.

Syn. MOLOSSUS CASTANEUS.—Geoff. Ann. Mus. VI. 155.—Desm. Mam. No. 156.

CHAUVÉ-SOURIS CHATAINE, ou SIXIÈME D'AZARA.—Quadr. Parag. II. 282.

Icon.

SPECIFIC CHARACTERS.

THE HAIR chestnut brown above, whitish beneath; a band extending from the muzzle to the forehead.

THE TAIL free for one-third of its length.

INHABITS Paraguay.

Our acquaintance with the Chestnut Bull-Dog Bat rests solely on the short description of Azara, this one forming the sixth of the twelve he has described.² It is chestnut-coloured above, and whitish beneath. It has a cutaneous band extending from the muzzle to the forehead; the alar membranes are blackish; the tail free only in its last third; the external ear is six lines high, rounded towards the point, and inclined somewhat forward, extending to the front band. Its length is four and a half inches; its extreme breadth fourteen. Its fur is short, soft, and close. It inhabits Paraguay, where, however, Azara states he never saw any other than the one from which he took his description, and which he bought.

(B.) BULL-DOG BATS OF THE OLD CONTINENT.

II. DYSOPE TENUIS.—SLENDER BULL-DOG BAT.

Syn. DYSOPE TENUIS, (Molosse grêle.)—Temm. Mon. Mam. I. 228.

Icon. NYCTINOMUS TENUIS.—Horsf. Jav.

Temm. Mon. Mam. I. pl. 19, (bis.)—Pl. 23, fig. 10 to 16, (crania and teeth.)—Pl. 24, fig. 1, (skeleton.)

SPECIFIC CHARACTERS.

THE HAIR blackish-brown above, ash-coloured beneath.

THE ALAR MEMBRANES very long and narrow.

THE INTERFEMORAL MEMBRANE sustained by scattered museular fibres. THE TAIL free for one-half of its length.

INHABITS Java.

¹ ACT. SOC. HIST. NAT. PAR.—Actes de la Société d'Histoire Naturelle de Paris. Paris, 1792.

² Essais sur l'Histoire Naturelle des Quadrupèdes de la Provence du Paraguay, tome II. 264—295.

The first published description and representation of this Bat of the Old Continent was supplied by Dr Horsfield, in his Zoological Researches in Java, and this was shortly afterwards followed by the original drawings and accounts of Temminck; so that our information regarding it is tolerably satisfactory and minute. It is about the size of the Barbastelle Bat, being nearly four inches long, and a foot across from tip to tip of the wing. The alar membranes appear long and slender, on account of their narrowness. The lips are very thick and broad; the upper being wrinkled vertically with very deep folds, the lower being covered with warts. The interfemoral membrane proceeds nearly at right angles from the ankle-joint, and envelops the larger half of the tail; the remainder is quite free. The ears, which are very large, are united on the chanfrin, and have a border on the outer margin.

The following is Dr Horsfield's description of the canine teeth. The canines are remarkable in both jaws; in the upper they present interiorly a very sharp cutting edge; in the lower jaw they are of uncommon size, greatly distended at the base, and provided with a strong, obliquely diverging process, resembling a thorn, which forces the front teeth in an oblique direction forward. This peculiar structure serves to prevent the escape, and to secure in the interior of the mouth, the minute insects which are seized in the rapid movements of these creatures, until they can be conveyed to the back part of the mouth, where the grinders furnish a most effectual apparatus for their immediate destruction.

The fur is very short, soft, and smooth; that on the upper part of the body is a blackish-brown, underneath it is ash-coloured. The very thick upper lips are studded throughout their whole length with a series of transverse warts, as is also the lower, but to an inferior extent. The interfemoral membrane is supported by rudimentary ossicula.

The island of Java is the only locality in which this species has hitherto been observed, though it is probable that they are also observed in Sumatra and Banda.

Dr Horsfield supplies the following particulars concerning the habits of this and the allied species. They feed at night. During my residence on the hills of Prowoto, their pursuit afforded me occasional amusement. They are peculiarly abundant on these hills, which are covered with a luxuriant vegetation, and afford a plentiful supply of their favourite food. They appeared after sunset, while the light was still sufficient for the purpose of distinguishing objects clearly. Observing them almost uniformly, and in quick succession, to direct their flight along the hedges which surrounded a village in which I had my abode, I watched them in this situation, and readily caught them with a large net. By this means I obtained them in great numbers.

12. DYSOPEs ÆGYPTIACUS.—GEOFFROY'S BULL-DOG BAT.

Syn. et Icon. NYCTINOMUS ÆGYPTIACUS.—Geoff. Descr. D'Egypte, tome I. pl. 2, fig. 2.

DYSOPEs GEOFFROYI.—Temm. Mon. Mam. I. 226.—Pl. 19.—Pl. 24, fig. 9, (teeth.)

SPECIFIC CHARACTERS.

THE HAIR red above, brown beneath; a margin of white hairs on the alar membranes along the sides.

THE INTERFEMORAL MEMBRANE destitute of muscular bands. THE TAIL free for one-half of its length.

INHABITS Egypt.

This species was first discovered by M. Geoffroy during the French Expedition to Egypt, was described by him in the *Mem. de l'Institut d'Egypte*, and represented in the accompanying atlas. More lately it was again sent from Egypt by M. Ruppell to M. Cretzschmar, keeper of the Museum at Frankfort, who subjected it to M. Temminck's inspection, so that all doubt is removed from its leading characteristics. Its habits, however, are still but little known; it is found among the catacombs and the subterranean vaults of the great deserted edifices.

The length of this Bat is about four inches, with an extreme breadth of ten. The ears, moderate in size, are roundish, but curved somewhat irregularly at their anterior margin; its base is provided with an internal operculum, and a second one externally, which is of a lenticular shape. Their inner margins do not coalesce. The tail is of the length of the body, half enveloped in the interfemoral membrane, and without muscular bands. The fur is close, the hair on the occiput and back of the neck being somewhat longer than elsewhere; a stripe of white hair extends along the alar membrane at its union with the sides. The upper lip is covered with wrinkles, which, however, are not very deep. Its markings are red above, particularly on the occiput; brown on the abdomen, with a faint white line running along the mesial line, and assuming somewhat of a rosy tint towards the flanks.

13. DYSOPEs CESTONII.—CESTONI'S BULL-DOG BAT.

Syn. DINOPS CESTONII.—Savi, in Nuov. Giorn. di Letter, No. 21, p. 230.—No. 37, p. 46.

MOLOSSUS RUPPELLII.—Less. Mam.

Icon. DYSOPEs RUPPELLII.—Temm. Mon. Mam. I. 224, pl. 18.—Pl. 26, fig. 6, 8, 9, (cran. and teeth.)

DYSOPEs CESTONII.—Bonap.¹ Faun. Ital.

SPECIFIC CHARACTERS.

THE HAIR uniform mouse grey above; paler beneath. THE EARS excessively large, shading the face not approximated.

THE INTERFEMORAL MEMBRANE without muscular bands. THE TAIL or the major part free.

INHABITS Egypt and Italy.

Cestoni's Bull-Dog Bat is about the size of the Common Bat of Europe. The external ears, especially the conchæ are excessively large, quite overshadowing the face; their internal margins, however, are not united, but project from the forehead by a common base, a large internal fold at the same time covering the eyes. The base of the ear is provided with an internal operculum, and with a second which is external, and lenticular in shape. The tail is of the same length with the body proper, and is thick, depressed, being more than half enveloped in the interfemoral membrane, which is destitute of muscular bands. The toes are covered with whitish bristles; and the great one is considerably freer than the others. The two upper incisors are wide apart, the six or four (as it may happen) inferior are crowded together, and the internal ones are projected forwards. There is a very small anomalous tooth in the upper jaw, between the canine and the first false molar. The fur is abundant, fine, close, and smooth, a large border of close hairs running along the origin of the alar membranes at the flanks. The muzzle is covered with black hairs, few and diverging; the lips are large, pendant, and folded. The upper parts of the body are throughout of a uniform mouse-grey colour, as are also the lower, but of a somewhat lighter shade. The alar membranes are very narrow, but the expanse from tip to tip of the wings is great, amounting to fifteen or sixteen inches.

The first notice of this species was given by Professor Savi of Pisa, who, however, was acquainted with the young only.

We owe our knowledge of the adult to the researches of M. Ruppell in Egypt, who has brought to light many of those animals which had been indicated by Aristotle and Pliny, and concerning which modern Naturalists had erred when they imagined that their prototypes were to be found in Southern Africa.

14. DYSOPEs PLICATUS.—CHAMCHECKA BULL-DOG BAT.

Syn. NYCTINOMUS BENGALENSIS.—Geoff. in Institut. d'Egypte Hist. Nat. II. 130.

DYSOPEs PLICATUS, (Molosse Chamché.)—Temm. Mon. Mam. I. 223.

Icon. VESPERTILIO PLICATUS.—Buchanan, in Linn. Trans. V. pl. 13.

SPECIFIC CHARACTERS.

THE HAIR of a sooty brown, mixed with grey above; paler beneath; a broad hairy band, arising from the sides, at the margin of the alar membrane.

THE INTERFEMORAL MEMBRANE naked, with muscular bands. THE TAIL free for one-half of its length.

INHABITS Bengal.

The Chamchecka Bat, to adopt its Hindoo name, was first described by the late celebrated Dr F. Hamilton Buchanan in 1799, in the fifth vol. of the *Linnaean Transactions*; it was then noticed in Egypt by M. Geoffroy, and Temminck tells us he saw a couple of specimens in the collection of a dealer in articles of Natural History in London. We shall here condense Dr Buchanan's account.

From the point of the nose to the root of the tail it measures three inches; from the extremity of one wing to that of the other twelve. The wings and naked parts of the body are soot-coloured; the hair is mixed with ash-colour, and is paler below than on the back. The head is large, thick at the shoulders, and tapers gradually to the snout, which is blunt, terminates in a heart-shaped margin, and projects far before the lower jaw, mostly naked; it has still some long erect bristles on it. The nostrils are small circular holes, remote from each other, and placed under the margin of the snout. The upper lip hangs over the under jaw, at the sides, and is there deeply wrinkled with seven or eight vertical folds. The ears are large, blunt, wrinkled, and somewhat pendulous: from being bent into several folds, they at first sight appear to be

¹ BONAP. FAUN. ITAL.—Iconografia della Fauna Italica di Carlo Luciano Bonaparte, Principe di Musignano. Roma, 1835, et seq.

thick and fleshy; they approach near at their insertion on the brow, and are naked, except in a sharp sinus towards the hinder part of the head; on their edge, near the tip, are five or six small warts. The eyes are in two small slits, above the angles of the mouth, and are almost covered by the ears. The neck is very short, and so covered with hair as to be scarcely observable; the shoulders are high and round, with a deep cavity between them; the body at the shoulders is much wider than at the haunches; the buttocks are bare. The tail is naked, round, and blunt, and is half inclosed in the interfemoral membrane. A broad hairy list surrounds the whole body, and covers the bottom of the membrane.

This animal inhabits caverns and old buildings.

15. DYSOPES TORQUATUS.—COLLARED BULL-DOG BAT.

Syn. CHEIROMELES TORQUATUS.—Horsf. Jav.

DYSOPES CHEIROPUS, (Molosse pédimane.)—Temm. Mon. I. 218.

Icon. Horsf. Jav.—Copied in Temm. Mon. I. pl. 17.—Pl. 25, fig. 15, (cranium and teeth.)

SPECIFIC CHARACTERS.

THE HAIR wanting on the back, somewhat long on the neck, forming collar.

THE THUMBS of the feet entirely free and opposable.

INHABITS Siam.

This very remarkable Bat was first obtained either at Penang or Singapore, by the late Dr George Finlayson, the meritorious Naturalist, who accompanied Mr John Crawford in his mission to Siam, Cochinchina, and the Indian Archipelago. On Dr F.'s decease, it was deposited, with the rest of his collection, in the Museum of the Honourable East India Company, and was minutely described and depicted by Dr Horsfield in his Zoological Researches. It was also carefully examined by M. Temminck during his visits to London.

It is the largest known species of the genus. The great toe, completely separated from the others, is quite free and opposable, like the thumb in the Quadrumana, and must greatly assist its powers of prehension. The ears, not united in front, are long and pointed, having a lobe or operculum at the inferior part, and a second or rudimentary one proceeding from the interior. Its large tail is half enveloped in a very short interfemoral membrane. The alar membranes proceed from the upper part of the back, very near the mesial line, but adhere to the sides in their progress downwards. This animal may be said to have no fur except along the sides, and on the front of the neck, where the hairs are coarse, very short, and far apart; a few slender hairs cover the interfemoral membrane and the thighs; whilst a kind of down, extremely short, and only recognizable by the touch, or the magnifying glass, covers the abdomen; the back is completely naked, and the muzzle is very sparingly provided with minute hairs; a sort of ruff, composed of brown hair, surrounds the neck. The great toe is not only free, but is supplied with a very large nail, broad and obtuse, and hid under a great tuft of hair. The tail is quite wrinkled in that part of it which is free. The ears are wide apart, long, and pointed.

To this condensed summary of characters by the accurate Temminck we shall add some further details, supplied by Dr Horsfield. The entire length, he remarks, of the specimen now before me is five and a half inches; its extreme breadth two feet. The great extent of the internal ear is one of the peculiarities of the animal; the entrance to the cavity of the tympanum is likewise of extraordinary size; the bones of the ear, in comparison with those of the human, are of enormous dimensions; the cochlea, too, is of uncommon extent. The eyes are small, and partially concealed; the eyelids are surrounded by a minute circle of rigid hairs, regularly disposed. The pouch or cavity, behind and below the arm-pit, and formed by the connection of the alar membrane with the body of the animal, though not peculiar to this species, is well worthy of attention. This cavity is about an inch deep, and nearly two inches long, and is lined by a very delicate membrane. It is bounded anteriorly by the membrane extending from the arm to the pectoral muscle, and posteriorly by the spine and haunches. This organization renders the animal specifically lighter, and assists its flight; and, by supplying a deep and extensive pouch, it affords to the young, while they continue at the breast, a convenient covering, and a retreat in which they find the security and warmth they require. The skin throughout is marked with very minute dots, and, when closely examined, exhibits the appearance of shagreen. The membranes of the wings and back, as well as the head, feet, and tail, are of a sooty black colour, with occasional modifications of tawny; the nails of a yellowish-brown colour. The brush on the great toe is of a peculiar character. It consists of stiff hairs, directed to one side, and forming a regular series along the outer margin of the thumb.

At the extremity the hairs are long, and spread like a fan over the nail; they gradually decrease in length, preserving the same direction; the separate hairs are rigid, and terminated by a hook; its use remains to be determined.

(C.) BULL-DOG BATS OF AUSTRALIA.

16. DYSOPES AUSTRALIS.—SOUTHERN BULL-DOG BAT.

Syn. MOLOSSUS AUSTRALIS.—Gray, in Mag. Zool. and Bot. II. 501.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dark brown, paler beneath, a broad white streak on each side, a narrow white streak beneath the edge of the rump.

THE EARS large, broad, rounded. THE TAIL nearly one-half free.

INHABITS New South Wales.

A specimen of this Bat, very recently discovered by Major MacArthur, is deposited in the Museum of the United Service Club, London.

DOUBTFUL SPECIES.

1. MOLOSSUS CRASSICAUDATUS, (Geoff. Ann. Mus. VI. 156.)—The hair is of a cinnamon brown colour, somewhat lighter beneath; the tail emarginated on each side by a prolongation of the interfemoral membrane. It is the tenth species mentioned by Azara. The hair is very short and soft. The interfemoral membrane envelopes more than half the tail.

2. M. ATER, (Geoff. loc. cit. p. 155.)—The fur is black and shining above. Habitat unknown. Specimen in the Paris Museum.

3. M. LONGICAUDATUS, (Geoff. loc. cit.)—Of a fawn grey colour; a band extends from the tip of the snout to the forehead; the tail nearly as long as the body. M. Geoffroy conceives this was the species described by Daubenton under the name of the *Mulot volant*, and figured by Buffon; but this is doubtful.

4. M. FUSCIVENTER, (Geoff. loc. cit.)—The fur brownish-grey above, and ash-coloured beneath, except on the abdomen, which is brown in the middle. This was also described by Daubenton.

5. M. LATEICAUDATUS (Geoff. loc. cit.)—is Azara's eighth species, and inhabits Paraguay. The fur dull brown above, somewhat lighter beneath. The tail emarginated by a continuation of the interfemoral membrane. The upper lip marked by vertical ridges; the tongue is also wrinkled.

6. M. URINUS, (Spix, Sim. et Vespert. Bras. p. 59, pl. 35, fig. 4.)—According to Spix, this species is black all over; the body and snout are very stout; and the anterior folds of the auricles meet on the forehead. It was found in the province of Para.

7. NYCTINOMUS ACETABULOSUS, (Geoff. in Mém. de l'Institut. d'Egypte Hist. Nat. II. 130.)—This species was discovered by Commerçon, and was found near Port Louis, Isle of France. Its fur is of a blackish-brown colour. The tail, for two-thirds of its extent, is enveloped in the interfemoral membrane.

8. D. TRICOLOR, (Spix, p. 61, pl. 36, fig. 9.)—The genus Thyroptera of M. Spix is founded upon the following character:—Pollice manus infra patella subconca armato. The specimen (a young one) was dark brown above, and quite white beneath, the membranes and feet black.

9. D. AURIPENDULUS, (Shaw, Gen. Zool. I. 137.)—The Slouch-eared Bat, with obtuse nose, and large pendant ears with pointed tips. Tail long, included in a membrane, and terminated with a hook. Colour above, deep chestnut, lighter in the belly; length three inches, extent of wing fifteen. Native of Guiana.

10. D. MOORS, (P. Cuv. Dents des Mam.)—The specimen upon which this species is founded was sent from India by MM. Diard and Duvaucel.

11. D. PUMILUS, (Rupp.¹ Atl., pl. 27, fig. a.)—scarcely three inches in length, is the smallest of those Bats which M. Ruppell has discovered in Northern Africa. It is dark brown above, light grey beneath, the limbs reddish, the membranes dark brown. It seems a miniature representation of *D. Cestonii*, already described, and is in all probability the young of *D. Ægyptiacus*.

IMAGINARY SPECIES.

1. DYSOPES PEROTIS (Pr. Maximilian Abbild.)—is identical with *D. rufus*.

2. *D. RUPPELLII* (Temm. Monogr.)—is the adult of a Bat previously described by Professor Paolo Savi of Pisa, under the name of *Dinops Cestonii*.

Note.—NYCTINOMUS BRASILIENSIS (Isid. Geoff. Ann. Sc. Nat.)—is the same as *Dysopes nasutus*; and

DYSOPES GEOFFROYI (Temm. Monogr.)—is but another name for *D. Ægyptiacus*.

¹ RUPP. ATL.—Atlas zu der Reise im Nördlichen Afrika, von Eduard Rüppell. Frankfurt am Main, 1826. (Säugethiere bearbeitet von Ph. J. Cretzschmar. Med. Dr.)

GENUS VII. STENODERMA.—NARROW-BANDED BATS.

Syn. STENODERMA.—Geoff. in Mém. de l'Institut. d'Egypte Hist. Nat. II.—Desm. Mam. p. 117.—Temm. Mon. Mam. II. 50.

GENERIC CHARACTERS.

THE EARS small, lateral, isolated, with an auricular operculum.

THE INTERFEMORAL MEMBRANE rudimentary, lining the thighs like a band.

THE TAIL wanting.

THE DENTAL FORMULA varying according to age.

$$\text{Young? } \frac{2 \begin{matrix} 2+C+4M \\ 2+C+4M \end{matrix} = 14}{14} = 28 \quad (\text{Geoffroy.})$$

$$\text{Adult? } \frac{2 \begin{matrix} 1+C+4M \\ 2+C+4M \end{matrix} = 12}{14} = 26 \quad (\text{G. Cuvier.})$$

INHABIT

To this place appears to belong a Genus of Bats, of which little is yet known beyond the characters enumerated above. It consists of a single species, the false molars of which are undetermined.

1. STENODERMA RUFUM.—RED NARROW-BANDED BAT.

Syn. STENODERMA RUFUM.—Geoff. in loc. cit.

Icon. Dict. des Sciences Naturelles, L. p. 499.

SPECIFIC CHARACTERS.

THE HAIR uniform reddish-brown. THE EARS middle-sized, oval, slightly notched on their external margin.

INHABITS

The length of this animal, of which nothing further is known, is about three inches; the expansion of its wings eleven inches nearly.

GENUS VIII. DICLIDURUS.—BOX-TAILED BATS.

Syn. DICLIDURUS.—Pr. Max. Reise.—Abbild.—Beitr.

GENERIC CHARACTERS.

THE HEAD broad. THE MUZZLE pointed.

THE EARS broad, inserted over the eyes.

THE TAIL consisting of two corneous valves, moveable and hollow; the os coccyx entering the upper valve.

THE INTERFEMORAL MEMBRANE extending beneath and beyond the caudal valves.

THE DENTAL FORMULA $\frac{2 \begin{matrix} 1+C+(F+4)M \\ 3+C+(F+4)M \end{matrix} = 14}{18} = 32$ in the single specimen examined by Prince Maximilian.

INHABITS Brazil.

This genus consists at present of one species only.

1. DICLIDURUS ALBUS.—WHITE BOX-TAILED BAT.

Syn. DICLIDURUS FREYREISSII.—Pr. Max. in Isis, 1819, p. 1629, Reise, II. p. 76.

DICLIDURUS ALBUS.—Ib.—Beitr. II. 242.

Icon. DICLIDURUS ALBUS.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR bushy, long, and whitish. THE ARMS long and robust.

INHABITS Brazil.

The White Box-Tailed Bat, the only one as yet referred to the genus *Diclidurus*, is in various particulars strikingly different from the nearest allied genera. The most remarkable feature unquestionably is the tail, distinct from all other tails we have heard of.

It is formed on the following plan: The coccygeal bones run out joined into two horny pieces, covered by the skin of the body, thus forming a kind of box out of the two capsules or valves taken together. The upper valve is shaped like a half moon, corneous, hollow, with somewhat of a protuberant and thickened edge, and hence in all respects is a hollow capsule. The lower valve smaller, somewhat triangular, pointed, applied horizontally against the upper, is likewise covered by the skin, and hollow. Both these corneous pieces are placed with their flattest surfaces horizontally; they are capable of moving upwards or downwards, of separating from each other, and being closed or applied to the body through a particularly fine membrane at their base. The coccygeal bones proceed into the upper valve.

The coat of the animal is white, and the box-like appendage is a deep black. The latter extends but a little way down the interfemoral

membrane, which in its mesial part is festooned up in a deep semicircle. The tibiae are very slender; and the feet, the long muzzle, and upper part of the face, are black; the membranes are of a dark flesh colour. The ears are short and broad, and overhang the eyes; the fur is bushy, composed of fine long whitish hair, and the arms are strong and long.

This singular Bat was discovered by M. Freyreiss upon the cocoa-trees near Canavievas, at the mouth of the Rio Pardo, where it concealed itself during the day in the foliage of those majestic palms. Of its habits nothing has been ascertained. The specimen is in the Neuwied Museum.

GENUS IX. NOCTILIO.—HARE-LIPPED BATS.

Syn. LES NOCTILIONS.—Cuv. Reg. Anim. I.

NOCTILIO.—Geoff.—Cuv.—Temm. et al.—PTEROPUS.—Ersl.

VESPERTILIO (in part.)—Linn. Gmel. I.

GENERIC CHARACTERS.

THE HEAD broad. THE MUZZLE short, swelling, cleft, and furnished with warts, or fleshy tubercles.

THE NOSE confounded with the lips. THE NOSTRILS almost tubular, approximated, prominent.

THE EARS small, lateral, isolated, with the auricular operculum placed interiorly.

$$\text{THE DENTAL FORMULA } \frac{2 \begin{matrix} 2+C+(F+3)M \\ 1+C+(2F+3)M \end{matrix} = 14}{14} = 28.$$

THE INTERFEMORAL MEMBRANE very broad, projecting, entire, with two prominent obtuse angles. THE TAIL mostly enveloped in the membrane, but free at the point above.

INHABIT South America.

The Hare-lipped Bats have a short swelling muzzle, cleft like a Hare-lip, and furnished with warts and uncouth fleshy tubercles; their ears are separate. They have four incisors above, and two below; their tail is short, and free above the interfemoral membrane.

1. NOCTILIO LEPORINUS.—RUFIOUS HARE-LIPPED BAT.

Syn. VESPERTILIO LEPORINUS.—Linn. Gmel. I. 47.

NOCTILIO AMERICANUS.—Linn. Syst. Nat. (Ed. 12.) I. 88.

NOCTILIO UNICOLOR.—Pr. Max. Beitr. II. 223.—Desm. Mam. No. 165.

NOCTILIO ALBIVENTER, (young.)—Desm. Mam. No. 167.

NOCTILIO DORSATUS.—Pr. Max. Beitr. II. 218.

PERUVIAN BAT.—Penn. Quadr. II. No. 500.—Shaw, Gen. Zool. I. 139.

NOCTILIO VITTATUS.—Schinz Thier. I. 170.

Icon. VESPERTILIO LEPORINUS.—Schreb. Säugeth. pl. 60.

NOCTILIO UNICOLOR.—Pr. Max. Abbild.

NOCTILIO DORSATUS.—Pr. Max. Abbild. (var.)

NOCTILIO ALBIVENTER, (young.)—Spix, Sim. et Vesp. Bras. pl. 35, fig. 2 and 3.

NOCTILIO RUFUS.—Spix, Sim. et Vespert. Bras. pl. 35, fig. 1.

SPECIFIC CHARACTERS.

THE HAIR uniform reddish-yellow above, paler beneath.

INHABITS South America.

Though this large and beautiful Bat has been long known, there is by no means all the accuracy and satisfaction concerning its appearance and history which is desirable. The difference between the only British representation of the animal which exists (Shaw's) and the foreign ones is so great, that they would never be taken for the same animal; and the shades of colour given in the plates of Schreber, and the *albiventer* and *dorsatus* of Prince Maximilian, are respectively pale straw coloured, light tobacco brown, and a very dark, almost black brown. Of its habits we have seen no account; and no description equal to that of the accurate Azara, which we, therefore, embody in our pages.

The celebrated Spaniard tells us he had been in possession of many of these animals, and that they were strikingly similar to each other. He gives the length of the body at five inches, the tail one; and the expanse across the wings scarcely two feet, whilst our English authorities make it of "the size of a middling rat, and the extent of the wings two feet five inches." The fur underneath, says Azara, (Quad. Parag. II. 280,) is of the colour of pale Seville tobacco; it is the same above, but mixed with brown, and along the back-bone there is a streak of a lighter colour. The interfemoral membrane originates as high up as the ankle, and the alar from the middle of the tibiae, a striking character in which most of the figures agree. The mem-

branes are ample; the interfemoral extends considerably beyond the feet, and the tail descends about a fourth of it. The ear is directed forwards; it is very acute, transparent, and more than an inch long. The head above is very flat. The muzzle is naked, very acute, and bent upwards, so that the animal has been compared to a pug-dog; the lip is divided by the cleft which separates the nostrils, and the mouth is festooned in a very peculiar manner. There is a white stripe along the dorsal ridge in some specimens.

2. NOCTILIO RUFIPES.—RED-CLAWED HARE-LIPPED BAT.

Syn. et Icon. NOCTILIO RUFIPES.—D'Orb. Voy.—Mammifères, pl. 9.

SPECIFIC CHARACTERS.

THE HAIR uniform reddish-yellow. THE MEMBRANES, EARS, and FEET, grey. THE CLAWS reddish. THE AURICULAR OPERCULUM deeply notched.

INHABITS South America.

This species is known to us only through the figure of M. D'Orbigny¹ above quoted.

IMAGINARY SPECIES.

1. NOCTILIO ALBIVENTER, (Spix, Sim. et Vesp. Bras. pl. 35, fig. 2 and 3,) is the young of *N. Leporinus* according to Temminck.

2. *N. dorsatus* of Geoffroy is a variety of sex or age of the same species.

DOUBTFUL GENERA AND SPECIES.

1. AËLLO.—Dr Leach (Linn. Trans. XIII. p. 71) has described a Bat under the name of *Aëllo Cuvieri*, now in the Museum of the University College, London. The head is nearly conical; the forehead flat; the

ears large and separate, apparently truncated at the extremity; the tail with a membranous band produced to the point of a large interfemoral membrane. Its colour is rusty brown; its alar membranes dark brown; the dimensions are not indicated, and its country is unknown. The dentition is $\frac{1+C+4M}{2+C+6M} = \frac{12}{18} = 30$.

2. CELÆNO.—This is another of Dr Leach's genera, reposing on a single specimen, which he styled *Celæno Brookiana*, (Linn. Trans. XIII. 70.) According to Mr John Edward Gray, the specimen in the Museum of the University College, London, is merely a *Noctilio*, in which the bones of the tail had been withdrawn from the skin.

3. PTERONOTUS.—Mr Gray (Mag. Zool. and Bot. II. 500) proposes a new genus to contain a Bat, named by him *P. Davyi*, from Trinidad. His account is as follows: Ears lateral, tragus elongate lobed; chin with a reflexed cartilaginous edge to the lower lip, and an erect membranous ridge across its lower part; wings only affixed by a narrow line to the middle of the back, which is covered with fur beneath them; hind-feet long, the ankle rather produced and exposed; the lower angle of the wing lies folded over it. Its dentition is not stated. Mouse-coloured, wings baldish; expanse of wing twelve inches. From a specimen in the Museum Fort Pitt, Chatham.

4. MYOPTERIS.—M. Geoffroy (Mém. de l'Inst. d'Égypte, II. p. 113) describes a Bat under the name of *Myopteris Daubentonii*. The nose is simple, the ears broad, separate, and lateral, with an internal operculum; the tail long, one half enveloped in the interfemoral membrane; the muzzle short and thick. The upper parts of the head and body are brown, beneath it is lighter. The dentition is $\frac{1+C+4M}{1+C+5M} = \frac{12}{14} = 26$. This is the *Rat volant* of Daubenton, (Mém. de l'Acad. de Paris, 1759.)

TRIBE II.—DIPHALANGIA ISTIOPHORA.

Syn. ISTIOPHORI, (in part.)—Spix, Sim. et Vespert. Bras.

PHYLLOSTOMINA.—Gray, in Mag. Zool. et Bot. II. 496.—Less. Mam.

CHARACTERS OF THE TRIBE.

THE INDEX with two ossified phalanges, the middle finger with three.

THE NOSE with one or two leafy appendages.

WE have now arrived at that group of Bats where the cutaneous system, ample in them all, acquires its maximum development. This is aided by the two phalanges of the index finger, and the three of the middle one; the phalanges being the frame-work of the membranes; and is manifested by the nasal appendages, consisting of the *horse-shoe*, (*fer-à-cheval*), a semi-circular cutaneous excrescence immediately below, and often involving the nostrils, and the *nose-leaf*, usually rising up at right angles to the horse-shoe, and exhibiting a resemblance to the leaves of some vegetables. A few remarks, then, on the more prominent peculiarities of this development, and the uses it subserves, are more especially required. In many of the genera the tegumentary folds, more especially the alar and interfemoral, are so superabundant, as well as those of the ears and nose, that the bodies themselves of these animals can scarcely be perceived: their aspect is thus rendered more shadowy, their physiognomy wilder, and, finally, their forms so vague and indistinct, as greatly to increase the horror which their alleged devastations inspire.

In the *Anistiophora* division just described, we had occasion to allude to the extraordinary development manifesting itself in the external ears, which, in some species, are approximated and festooned over the eyes; but in some of those we have yet to review the external auricle nearly equals in dimensions the whole body. The external ear, in fact, instead of being single, as in all other animals, may be said to be double in many of the Bats; for, in addition to the external concha, which they have in common with other terrestrial Mammalia, they have a second and internal one, which more directly surrounds the auditory foramen. This second auricle is derived from the tragus, or rather, according to M. Geoffroy's well known views, is the tragus itself, though we are led to suppose it a distinct part, on account of its great volume, in proportion to that of the ear, and on account of this latter being so folded and rolled upon itself. A precisely corresponding change takes place at the nostrils, which are furnished with borders in the form of crests and leaves supplied by duplica-

turs of the skin; these membranes are somewhat tubular in shape, and the bottom of the funnel constitutes the entrance of the nasal apertures. This arrangement then prevails in the organ of smell as of hearing; both being provided with conchæ, or external trumpets.

The consequence of this is not less apparent than it is striking. Most of the senses of these Bats are thereby rendered exquisitely acute. From the great expanse of their alar and interfemoral membranes, they acquire, by means of the aerial vibrations, information of many minute bodies, of which other animals are perfectly unconscious. Hence the observations of Spallanzani led him to infer, that most frequently they perceive the indications of touch without requiring immediate contact; and hence, according to the judicious remark of Cuvier upon these experiments, all that they require to be adverted of the immediate presence of corporeal objects, is to beat, or rather feel, the air which is interposed between them and these objects, judging by the manner in which it acts upon their membranes. Spallanzani states this may be considered as the possession of a sixth sense. That the ample dermal apparatus at the ears and nostrils produces corresponding effects on the senses of hearing and smelling, is too evident to be dwelt upon,—a remark the more valuable when associated with an observation of Dr Horsfield formerly noticed with regard to the *Dysopes torquatus*, (p. 20,) that the development of the internal ear, when compared to that of Man, is enormous. All this acuteness of apprehension is necessary for the exercise of their predatory propensities against nocturnal insects, during the twilight, and even midnight darkness. And, lest the sensibility should overwhelm them under the scorching influence of a tropical sun, it is not less interesting to observe, that these same tubes and conchæ are, by a slight muscular agency, at the will of the animal, converted into so many plugs and valves, whereby all smells and sounds are shut out as effectually as is the light by the closed eye-lids. The "operculum," says M. Geoffroy, "is placed at the margin of the meatus auditorius, in such a way as at will to be-

¹ It is much to be regretted that the elegant Work of M. D'Orbigny, published under the auspices of the French Government, proceeds at a rate of intolerable slowness; the descriptions of many Plates, which have long been in our possession, are still withheld.—Should not a public work of that kind be issued at a lower price, and the separable portions in distinct series?

come a valve which closes its entrance, and the folds and pads of the nose-leaf effect the same object at the nostrils; so that," continues the ingenious Naturalist, "it is not without a purpose that, in the Bats, the cutaneous system acquires so great a development."

GENUS X. VAMPYRUS.—VAMPYRE BATS.

Syn. PHYLLOSTOMA, (in part.)—Cuv. Geoff. et al.

VAMPYRUS.—Leach, in Linn. Trans. XIII.—Spix, Less. et al.

GENERIC CHARACTERS.

THE HEAD long and narrow. THE MUZZLE lengthened.

THE EARS middle-sized, separate. THE AURICULAR OPERCULUM notched, placed interiorly.

THE TONGUE extensile; point formed for suction; the papillæ directed backwards.

THE NOSE with two appendages, the one horizontal, in the form of a horse-shoe, the other erect, resembling a javelin.

THE DENTAL FORMULA $\frac{2+C+(2F+3)M}{2+C+(3F+3)M} = \frac{16}{18} = 34$.

INHABIT South America.

The appellation *Vampyre* was introduced into Natural History by Linnaeus, and applied by him to the Great Roussette Bats already described. Buffon again applied it to the animal we are now about to consider, under the conviction that the habits which made the name applicable belonged exclusively to this species. In this conclusion, it speedily appeared he was mistaken, as there were many South American Bats, closely allied in several of their features, all of which have blood-sucking propensities. MM. Cuvier and Geoffroy, about the year 1809, in examining together the family of Bats, associated these together under the name of *Phyllostoma*, which group becoming very numerous, has again been subdivided into smaller sections. The Vampyre was, of course, for a long time ranked by all writers, foreign and domestic, as a *Phyllostoma*. M. Geoffroy, twenty years later, (in 1829,) in his *Leçons*, separated the Vampyres from the last named group, grounding the distinction on the difference of the shape of the crania, those of the *Phyllostomes* being short, with a broad muzzle, whilst the cranium and muzzle of the Vampyre are very narrow: a difference likewise exists as to the number of the teeth.

After these explanatory remarks, it will readily be understood that many of the relations which have been published concerning the blood-thirsty propensities of Bats, do not refer exclusively to what is now considered as the true Vampyre: though this, however, is the case, yet, as the last named animal possesses them in a prominent degree, we shall in this place introduce such general observations as are required for the illustration of the subject.

It is not for a moment to be imagined that any of these animals live on blood alone. No more is it to be supposed that, though distinguished as the insectivorous tribe, they confine themselves to this species of food.—On the other hand, it is here, as previously observed, that as the frugivorous Bats sometimes devour flesh, so these insectivorous Bats are sometimes frugivorous. Nor is this to be regarded as a rare or trivial occurrence. It would, on the other hand, appear that the Bats immediately under consideration are decidedly omnivorous, and that their depredations upon fruit are occasionally troublesome and as vexatious, as is experienced from the ravages of the true Frugivore. A fact or two will illustrate this. "When the moon shone bright," says Mr Waterton, "and the fruit of the Banana-tree was ripe, I could see the Vampyre approach and eat it. He would also bring into the loft where I slept, from the forest, a green round fruit, something like the wild guava, and about the size of a nutmeg. There was something also in the blossom of the Sawari Nut-tree which was grateful to him."—(Wanderings, 179.) M. Palissot-Beauvois again, as mentioned by M. Geoffroy, was an eye-witness of the devastations they made of fruit, to the great annoyance of the agriculturist. From Hayti this gentleman wrote: "One morning my friend exclaimed, 'Shall I gather the beautiful fruit from that superb tree to-day, or wait for its perfect maturity to-morrow? If I take this latter course, I am afraid of the Bats.' The fruit was left, and the gentleman's worst anticipations were realized. During the night a cloud of Bats made their appearance, and left scarcely a sample behind." M. Geoffroy was so much interested in this recital, that he wrote inquiring what particular Bat had wrought the mischief; specimens both of the fruit and its devourer were transmitted to France, and the latter turned out to be the Spectacled Javelin-Bat soon to be noticed.

That they are also pre-eminently insectivorous cannot be doubted; often have multitudes of these troublesome tribes been found in their stomachs after death, and in this way much must be done to keep these hordes in their proper subordination.

With regard to the attacks of these creatures on the other animals and Man, D'Azara states that it is only in lack of their more common food that they resort to nobler prey. Be this as it may, they are in this way often troublesome, and sometimes, it would appear, destructive. The range over which they extend seems to be wide. P. Martyr mentions the existence of these animals at the Isthmus of Darien; both the Ulloas report their presence at Carthagena; Roume discourses of the Vampyre of the Island of Trinidad, and D'Azara encountered them in Paraguay. The injury they produce has probably been exaggerated, and yet it is such as not to be despised. The great Spanish Naturalist informs us that they frequently attach themselves to the combs and wattles of the domestic fowl and destroy them; not so much by the hemorrhage they produce, as from the injurious effects of their wounds. Mules, Asses, Horses, and horned Cattle, in fact, all Quadrupeds are exposed to their attack, and to an extent which is characterized by Mr Darwin in relation to the Horse, as "often the cause of much trouble." M. Geoffroy seems perfectly to credit the narrative related by M. de la Condamine, that the attacks of these animals destroyed the herds and flocks which the first European settlers succeeded in conveying to the New World. "When some Spaniards," says he, "at the epoch of the discovery of America, detesting the cruelty and villany of their compatriots, were led to cherish more honorable sentiments towards the Aborigines, and, in the exercise of their philanthropy, thought of compensating for the massacre of man by the gift of the European domestic animals, the *Phyllostomes* frustrated this generous enterprise; these Bats in numbers attacked the first Cattle and Sheep which the missionaries transported into America, and destroyed them by sucking their blood."

Finally, in relation to Man, it is certainly not a little curious that the attacks of the Vampyres should be confined to his great toe; for of all narratives we have met, this part alone has been signalized. Another curious fact is, that it is only during sleep that they commit their depredations, and so dexterously as not even to awake the sufferer. These certainly curious circumstances have led to various hypotheses for their explanation, none of which, however, appears very satisfactory, and hence the phenomena are still regarded as mysterious. Buffon detected something peculiar in the tongue of his "Vampyre," which, in his estimation, constituted it a peculiar organ of suction, capable of drawing blood without inflicting a wound; but unfortunately for this ingenious speculation, Buffon's Vampyre, as stated above, was a Roussette, and not a Vampyre—a frugivorous, not an insectivorous Bat,—and guiltless, in short, of such bloody deeds. Led on Buffon's track, M. Geoffroy assures us he has made the identical discovery which Buffon had anticipated. "The tongue of the *Phyllostomes* presents a very curious organization, whence they are endowed with a power of suction. Close to its extremity is a cavity, in the centre of which there is a small point in relief, and round its circumference are placed eight warty projections, somewhat less prominent than the central one." (Ann. des Sc. Nat. XV. 163, *Leçons*, XIV. p. 31.) And again, "I have now satisfied myself that the *Phyllostomes* are endowed with a real organ of suction at the extremity of the tongue, in the midst of a circle of warty papillæ. The tip begins to act in a plane, which is quite level: in this state it is applied in immediate contact to the point about to be operated upon; the muscular fibres, which are attached by a tendon to each wart, now contract, hence they are all simultaneously approximated, and a smaller circle is formed within the original one." (*Leçons*, XIV. p. 35.) This is a curious fact; but the ingenious Naturalist does not rest here. In connection with the admitted truth, that the blood is abstracted during sleep without waking the subject of attack, he concludes that this could not occur if the skin were wounded as in an ordinary bite, and that sometimes there is no lesion in the integument at all. This we apprehend is carrying the matter too far. That they inflict a wound is attested by numerous eye-witnesses. "The wounds on my toes," says D'Azara, "which, however, I knew nothing of at the time of their infliction, were circular or elliptical, from a line to a line and a half in diameter;" and Waterton, "on the great toe there was a wound somewhat less than that made by a leech, whence the blood was still oozing." That they give pain is no more doubtful:—"When bivouacking late one evening," says Mr Darwin, "near Coquimbo, my servant noticing that one of the horses was very restive, went to see what was the matter, and fancying he could distinguish something, suddenly put his hand on the beast's withers, and secured a Vampyre." (*Zool. of the Beagle*, Mam. p. 2.) The mystery is probably less than usually imagined. The leech, though its bite is sufficiently sharp, is often applied to man asleep without awakening him. The teeth of the Vampyre are sharp; a slight incision, with the help of the sucking apparatus, is all that is required, and the sleeper's repose is undisturbed.

The quantity of blood drawn by the Vampyre does not appear to be very great; but considerable oozing often continues, so that much may be lost. The wound is troublesome for a few days, but in man usually heals without

difficulty. D'Azara, who was himself bitten four times, states that the inhabitants of Paraguay thought but little of these attacks, or of the animals which made them.

1. VAMPYRUS SPECTRUM.—COMMON VAMPIRE BAT.

- Syn.* VESPERTILIO SPECTRUM.—Linn. Gmel.
 PHYLLOSTOMA SPECTRUM.—Geoff. Ann. Mus. XV. 174, 186.—Desm. Mam. No. 175.
 VAMPYRUS SPECTRUM.—Leach, in Linn. Trans. XIII. 80.
 LE VAMPIRE.—Cuv. Reg. Anim. I. 117.
 SPECTRE BAT.—Penn. Quadr. II. 508.—Shaw, Zool. I. 143.
Icon. Geoff. Ann. Mus. XV. pl. 11, fig. head, cran., and teeth.
 Seba, pl. 58.—Schreb. Säugeth. pl. 45, B.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown above; reddish-yellow beneath.

This Vampire is the Andira-guagu of the Brazilians, figured in Seba, pl. 58. Its leaf is oval, and hollowed in the shape of a funnel. This animal comes from South America; it is reddish-brown, and about the size of a Magpie. It has been accused of destroying men, and the lower animals, by sucking their blood, but it merely inflicts some very small wounds, which may sometimes become inflamed by the climate.

Though much of the alarm and apprehension which attached to this animal, and led Dr Shaw to dilate upon it as "a tremendous creature, said to be sometimes six feet in extent," is now removed, yet its habits are so peculiar, annoying, and, we may add, destructive, that the popular interest with which it is still regarded is not by any means surprising.

We believe it is larger than any of the Phyllostomes, with which it is so closely associated. It is commonly stated to be about nine inches in extreme length, from the tip of the nose to the termination of the hind-feet, and from eighteen inches to two feet in extreme breadth, though Mr Waterton informs us he once killed one which measured thirty-two inches across, from the tip of one wing to that of the other; the ears are about fourteen lines high; the nasal leaf six; the interfemoral membrane nearly three inches. The incisor teeth are closely set between the canines; in the upper jaw the two mesial ones are larger than the lateral; and in the lower they are all very small and pushed forward; the canines are strong; the molars have all the characters of a carnivorous animal. Its physiognomy is singular, and far from being captivating; its muzzle is long, its mouth large, its teeth formidable, and the ears are of great size in length and breadth, with a marked operculum; the nasal leaf is of medium size, prolonged from the horse-shoe, without any intervening division; its middle stem is not very thick, and the lateral lobes are rounded, and terminate somewhat on this side of the point. The alar membranes extend from the ankle to the origin of the thumb; the interfemoral occupies the whole space included between the limbs; its terminal edge forming a salient angle, shaped, as in a demi-hexagon, the product of three equal lines, the two external terminating at the spurs, and the third at that part of the membrane which is destitute of support. We need scarcely remark, it has no vestige of a tail, though this appendage is conferred upon it in some of the older descriptions. The fur is soft, chestnut-coloured above, and of a reddish-yellow colour beneath.

The whole extent of the South American Continent is usually assigned as the habitat of the Vampire, though this probably has arisen from the name being applied indifferently to a number of the Phyllostomes. That it occurs in Guiana seems to admit of no doubt; and in proof of this, as well as illustrating its habits and blood-thirsty propensities, we shall quote some of Mr Waterton's interesting remarks. "As there was a free entrance and exit to the Vampire in the loft where I slept, I had many a fine opportunity of paying attention to this nocturnal surgeon. He frequents old abandoned houses and hollow trees; and sometimes a cluster of them may be seen in the forest hanging head downwards from the branch of a tree; as stated by Goldsmith—

'In matted woods, where birds forget to sing,
 And silent Bats in drowsy clusters cling.'

"Some years ago I went to the river Paumaron with a Scottish gentleman. We hung our hammocks in a thatched loft of a planter's house. Next morning, as soon as there was light enough, I went to his hammock, and saw it was much stained with blood. On examining his foot, I found the Vampire had tapped his great toe; there was a wound somewhat less than that made by a leech; the blood was still oozing from it; I conjectured he might have lost from ten to twelve ounces of blood. On another occasion, they sucked a young man of the Indian breed very

severely, as he was sleeping in the shed next to mine; his great toe seemed to have all the attractions. I examined it minutely as he was bathing it in the river at day-break. The midnight surgeon had made a hole in it, almost of a triangular shape, and the blood was then running from it apace."—(Waterton's Wanderings, pp. 179, 301.)

DOUBTFUL SPECIES.

1. VAMPYRUS SORICINUS, (Spix, Sim. et Vespert. Bras. pl. 36, fig. 2 and 6.)

The body rather slender; incisors with a somewhat diverging apex; the nose-leaf entire, continuous below and in front with the lip; the lips are undivided, and free from warts; a few on the chin.

Frequents the roofs of the houses of Rio Janeiro, and the banks of the St Francis.

2. V. CIRRHOSUS, (Spix, pl. 36, fig. 3.)

The head somewhat prolonged; the lips, sides, and lower part of the nose-leaf, and especially the chin, studded with warts.

Habitat not ascertained.

3. V. BIDENS, (Spix, pl. 36, fig. 5.)

The muzzle acute; the incisors long; ears wide spreading; the fur above is brownish-black, beneath mouse-coloured; the alar membranes are black and naked; the point of the tail perforates the interfemoral membrane externally; the spurs are very long, and concave towards the lower margin of the membrane, to which they give a bifurcated appearance.

Inhabits the banks of the St Francis.

GENUS XI. PHYLLOSTOMA.—JAVELIN-BATS.

- Syn.* PHYLLOSTOMA, (in part.)—Geoff. Cuv. et al.
 MONOPHYLLUS et ARTIBEUS.—Leach, in Linn. Trans. XIII.
 CAROLIA et MACROPHYLLUM.—Gray, in Mag. Zool. and Bot. II.
 LOPHOSTOMA.—D'Orb. Voy.

GENERIC CHARACTERS.

THE HEAD short and thick. THE MUZZLE short and broad.

THE DENTAL FORMULA $\frac{2+C+(2F+3)M}{2+C+(2F+3)M} = \frac{16}{16} = 32.$

(For the other characters, see Vampyrus, p. 23.)

Among the Javelin-Bats the normal number of incisors is four in each jaw, but a part of those in the lower often fall out, expelled by the growth of the canines. They are further distinguished by their leafy appendage being turned up across the tip of the nose. The tragus or operculum of the ear is shaped like a small leaf more or less dentated. Their tongue, capable of great extension, is terminated by papillæ, which appear to be so arranged as to form an organ of suction, and, further, their lips have tubercles symmetrically arranged. These are American animals, which run upon the ground with more facility than the other Bats, and (along with the Vampyres and Long-tongued Bats) are in the habit of sucking the blood of animals.

Having already, under the genus Vampyrus, treated so fully of the characters and habits of the Phyllostomes, little additional will be required in this place. The alar membranes are of large dimensions, arising from the additional phalanx of the middle finger, viz. the unguinal one, which, however, has no nail, but a cartilage bent and drawn inwards by the membrane. The interfemoral extends across from limb to limb, and usually projects outwards; at the same time this great extent receives but an inconsiderable support from the os eoecyx. Some of the Phyllostomes are destitute of tails; and among those in which they appear they are usually short, and very partially engaged in the membrane, piercing it either above or beneath.

(A.) TAIL-LESS JAVELIN-BATS.

1. PHYLLOSTOMA PERSPICILLATUM.—SPECTACLED JAVELIN-BAT.

- Syn.* LA LUNETTE.—Cuv. Regn. Anim. I. 117.
Icon. PHYLLOSTOMA PERSPICILLATUM.—Geoff. Ann. Mus. XV. pl. 11, (head.)
 D'Orb. Voy. (Mamm.) pl. 9, fig. 7 and 8.
 GRAND FER-DE-LANCE.—Buff. Hist. Nat. Suppl. pl. 74.

SPECIFIC CHARACTERS.

THE HAIR dark brown above, light brown beneath; a white band extends from the nose to each ear.

THE NASAL APPENDAGE short, furrowed towards the point.
INHABITS South America. Also Hayti.

The Spectacled Javelin-Bat was designated the *Grand fer-de-lance* by Buffon, and yet, according to M. Geoffroy, it is of smaller dimensions than the *Common* one bearing the name. Its extreme length from the tip of the nose to the extreme part of the interfemoral membrane is five inches; its extreme breadth eighteen inches. The muzzle is short and broad; the lower incisors are regularly placed between the canines, which are far apart, and the two internal ones are bilobed; the external ears are slightly emarginated at their external border, and the opercula are deeply denticulated; an irregular row of warts encircles the lips, and there are considerable excrescences on the articulations of the third and fourth toes; the interfemoral membrane forms an entering angle with the hind-foot, and the inferior support it receives is inconsiderable on account of the diminutive size of the bony spurs. The nasal leaf is formed of a strong central part, with membranes at its sides, which do not extend quite to the point; it is sloped, oval-shaped at its lower extremity, and terminated in front by the common horse-shoe membrane. The fur is of a blackish-brown colour on the back, and of a light brown on the abdomen; a white line rises at the nose, and extends along the side of the head as far as the ear.

It has been clearly ascertained that this Phyllostome (and probably its congeners) is not only insectivorous, but is frequently a great annoyance to the agriculturist, from the immense quantities of ripe fruits it devours. Thus, in M. Geoffroy's 14th Leçon, (Cours de l'Hist. Natur.,) we have the following interesting particulars extracted from a letter of Dr Alex. Ricord, an able Naturalist, who has long resided in Hayti. "After leaving Hayti I preserved these animals alive, and fed them on Common Sappotas, (*Achras Sapota*,) the fruit of a Mammee tree, which they prefer to all others. Every evening, two hours after sunset, they leave the virgin forests which they frequent during the day, and, in flocks of thousands, precipitate themselves upon the Naseberry trees. I have often observed them bite indiscriminately every one of the fruits on the trees, to discover those which are ripe, for by the touch alone they cannot do this; and hence great mischief follows, for the fruit has but a slender hold of the tree, and falls on the slightest injury. Often have I noticed these animals suspending themselves on the wing, without changing their position, and devouring the ripe fruit with the greatest avidity. They do not quarrel much, but rather maintain a mutual good understanding. The noise which they in this way produce among the branches resembles that made by birds about to rest on ceasing their flight. They utter a feeble cry; and nothing can scare them away. Shots from a musket do not annoy them. I have watched these Bats throughout the whole night, and have seen them depart an hour before the break of day, betaking themselves towards the forests, where they reside, at the foot of the mountains, in places not far distant from human habitations."

VAR. SUPERCILIATUM.—REDDISH S. J. BAT.

Syn. PHYLLOSTOMA SUPERCILIATUM.—Pr. Max. Beitr. II. 200.
CHAUVE-SOURIS OBSCURE et RAYÉE ou CH. PREMIÈRE.—D'Azar. Quadr. Parag. II. 269.

We are inclined to consider the Ph. Superciliatum of Prince Maximilian to be merely a variety of the Spectacled Javelin-Bat already described; its ears are short, pointed, and white; the hair is dark brown; there is a white streak from the nasal appendage to each ear. It was found on the sea coast to the north of Cabo Frio.

2. PHYLLOSTOMA LINEATUM.—STRIPED JAVELIN-BAT.

Syn. CHAUVE-SOURIS BRUNE et RAYÉE.—Azar. Parag. II. p. 271.
PHYLLOSTOMA LINEATUM.—Geoff. Ann. Mus. XV. 186.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brown above, lighter beneath; four white stripes on the face, and one on the back.

THE NASAL APPENDAGE entire.

INHABITS Paraguay and Brazil.

This Striped Phyllostome, and the two which succeed, are founded upon the descriptions of the indefatigable D'Azara, and, though defective in the synonymy, and incorrect, in so far as he has identified them with previously described species, yet they so conspicuously bear the traces of his accurate hand, that it is impossible for a moment to doubt their specific and distinct existence. The Lineatum forms the second on his list, and he remarks that he had possessed many of them, and that they strongly resembled each other. Their length very nearly reached three inches, their extreme breadth fourteen. The colour of the fur is brown, lighter beneath. A white stripe commences at the oocyte, and runs in a

straight line to the occiput: besides this great band, two others, which, like it, are white, extend from the nostril to the ear, at the elevated part of the hind-head, and two others, also white, from the angle of the mouth to the lower part of the ear. The ear is very narrow, and shovel-shaped, generally flat, but reflected on its edges. At about a line from the extremity of the muzzle, which is not acute, the horse-shoe membrane commences, from the centre of which springs the nasal one, forming an angle with the forehead of seventy degrees, extending four lines, and terminating in a point. D'Azara says nothing of its habits.

3. PHYLLOSTOMA ROTUNDUM.—ROUND-LEAFED JAVELIN-BAT.

Syn. CHAUVE-SOURIS TROISIÈME ou CH. BRUN.—Azar. Parag. II. p. 277.
PHYLLOSTOMA ROTUNDUM.—Geoff. Ann. Mus. XV. 181.

Icon.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown.

THE NASAL APPENDAGE entire, rounded at the extremity.

INHABITS Paraguay.

This Javelin-Bat was supposed to be the true Vampire by the Spanish Naturalist D'Azara,—a mistake arising partly from the imperfect descriptions of these South American species, current in his day, and partly from his not being aware that most of them had never been described; hence he erroneously identifies them with their congeners. The length of this Bat is three inches and a half; its extreme breadth nearly seventeen. Its colour is brown, somewhat lighter underneath. The alar membrane arises from the tibia four lines from its articulation. The ear is acute, straight, eight lines high, and has a projecting operculum. The muzzle is rather acute than flat, and the nasal leaf, flatter than in most others, does not terminate in a point, but is rounded. The lower jaw is somewhat the largest, and the whole physiognomy may perhaps be considered by some as very ugly. In this description the colour, the rounded leaf, and the dimensions reaching only one half, distinguish this Bat from the true Vampire. It is very common in Paraguay, where D'Azara says it differs from all the others, in running as swift as a Rat when on the ground, and in delighting in sucking the blood of men and animals.

4. PHYLLOSTOMA LILIUM.—FLEUR-DE-LIS JAVELIN-BAT.

Syn. CHAUVE-SOURIS BRUN-ROUGEATRE ou CH. QUATRIÈME.—D'Azar. Quadr. Parag. II. p. 277.
PHYLLOSTOMA LILIUM.—Geoff. Ann. Mus. XV. 186.

Icon.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown above, lighter beneath.

THE NASAL APPENDAGE entire, length equal to its breadth, narrow at the base. THE JAWS elongated.

INHABITS Paraguay.

D'Azara imagined that the animal described by him as his fourth species, under the appellation of the *Brun-Rougeatre*, was identical with Buffon's *Fer-de-lance*; but this is manifestly a mistake. The one in hand is three inches and a half long, and thirteen inches across the wings, and is destitute of a tail, whilst the *hastatum* has a tail, and measures seven inches by nineteen. Its ear is straight and acute; its eye, though small, is, according to Azara, somewhat larger than in his other Bats, and is placed equidistant between the ear and tip of the muzzle, which is very obtuse, and somewhat cleft. M. Geoffroy assigned it its specific name, from the resemblance of the leaf to that of the middle petal of the fleur-de-lis of heraldry; it is pointed at its tip, and as straight as that of the *hastatum* at its extremity, but it bulges out more, being as broad as it is long. D'Azara compares its form to that of a military spear.

5. PHYLLOSTOMA BRACHYOTUM.—BROAD-EARED JAVELIN-BAT.

Syn. PHYLLOSTOMA BRACHYOTUM.—Pr. Max. Beitr. II. 196.
CAROLINA BRAZILIENSIS.—Gray, in Mag. Zool. and Bot. II. 488.

Icon. Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR dark greyish-brown above; the points of the hairs sooty; lighter beneath.

THE EARS short and broad. THE OPERCULUM short and rounded.

THE NASAL APPENDAGE narrow and pointed.

INHABITS Brazil.

This Phyllostome might with as much propriety be designated broad-bodied as broad-eared. It is singularly broad across the shoulders, and short in the length of the body; head included, it is somewhat heart-

shaped, and its shoulders seem covered with a short mantle. The hair of the entire body is soft, tolerably long, and plentiful, of a dark russet colour all over. The hair on the throat is greyish-brown, dark at the points. The under part of the body is lighter, tending more to a greyish-brown. These animals fly about the dense foliage of the forests, and towards the approach of night. The only known specimen was captured by Prince Maximilian in his apartments near the Mucuvi in the Brazils.

6. PHYLLOSTOMA JAMAICENSE.—LEACH'S JAVELIN-BAT.

Syn. ARTIBEUS JAMAICENSIS.—Leach, in Linn. Trans. XIII. 75.

Icon. PHYLLOSTOMA JAMAICENSE.—Horsf. in Zool. Journal, III. 236, and pl. 21, Suppl.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown above, lighter beneath, and blueish.

THE NASAL APPENDAGES and MEMBRANES nearly black. The sides of the nose without warts.

INHABITS Jamaica and Cuba.

This species was first described shortly, in the year 1820, by the late Dr Leach in Vol. XIII. of the Linnean Transactions as noted above, from a specimen sent him from Jamaica by a correspondent; and in the year 1827, the well-known Naturalist, W. S. Macleay, Esq., sent another specimen to Dr Horsfield from the Havannah, of which the Doctor supplied an excellent description in the Zoological Journal, after having compared it with the identical individual which had fallen into Dr Leach's hands, and which had formed a part of Mr Brooke's museum.

The body of this Phyllostome is robust, and covered both above and beneath with long silky hairs of a very soft texture; the colour of the body and head above is grey, inclining to brown, but without any tinge of yellow or red; underneath it is paler and blueish; the hairs above are darker at their extremity, so that the fur appears of darker and lighter shades, according to the position of the hairs, and underneath it has a silvery gloss on the surface. The wings, interfemoral membrane, and nasal appendages, are nearly black; the ears are narrow, rounded, and somewhat lengthened; the nose is covered at the sides with a soft down, through which a few bristly hairs are scattered; its leaf is horizontally somewhat undulated, is acute towards the point, and marked in front with striae. Of the four upper incisors the two lateral ones are smaller; the lower are uniform in size, and regularly disposed. The interfemoral membrane is deeply excavated; the toes are uniform in length and size, and have all the same direction; the claws are partially covered by stiff projecting bristles. The lower lip is surrounded with a regular row of warts, and "the mouth is provided internally with a narrow, fimbriated, eribri-form membraue." The specimens examined by Dr Horsfield had an expansion of the flying membranes, amounting to one foot and three inches; and the entire length from the muzzle to the extremity of the interfemoral membrane is four inches and ten lines.

7. PHYLLOSTOMA OBSCURUM.—SOOTY JAVELIN-BAT.

Syn. PHYLLOSTOMA OBSCURUM.—Pr. Max. Beitr. II. 203.

Icon. Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR sooty-black above, ash-grey beneath.

THE EARS nearly ovate. THE AURICULAR OPERCULUM very small, rather broad.

INHABITS Brazil.

This specimen was found by Prince Maximilian at Villa Viçozza, on the river Peruhype.

(B.) TAILED JAVELIN-BATS.

8. PHYLLOSTOMA HASTATUM.—COMMON JAVELIN-BAT.

Syn. LE FER-DE-LANCE.—Cuv. Reg. Anim. I. 117.

VESPERTILIO HASTATUS.—Linn. Gmel.

Icon. PHYLLOSTOMA HASTATUM.—Geoff. Ann. Mus. XV. pl. 11, (head).—Pr. Max. Abbild.

Buff. Hist. Nat. XIII. pl. 33.—copied in Schreb. pl. 46, B.

VESPERTILIO PERSPICILLATUS.—Schreb. pl. 46, A.

SPECIFIC CHARACTERS.

THE HAIR varying from dark to light brown, sometimes tipped with grey.

THE NASAL APPENDAGES smooth on the margins. THE TAIL wholly engaged in the interfemoral membrane.

INHABITS Brazil.

Buffon first described this Bat under the appellation of *Fer-de-lance*, from the resemblance of its nasal leaf to the head of a spear. This appendage is undivided, without any ridge at its point, or any heel or pad; the middle line is somewhat elevated, and its base is so narrow, that the leaf seems as if supported by a slender petal; the horse-shoe, on the other hand, is broader than in any other species of the genus. It is a strong, robust-looking animal, largely endowed with membranes; its extreme length, including the head and membrane, is about seven inches, and breadth between nineteen and twenty inches. The fur is short, of a chestnut colour above, and fawn brown on the abdomen; the membranes are reddish-brown, and the leaf, ears, and limbs, of a blackish-brown. The muzzle is short and broad; the incisors regularly set between the canines, which are wide apart; the ears are long, and project upwards; a row of warts, in the form of the letter V, appears on the lower lip; the tail, half an inch long, is all but completely enveloped in the interfemoral membrane, which is prolonged as far as the toes, and is abundant.

9. PHYLLOSTOMA ELONGATUM.—SHORT-TAILED JAVELIN-BAT.

Syn. et Icon. LE PHYLLOSTOME À FEUILLE ALLONGÉE, (*Ph. elongatum*).—Geoff. Ann. Mus. XV. 185, pl. 9.

PHYLLOSTOMA BREVICAUDUM?—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown above, lighter beneath.

THE NASAL APPENDAGE long, pointed, and entire.

THE TAIL free at the point.

INHABITS Brazil.

It is to M. Geoffroy that we are likewise indebted for all our knowledge of this very remarkable-looking species. He found it in the Paris Museum, and could learn nothing of its origin or history. This animal strikingly illustrates the superfluity of cutaneous texture with which this genus abounds; the wings are most ample, and the interfemoral membrane a large parachute; its lower margin springing at right angles from the ankles: the tail extends about one third of its length, and then perforates it, not, as in the former species, on the inside, but on the outside. The nasal leaf of this species surpasses in length that of all the other known species; it is terminated at its base by a sinuose border, and united in front with the horse-shoe, both being narrow at their junction. The ears are broad, striated, and straight towards the point; the operculum is notched as mentioned in the last species; the muzzle is large and short, a regular row of warts appears on the under lip, and the incisors are regularly arranged. Its extreme length from the snout to the inferior extremity of the interfemoral membrane is about six inches; its breadth across one foot four inches.

10. PHYLLOSTOMA CRENULATUM.—NOTCHED JAVELIN-BAT.

Syn. LE FER CRÉNELÉ.—Cuv. Reg. Anim. I. 117.

Icon. PHYLLOSTOME CRÉNELÉ, (*Ph. crenulatum*).—Geoff. Ann. Mus. XV. pl. 10.

SPECIFIC CHARACTERS.

THE NASAL APPENDAGE triangular, notched on the margin.

THE TAIL free at the point.

INHABITS South America.

This species was first noticed by M. Geoffroy in the year 1810, and we are not aware that any further information has since been added to his short, but excellent description. The French Naturalist found a specimen in the Paris Museum, and inferred that it came from South America. Its habits, accordingly, are quite unknown.

The most marked peculiarities of this interesting species are the striking indentations or notches upon the outside of the leaf of the nose and the projecting operculum of the ear, which at once attract attention on a front view of the animal, and from which it has received its specific name. The leaf is, moreover, singular in these respects, that it is the only one known in which the edge is straight, not curved, but like an isosceles triangle, or a serrated halbert head, and does not spring from the horse-shoe. Its muzzle is short, thick, and obtuse; its lower lip is studded with warts; its ears are broad, and nearly regularly oval; the tail extends more than half way down the interfemoral membrane; and its point, for more than a line, is free from the membrane, projecting on the inner side. The body is stout, and about two inches and a half long; the head is an inch; the ears ten lines, the leaf nearly six; the extreme breadth from the tip of the one wing to that of the other thirteen inches, the tail eleven lines.

11. PHYLLOSTOMA MACROPHYLLUM.—LONG-TAILED JAVELIN-BAT.

Syn. DAS GROEBLAT.—Pr. Max. Beitr. II. 188.
Icon. PHYLLOSTOMA MACROPHYLLUM.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR sooty-black.
THE NASAL APPENDAGE very long and pointed. THE TAIL nearly as long as the body.
THE INTERFEMORAL MEMBRANE marked with concentric lines, and semicircular.
INHABITS Brazil.

This Bat is found, though rarely, in the large forests which skirt the banks of the Mucuri. During the day they remain suspended by the rocks and trunks of trees. The interfemoral membrane is much longer than in most of its congeners, and the species can be at once distinguished by the semicircular rugæ.

12. PHYLLOSTOMA GRAYII.—GRAY'S JAVELIN-BAT.

Syn. et Icon. PHYLLOSTOMA GRAYII.—Waterh.¹ in Voy. Beagl. II. 3, Mamm. pl. 2.

SPECIFIC CHARACTERS.

THE HAIR dark brown, mixed with grey. THE MEMBRANES sooty-black.
THE TAIL short, included in the interfemoral membrane.
THE UNDER-LIP with an ovate group of warts.
INHABITS Pernambuco, Brazil.

Mr Darwin informs us that this species appeared to be common at Pernambuco, (five degrees north of Bahia.) Upon entering an old lime-kiln in the middle of the day, he disturbed a considerable number of them: they did not seem to be much incommoded by the light, and their habitation was much less dark than that usually frequented as a sleeping place by these animals.

13. PHYLLOSTOMA? SYLVICOLUM.—RUSTIC JAVELIN-BAT.

Syn. et Icon. LOPHOSTOMA SYLVICOLA.—D'Orb. Voy. Mamm. pl. 6.

SPECIFIC CHARACTERS.

THE HAIR on the face brown, whitish beneath the neck, elsewhere grey.
THE NASAL APPENDAGES entire, long, pointed.
THE EARS divided by a membrane into two compartments.
THE TAIL short, free at the point.
INHABITS South America.

This animal is only known to us through the beautiful drawing of M. D'Orbigny. As that Naturalist has not yet published the characters on which he reposes the genus Lophostoma, we are unable to speak with certainty thereon; but from the appearance of the cranium, we are inclined to regard it as a Phyllostome which had lost two of the lower incisors through the development of the canines.

DOUBTFUL SPECIES.

1. PH. PLANIROSTRE, (Spix, Sim. et Vespert. Bras. pl. 36, fig. 1.)—The head is broad, and depressed above: sides of the nose studded with verrucose tubercles, the lower margin of the nose-leaf is free and hanging; lips notched at the margin; chin not deep but broad.

It frequents the suburbs of St Salvador.

2. PH. CHILDRENI (Gray, in Mag. Zool. and Bot. II.) has the lower lip studded with an half ovate group of crowded warts. It is brown, slightly grizzled, hairs grey-tipped; it is greyer beneath; ears large, membranous, rounded at the ends; nose-leaf ovate, lanceolate, rather longer than wide; wings brown; warts of lower lip in three or four arched series; expanse twelve inches.

It inhabits South America. Specimen in British Museum, received from J. G. Children, Esq.

3. PH. BENNETTI, (Gray, loc. cit.)—We are informed that, on the front of the lower lip of this Phyllostome, there is a small ovate space formed of two small tubercles, as in the Vampire. Its colour is fulvous brown, rather paler beneath; hair is very long, soft, with greenish tips; ears very large, rather acute; nose-leaf very large, ovate, lanceolate, with a thick convex midrib; wings brown. Expanse twelve inches; nose-leaf eight lines.

It inhabits South America. Specimen in the British Museum.

4. PH. BREVICORNUM, (Pr. Max. Abbild. and Beitr.)—The length of this species is described as about two inches and three lines, and the extreme

breadth eleven inches; the ears are broad, and the short tragus is narrow and lance-shaped. The muzzle is broad and obtuse; the interfemoral membrane springs from the upper part of the ankle, and, approximating the tail, is crescent-shaped. The fur on the body appears to be copious; it is russet brown on the head and back, and somewhat paler underneath. The ears, nasal leaf, and membranes, are dark brown. It is gregarious in the old buildings of Coroaba, and in the Brazilian forest on the banks of the Jueu.

Is this not the young of Ph. elongatum?

Note.—PHYLLOSTOMA SORICINUM, Geoff., belongs to the Genus Glossophaga.

PHYLLOSTOMA SPECTRUM, Geoff., belongs to Vampyrus; probably also Ph. soricinum, cirrhosum, and bidens of Fischer, (Syn. Mamm.)

DOUBTFUL GENUS AND SPECIES.

1. MONOPHYLLUS REDMANNI, (Leach, in Linn. Trans. XIII. 75.) This species was sent to the British Museum by R. S. Redman, Esq.; and Dr Leach precipitately regarded it as entitled to a generic distinction from having four incisors in the upper jaw, and none in the lower. This animal had a short tail, and the nose-leaf was erect. The colour above, as of the membranes, ears, and nose-leaf, was brown; beneath mouse-coloured. The ears were round, and the beard long.

GENUS XII. GLOSSOPHAGA.—LONG-TONGUED BATS.

Syn. LES GLOSSOPHAGES, (Glossophaga.)—Geoff. Mém. Mus. IV. 418, et al. DIPHYLLO.—Spix, Sim. et Vespert. Bras.—D'Orb. Voy. MADATEUS.—Leach, in Linn. Trans. XIII. PHYLLOPHONA, ANOURA, and BRACHYPHYLLA?—Gray, in Mag. Zool. and Bot. II.

GENERIC CHARACTERS.

THE HEAD broad. THE MUZZLE produced and narrow.
THE EARS small, with an operculum.
THE NASAL APPENDAGE double; the upper one erect, almost hastate small; the lower blending into the upper lip.
THE TONGUE very long, extensile, slender, channelled, and rough, with reversed papillæ.
THE INTERFEMORAL MEMBRANE imperfect or wanting.
THE TAIL short or wanting.

THE DENTAL FORMULA $\frac{2+2+C+(4F+2)M}{2+C+(3F+3)M} = \frac{18}{18} = 36$.

INHABIT South America.

M. Geoffroy (Mém. du Mus. IV. p. 418) separates from the Javelin-Bats those species having the tongue slender, capable of extension, and furnished with papillæ resembling hairs. To these he assigns the name of Glossophaga, all of which are likewise from America.

By the above arrangement of M. Geoffroy, proposed in the year 1818, the blood-sucking Bats were thus divided into three groups, Vampyrus, Glossophaga, and Phyllostoma, their natural arrangement, according to him, being in the order in which they are above enumerated.

The chief distinction of the Glossophaga, as may be supposed, is founded on the characters of their tongue, which is very long, straight, extensile, and capable of longitudinally folding upon itself. Its length is so great, that, after death, it generally projects to a great extent from the mouth, and it is next to impossible by any means to return it: hence these animals are usually represented with this member protruding. But the most remarkable peculiarity of their tongue consists in its edges, or what may be called its border. It has the power of being folded superiorly upon itself from side to side, so that there is a deep hollow, or rather a true canal, formed throughout its whole extent; the edge being surmounted with small papillæ, and covered with cilæ. Pallas long ago represented this in his Spicilegia Zoologica, both of the natural size, and as seen under the microscope. It will be recollected that, whilst dwelling upon the sucking apparatus of the Vampyres, we remarked that particular attention had been paid to a number of warts, which were arranged in a circular form upon the centre of the tongue, and considerable discussion maintained upon the manner in which these acted in the production of a vacuum. But, however admirably those parts may in them discharge this function, their efforts are feeble when compared with this interesting piece of anatomy in the glossophagæ. The resources in these latter for the production of a vacuum is augmented in proportion to the

¹ WATERH. IN VOY. BEAGL.—The Zoology of the Voyage of H.M.S. Beagle, under the command of Captain Fitzroy, R.N., during the years 1832 to 1836, published with the approval of the Lords Commissioners of Her Majesty's Treasury. Mammalia by George R. Waterhouse. London, 1838.

number of the points of the tongue they apply; and it is manifest, that the whole organ is engaged in the operation.

The eranium, moreover, is broader, and proportionally quite as long as that of the Vampyres; its case also is more voluminous, and the maxillary bones by no means so contracted, hence the teeth are freer during their growth. The incisors are persistent, and regularly arranged. The head is long, and remarkably conical. The extremity of the muzzle is slender; the leaf is very near its extremity, and inconsiderable in size. Its mantle, likewise, is not remarkably large, the interfemoral membrane especially being sometimes very small, or even quite deficient.

On examining the several species, it will be found that there is a strong resemblance in their heads and nasal apparatus, and that the most striking characters are to be found in the interfemoral membrane; in some it is sufficiently ample, whilst in others it is very insignificant, and almost rudimentary; at one time, again, there is a tail, and at another none.

Pallas foresaw that the presence or absence of this appendage might be construed into a characteristic distinction of the two sexes. He accordingly reports that he had seen many individuals of the species he described, and that he never observed in any of them, male or female, the slightest vestige of a tail,—*caudæ nullum vestigium*. In the Knot-tailed Bat, which, by the extent of its interfemoral membrane, closely approximates to Pallas' animal, the tail exists: it is a very small appendage, which is not prolonged beyond a fourth of the extent of the membrane, and which appears externally as a mere point or nodosity. It might be designated a tubercle, manifesting the tendency of the tail to render itself free.

1. GLOSSOPHAGA SORICINA.—PALLAS' LONG-TONGUED BAT.

Syn. VESPERTILIO SORICINUS.—Linn. Gmel. I.

LEAF-BAT.—Penn. Quadr. No. 498.—Shaw, Gen. Zool. I. 141.

Icon. PHYLLOSTOMA SORICINUM, (Musette.)—Geoff. Ann. Mus. XV. pl. 11. VESPERTILIO SORICINUS.—Pall. Spicil. Zool. III. pl. 3 and 4.—Copied in Schreb. Säugeth. pl. 47; and in Buff. Hist. Nat. Suppl. III. pl. 53.

SPECIFIC CHARACTERS.

THE HAIR greyish-brown above, whitish beneath.

THE INTERFEMORAL MEMBRANE broad. THE TAIL wanting.

INHABITS Surinam and the Carribbee Islands.

This species is found in Surinam, and in the islands which lie near the coast. The account which Pallas supplied, both of its external characters and anatomical structure, is drawn up with the usual ability of this Naturalist, and leaves nothing to be desired. It is small when compared to the Phyllostomes. Its muzzle is proportionably long and stout; hence the canines are wide apart; the incisors are not crowded, and are in a single row. The nasal leaf is small, and at the very extremity of the snout; it is in the shape of a heart, broadest at its base in the males, and terminating in an acute point. The ears are small and oblong. The interfemoral membrane starts upwards from the ankle, making rather an acute angle with the tibia, and is supported by very short spurs or ossicula. The tongue is very large, remarkably long, and formed into a deep canal, whose edges are covered with papillæ, which overlap, and resemble minute hairs. This deep furrow can, without doubt, be converted during life into a regular tube or cylinder; and it is through these canals that the blood, in which these animals delight, flows while they feed. The fur of this animal is soft and woolly; its back is of a greyish-brown; its abdomen whitish. Its dimensions from the tip of the snout to the origin of the tail is scarcely two inches; its tail does not exceed two lines; its extreme breadth is nearly nine inches.

2. GLOSSOPHAGA AMPLEXICAUDATA.—KNOT-TAILED LONG-TONGUED BAT.

Syn. PHYLLOPHORA AMPLEXICAUDATA.—Gray, in Mag. Zool. and Bot. II.

Icon. GLOSSOPHAGA AMPLEXICAUDATA.—Geoff. Mém. Mus. IV. pl. 18, A. Pr. Max. Beitr. II 208.—Spix, Sim. et Vespert. Bras. pl. 36, fig. 4.

SPECIFIC CHARACTERS.

THE HAIR dark greyish-brown above, paler beneath.

THE INTERFEMORAL MEMBRANE broad. THE TAIL short, included in the interfemoral membrane, and ending in a nodule.

INHABITS Brazil, about Rio Janeiro.

This species was first discovered in Brazil by the younger Delalande, who transmitted it to Paris, where it was examined and classified by M. Geoffroy in 1818. It is one of that section that has rather a large interfemoral membrane and a tail. The length of its head and body is three inches; of the tail two lines, of the nose-leaf scarcely two lines, of the external ear one and a half line; extreme expanse, ten inches and two

lines. The nose-leaf is spear-shaped and pointed; the lip is fissured and notched on the margin; the ear naked, and without a margin; the alar membrane is long, rather narrow, naked, and, near the body and joints, ornamented with rows of spots. The fur of the whole body is very copious, soft, and loughish; above it is of a dark greyish-brown; beneath the colour is paler.

It inhabits the houses of Rio Janeiro, and is common throughout Brazil.

3. GLOSSOPHAGA CAUDIFERA.—FREE-TAILED LONG-TONGUED BAT.

Syn. et Icon. GLOSSOPHAGA CAUDIFERA.—Geoff. Mém. Mus. IV. pl. 17.—Dict. des Sc. Nat. XI. p. 118.—Desm. Mam. No. 178.—Gray, in Mag. Zool. and Bot. II.

SPECIFIC CHARACTERS.

THE HAIR dark brown.

THE INTERFEMORAL MEMBRANE very short. THE TAIL free at the point.

INHABITS Brazil, near Rio Janeiro.

The Free-tailed Glossophaga was also discovered in Brazil by M. Delalande, and was examined by M. Geoffroy, although the details of its organization have as yet been scantily provided. The interfemoral membrane is very short and narrow, forming but a slender margin from the spurs to the coccyx; the tail is very short, and yet projects somewhat beyond the membrane. The ears are of rather small dimensions, with a small operculum; the lower lip is deeply fissured; the horse-shoe is well marked; the nose-leaf distinctly marked, broad, and not high, but pointed; a copious supply of small bristles surrounds the nose and lower lip. It is a trifle longer in its proportions than the preceding species. Its colour is dark brown.

This species was discovered in the Brazils, near Rio Janeiro.

4. GLOSSOPHAGA ECAUDATA.—TAIL-LESS LONG-TONGUED BAT.

Syn. ANOURA GEOFFROYI.—Gray, in Mag. Zool. and Bot. II.

Icon. GLOSSOPHAGA ECAUDATA.—Geoff. Mém. Mus. IV. pl. 18, B.—Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR dark brown above, paler beneath.

THE INTERFEMORAL MEMBRANE very short. THE TAIL wanting.

INHABITS Brazil, near Rio Janeiro.

The length of the head of this species is eleven lines, of the body two inches and five lines; the extreme expanse is about eleven inches and a half. The length of the auricle is almost four lines; of the nose-leaf two. The head is both long and broad; the body is proportionably stout; the lip is cleft; the nose-leaf triangular in shape, the spur small and pointed. The face is covered with minute bristles; the whole body is clad with soft hairs as in the mouse, longest on the back, where the colour is dark brown, and is paler underneath, merging to a greyish-brown.

M. Delalande found this animal near Rio Janeiro, and Prince Maximilian at Porto Seguro.

DOUBTFUL GENERA AND SPECIES.

1. DIPHYLLOPS ECAUDATA, (Spix, Sim. et Vespert. Bras. p. 68, pl. 36, fig. 7.)—The peculiar distinctions of this proposed genus of Spix are a bifoliate nose-leaf, and a total absence of the interfemoral membrane and tail. The length of this animal is three inches, the extreme width between ten and eleven; its back is of a dark brown colour, the abdomen and under part of the head light brown; the wings are black, and almost naked.

2. BRACHYPHYLLA CAVERNARUM, (Gray, in Mag. Zool. and Bot. II. 489.) Specimens of this Bat are to be found in the Museums of the British Museum and of the Zoological Society, having been received from St Vincents, West Indies. The following is Mr Gray's description of the generic characters: "Tail very short, interfemoral membrane deeply nicked, two rayed; nose-leaf small, surrounded by a deep groove, which separates it from the face; front of under lip with a smooth triangular space bearded on the edge."

3. MADATEUS LEWISI, (Leach, in Linn. Trans. XIII. 81.)—This animal constituted the seventh and last genus of Dr Leach's Nose-leafed Bats. It had four incisors above and four below; two nose-leaves, one horizontal, the other vertical, and no tail. The specimen described formed part of Mr Brook's Museum, and was sent from Jamaica by Mr D. Lewis. Its extreme expanse was seventeen inches. Its colour generally black; its teeth were transversely striated, and the interfemoral membrane acutely emarginated.

TRIBE III.—MONOPHALANGIA ISTIOPHORA.

Syn. ISTIOPHORI, (in part.)—Spix, Sim. et Vespert. Bras.
RHINOLOPHINA.—Gray, in Mag. Zool. and Bot. II.—Less. Mam.

CHARACTERS OF THE TRIBE.

THE INDEX with only one ossified phalanx, the other fingers with two.
THE NOSE with one or more leafy appendages.

GENUS XIII. MEGADERMA.—BROAD-WINGED BATS.

Syn. LES MÉGADERMES.—Cuv. Reg. Anim. I. 118.
MEGADERMA.—Geoff. Ann. Mus. XV. 197, et al.
LAVIA.—Gray, in Mag. Zool. et Bot. II.

GENERIC CHARACTERS.

$$\text{THE DENTAL FORMULA } \frac{2 \left| \begin{array}{c} C+(F+3)M \\ 2+C+(2F+3)M \end{array} \right.}{16} = 26.$$

THE NOSE with three appendages, the upper one vertical, the second horizontal, and the lower resembling a horse-shoe.

THE EARS very large, united over the forehead; the opercula prominent.

THE TONGUE short and slender.

THE INTERFEMORAL MEMBRANE bounded by a straight margin.

THE TAIL wanting.

INHABIT Africa and the East Indies.

The Broad-winged Bats have their nasal appendages as complicated as those of the Phyllostomes; the opercula are large, often furcated; the conchæ of the ears are very ample, and blended one into the other on the top of the head; the tongue and lips are smooth; the interfemoral membrane entire; and the tail wanting. Their incisors are four in the lower jaw; these teeth are wanting in the upper, and the intermaxillary cartilage never becomes ossified.

They all come from different parts of the Old Continent, such as Africa, and the Eastern Archipelago; and, like the Phyllostomes, may most readily be distinguished among themselves by the forms of their nasal appendages.

The Megadermata constitute a link in the animal series which, in an interesting manner, connects the Phyllostomes we have left, with the Genus Rhinolophus, to which we next proceed. This link is in itself perfectly circumscribed, and on either side there is an interval or hiatus which is distinctly marked. The Broad-winged Bats are furnished with an operculum, and have no tail, so that they cannot be confounded with the Rhinolophi. In these points they agree with the Phyllostomes, but then they want the long tongue, and the extraordinary papillæ and warts with which these last are furnished; neither their tongue, nor their lips, which are smooth, and without notches or tubercles, are peculiarly formed for the purpose of sucking. They are not endowed with the additional phalanx upon the middle finger, and yet none of the Bats are more copiously supplied with the dermal development, as it respects the wings and other parts. The ears are so large that they not only come into contact, but unite to a greater or less extent above the forehead. The nasal appendage likewise so superabounds, that, in addition to the horse-shoe, and nose-leaf proper, there is an additional one which protrudes on either side horizontally from between the nostrils, and acts as a distinct valve to these apertures. M. Geoffroy speculates whether it be owing to the extraordinary development of this apparatus that there is a diminution, or rather, we might say, extinction of the intermaxillary bones, and decidedly inclines to this belief. Be this, however, as it may, the fact remains the same, viz. that the intermaxillary bones are either quite wanting, or degenerate into mere membranes, which are suspended in the soft parts of the upper lip; their absence accounts for the want of the upper incisors.

The species in this genus have no tail, but possess an interfemoral membrane, which is of very considerable dimensions; and, to make up the deficiency arising from the want of the former appendage, we find there are two strong ligaments which have their origin in the sciatic region, and run obliquely to the heels; they are inclosed in the coats of the membrane, and contribute to its support.

The geographical distribution of these Megadermata, as well as of the Rhinolophi, is the Old World, more especially the Indian Archipelago, though they are also found on the continents of Asia and Africa; whilst the Phyllostomes, as we have seen, are confined to the New World.

1. MEGADERMA SPASMA.—TREFOIL BROAD-WINGED BAT.

Syn. LE SPASME DE TERNAË.—Cuv. Reg. Anim. I. 118.
MEGADERMA SPASMA.—Geoff. Ann. Mus. XV. 198.

VOL. II.

CORDATED BAT.—Penn. Quadr. No. 499.

LE THÉFLE DE JAVA.—Cuv. Reg. Anim. I. 118.

MEGADERMA TRIFOLIUM.—Geoff. Ann. Mus. XV. 197.

Icon. Geoff. Ann. Mus. XV. pl. 12, (heads Spasma and Tréfle.)—Seba, pl. 56, fig. 1, copied in Schreb. pl. 48, and again from the latter in Shaw, Zool. pl. 42.

SPECIFIC CHARACTERS.

THE VERTICAL NASAL APPENDAGE ovate or cordate, resembling the horizontal; size, one-fifth of the auricle.

THE OPERCULA bi- or tri-lobed.

INHABITS Ternate and Java.

This very singular-looking Bat has long occupied a place in the annals of the science, without much being actually known of its history. It is the *Glis volans Ternatanus* of Seba, and the *Vespertilio Spasma* of Linnæus and Cuvier, in Tab. Element. des Animaux. Long after the discovery of Seba, M. Leschenault de la Tour encountered in Java a Bat, which he sent, along with a description, to Paris, where it fell under the inspection of M. Geoffroy, who regarded it as a new and distinct species, a view which subsequently was adopted in the Regne Animal, and in most systematic works. Additional information, we apprehend, has led M. Temminck and J. B. Fischer to regard these animals as one.

The *Spasma* exhibits very strikingly the three-crested appearance of the nasal appendages of the genus. It has first a large horse-shoe, then what is called the horizontal leaf, and, finally, the perpendicular one; these latter are heart-shaped, with the base downwards; the lower is the larger, and more immediately covers the entrance of the nostrils. The name *Trifolium* has been applied to this animal from the peculiar shape of its very large operculum, having three not very symmetrical lobes, the central one of which is much the longest, and is acutely pointed. The auricles correspond to the great size of the opercula: they are very broad, full, and high; they meet over the forehead, and are there united to about one-third of their extent. The only other specific differences which require to be dwelt upon regard the membranes. The spurs or spicula of the tarsus are long, so affording firm support to the interfemoral membrane, and the alar membranes are very diaphanous, being free from tendinous fibres than some of their congeners. Its fur is very long and soft, and its colour is mouse-grey. Seba described the animal he observed as having its forehead a light red, and the other parts of its body of a russet hue. The length of the head and body is four inches, of the interfemoral membrane one and a half, the extreme breadth ten and a half inches.

The last named observer found this animal in the island of Ternate, and Leschenault in Java. Of its habits nothing has yet been recorded.

2. MEGADERMA LYRA.—LYRE-NOSED BROAD-WINGED BAT.

Syn. LA LYRE.—Cuv. Reg. Anim. I. 118.

Icon. MEGADERMA LYRA.—Geoff. Ann. Mus. XV. 198, pl. 12, fig. and cranium.

SPECIFIC CHARACTERS.

THE VERTICAL NASAL APPENDAGE rectangular; the horizontal one-half less.

INHABITS India.

The size of the Lyre-nosed Bat very nearly agrees with that of the preceding species. M. Geoffroy received a specimen of the animal from Holland, and hence inferred it must have been procured from some of the Dutch Colonies in the East Indies: the name he conferred on it agrees perfectly with the form of the nasal leaf. Mr Gray informs us there is a specimen in the British Museum.

The mid-rib of the nose-leaf appears more prominent than in the Phyllostomes, though in reality it is not so thick; the appearance being owing to a fold extending the whole length of the lateral lobes, which are somewhat hollow, and curve forward. The leaf at its upper extremity is square pointed, as may be proved by unfolding it, otherwise it seems to terminate in three points, the centre one being the most projecting. The lateral lobes are continuous with the horse-shoe, or the semicircular ridge situate before the nostrils. Besides these, there is the fold which covers the base of the conc; it is concentric with the horse-shoe, and takes its rise from the root of the projection; ad ering

in its medial line to the cartilages which form the nostrils, it becomes in a measure a pair of auricles to these apertures, whose openings are lateral; this fold is about half the breadth of the leaf properly so called.

The ears are very large, and the portion which is united over the forehead exceeds that which is free above. The operculum consists of two lobes, in the form of half a heart; the internal lobe is round at its extremity, the external acute, and twice the length of the other. The interfemoral membrane includes three tendons, which take their origin at the coccyx, and run in a straight line, the lateral ones to the tarsi, and the middle one to the external margin in the course of the mesial line. These tendons appear useful in confining and folding the interfemoral membrane when required. The fur is red above, and fawn coloured below.

3. MEGADERMA FRONS.—SMALL-EARED BROAD-WINGED BAT.

Syn. LA FEUILLE.—Cuv. Reg. Anim. I. 118.—Buff. Hist. Nat. XIII.

MEGADERMA FRONS.—Geoff. Ann. Mus. XV. 198.

LAVIA FRONS.—Gray, in Mag. Zool. et Bot. II.

Icon. Geoff. Ann. Mus. XX. pl. I, (head.)

SPECIFIC CHARACTERS.

THE VERTICAL NASAL APPENDAGE oval; size, one-half of the auricle.

INHABITS Africa.

This Bat, remarkable for the size of its nose-leaf, and described about seventy years ago by the accurate Adanson, was long forgotten by Naturalists. M. Daubenton, in the *Memoires de l'Acad. des Sciences*, first noticed it under the name of the Leafed-Bat. Its appendage is eight lines high, and six broad, a great size in proportion to that of the animal, which is only two inches and a quarter long from the tip of the snout to the extremity of the body. The ears are about twice the size of the nose-leaf, and these appendages are united above the forehead for half the extent of their inner margin; the operculum again is half the length of the external ear, and very narrow and pointed towards the extremity. The fur is of a beautiful ash-colour, having here and there shadings of a delicate yellow tint.

Adanson found it at Senegal; it is also stated to exist in Gambia and Egypt. Mr Gray reports there is a specimen in the British Museum.

IMAGINARY SPECIES.

1. M. TRIFOLIUM.—After the statements made above, we need scarcely remark that this alleged species is to be regarded as identical with M. Spasma.

GENUS XIV. RHINOLOPHUS.—HORSE-SHOE BATS.

Syn. LES RHINOLOPHES.—Cuv. Reg. Anim. I. 118.

RHINOLOPHUS.—Geoff. Ann. Mus. XX. et al.

HIPPOSIDEROS et ARITEUS.—Gray, in Mag. Zool. et Bot. II.

PHYLLORHINA.—Bonap.

NOCTILIO.—Kuhl et Bechstein.

VESPERTILIO, (in part.)—Linn. et Erxl.

GENERIC CHARACTERS.

$$\text{THE DENTAL FORMULA } \frac{2 \frac{1}{2} + C + (2F + 3)M}{2 + C + (3F + 3)M} = \frac{14}{18} = 32$$

$$\text{More generally } \frac{2 \frac{1}{2} + C + (2F + 3)M}{2 + C + (2F + 3)M} = \frac{14}{16} = 30$$

$$\text{or, only } \frac{2 \frac{1}{2} + C + (F + 3)M}{2 + C + (2F + 3)M} = \frac{12}{16} = 28$$

THE MUZZLE obtuse. THE MAMMÆ two, pectoral; two inguinal glands not lactiferous.

THE EARS large, separated, without opercula.

THE NOSE with complicated membranes.

THE INTERFEMORAL MEMBRANE entire.

THE TAIL middle sized, included in the interfemoral membrane.

INHABIT the Old World.

The Rhinolophi, commonly called Horse-shoe Bats, (*Fers-à-cheval*), have the muzzle supplied with very complicated membranes and crests, attached to the chanfrin, and presenting some resemblance to a Horse's shoe: the tail is long, and included in the interfemoral membrane. They have four incisors below, and two very small ones above, placed in the intermaxillary cartilage. Two of the species, very common in France, were discovered by Daubenton.

The variations presented by the teeth of the animals composing this genus have long been a cause of annoyance to Naturalists and confusion in the Science, which M. Temminck has at last succeeded in removing. That distinguished Professor, as is well known, has long been engaged with several monographs on various tribes of the animal series, amongst others on these Bats; and we avail ourselves of the present opportunity to express our obligations to him, our admiration of his ardent zeal, and the successful issue of his labours. Generally two incisors are found in the upper jaw, but sometimes there are none:—they are connected with the intermaxillary cartilages, which again are connected with the nasal cartilage; they are obtuse, very small, sometimes scarcely visible, and often fall out in advanced age. The lower incisors are somewhat crowded, and are either bi-lobed or tri-lobed. The canines have a heel of very considerable size, which is developed with age, and yet does not displace the incisors as we have previously seen in other genera. The variation in the molars, which have three sharp cusps, is also remarkable. Sometimes there are four in the upper jaw and five in the under; and in this case there is no kind of anormal or false grinder:—sometimes again there are five above and five below; and when this occurs, we find an anormal tooth, not in the regular line of the teeth, placed externally upon the heel of the canine, and without any apparent use:—finally, again, there are sometimes five teeth above and six below, and then there is an additional false molar in the lower jaw. Thus we explain how the total number of teeth is twenty-eight, thirty, and more rarely thirty-two.

We have now in addition to notice, that the Rhinolophi are destitute of an intermaxillary bone connected in the usual way with the maxillaries; and this bone is replaced in those species which are furnished with upper incisors, (as already stated respecting the Megadermata,) with two small osseous laminae, which are flat, very thin, diverging at their extremities, and touching each other in the middle; each of these small laminae suspended in the nasal cartilage supports a tooth, not very firmly attached to these moving laminae, and falling out under the slightest violence. Notwithstanding this, however, they do not regularly disappear, and when exposed to pressure they must yield and recoil, for the great majority of this group are generally found with these teeth in the adult state, and they are always in the young. Those species, again, which altogether want these teeth, are found destitute of them at every period of their existence, in consequence of the absence of the intermaxillary laminae, which are replaced by a simple cartilage. This singular intermaxillary apparatus is put into action by sets of muscles, which give to this genus, as we have already noticed in others, the power of elevating or depressing the upper incisors; thus exhibiting in these Mammalia an analogy with the peculiar formation which exists in numerous Serpents. The posterior extremity of the nasal cartilage and the two bony laminae are suspended at the anterior extremity of the vomer; and their movements seem to depend upon the organ of smell, which is very delicate in these animals, and to which we shall presently revert.

The Rhinolophi are quite destitute of the fibula, or smaller leg-bone; the tibia again is long and slender; and they have no great toe, which, as in the genus *Dysopes*, is separate and opposable to the others. The radius is much bent, and the accompanying ulna is remarkably short and rudimentary. The sternum is projecting, and its angle salient. As to the phalanges of the toes, the index finger has but one, and the others have two or three, the metacarpal bone being taken into account. The tail is long, and wholly or partially embraced even to its last articulation by the interfemoral membrane.

For a long time doubts were entertained as to the use which was to be ascribed to two abdominal papillary tubercles which were placed a little above the pubis; some authors believing they were a second pair of true mammae. Kuhl, in speaking of one of the species, mentions that they had not appeared in the females of a year old, that they are scarcely visible in those that are two years old, and that they are not completely developed till the age of three. The same Naturalist also demonstrated that these parts were not mammae properly so called, because they did not terminate in glands which served for the secretion of the milky fluid; he affirmed, on the other hand, that they terminated in the cavity of the pelvis. Curious to verify the observations made by M. Kuhl, as well as by Bechstein and others, M. Temminck informs us that he made minute investigations in half a dozen of species, and the result satisfied him that these nipples in no degree subserve the function of lactation, but give issue only to an oily and fetid secretion, which greatly increases the disagreeable odour which these animals exhale; and which confined to the males serves the same ends as the syphons or odoriferous glands which are observed in many other genera of the Chiroptera. They are found in most of the *Dysopes*, and in many of the *Fru-givori*, in some *Phyllostomes*, and in the species *Speoris* and *nobilis* of our present genus.

It has been stated that the ear of the Rhinolophi possesses nothing which can supply the deficiency of the operculum or tragus; an asser-

tion which is true concerning some of the species. It applies to all those which have the nose-leaf simple and transversal, and which will be found arranged in the first section of the genus; in these we may say there is no operculum, or it is very imperfectly developed, their ear is straight, without the tragus, or any conspicuous lobe. On the other hand, all those species which have a complicated nose-leaf, or one in the form of a spear-head, and which go to form the second section of our arrangement, are possessed of an inferior lobe more or less distinct, and transversal, detached from the ear by a furrow more or less marked, and which effects the closing of the organ as completely as it is possible to conceive that any other apparatus could do. This lobe is in a remarkable degree developed in some species which belong to India, of which we may mention the *Trifolius*, *Lactus*, *Eurotis*, and *Diadema*; it is also very distinct in some of the European species.

The organ of smell presents a complication in this genus similar to what we have seen in the Megadermata, and such as we shall find in some genera which succeed. The nasal chambers do not extend beyond the first molars, and are tortuous and globose; the entrance to the nostrils is found in front and below; it is a large opening which the intermaxillary bones, reduced to two thin laminae, terminate, and which accompany the motions of the lips; these latter parts, again, rising in folds as high as the chanfrin, leave between themselves and the nasal chambers a void space, at the bottom of which, and as it were in a tube, are the openings of the two nostrils, a fold of the skin protecting and clothing the tube, and forming a concha. This fold projects from the nostrils in the form of a horse-shoe, whence the Rhinolophi of Europe have derived their name; and it is detached and rises backwards in a leaflet which differs in form in the different species. The thickness of the lips results from the aggregation of the muscular fibres, which are entwined with each other and opposed in their course. The intermaxillary laminae, and in their absence the mere cartilage which is their substitute, are moved by those fibres, and follow all the vibrations of the organ of smell.

The result of the inquiries hitherto made lead to the conclusion, that none of the genus *Rhinolophus* have as yet been found in America, nor in the region known under the name of Oceanica; the Sonda Islands, along with India, Asia, Africa, and Europe, supplying the types of the group.

The Rhinolophi, as we have seen of some other genera, spend a great part of the year united in bands of many hundreds of individuals of the several sexes in immense caverns, old buildings, or in the enormous trunks of the worm-eaten trees of the virgin forests. When the season of love is past, the females separate from the males, establish themselves in large bands in distinct caverns, and occupy themselves in each other's society, in the care of the two little ones they bring into the world; the males, at this period, also live in bands; and the social habits of the whole family are not resumed till the young ones are in a condition to provide for their own wants. M. Temminck informs us that he has reason to suppose that this kind of separation occurs among the majority of the Chiroptera, and that the young of the first year congregate by themselves.

We shall now make a few remarks upon the labours of those Naturalists who preceded M. Temminck in his meritorious exertions. Linnæus, Erxleben, and Bechstein, took into their accounts neither the dental, aural, nor odoriferous organization of these Bats, which so remarkably distinguishes them from all their European congeners, but associated them all under the common name *Vespertilio*. Linnæus, moreover, confounded the two distinct European species, ascribing their dissimilarity to a local and accidental cause, and classed them together under the name of *V. ferrum equinum*, and for a long time his disciples maintained the erroneous opinion of their master. Bechstein was the first who distinguished the European species into two, assigning the name *Hipposideros* to the second; mistaking, however, another animal for it. Daubenton was at last right, distinguishing them as the large and small *Fer-à-cheval*. M. Geoffroy afterwards published a memoir upon the Chiroptera with a compound nose-leaf, and separated these species under the generic title *Rhinolophus*, adding four foreign species; Cuvier adopted the views of his worthy colleague, and Dr Horsfield reviewing the species, added several from Java.

M. Temminck divides the genus into two sections; in the former of which he places all the species which have the nose-leaf not complicated, with a smooth edge, placed transversely, ribband-like, on the chanfrin; these have no distinct lobe at the base of the concha of the ear, or, at all events, it is very insignificant: this section has no representative in Europe. The second group includes those species which have the nose-leaf more or less complicated, elevated in the form of the lance-head, and having a cartilaginous leaf-stalk; these animals have a marked lobe at the base of the aural concha, and this lobe, more or less developed, is used in closing the auditory foramen, and is the substitute of the more largely developed tragus of the other genera of the Chiroptera. The two European species belong to this section.

(A.) WITH A SIMPLE NOSE-LEAF, TRANSVERSAL,
AND MORE OR LESS CIRCULAR.

(HIPPOSIDEROS,) GRAY.

1. RHINOLOPHUS NOBILIS.—KEBBLECK HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHUS NOBILIS.—Horsf. Jav.—Temm. Mon. Mam. II. 10, pl. 28, pl. 29, fig. 1.

SPECIFIC CHARACTERS.

THE HAIR chestnut-brown above, paler beneath; on the sides of the neck, abdomen, and arms, whitish.

THE TAIL as long as the tibia.

THE NASAL APPENDAGE with the edge notched.

THE EARS broad and pointed.

INHABITS Java, the Moluccas, and Timor.

This is the largest of the known Rhinolophi; its total length being about five inches, of which the tail and membrane occupy one and a half inch; its extreme breadth is nineteen inches. Dr Horsfield supplied a description of the first specimen which reached Europe, since which, M. Temminck has received others from Java and the Moluccas, and some from Timor. Its head is large; the ears are simply shell-shaped, nearly as broad as they are high, without any distinct lobe, and clothed with fur exteriorly at their base. The nose-leaf is simple, with its terminal edge notched somewhat like a crown; behind, and at the base of this leaf, there exist four small orifices or syphons, almost imperceptible to the naked eye; the horse-shoe discharges the office of a funnel, and consists of a broad membrane, which is pointed forwards, and of lateral folds; the tail is half the length of the fore-arm. In the adult the two upper incisors are approximated and converging; the four lower are lobed, and more or less crowded according to the development of the heel of the canines. There are five molars above, the one connected with the canine being very small, and without any apparent function. The fur is very soft and fine; it is also long, abundant, and shaggy. The shoulders and middle of the back are of a fine chestnut colour; below, the shoulders and the lateral parts of the back are pure white; the top of the head and the back of the neck are whitish-grey; the tips of the hair being brown; at the region of the head of the humerus a chestnut band surrounds the white; the sides of the chest, the flanks, and arms, are pure white; the cheeks and sides of the neck brownish-grey, the hairs tipped with white; the middle of the chest and abdomen mouse-coloured. The membranes are of a deep brown; the ears are clad nearly to their middle, the remainder is naked, and marked with striae. These are the markings of the adult; those of the young and mean age are still wanting to complete the history of this beautiful species.

The *nobilis* appears, as already stated, to have a wide distribution. Two specimens exist in the museum belonging to the Honourable East India Company, and numerous specimens in those of the Netherlands. It issues from its native haunts in the evening, flying about the roads and shady walks, and during the day clings in preference to the leaves of the Banana-tree, (*Musa sapientum*.) It feeds on nocturnal insects. The Javanese call it *Kebbleck*.

2. RHINOLOPHUS DIADEMA.—DIADEM HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHUS DIADEMA.—Geoff. Ann. Mus. XX. 263, pl. 6, pl. 5, (head.)—Temm. Mon. Mam. II. 12; pl. 26 and 27, copied from Geoff.

SPECIFIC CHARACTERS.

THE HAIR golden reddish-brown above, greyish beneath, and on the head.

THE TAIL as long as the tibia.

THE NASAL APPENDAGE resembling a crown; the upper margin rounded.

THE EARS broad and pointed.

INHABITS Timor.

The Diadem Rhinolophus is somewhat less than the preceding, its length being five inches, two of which go to the tail, and the extreme breadth sixteen. The head is small in proportion to the size of the ears, which are large, and higher than broad, the pointed extremity being somewhat curved backwards; they are naked, diaphanous, and have something like a lobe towards the base of the concha. The nose-leaf is simple, the terminal edge being in the shape of a quadrant, more or less rolled upon itself; another transverse folicle, somewhat elevated into a point towards the centre, is found between the great leaf and the nostrils; its lateral margins unite with the horse-shoe, and form, as pointed out by

M. Geoffroy, a kind of crown which surrounds the olfactory organ, several folds ornamenting the lateral margin of the horse-shoe. The tail is two-thirds of the length of the fore-arm, and free at the extremity. In the *adult state* the two upper incisors approximate, and the four lower are tri-lobed and ranged in a line; there are five molars above, the so called false one being very small, and attached to the heel of the canine; the five below have pointed cusps.

The remarkable difference between the crania of the *nobilis* and *Diadem* species requires the more ample detail, since the outward forms of the two are so much alike. The olfactory and auditory appendages present no other differences than those connected with the larger size of the former animal; their other dimensions are also proportional, and their colouring differs only in that of the *Diadem* being somewhat more uniform. The cranium of the *nobilis* is larger, owing to the greater width of the zygomatic arches, and the dilatation towards the auditory concha is more considerable; its chanfrin also is broader, and nearly flat, whilst in the *Diadem* the anterior part of the chanfrin is demi-spherical, and its back part forms a fossa with salient edges.

The fur of this animal is soft, fine, long, and abundant, of nearly a uniform colour every where, though somewhat deeper above than below. The head is brownish-grey; the upper parts a golden reddish-brown; the inferior parts a greyish-brown, the base of the hair being every where whitish, and the darker shade proceeding from the tips.

Two specimens of this species were brought from Timor by MM. Peron and Lesueur, and now form a part of the Paris Museum. One of them was sent by M. Geoffroy to M. Temminck for examination; and hence the satisfactory details we have been enabled to present.

3. RHINOLOPHUS INSIGNIS.—UNIQUE HORSE-SHOE BAT.

Syn. RHINOLOPHUS INSIGNIS.—Horsf. Jav. in loc.

RHINOLOPHUS VULGARIS.—Ibid.—(Fem.)

Icon. Temm. Mon. Mam. II. pl. 29, fig. 2.

SPECIFIC CHARACTERS.

THE HAIR on the head and neck white; the body dark brown in the male; redder in the female.

THE NASAL APPENDAGE rounded on the margin, broad, three folds on each side of the horse-shoe.

THE EARS broad, margin partially clipped, wanting the lobe.

INHABITS Java and adjacent islets.

The male of this animal was first described by Dr Horsfield in his Researches; and the descriptions supplied by Temminck of male and female were, he informs us, derived from an examination of not fewer than thirty specimens. The whole length of the adult is four inches, the tail occupying somewhat more than one; the extreme breadth is between twelve and fourteen inches. The nose-leaf, with a round edge, is broader than it is high; between it and the horse-shoe there is another leaflet, which is hairy, and flanked on both sides with three lateral folds. The *male* has, behind the leaf, a large syphon or bag, and on either side a small orifice which is scarcely visible, but which is made more conspicuous by three minute pencils of hairs. The ears are broad, trumpet-shaped, with the margin as if partially cut off, and without a lobe. The two incisors above, not far apart, are broad, and either bi-lobed or smooth; the four below are more or less crowded, the small false molar of the upper jaw being found in some individuals in its usual place close to the heel of the canine. This anomalous molar is not found in the old; and except in a minute point rising from the gum, scarcely leaves a trace. The fur is copious, smooth, and bicoloured above. The head and neck are white, the tips of the hairs being chestnut coloured; the extent of this whitish portion, waved with chestnut, is not confined solely to the neck, but is continued in a pointed shape towards the upper part of the back, and prolonged between the shoulders, whose colour, as well as that of all the other superior parts of the body, is a pure chestnut, though each hair is of the party colour already described. The neck, middle of the chest, and abdomen, are light brownish-grey, and the sides of the chest, at the insertion of the wings, are dullish brown, darker than the belly. The *female* is generally of a redder hue than the male. She has not the two lateral orifices, and the bag of the nose-leaf with which her mate is supplied; a minute orifice which is scarcely visible upon the living animal, and on the dead leaves no other trace than a few brown hairs, indicates the locality of the syphon of the male.

From the manuscripts of M. Van Hasselt, we have an interesting note on this species. We captured, it is stated, a great number on the shores of the island *Duars in de Weg*, on the eastern side of Java, in the grottoes where the *Salanganes* (*Cypselus esculentus*) construct their nests. Their cry is feeble, and their odour particularly disagreeable. The little bag under the forehead is formed by a fold of the skin, whence there is a small tube to the frontal muscles; by a slight compression the bag may be extended, and then resembles an inverted finger of a glove. A red powder is secreted by this organ, which always covers the neighbouring

projection, and exhales a penetrating odour. The above account has been confirmed by M. Müller, who gives, moreover, a particular account of the separate retirement of the two sexes already mentioned, and adds, that the young animal remains fixed to the body of the mother during the whole period of lactation.

4. RHINOLOPHUS SPEORIS.—CYCLOPS HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHUS SPEORIS.—Geoff. Ann. Mus. XX. 261.—pl. 5, (head,) copied in Temm. Mon. Mam. II. pl. 27.—Schreb. Säugth. pl. 59, B.

RHINOLOPHUS CRUMENIFÈRE.—Péron, Voy. pl. 35.—Temm. II. 17.

SPECIFIC CHARACTERS.

THE HAIR white, and brown above in the male; reddish-chestnut above in the female; white beneath.

THE NASAL APPENDAGE and EARS as in the last species. A round ODORIFEROUS GLAND in the centre of the forehead.

INHABITS Java and Amboyna.

The total length of this Bat is about three inches and a half, of which the tail and membrane occupy one inch: the extreme expanse is somewhat more than twelve inches. The nose-leaf and folicle are precisely the same as in the species we have just left; as are also the teeth and cranium; whilst it should be remarked, as it regards the former parts, that the male has only one opening or syphon, without any trace of a lateral orifice, and as to the other, as well as the general dimensions, they are on a somewhat smaller scale. The fur is short, smooth, and bicoloured above. All the superior parts are covered with hairs which are partly white and partly brown in the male, and reddish chestnut in the female; underneath they are completely white; the insertion of the wings along the sides is light red.

M. Geoffroy states that he had always found the little bag in front empty, and could not therefore assign its use,—suspecting, however, it might secrete an odorous fluid which might attract insects. Temminck remarks that the apparatus exactly resembles the eye of a Cyclops with the eyelids closed, and that both the powder already mentioned, and the unctuous matter which it secretes, exhale a smell similar to that which has been previously noticed in the Bull-dog Bats, (*Dysopes*), and the Phyllostomes of America, in which the matter issues from a gland situate on the chest. In *Dysopes pedimanus*, and in *Taphozous saccolainus* of Java, there is a very large one under the chin; and in these two species the females are possessed of them as well as the males. Some of the *Rousseltes* and *Pachysomata*, it will be remembered, exhibit these secretory organs, and only in the males; and, finally, we shall discover similar odoriferous glands in all the species, and in both sexes in the great majority of the *Vespertiliones*, the organ existing in front of the eyes, or above the orbit, and still more frequently near the nostrils. The emanations produced by this apparatus more or less occasion the disagreeable smell exhaled by certain species, and Temminck suspects it is the especial means by which the different sexes discover each other in the obscure and hidden retreats which they inhabit.

Hitherto this species has only been found in Timor and Amboyna. The two specimens in the Paris Museum are from the former island; those of the Leyden Museum are from Amboyna.

5. RHINOLOPHUS BICOLOR.—PIEBALD HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHUS BICOLORE.—Temm. Mon. Mam. II. 18, pl. 29, fig. 3.

SPECIFIC CHARACTERS.

THE HAIR chestnut red, marked with white.

THE NASAL APPENDAGE surrounded by a notched membrane.

THE LOWER LIP with a large wart in the centre.

INHABITS Amboyna, Java, and Timor.

The Piebald Rhinolophus has a total length of two inches, three lines, (French,) of which the tail and interfemoral membrane occupies ten lines, and its extreme width varies from eight and a half inches to nine and a half inches; the ears are broader than they are high, with a round terminal margin, not cut out; there is also a very small distinct lobe, with an internal fold. The nose-leaf is small, and transversal, with a marked protuberance, besides the horse-shoe, which is surrounded with a notched membrane at its two extremities; there is a large wart in the centre of the lower lip, and a longitudinal one at either side. The two incisors of the upper jaw are broad, nearly approximated on their inner side, but distant at their base; the inferior four are tri-lobed; there are five molars on both sides, and the upper false molar is scarcely visible. The fur is long, very fine, smooth, and of two colours throughout. Above it is of a very pure white from the base two-thirds upwards, and is then of a chestnut red to the point, so that the white presents an irregular medley; the white prevails

still more below, because here only the actual points are tipped with brown. The membranes are light brown. This accurate description is drawn up by M. Temminck from the examination of fourteen specimens.

This small species was found by M. Van Hasselt in the bamboo buildings on the coast of Anjer: he says nothing of its habits. M. Boié captured it in the solitary woods on the banks of the Tjetarem, where it infests the dwelling-houses. It has been procured in the islands of Amboyna, Java, and Timor, those specimens brought from the first named place being somewhat larger than those from the second.

6. RHINOLOPHUS TRIDENS.—TRIDENT HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHE TRIDENT.—Geoff. Ann. Mus. XX. 260, pl. 5, (head and cran.,) copied in Temm. pl. 27.
Geoff. Descr. Egypt. Hist. Nat. II. pl. 2, fig. 1.
Temm. Mon. Mam. II. 19.

SPECIFIC CHARACTERS.

THE HAIR light ash-colour.

THE NASAL APPENDAGE trident-shaped above.

INHABITS Egypt and Nubia.

This species is about two inches three lines long, of which the tail occupies eight lines; the extreme expanse is eight and a half inches. The ears are higher than they are wide, they have a round terminal edge, and no distinct lobe. The nose-leaf terminates in three points, trident-shaped. The two upper incisors are extremely small, and wide asunder; the lower four are crowded and tri-lobed. There are four upper molars, and no appearance of an anomalous tooth, either in the young or old; five below. The fur is scanty, short, and smooth, of a light white ash-colour; the pubis and thighs are naked. The horse-shoe covers the whole surface of the muzzle; but the nose-leaf is not complicated; it is broad at the base, and rises like a broad lance, the upper part of which terminates in three indentations; the ears are also broad, but not close down in front, owing to their being partially attached to the chanfrin. The tail is short, but remarkable in this respect, that, for a third of its length, it is free above the interfemoral membrane, which is cut square off, but makes up in breadth what it wants in length, and thus the lower part of the tibia is free from membrane.

M. Geoffroy reports that this species is found in the deepest excavations of the mountains, and especially in the most retired portions of the sepulchres of the Egyptian kings at the temple of Denderah. M. Ruppell captured many of them during his travels in Egypt and Nubia.

7. RHINOLOPHUS TRICUSPIDATUS.—LEAST HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHE TRICUSPE.—Temm. Mon. Mam. II. 20, pl. 29, fig. 4.

SPECIFIC CHARACTERS.

THE HAIR reddish-brown.

THE NASAL APPENDAGE with three points above.

INHABITS the Molucca Islands.

This is the smallest of the known Rhinolophi; its total length being two inches and three lines, ten lines of which go to the tail; the extreme expanse is about seven and a half. The ears are small, higher than wide, and pointed. The nose-leaf is large, and nearly square, terminating superiorly in three points, that of the centre being spear-shaped, and the lateral one drawing to a converging point. The horse-shoe is surrounded by a small rudimentary membrane. The extreme expanse is very great when compared to the very small size of the body; the interfemoral membrane also is large, cut square, and surpassed to the extent of two lines by the free extremity of the tail. The two upper incisors are very fine, distant, and converging at their points; the four inferior are tri-lobed; there is a false bi-lobed molar in the upper jaw. The fur is short, fine, smooth below; of a clear reddish-brown above, but light brown at its base, the points on the back being blackish-brown; the colour is pure brown upon the side, and towards the crown; the membranes are blackish. MM. Macklot and Müller discovered this small species during their sojourn amongst the Molucca group.

(B.) NOSE-LEAF MORE OR LESS COMPLICATED, THE POSTERIOR LEAFLET BEING SPEAR-SHAPED, AND A FOOT-STALK RISING FROM THE CENTRE OF THE HORSE-SHOE.—(PHYLLORHINA, Bonap.)

8. RHINOLOPHUS LUCTUS.—MOURNING HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHE DEUIL.—Temm. Mon. Mam. II. 24, pl. 30.
VOL. II.

SPECIFIC CHARACTERS.

THE HAIR sooty black, with ash-coloured tips.

THE NASAL APPENDAGE shaped like a Maltese cross, rounded on the edges, and consisting of several leaflets.

THE EARS very large, pointed, almost united at the base, with a large rounded lobe.

INHABITS Java.

The Mourning Horse-shoe Bat is much larger than any of our European species, being five inches long, of which the tail and membrane occupy one inch eight lines, and the extreme expanse is fourteen inches two lines, thus equalling the dimensions of the *R. nobilis*, our first species. The cutaneous system is excessively developed in the breadth of the wings, the immense size of the ears, and the nasal appendages, which so overshadow the countenance that its usual features cannot even be discerned: the wings withal are short in proportion to the volume of the body; the tail is as long as the hinder limbs, and its point exceeds the limit of the interfemoral membrane. The enormous ears are almost united at their base, and their mesial margins nearly touch; they are much pointed at their tips, which turn somewhat outwards; the conchæ are very broad, and have a great rounded lobe which is used to close the external foramen. The nasal apparatus is composed of a great number of leaflets. The horse-shoe is formed of a great membrane which overhangs the whole of the upper lip; it is connected at its extremities, and by a lateral prolongation to the first set of membranous leaflets which form the spear-head; from the centre of the horse-shoe springs the great leaf-stalk, supporting four leaflets, which form precisely a Maltese cross, with rounded edges; and behind the leaf-stalk the spear-head rises, composed of three rows of leaves, the first two of which are rounded, and the third pointed and blunt. There are two triangular warts upon the lower lip. The cranium seems to be in an extraordinary degree compressed between the zygomatic arches, in which a triangular cavity is formed, uniting the protuberance of the chanfrin to the strong and large coronal crest. The two upper incisors are fixed in the cartilage, are obtuse, and somewhat removed from each other; the four lower ones are tri-lobed and crowded. There is a sixth small and obtuse molar tooth in the lower jaw, placed between the false and true molars, without any fellow above, not in the line of the others, and without any apparent function.

The fur in this species is exceedingly long, abundant, and woolly; the head is nearly entirely covered by the hair, which does not pervade the membranes, but abounds on the coccygeal and pubic regions. The colour of the coat is the same in the two sexes: it is dull sooty-black, with the tips of the hairs light grey, so forming a slight ash-coloured cloud over the whole robe. The membranes and leaflets are quite black.

A female of this species was first discovered by M. Boié in the wild district of Tapos in Java; but several others have since been added to the Leyden Museum.

9. RHINOLOPHUS EURYOTIS.—BROAD-EARED HORSE-SHOE BAT.

Syn. RHINOLOPHUS EURYOTIS.—Temm. Mon. Mam. II. 26.
Icon. Ib. pl. 29, fig. 5, (head.)

SPECIFIC CHARACTERS.

THE HAIR brown, tending to reddish above, and whitish beneath.

THE NASAL APPENDAGE very complicated, (see description.)

THE EARS very broad, points turned outwards, with a broad lobe.

INHABITS the Molucca Islands.

The dimensions of the Euryotis are about three inches in extreme length, and a foot in extreme breadth. The cutaneous system and ears are greatly developed; the tail very short, only one-third the length of the tibia. Owing to the shortness of this appendage the interfemoral membrane has the appearance of a curtain which is drawn up in the middle, and, after it is dried, and the specimen prepared, the membrane forms a large semicircle, the extremities of which are connected with the cartilages of the tarsi. The ears are not united, and their points are turned outwards; the conchæ are very broad, much sloped, and give rise to a large round lobe, which closes the organ. There is a large spear-head behind the leaf-stalk, supporting a solitary leaflet, which is oblong, straight, and having a point which is dome-shaped; there is a small descending lobe upon each side of the nostril apparently intended to close that avenue: the horse-shoe is surrounded by a very broad uniform membrane, which conceals the upper jaw, and is united on both sides to the spear-head starting from behind the leaf-stalk. There are four great warts on the margin of the lower lip, and the gape is very wide. The two incisors above are very small, widely separated, and at-

tached to the edge of the cartilaginous laminae; the under ones are trilobed, and crowded: there is a blunt false molar in the upper jaw.

The fur is bushy, coarse, and of many colours. On the upper parts of the body the hairs are white at the base, then brown like a decayed leaf, and light red at the point; the back and neck are quite brown; the face and sides of the neck light brown, the chest is whitish, with a shade of brown; the flanks are deep brown, and the middle of the abdomen light brown; the ears and nose-leaf are dark brown, and all the other membranes blackish-brown.

This description of *M. Temminck's* is taken from the examination of five individuals which *MM. Macklot and Müller* procured during their residence in the Moluccas.

10. RHINOLOPHUS TRIFOLIATUS.—TREFOIL HORSE-SHOE BAT.

Syn. RHINOLOPHUS TRIFOLIATUS.—*Temm. Mon. Mam. II. 27.*

Icon. *Ib.*—pl. 31.

SPECIFIC CHARACTERS.

THE HAIR ash-red above; ash-brown beneath.

THE NASAL APPENDAGE with three leaves, complicated, (see description.)

THE EARS broad, pointed, and much sloped; the lobe one-half the size of the concha.

INHABITS Java.

The discovery of this singular species was made by the Dutch traveller *Van Hasselt* in one of his peregrinations in the wild district of *Bantam*, where he found two individuals suspended in a large tree in the depths of the forest. The native inhabitants denominate it *Tyoma-maal*; and it is free from any disagreeable odour.

The size of this Trefoil Rhinolophus is in extreme length three inches, and in extreme breadth twelve. The tail is as long as the tibia; the cutaneous system is very complicated, and much developed, the alar membranes being large, as are the ears, which are broad, pointed, and much sloped; the inferior lobe is half the size of the superior, and forms a transverse fold, which can completely shut the meatus. The nose-leaf is double, the anterior one being transversal, rounded, and united by a slip to the great posterior leaf, which is shaped like a spear-head: the horse-shoe is also formed of two membranes, the outer of which forms a large border; the leaf-stalk, composed of a thick membrane, springs from the middle of the horse-shoe, and ascends nearly as far as the great leaf; it is divided into three pointed leaflets, not unlike the Clover leaf; there are also two large warts upon the upper lip. In the adult there are no incisors in the upper jaw; the four of the lower are crowded, and the mesial ones sometimes fall out; there is no small anormal tooth between the canine and first molar of the upper jaw.

The fur is very long, copious, and fine: the base of the muzzle, the eyes, and a portion of the ears, being hid under it. The upper parts of the body are of an ash red colour, lighter towards the head than on the back; the head and neck are reddish-white, the chest and abdomen ash-brown; the auricle and nasal membranes are yellow and blackish-brown at the points. The flying membranes are naked, of a light brown colour, but blackish-brown where they adhere to the body and fore-arm.

11. RHINOLOPHUS UNIHASTATUS.—GREATER HORSE-SHOE BAT.

Syn. VESPERTILIO FERRUM EQUINUM α MAJOR.—*Linn. Gmel. I. 50.*

HORSE-SHOE BAT.—*Penn. Quadr.—Shaw, Zool.*

RHINOLOPHUS FERRUM EQUINUM.—*Jenyns, Man.¹ p. 19.*

Icon. RHINOLOPHUS UNIHASTATUS—(unifer).—*Geoff. Ann. Mus. XX. pl. 5, copied in Temm. Mon. II. pl. 27.*

GRAND FER À CHEVAL.—*Buff. Hist. Nat. VIII. pl. 17, fig. 2, copied in Schreb. Säugth. pl. 62, (upper figs.)*

SPECIFIC CHARACTERS.

THE HAIR grey in the male, reddish in the female.

THE NASAL APPENDAGE lanceolate, complicated.

THE EARS notched on the outer margin.

INHABITS Europe, (including Britain;) Northern and Southern Africa.

The Greater Horse-Shoe Bat inhabits the quarries, where solitary individuals are found, suspended by their feet, and enveloped by their membranes so as to permit no other part of the body to be seen.

At length we arrive at the first British animal, next to Man, in the natural series. These diminutive animals are found in caves in the South of England, or in old buildings, such as Bristol and Rochester Cathed-

drals, Dartford Powder Mills, &c. Their range extends eastward, over France and Germany, to the borders of the Caspian Sea, and southward to the Cape of Good Hope.

These Bats are usually observed in company with *Vespertilio murinus* and *auritus*, very seldom in woods or gardens, but most commonly in old buildings, behind the partitions or wainscoting. Their hibernation is not by any means profound. It is no uncommon thing to see them flitting about during a fine day in winter, at a season when other Bats would inevitably perish. In spring they are the first of the tribe to awaken, and thus seem less susceptible of cold than any other species with which we are familiar.

As they resume their active functions at an early period of the year, it would have been difficult for them to find adequate means of support had not a wise instinct directed them to the ponds for food. Here they flutter for hours, with the head hanging downwards, and touching the water in search of the larvæ of insects. It was probably in accordance with this instinct that Nature has supplied them with their singular nasal appendage, which, acting as an inverted bell, may steady the head, and prevent it from becoming immersed. Spiders also contribute to their support.

The female commonly bears two young, after a gestation of three weeks; they are deposited in some crevice of the walls, and are able to cling from the moment of their birth; hence the crevice in which they are placed is often little more than a simple depression.

In warm days they are seen hanging or sleeping under the roofs of houses, and the slightest stroke occasions them to fall down dead. Owls, Weasels, and Cats, prey on them; their bodies are subject to the attacks of *Acarus ricinus*, which is found even during hibernation.

This species sometimes attains the length of four inches nearly, the tail occupying rather more than an inch, and the extreme expanse fifteen inches. Its wings are long, and of medium breadth; the tail, which is enveloped in the interfemoral membrane, is two-thirds the length of the fore-arm. The ears are large, pointed, distant, and with a sloping edge; the inferior lobe is distinct but small. The nose-leaf is doubly festooned at its base, terminates in a spear-head, which is covered towards its point with hair and some slender bristles. The horse-shoe is formed by a broad lateral membrane divided in front; a leaf-stalk, which does not support the lance-shaped membrane, springs from the middle of the horse-shoe. A solitary transverse wart is situated at the margin of the lower lip. The two upper incisors are scarcely visible, and have a weak attachment to the cartilaginous laminae; the four under ones are crowded; the obtuse false molar is very small.

The fur is long but smooth; the hair bi-coloured above, and of one colour below, is long and straight on the front of the neck, covering the half of the fore-arm, and of the side membranes; the ears likewise are clad at the base, and in the interior of their posterior edge. The superior parts of the male are ash-coloured, with a shade of blue more or less deep, although all the hairs are whitish at their base. Underneath the colour is light grey, somewhat darker upon the fore-arm and flanks, the long hair on the front of the neck being fairer. The membranes are a dull black. In the female, the roots of the hair are white, and they are red or reddish towards the points; the under parts of the body are of a slightly red ash colour. *M. Temminck* mentions that, judging from the numerous specimens he has examined, he concludes that there are slight local differences of shade in the colour of the fur; the males of temperate and colder countries having the upper parts of their body of a very deep grey, and the females of a lively russet hue, whilst individuals in the south of Europe, Egypt, the Cape of Good Hope, have brighter tints, ash-coloured in the male, and light red in the female.

This species is found in some parts of Europe, particularly the south; also in the northern and middle portions of Africa. The majority of those received by *M. Temminck* were captured in the ruins of the old castle of Heidelberg. *Bechstein* informs us that they are very common in Thuringia.

12. RHINOLOPHUS JAPANICUS.—JAVANESE HORSE-SHOE BAT.

Syn. RHINOLOPHUS NIPPON.—*Temm. Mon. Mam. II. 30. a.*

Icon.

SPECIFIC CHARACTERS.

THE HAIR in the male brown above, ash-grey, tipped with brown, beneath; in the female, dull red above, white, tinged with red, beneath.

THE NASAL APPENDAGE complicated, much developed.

INHABITS Java.

¹ JENYNS, MAN.—A Manual of British Vertebrate Animals. By the Rev. Leonard Jenyns.—Cambridge, 1835.

This species, which has recently been sent in considerable quantities from Japan, is somewhat larger in all its dimensions than the unihastatus of Europe. Its alar membranes are sufficiently developed, but not in the same proportion to the size of the body; the tail, somewhat larger than half the length of the fore-arm, is wholly enveloped in the large interfemoral membrane, which is cut horizontally across; the ears are large, long, and terminated in a point; the broad and great horse-shoe, which is surrounded with two membranes, springs from the stem deeply hollowed and furrowed in front, and rises in an obtuse point; the spear-head is simple, formed of a single membrane, which is long and pointed; and quite covered with long hairs. One single warty excrescence pervades the whole of the lower lip. The upper incisors, wide apart, are placed at the angles of the moveable cartilage; the four lower ones are crowded, and tri-lobed. There are only four molars above, owing to the complete want of the small false one.

The fur is very long and silky; the ears naked, but with the lobe clad at its base. All the superior parts of the male are brown, although the base of the hairs is of a whitish ash colour, which makes the whole appear greyish-brown; underneath the hairs are ash-coloured at their roots, and tipped with brown. The membranes of the male have a brown tint; those of the female a slight rosy shade. The upper parts of her robe are of a dull red colour, although the base of the hairs is whitish; underneath she is whitish, with a slight tint of red.

This animal invariably differs from the unihastatus of Europe in the relative dimensions of the tail with the total length, and though the body is more robust, the wings are shorter and broader; the nasal leafy apparatus is also more developed, and the ears are larger and not so hairy. Lastly, the fur is longer, more silky, and less lustrous than in the above named Bat.

13. RHINOLOPHUS AFFINIS.—AFFINIS HORSE-SHOE BAT.

Syn. RHINOLOPHUS AFFINIS.—Temm. Mon. Mam. II. 31.

Icon. Ibid. pl. 29, fig 6, (head.)—pl. 32, fig. 16 and 17, (cran.)

SPECIFIC CHARACTERS.

THE HAIR in the male sooty-brown above, ash-brown beneath; in the female, russet-brown above, reddish beneath.

THE NASAL APPENDAGE complicated. THE LOWER JAW with four warts.

INHABITS Java and Sumatra.

This species was first indicated by Dr Hensfield, but in terms so laconic that it could not have been recognised without difficulty. M. Van Hasselt captured them in great numbers, in certain grottoes in Java and neighbouring islands, where they associate in great bands, suspended to the roof of the caverns; they live upon nocturnal insects, utter an insignificant cry when on the wing, and exhale a powerful odour.

The Affinis is of smaller dimensions than the unihastatus of Europe; the tail is half the size of the fore-arm; the ears are large, and terminate in a point; they are slightly keel-shaped, possessing a considerable lower lobe, whose point is rounded at the sides. The lanceolate leaf is united with a rounded follicle, and there is a strong leaf-stalk in the centre of the horse-shoe, which is surrounded by two membranes. There are four warts on the lower jaw, the central ones of which are triangular, and the external longitudinal. The upper incisors are wide asunder, the laminae on which they are supported being separated by the intervening cartilage, they are also very minute, and on falling out leave no trace behind. The four lower ones are also very small; the fifth molar above is in the same line with the others, and forms a pointed false molar; the number of six molars in the lower jaw is made up by a very small tooth which rests upon the last two molars. The fur is abundant, somewhat rough, and of a uniform colour, covering the membrane which runs along the flanks underneath. The males are above of a sooty-brown colour, beneath ash-brown. The females above are russet-brown, beneath brightish red. The membranes are blackish-brown.

14. RHINOLOPHUS ROUXII.—ROUX' HORSE-SHOE BAT.

Syn. RHINOLOPHUS ROUXII.—Temm. Mon. Mam. II. 30, b.

Icon.

SPECIFIC CHARACTERS.

THE HAIR in the males brownish above, light grey beneath; in the females bright red above, golden red beneath.

INHABITS Hindoostan.

This species has been designated by M. Temminck after M. Roux, a French Naturalist, who, with uncommon assiduity, commenced his labours in the vast field of India, and there speedily found his tomb. It appears to range over a wide space, is common in the museums of Pondi-

cherry and Calcutta, and has been abundantly sent from other quarters to this country.

So far as is yet known, it has no incisors in the upper jaw, the cartilage appearing too thin and diaphanous for their support. It is possible, however, that they may appear at an early period of life, and the more so that M. Temminck has only examined adult specimens. The upper molars are of the same number as in the affinis; whilst the lower are only five, or one less, owing to the absence of the very small one. The fur is very short, cottony, and frizzled, and covers the body only, without forming any fringe along the membranes where attached to the sides. The males are above of a brownish shade, although the base of the hairs is ash-grey; underneath they are light grey, somewhat darker on the arm and flanks. The females are above of a bright red, although the tips of the hairs are reddish brown; the inferior parts are of a beautiful golden red; more rarely the tints are a pale russet above and an ash red beneath. The total length of this species is about three and a half inches, the tail occupying nearly an inch. The extreme width is nearly a foot.

15. RHINOLOPHUS CLIVOSUS.—CLOVEN-LEAF HORSE-SHOE BAT.

Syn. RHINOLOPHUS GEOFFROYII.—Smith, in Zool. Jour. IV. 433.

RHINOLOPHUS CLIVOSUS.—Temm. Mon. Mam. II. 32.

RHINOLOPHUS CAPENSIS.—Lichtenst. Doublet. p. 6.

Icon. Rupp. Atl. pl. 18.—Tem. pl. 29, fig. 7, (head.)—pl. 32, fig. 18, (cran.)

SPECIFIC CHARACTERS.

THE HAIR greyish-white.

THE NASAL APPENDAGE lance-shaped; the leaf-stem cloven in front.

THE LOWER LIP with a single wart.

INHABITS Egypt, Southern Africa, Dalmatia, and the Levant.

The tail of this species is a third of the length of the fore-arm, and much longer than the tibia. The ears are large, terminate in a point, are somewhat cut away, and supplied with five rugæ; the lower lobe, very large, is covered with hair, and completely shuts up the organ. The nose-leaf is simple, lance-shaped, somewhat elevated, and clad with hair. The leaf-stem is completely naked, (a remark which extends to all the species of this section,) and furrowed or somewhat cleft in front, (whence probably its name,) and rises from the centre of the horse-shoe, which is formed of a single membrane though funnel-shaped. A single wart is conspicuous on the margin of the lower lip. The two upper incisors, imperceptible to the naked eye, are wide asunder, the four lower ones are crowded, and have each three cusps; there are four upper molars, though sometimes there may be also a small additional anormal one, and five lower. The fur is long and copious, and abundantly covers the side membranes both above and below. The hair above is bi-coloured, below of a uniform tint. The upper portions of the body are whitish, the base of the hairs, which are tipped with grey, being of the tint of wine lees; the lower parts of the body are likewise whitish and of the same shade; all the membranes are black and diaphanous, having the colour of a light shade of China ink. The total length is about three inches, the tail extending to about eighteen lines; the extreme breadth is about a foot.

Specimens of this species have been derived both from the northern and southern parts of the African continent. It is common near Cape-Town, and M. Ruppell captured it in Egypt. Individuals from these two regions have been carefully compared, and no other difference can be detected than that the specimens from the Cape have the fur somewhat darker than those from Egypt. This animal is also found in Dalmatia and in the Levant, so that it may be classed in our catalogues as one of the European Mammalia.

16. RHINOLOPHUS BIHASTATUS.—LITTLE HORSE-SHOE BAT.

Syn. LE PETIT FER-À-CHEVAL.—Cuv. Reg. Anim. I. 118.

VESPERTILLO IMPOSIDERO.—Bechst.

RHINOLOPHUS BIHASTATUS.—Geoff. Ann. Mus. XX. 259.

Icon. Geoff. loc. cit. pl. 5. (R. Bifer.)

Buff. Hist. Nat. VIII. 17, fig. 2.

SPECIFIC CHARACTERS.

THE HAIR white, with the tips reddish.

THE NASAL APPENDAGE lanceolate, erect, reddish; a second lance-shaped membrane in the centre.

INHABITS France and Germany.

The R. Bihastatus is rare even in the districts it most frequents. It is found both in Germany and France, delighting in old buildings and

caverns; in these it prefers those nooks which are most inaccessible and obscure, and hence is scarcely ever found without much difficulty. The size of the largest individuals is about three inches in length, with an expanse of about ten.

The tail is two-thirds the length of the fore-arm, and enveloped in the interfemoral membrane. The ears are very large, with the point bent outwards, much sloped, and more approximated than in the *unihastatus*; they have very large and well marked lower lobes. The nose-leaf is straight, lance-shaped, and covered with a few hairs; the horse-shoe is surrounded by three ranges of membranous folds; there is also a leaf-stalk which supports a second lance-shaped membrane which springs from the midst of the horse-shoe. There is a single wart upon the margin of the lower lip. M. Temminck informs us that he has not found incisors in the upper jaw at any period of life; the chanfrin is simply cartilaginous, and there is no trace of laminae. The four lower incisors are extremely small. The first of the five molars of the lower jaw is in the same line with the others, and not at the heel of the canine as in the *unihastatus*. The whole fur is of a beautiful shining white colour, although in the adult the tips of the hairs in the superior parts of the body are dark coloured, a tint which extends to about a half of each hair in the young. The membranes are diaphanous, of a deep ash-colour in the males, and yellowish in the females.

17. RHINOLOPHUS MINOR.—DWARF HORSE-SHOE BAT.

Syn. RHINOLOPHUS MINOR.—Horsf. Jav.

Icon. Temm. Mon. II. pl. 32, fig. 20 and 21, (cran.)

SPECIFIC CHARACTERS.

THE HAIR in the male dark-brown above, lighter beneath; in the female red, deeper above.

THE NASAL APPENDAGE lanceolate, complicated.

INHABITS Java, Sumatra, and Timor.

This Rhinolophus is about the size of the last species, the *Bihastatus* of Europe. The ears are shaped as in that animal, much sloped, and having a largely developed lobe on the side. The tail is of the length of the tibia and toes, or two-thirds the length of the fore-arm. The nose-leaf is complicated, consisting of a spear-head, bristled with hair at its point—a leaf-stalk divided at its upper part into indentations, the one of which points forward, and the other is bent to the right side, and the horse-shoe very large and festooned. The upper incisors approximate and are tri-lobed, as are also the four inferior; there is a pointed anomalous molar in the upper jaw. The fur of the male is dark brown, slightly tinged with grey above, and light brown ash beneath. The female is wholly red, deeper above than beneath. The young females are of the same markings with the males. The robe of some is found spotted with red and brown, and these are usually females, whilst passing from the one dress to the other. The length of the adult is about two and a half inches, the tail occupying about ten lines; the extreme expanse is about ten inches.

Dr Horsfield first supplied a succinct account of this species in his *Zoological Researches*, and the Dutch Naturalists in India have since more abundantly furnished materials for description.

18. RHINOLOPHUS PUSILLUS.—PIGMY HORSE-SHOE BAT.

Syn. et Icon. RHINOLOPHUS PUSILLUS.—Temm. Mon. Mam. II. p. 36, pl. 29, fig. 8, (head.)—pl. 32, fig. 22 and 23, (cran.)

SPECIFIC CHARACTERS.

THE HAIR white, brown at the tips above, chocolate colour beneath.

THE NASAL APPENDAGE elevated, lanceolate, complicated.

INHABITS Java.

The *Pusillus* is a trifle smaller than the preceding species, and has ears of precisely the same shape; the tail is likewise of the length of the tibia and toes. The very high nose-leaf consists of the spear-head, which is supplied with bristles from the leaf-stem, in front of which there is a narrow leaf whose point bends forward, and the horse-shoe composed of a broad membrane. There are two warts on the lower lip. The two upper incisors, which are scarcely visible with a glass, are obtusely pointed and wide asunder, the false molar is also pointed. The fur of both sexes is strikingly party-coloured above, and of a uniform tint beneath. Upon the upper part of the body the hairs are long, and pure white from the base to about two-thirds of their length, the rest is ash-brown, so producing a mixture of white and light brown; underneath the only tint is fawn-colour, like that of *cofé-au-lait*, darkest towards the sides.

This species was discovered by those Naturalists from the Low Countries, who have been recently making investigations over the Con-

continent of India. It prefers trees and old buildings. In many of its characters it might be mistaken for the *R. minor*, but is easily distinguished by its very distinct party-coloured fur, and also from there being scarcely any difference between the markings of the male and female.

19. RHINOLOPHUS CORNUTUS.—HORNED HORSE-SHOE BAT.

Syn. RHINOLOPHUS CORNUTUS.—Temm. Mon. Mam. II. 37

Icon.

SPECIFIC CHARACTERS.

THE HAIR light yellow, darker at the points above; whitish, and reddish-brown at the points beneath.

THE NASAL APPENDAGE complicated, lanceolate, broad.

INHABITS Japan.

The Horned Rhinolophus has within these few years been sent from Japan by M. Bürger to Leyden, where it fell under the investigation of M. Temminck. Its extreme expanse is somewhat less than that of the *Bihastatus*. The ears are very large, pointed, sloped at their inner margin, and are furnished with a very large lobe. The tail is completely enveloped in the interfemoral membrane, which is terminated by a horizontal line across; it is longer than the tibia. The membrane of the horse-shoe is broad; the leaf is complicated, consisting of the spear-head bristled with hairs, and the leaf-stem standing up like an obtuse horn, inclining forwards. The upper incisors are very small and widely spaced; the four lower ones are crowded and tri-lobed. The fur is long, silky, and party-coloured throughout; underneath it is pale yellow, the hairs being tipped of the colour of wine lees; on the upper parts the roots of the hairs, and half their extent, are whitish, and the points are reddish-brown; all the membranes are light black.

DOUBTFUL SPECIES.

1. *R. LANDERI*.—(Proc. Zool. Soc. Part V. 101.)—Towards the close of the year 1837, Mr W. Martin exhibited to the Zoological Society a specimen of the above animal, accompanied with the following description.

This beautiful little species of Bat is a genuine Rhinolophus; the nasal appendages consist of a horse-shoe, a crest, and an elevated leaf. The horse-shoe is broad, with indications of a double furrow; its outer margin is free, and bifid anteriorly. In its centre is placed a little cup-like depression, with an elevated rim, from the back of which rises a bifid crest, not much elevated; the large apex is the posterior of the two. On each side of this crest and behind it, the skin, continued from the horse-shoe, and forming the base of the leaf, is furrowed by two deep but unequal *sulci*, with a marked posterior ridge, elevated across the base of the leaf, which latter ends in a short acute lanceolate point; posteriorly it is curved with short hairs, anteriorly it is nearly naked: its length is two lines. The ears are large, broad, and pointed, the outer margin is emarginate, and passes into a round accessory lobe, closing the ear anteriorly. The *antibrachia* are short, the thumbs small, the tibia slender. The fur is soft and delicate, and of a fine light or rufous chestnut, a little darker on the middle of the back; the wings are blackish. The length of the head and body of this specimen is one inch $4\frac{1}{2}$ lines, of the tail 9", of the ear $7\frac{1}{2}$ ", of the antibrachium $1'' 7\frac{1}{2}'''$, of the leg 8", of the spur $4\frac{1}{2}'''$, the extent of the wings 9". It is to be regretted there is no accompanying plate.

Mr Martin named this species in honour of the late enterprising but unfortunate Mr Lander, during whose expedition it was taken at Fernando Po.

2. *R. COMMERSONII*.—Ann. Mus. XX. 263.—Tem. Mon. Mam. II. 21.—Under this appellation M. Geoffroy alludes to a Bat which was noticed in the drawings and notes of Commerçon, under the title of the Port-Dauphin Bat of the Island of Madagascar. M. Geoffroy published an excellent representation of the original drawing, whence it would appear to be a true Rhinolophus. M. Temminck again copies it in his *Monograph*. The characters assigned by Commerçon are so far from being specific, that, according to Temminck, they might be applied to all the known Rhinolophi, and probably to all that will ever be discovered. We need not therefore trouble the reader with them.

3. *R. LANATUS*.—(Horsfield's Java.)—M. Temminck puts into this same category the above species of Dr Horsfield, which, though detailed with minute accuracy in the *Zoological Researches*, yet wants specific characters to distinguish it from some three or four of its congeners. In addition to this important deficiency, there is the fact that, of the many Naturalists who, since Dr H.'s time, have been exploring the different districts of Java, none of them have sent home a specimen requiring a specific arrangement different from those already described.

4. *R. DUKHUNENSIS*.—An animal under this appellation is enumerated in the "*Catalogue of the Mammalia observed at Dukhun, East Indies.*" By Major Sykes. The description is brief, and therefore we are not to

be surprised at M. Temminck's decision. "This description is so superficial, and the specific characters so loosely established, that it is impossible to admit this animal into the catalogue of the Rhinolophi."

IMAGINARY SPECIES.

1. R. VULGARIS (Horsfield's Java) is regarded by M. Temminck as nothing more than the female of the R. insignis.—(See sp. 3.)
2. R. DEFORMIS of Horsfield, having been described from a very imperfect specimen, should be altogether removed from the catalogue.

GENUS XV. NYCTOPHILUS.—SOUTH-SEA BATS.

- Syn.* NYCTOPHILUS.—Leach, Linn. Trans. XIII. 78.—Gray, Mag. Zool. and Bot. II. 496.
 NYCTOPHILE.—Temm. Mon. Mam. X. p. 46.—De Blainv. Ann. de Scien. Nat. 2d. Série, IX. 360.

SPECIFIC CHARACTERS.

THE DENTAL FORMULA $\frac{2 \cdot 1 + C + 4 M}{2 + C + 4 M} = \frac{12}{14} = 26.$

- THE EARS very large, united over the forehead, the tragus lanceolate.
 THE TAIL not forked.
 THE MEMBRANES not so developed as in Nycteris.
 INHABIT the Islands in the Southern Ocean.

The upper incisors in this genus are long, conical, and pointed; and, by their position, which is near the canines, and their conical and curious curved form, they have somewhat the appearance of a second pair of canines: the inferior ones are somewhat crowded, ill arranged, broad, and tri-lobed. The canines are so free that they do not interfere with the development of the incisors, as in the Bull-Dog Bats, (Dysopcs.) All the molars are tubercular, the lower ones being most conical. This dental apparatus, so far as the incisors and canines are concerned, allies this genus to the Rhinolophi, whilst the molars, by their number and shape, associate it with Nycteris. Hence it is intermediate between these genera. It moreover agrees with the latter in the extraordinary development of the ears, (which are united in front,) as well as in the lanceolate operculum, and nasal follicles. The tail is not terminated by a forked cartilage, and the cutaneous system is less developed, thus approximating them to the true Bats.

This genus as yet consists but of one species; but the link is well characterized among the Nose-leaf Bats.

1. NYCTOPHILUS GEOFFROYII.—GEOFFROY'S SOUTH-SEA BAT.

- Syn.* NYCTOPHILE GEOFFROY.—Temm. Mon. Mam. II. 47.
Icon. Temm. Mon. Mam. II. pl. 34.

SPECIFIC CHARACTERS.

- THE HAIR black at the root, brown at the point above, grey beneath.
 THE EARS very large, and joined in front by a transverse band.
 THE TAIL not forked at the extremity.
 INHABITS the South Sea Islands.

The ears of this species are very large, long, rounded at the point, and united in front by a large transversal fold; the internal border extending even to the commissure of the lips. The operculum, half the length of the ear, is broad at its base, and terminated by a rounded leaf. The muzzle is pointed. There are two small transversal leaflets upon the nose; the posterior one is most elevated, contracted in the centre; the other is rudimentary, and in a line parallel to the orifices of the nostrils. The tail is longer than the body, and is not forked at the point. The total length is nearly three inches, and the extreme breadth nearly nine.

The hair is bi-coloured: above it is black at the root, and deep brown towards the point; beneath the base is black, and the tip pale ash-colour. There are hairs upon the membranes, where they join the sides, and upon the upper part of the sides of the interfemoral.

GENUS XVI. NYCTERIS.—CHEEK-POUCHED BATS.

- Syn.* LES NYCTÈRES.—Cuv. Reg. Anim. I. 119.—Geoff. Ann. Mus. XX. 11.—Desm. Mam.
 NYCTERIS, (Nachtfliieger.)—Illig. Prodr. 119.—Fisch. Syn. Mam.—Gray, Mag. Zool. and Bot. II. 494.
 VESPERTILIO, (in part.)—Linn. Gmel. I.—Schreb. Säugth.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2 + C + (F + 3)M}{3 + C + (2F + 3)M} = \frac{14}{18} = 32.$

VOL. II.

THE UPPER INCISORS very small, continuous, and bi-lobed; THE LOWER tri-lobed or bi-lobed.

THE NOSTRILS simple, the cartilage forming a moveable operculum.

THE CHANFRIN marked by a deep longitudinal furrow.

THE INTERFEMORAL MEMBRANE longer and wider than the body.

THE TAIL long and bifurcated at the tip.

A POUCH at each side of the mouth, communicating with large membranous sacs.

INHABIT the African Continent, and perhaps Java.

The chanfrin in this Genus is hollowed out by a longitudinal fossa, which is indicated on the cranium, and bounded by a cutaneous fold, which partly covers it. The nostrils are simple. There are four incisors above, [generally] without any interval between them, and six below; the ears are large, [often] not united, and the tail is included in the interfemoral membrane. Daubenton has described one under the name of *Campagnol volant*, and M. Geoffroy has discovered others in Egypt.

The Genus Nycteris, instituted by M. Geoffroy, is distinguished by the following characters. The upper jaw has four incisors, which are bi-lobed, very small, and generally contiguous, then a caninc, and four molars on each side; the six lower incisors are tri-lobed, and, in other particulars, agree with those of the upper jaw: the whole of the incisors are but little worn, owing to the points not meeting or fitting at all accurately. The intermaxillary bone is moveable, and always following the motions of the lip, makes the upper jaw appear shorter than the lower. The chanfrin is occupied with a longitudinal and wide groove, formed internally by means of laminae rising from the frontal bone, and uniting at the top; the outer edges being formed by a fold of skin, well clad with fine hair. The nostrils are situate at the lower part of this fossa, having their orifice habitually closed with a tubercle, like the head of a nail, and which is, in fact, the cartilage of the nostrils. The ears are large, generally longer than the head, and extending far in front, and sometimes even meeting; there is an operculum or tragus which is not very large. Their integuments are more developed than those of the true Bats: the interfemoral membrane being both broader and longer than their bodies; their wings also are very ample, but more in breadth than extreme length. The index finger is composed of the metacarpal bone alone, and the others have only two phalanges proceeding from their metacarpals. The tail is composed of seven prolonged vertebræ, and in some of the species the last of them is distinctly bifurcated.

In addition to those very distinct generic characters, M. Geoffroy describes another very remarkable one, which is not only peculiar to this genus of Bats, but is not to be found in any other of the Mammalia. We shall describe this singular structure on M. Geoffroy's authority; at the same time, it would be satisfactory if his observations were confirmed. According to that ingenious Naturalist, the Nycteri are possessed of certain vesicles, which, like Birds, they have the power of filling, and which, of course, greatly diminishes their specific gravity. He informs us that their skin does not adhere to the parts underneath with its usual closeness, and that the cellular tissue by which it is attached is so loose and extensile that the air can be readily introduced, and easily retained: the only obstacles it encounters being certain bands of aponeurosis which occur on the sides; complete obstructions occurring only around the various apertures of the body. This great sac communicates with the mouth, by two considerable openings, one on each side, like the cheek-pouches of certain monkeys, and by means of these canals the animal has the power, at will, of filling and emptying these vesicles, there being conspicuous sphincters round the foramina, and also large valves situate upon the back and neck. The quantity of air that these animals can thus introduce is such that, like the fish of the genus Tetrodon, they can assume a shape nearly spherical, and thus become not unlike balloons supplied with great wings, a head, and feet.

These animals inhabit the warm regions of the Old World, and frequent dark and fulsome caverns.

1. NYCTERIS HISPIDA.—BEARDED CHEEK-POUCHED BAT.

- Syn.* NYCTERIS DAUBENTONII.—Geoff. Ann. Mus. XX. 19.—Desm. Mam. No. 191.
 VESPERTILIO HISPIDUS.—Linn. Gmel.
 BEARDED BAT.—Penn. Quadr. II. 313.
Icon. CAMPAGNOL VOLANT.—Daubent. Mem. de l'Acad. 1759, pl. 33, fig. 7.
 AUTRE CHAUVE-SOURIS.—Buff. T. X. pl. 20, fig. 1, 2; copied in Schreb. pl. 56.

SPECIFIC CHARACTERS.

- THE HAIR reddish-brown above, and whitish beneath.
 THE EARS large, oblong; THE NOSE-LEAF very small.

K

THE LOWER LIP simple.

INHABITS Senegal.

This first species of *Nycteris* was described by Daubenton in the *Memoirs of the Academy of Sciences* for the year 1759, under the appellation of the *Campagnol volant*; from this description Linnæus gave his account of his *Vespertilio hispida*, and Desmarest very properly applied to it its present name, *N. hispida*.

The head of this species is large; its muzzle bulky, and its forehead as if hollowed out by a deep furrow; the nostrils, which approximate, are placed in front of a small hollow; the furrow on the forehead is deep and naked, having long hairs round its edges. The hair of the head, except that on the crown, that of the neck, of the chest and abdomen, is whitish, with a fawn tint; that of the crown and occiput, the upper parts of the neck and shoulders, the back and croup, are of a russet brown, and nearly five lines long: the ears and membranes are of different shades of blackish and reddish-brown; the nails are yellow. The dimensions of the individual examined by Daubenton were from the tip of the snout to the origin of the tail, one inch and a half; the extreme breadth nearly eight inches, of the tail one inch and three lines; of the ears ten lines.

2. NYCTERIS HUZARDII.—HUZARD'S CHEEK-POUCHED BAT.

Syn. NYCTERIS GEOFFROYII.—Desm. *Mam.* No. 190.

NYCTÈRE DE LA THÉBAÏDE.—Desm. *Nouv. Dict. d'Hist. Nat.*

Icon.

SPECIFIC CHARACTERS.

THE HAIR brown above, brownish-grey beneath, soft and fine.

THE EARS very high, united in front. THE OPERCULUM twice as broad as high. THE NOSE-LEAF very complicated, (see description.)

THE LOWER-LIP as if cleft, with a large wart in the middle.

THE TAIL having the last joint deeply bifurcated.

INHABITS Senegal.

The description of the specimens examined at Senegal by the younger M. Huzard, as given by M. Desmarest, is by far the most satisfactory of any we have seen, and, therefore, though compelled to distinguish it as a new species, we submit it for the satisfaction of the reader. M. Desmarest identifies it with the next species, viz. that of *Thebes*, but immediately afterwards points out so many differences as to leave little doubt that they are distinct. This view is strongly corroborated by the remarks of M. Geoffroy, who says, "he presumes there are two species at Senegal; Daubenton," he remarks, "having described two varieties he had received from that neighbourhood;" and adds, "I have myself examined the cranium and osteology of the one of these, and these parts agree neither with the dimensions, nor the details in shape, of either the *hispida* or the *Theban* species."

The following is a condensed account of M. Huzard's excellent account. The head is large, and much prolonged in front; the cranium being voluminous, and much rounded behind; the muzzle is very full; the upper lip very broad, rising high; the lower is as if bifurcated, exhibiting two thick and naked folds of skin forming an angle, the point of which is produced below the chin, and the upper part embracing a great wart, at the edge of the lip. The canines are rather strong; the incisors very small, and bi-lobed or tri-lobed; the tongue is long, rounded at its extremity, and having its surface studded with very fine horny papillæ. The nose-leaf is very complicated, being composed, 1st, of the nasal apertures which closely approximate, and are situate at the anterior part of the great fossa of the chaufrein, extending from the lip to the commencement of the cranium, properly so called; 2dly, of a delicate fold of skin covered with hair, surrounding this fossa, and best seen when raised up by a sharp instrument; 3dly, of two still more delicate folds, longitudinal, hairless, lying parallel to each other at the bottom of the fossa; and, lastly, of two spiral and somewhat rounded pieces of the skin, covering the middle part of this fossa. The ears are placed within a third of the back of the head, and are nearly twice its height; their inner margins approximate, and are united on the forehead; they are thickly clothed close to the head, and a few hairs are scattered throughout both inside and out; the tragus small, twice as broad as high, and clad anteriorly. The body is very stout and muscular in front, the chest is full and broad, the wings are large and broad; the thumb slender, the nail weak. The interfemoral membrane is particularly ample, and supported by spurs as long as is the leg, embracing the tail, formed of seven vertebrae, and terminated by a cartilage in the form of the letter T, whose branches extend to right and left. The fur is soft and fine; the colour being brown above, and light brownish-grey beneath. The dimensions are from the tip of the snout to the origin of the tail two inches; of the tail two; of the ears one; extreme expanse almost ten.

3. NYCTERIS THEBAICA.—THEBAN CHEEK-POUCHED BAT.

Syn. et Icon. NYCTÈRE DE LA THÉBAÏDE.—Geoff. *Mém. de l'Institut. d'Égypte, Hist. Nat.* II. pl. 1 and 2.

NYCTERIS THEBAICUS.—Geoff. *Ann. Mus.* XX. 20; pl. 1, (head.)

NYCTERIS THEBAICA.—Gray, *Mag. Zool. and Bot.* II. 494.

SPECIFIC CHARACTERS.

THE HAIR above bright brown, beneath of an ash-colour.

THE EARS very large; OPERCULUM shaped like a half trefoil leaf.

THE NOSE-LEAF considerably developed, and somewhat in a spiral form.

THE LOWER-LIP has a wart in the centre.

INHABITS Upper Egypt.

The *Theban* Bat is about two inches long from the tip of the snout to the origin of the tail, and its extreme breadth nearly ten. The length of its ears is one inch; of its tail two. Both the auricular and caudal appendages are in this way very large, and in no degree less are the alar and interfemoral membranes; the latter especially being amplified by the very long spurs, which descend nearly an inch from the ankle, and go so far to meet the singular bifurcated and curved points of the last caudal vertebra. The operculum or tarsus is not very large in relation to the ample auricles, and is shaped like a half trefoil leaf. The horse-shoe on the upper lip is broad and ample, and from its centre there ascends a leaf-stalk or tendril on to the outer side of the nostrils, from which, after making a spiral turn round them, it ascends on the chaufrein. The underlip has a large wart in its centre, imbedded in a double fold of skin, shaped like the letter V. On the upper parts of the body it is of a bright brown, on the under of an ash colour. A specimen, Mr Gray states, is in the collection of the British Museum.

4. NYCTERIS JAVANICA.—JAVA CHEEK-POUCHED BAT.

Syn. NYCTERIS JAVANICUS.—Geoff. *Mém. de l'Institut. d'Égypte, Hist. Nat.* II. p. 123.—Geoff. *Ann. Mus.* XX. 20.—Desm. *Mam.* No. 192.

NYCTERIS JAVANICA.—Gray, *Mag. Zool. and Bot.* II. 494.

Icon. Geoff. *Ann. Mus.* XX. pl. 1.

SPECIFIC CHARACTERS.

THE HAIR above of a lively red colour, below reddish-grey.

INHABITS Java.

This species was transmitted from the island of Java to Paris by M. Leschenault de la Tour, and is now in the Natural History Museum at Paris; Mr Gray states it is also to be found in the Museum of the Hon. East India Company. It is larger than any of the previously described species; its head and body being more than two and a half inches long. All the upper parts of the body are of a lively red colour, and the under of a reddish-grey. No more detailed description has yet been published.

5. NYCTERIS CAPENSIS.—CAPE CHEEK-POUCHED BAT.

Syn. NYCTERIS CAPENSIS.—Dr A. Smith, *Zool. Journ.* XVI. 434.—Fisch. *Syn. Mam.* p. 662.

Icon.

SPECIFIC CHARACTERS.

THE HAIR above blackish-brown, below greyish; MEMBRANES reddish-brown.

THE TAIL slightly forked; last vertebra but one the shortest.

INHABITS South Africa and its Eastern Coasts.

This and the next species were discovered by Dr Smith during his residence at the Cape of Good Hope. The neck above, he states, and the back of this animal, are blackish-brown, the sides of the neck dirty white, below it is cinerous white, with blackish shades. The membranes are reddish-brown; height of the ears from fur to tip seven-eighths of an inch, width better than six-eighths; tragus short, apex semicircular, and its upper edge clothed with a tuft of long, white, woolly fur; termination of the tail but slightly forked, last vertebra but one, if any thing, the shortest. Length from nose to root of the tail, better than two inches; expanse of the wings ten inches.

Found in the interior parts of South Africa, as well as upon the Eastern Coast.

6. NYCTERIS AFFINIS.—AFFINIS CHEEK-POUCHED BAT.

Syn. NYCTERIS AFFINIS.—Dr A. Smith, *Zool. Journ.* XVI. 434.—Fisch. *Syn. Mam.* p. 662.

Icon.

SPECIFIC CHARACTERS.

THE HAIR tawny brown above, tawny white beneath; MEMBRANES blackish-brown.

THE TEETH of the upper jaw in pairs.

THE TAIL deeply forked; last vertebra but one the longest.

INHABITS South Africa.

Of this species, we shall give the description of the discoverer verbatim. Neck above, and back reddish-brown or tawny, sides of neck before wings

reddish-white; behind ears somewhat rufous; beneath tawny-white, membranes blackish-brown. Incisors of upper jaw in pairs, which are separated from each other by a distinct open space immediately in the front of the jaw. Length from nose to root of tail two inches; ears rather longer and broader than in the last species, tragus short, and its apex semicircular; termination of tail deeply forked, with the last vertebra but one the longest. The arrangement of the incisors of the upper jaw, the marked difference in respect to the last joint but one of the tail, added to the depth of the fork, and the greater proportion of transverse veins, in the portion of the interfemoral membrane connected with the joint named, tend, with other characters, to establish this as a distinct species from the last.

GENUS XVII. DESMODUS.—CURVED-TOOTH BATS.

Syn. DESMODUS.—Pr. Max. Beitr. et Abbild.
EDOSTOMA.—D'Orb. Voy.

GENERIC CHARACTERS.

$$\text{THE DENTAL FORMULA } \frac{2 \begin{matrix} 1+C+2 \\ 2+C+3 \end{matrix} M}{M} = \frac{8}{12} = 20$$

THE HEAD small. THE MUZZLE obtuse.

THE EARS with opercula. THE NOSE with complicated membranes.

THE THUMBS very long and strong.

THE INTERFEMORAL MEMBRANE narrow, lining the interior of the thighs. THE TAIL wanting.

INHABIT South America.

This genus, introduced by Prince Maximilian de Neuwied, seems unanimously to have been adopted by all the Zoologists who have subsequently laboured in this department of Natural History, among whom we may mention MM. Fischer and De Blainville, and Messrs Gray and Waterhouse. It seems well characterized by its dental formula, although this requires perhaps some further confirmation. Both the two upper and the four lower incisors appear to be peculiar; especially the former, which are very large, singularly conical, curved, compressed, with a very broad base, and acuminate; the latter, again, are somewhat flattened down, and have their edges deeply bifid, the lobes being cylindrical, and the apices roundish. The canines are large and sharp. Prince Maximilian does not seem to have ascertained the number of the molars in the upper jaw, though they are clearly given in D'Orbigny's plate: the number of the lower correspond accurately in the Prince's and the French traveller's drawings: the two upper are close to the great canine and to each other, the posterior being most indented; of the three lower the front one is somewhat removed from the canine, leaving room for the descent of the upper one, the second as well as the first have but one cusp, and are closely approximated; the third is bi-cuspid. The head, moreover, is very short, and not less the jaws, the lower being a trifle the longer; the nose-leaf is usually supplied with minute bristles; the anterior extremity is peculiarly robust; the alar membranes copious, the interfemoral very spare, being merely marginal to the thigh bones; there being no tarsal spur, and no tail.

I. DESMODUS RUFUS.—RED CURVED-TOOTH BAT.

Syn. DER ROTHBRAUNE BUNDELZAHN.—Pr. Max. Beitr. II. 233.
Icon. Pr. Max. Abbild.—(Desmodus rufus.)

SPECIFIC CHARACTERS.

THE HAIR red, tinged with yellow.

THE EARS short and broad; round at the points.

INHABITS Brazil.

"This interesting Bat," says the Prince of Neuwied, "was found at Fazenda of Miribeca, upon the river Itabapuna, between the 21° and 22° S. lat.; where, however, it appears exceedingly rare, as I was able to procure only a single individual." Its arm and alar membrane, and the fingers also, are remarkably strong; and the humerus, the lower extremities down to the foot, the great toe, and the membranes where they rise from the body, are covered with long and soft hair, as are also the face and nose-leaf, where, however, it is much finer, and not so abundant. Whilst the wings are very long, the interfemoral membrane is exceedingly curtailed, rising from nearly the top of the tibia. The cranium is very short, so that the lower jaw, though it projects somewhat beyond the upper, can scarcely accommodate the four molar teeth with which it is furnished. The ears are of medium size, and rather oblong than round; the operculum is narrow, pointed, and somewhat falciform; the nostrils obliquely approximate towards each other, and the nose-leaf, which is by no means complicated or copious, is of a circular shape. This Bat is destitute both of the tail and the tarsal spur. The base of each hair is a faint yellow, towards the tip it acquires a reddish or cinnamon tint, so

that, throughout the whole body, the colour generally is ferruginous; paler below than above; all the membranes are brownish-black. The total length of this species is nearly four inches; its extreme breadth about fifteen. It is believed to frequent old buildings; but of its habits little or nothing is known.

2. DESMODUS CINEREUS.—GREY CURVED-TOOTH BAT.

Syn. et Icon. EDOSTOMA CINEREA.—D'Orb. Voy.

SPECIFIC CHARACTERS.

THE HAIR grey, tinged with brown.

THE EARS long and pointed.

INHABITS

This Grey Edostome of M. D'Orbigny seems very properly placed in Prince Maximilian's Genus Desmodus by M. de Blainville;² but, as the illustrious traveller's description has not yet been published, we can derive our information regarding this species only from the beautiful representation which has appeared. It has a strong general resemblance to the former species in the strength of the anterior extremity, the extent of the alar membranes, which are also clad at their attachment to the body, and the curtailed interfemoral membrane, being a mere fringe which rises from about the lower third of the tibia; it is also destitute of spur and tail. The ear of this species is rather long and pointed; the operculum is also pointed; the nose-leaf, whilst having a general resemblance to that of the last species, is not so circular, the horse-shoe extending along the whole of the upper lip, and being scarcely as high as it is broad; it is irregularly triangular, and double the size of the one perforated by the nostrils, anterior, and including within the limits of the other; the lower lip seems to be deeply cleft. The fur, which is abundant, is soft and wavy. The colour generally is grey, being dark on the head, and light on the face, chest, and abdomen. The claws are yellowish, the membranes darkish grey.

3. DESMODUS D'ORBIGNYI.—CHILIAN CURVED-TOOTH BAT.

Syn. et Icon. DESMODUS D'ORBIGNYI.—Waterh. in Zool. Beagl. p. 1. pl. 1.

SPECIFIC CHARACTERS.

THE HAIR deep brown above, ashy white beneath.

THE EARS short, and broad; round at the points.

INHABITS Coquimbo, Chile.

Since the publication of M. D'Orbigny's elegant plate, a third species has been introduced into this genus, procured by Mr Darwin, and described by Mr Waterhouse in the "Zoology of the Beagle."

"The fur of this Bat," says Mr Waterhouse, "is glossy, and has a silk-like appearance; that on the top of the head, sides of the face, and the whole of the upper parts of the body, is of a deep brown colour; all the hairs on these parts, however, are white at the base. The flanks, interfemoral membrane, and arms, are also covered on their upper side with brown hairs. On the lower part of the sides, and the whole of the under parts of the body, the hairs are of an ashy-white colour. The membrane of the wing is brownish. The ears are of moderate size, and somewhat pointed; externally they are covered with minute brown hairs, internally with white; the tragus is also covered with white hairs; it is of a narrow form, pointed at the tip, and has a small acute process in the middle of the outer margin. The nose-leaf is pierced by the nostrils, which diverge posteriorly, and is so deeply cleft on its hinder margin, that it may be compared to two small leaflets joined side by side near their bases. These leaflets lie horizontally on the nose, to which they are attached throughout, a slight ridge only indicating their margin. Behind the leaf there is a considerable naked space, in which two small hollows are observable, situate one on each side, and close to the nose-leaf; and, at a short distance behind the nose-leaf, this naked membrane is slightly elevated, and forms a transverse fleshy tubercle. The extreme length is 3" 3''' ; the extreme breadth 12" 8''' ; of the antibrachium 2" 2''' ; of the nose-leaf 2 1/4'''."

This Bat is a blood-sucker, and hence has been designated a Vampire by Mr Darwin. It is on this species he has the following note: "The Vampire Bat is often the cause of much trouble by biting the horses in their withers. The injury is generally not so much owing to the loss of blood as to the inflammation which the pressure of the saddle produces. The whole circumstance has lately been doubted in England; I was therefore fortunate in being present when one was actually caught on the horse's back. We were bivouacking late one evening near Coquimbo, in Chile, when my servant, noticing that one of the horses was very restive, went to see what was the matter, and fancying he could distinguish something, suddenly put his hand on the beast's withers, and secured

¹ Mr Gray (Mag. Zool. and Bot. II. p. 89) considers *Stenoderma rufum*, Geoff. to be identical with *Desmodus rufus*, Pr. Max.
² See *Annales des Sciences Naturelles*, 2d Série, T. ix. 361.

the Vampire. In the morning, the spot where the bite had been inflicted was easily distinguished from being slightly swollen and bloody. The third day afterwards we rode the horse, without any ill effects."

"The structure of this animal," says Mr Waterhouse, "is found perfectly to correspond with its habits. There is a total absence of true molars, [which, however, must surely have been accidental,] and consequent want of the power of masticating food. On the other hand, the canines and incisors are perfectly fitted for inflicting a wound, while the small size of the interfemoral membrane, giving freedom to the legs, together with the unusually large thumb and claw, enable the Bat to fix itself with security to the body of its prey."

GENUS XVIII. RHINOPOMA.—LID-NOSE BATS.

Syn. LES RHINOPOMES.—Cuv. Reg. Anim. I. 119.—Geoff. Collect. du Mus.—Desm. Mam. p. 129, et al.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2}{1} \frac{1+C+(F+3)M}{2+C+(2F+3)M} = \frac{12}{16} = 28$

THE NOSE long, conical, truncated; NOSE-LEAF small; NOSTRILS narrow, transversal, and covered with a lid.

THE CHANFRIN broad and concave.

THE EARS large, united, and connected with face; the TRAGUS external.

THE INTERFEMORAL MEMBRANE narrow and truncated. THE TAIL long, and free towards the tip.

INHABITS Egypt.

The fossa upon the chanfrin of the Rhinopoma is less marked than in the preceding genus, Nycterus; the nostrils, at the end of the snout, and the small lid which overhangs them, resemble the knife used in dressing the hoofs of horses; their ears are united, and their tail extends considerably beyond the membrane. Only one species is as yet ascertained, which was found among the pyramids.

1. RHINOPOMA MICROPHYLLUM.—SMALL-LEAF LID-NOSE BAT.

Syn. et Icon. RHINOPOME MICROPHYLLUM.—Cuv. Reg. Anim. I. 119.—Desm. Mam. No. 193.—Geoff. Descript. de l'Egypte, Part. d'Hist. Nat. II.

VESPERTILIO MICROPHYLLUS.—Brunnich Descript. du Cabinet de Copenhague, p. 50, tab. 6, fig. 1, 2, 3, 4.—Schreb.

CHAUVE-SOURIS D'EGYPTE.—Belon de la Nature des Oiseaux, liv. 2, chap. 39.

SPECIFIC CHARACTERS.

THE HAIR ash-coloured.

THE TAIL very long and slender.

INHABITS Egypt.

This Bat is rather more than two inches long, the tail being about two more; its extreme breadth is about eight inches. Its fur is long and thick, of an ash-colour; the tail, which is composed of eleven vertebræ, is black and smooth, and far surpasses the interfemoral membrane, which is extremely short; and receives no support from tarsal spurs. The nostrils and upper lip exhibit an apparatus which is sufficiently complicated, and which projects beyond the jaw; they appear truncated at the extremity, and terminate in a kind of circular fold, surmounted by a small leaflet, and pierced in the centre by two oblique clefts, which are the nasal apertures, and which, at the will of the animal, are very conspicuously opened and closed, as occurs in Seals. The leaflet, at the upper part of the nasal cartilage, also moves separately. The nostrils, which are prolonged across the lip of the upper jaw, are very narrow, and terminate in a chamber which is very short, but greatly widened by the curve of the intermaxillary bone above. The intermaxillary bone is entire, and fixed firmly into the maxillaries. The two upper incisors are wide asunder; the four lower are crowded. The ear projects anteriorly, and unites with its fellow. The tragus is on the edge of the meatus, projecting somewhat externally.

Belon was the first who discovered this Bat, and in the pyramids of Cairo. Hasselquist alluded to some which were taken in the pyramid of Gyzeh, but which were for a long time overlooked, until again described in the year 1782 by Brunnich. M. Geoffroy found this species in many of the tombs of Upper Egypt; he observed that, when provoked, it was very irritable, like our European Bats; but that when at liberty, what most attracted attention was the movement of its nostrils corresponding with that of the chest; sometimes closing them so completely that no trace can be seen, and then covering them with its leaflet.

DOUBTFUL SPECIES.

1. M. Geoffroy states, that he believes there is a second species of the same genus in Egypt, which differs from the former chiefly in having a shorter tail, and a less acute snout. He does not supply a name for it.

2. RHINOPOMA CAROLINIENSIS. (Geoff. Collect. du Mus.—Desm. Mam. No. 194.)

A specimen of this animal was presented to the Paris Natural History Museum by M. Brongniart, who thought, although by no means certain, that it came from Carolina. In length and breadth it corresponds with the microphyllum; its tail, however, is only one and a half inch long; its ears are somewhat triangular in shape, and do not appear to coalesce; the lower incisors are described as bi-lobed. The fur is brown, and the membranes dark.

3. RHINOPOMA HARDWICKII. Gray, Zool. Misc. 37.—Mag. of Zool. and Bot. II. 486.

Dark brown, rather paler beneath; tail longer than the body, more than two-thirds free. Inhabits Bengal. General Hardwicke's Collection; the Collection of the British Museum. Such is Mr Gray's description.

GENUS XIX. TAPHOZOUS.—WING-POUCHED BATS.

Syn. TAPHOZOUS.—Reg. Anim. I. 119.—Geoff. Mém. de l'Inst. d'Egypte, Hist. Nat. II. 129: et al.

VESPERTILIO.—Schreb. Muller,—SACCOPTERYX.—(Täschelfittig.)—Illig. Prodr. p. 121.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2}{1} \frac{C+(2F+3)M}{2+C+(2F+3)M} = \frac{12}{16} = 28$

THE CHANFRIN furrowed, but without overlapping edges or lids.

THE NOSE destitute of a nose-leaf.

THE UPPER-LIP very thick. THE MUZZLE produced.

THE EARS of moderate size. THE OPERCULUM internal.

THE INTERFEMORAL MEMBRANE large and salient. THE TAIL composed of six vertebræ, not so long as the membrane, and free on its upper side.

INHABITS the Old and New Continents.

The Taphiens have a rounded fossa on the chanfrin; but their nostrils are not furnished with any projecting laminae; their head is pyramidal; and they have only two incisors above, (?) which are often wanting. They have four lower incisors, which are trilobed; their ears do not meet, and their tail is free above the membrane. The males have a transversal cavity under the throat, (?) and a slight prolongation of their alar membrane forms a kind of pouch near the earpus. M. Geoffroy discovered one of the species in the catacombs of Egypt.

This genus, as hinted above, was established by M. Geoffroy in the grand work of L'Institut d'Egypte. Recent examination has demonstrated that it has no incisors in the upper jaw; the four lower ones are tri-lobed. The canines are distinct, long, and conical.

1. TAPHOZOUS PERFORATUS.—PERFORATED WING-POUCHED BAT.

Syn. TAPHOZOUS PERFORATUS.—Geoff. Descript. d'Egypte, Hist. Nat. II. 126.—Fisch. p. 120.

LE TAPHIEN PERFORÉ.—Cuv. Reg. Anim. I. 120.—Desm. Mam. No. 197.—Less. Mam. No. 191.—Gray, in Mag. Zool. and Bot. II. 499.

Icon. Geoffroy, loc. cit. pl. III. fig. 1.—(Skeleton and cranium,) fig. 4, 4, 4.

SPECIFIC CHARACTERS.

THE HAIR reddish-grey above, ash-coloured beneath.

THE OPERCULUM in the form of a hatchet.

INHABITS Egypt.

The muzzle of this species is obtuse; the tail is longer than the thigh bone; the spur which supports the interfemoral membrane is longer than the foot; the operculum, or tragus, is in shape of a hatchet, and terminates in a round edge; the ears are oblong. The upper lip extends somewhat beyond the lower jaw; the nasal apertures are very narrow, of a circular form, and partly covered by a membrane. The chanfrin is hollowed out. The fur is plentiful; the roots of the hair are all white; but the points being coloured, the upper parts are reddish-grey, and the lower ash-coloured. The length of the head and body is somewhat more than three inches; the extreme breadth nearly ten.

It inhabits Egypt. Specimens are to be found in the Paris and British Museums.

2. TAPHOZOUS SENEGALENSIS.—SENEGAL WING-POUCHED BAT.

Syn. TAPHOZOUS SENEGALENSIS.—Geoff. Descrip. de l'Égypte Hist. Nat. II. 127.—Fisch. Syn. Mam. 120.

TAPHIEN LÉROT-VOLANT.—Desm. Mam. No. 195.

LEROT-VOLANT.—Daubenton, Mem. de l'Acad. des Sciences de Paris, 1759, 386.

Icon.

SPECIFIC CHARACTERS.

THE HAIR brown above, greyish-brown beneath.

THE OPERCULUM roundish.

INHABITS Senegal.

It was Adanson who first noticed the existence of this species; he transmitted a specimen to Paris, where it fell under the review of the accurate Daubenton. Its muzzle is broad and prolonged; its ears are of moderate size, and have a very short operculum, which is very broad and rounded; the extremity of the tail is free in the membrane; the head and upper part of the body are of a brown colour; the inferior parts are of a lighter brown, with a greyish tint.

3. TAPHOZOUS MAURITIANUS.—MAURITIUS WING-POUCHED BAT.

Syn. TAPHOZOUS MAURITIANUS.—Geoffr. Descrip. de l'Égypte Hist. Nat. II. 127.—Less. Mam. No. 190.

LE TAPHIEN DE L'ISLE DE FRANCE.—Cuv. Reg. Anim. I. 120.—Desm. Mam. No. 196.

Icon.

SPECIFIC CHARACTERS.

THE HAIR chestnut-coloured above, and reddish beneath.

THE OPERCULUM with a sinewy edge.

THE TAIL shorter than the thigh.

INHABITS the Isle of France.

This Bat was discovered in the Isle of France by Colonel Mathieu of the Royal Artillery. It is not very unlike the preceding species; but differs in the proportion of the head, and the form of the operculum; also, in the tail being shorter, and in the extent of the interfemoral membrane. Its muzzle is more acute, and the tail shorter than the thigh bone. The spur is equal in length to the foot. The operculum is, at its origin, accompanied with a small lobe, and is terminated by a sinewy edge; the ears are short and round. Its length, from the muzzle to the origin of the tail, is about three inches and nine lines; its extreme breadth about ten inches. Its fur is of a chestnut colour on the back, and reddish underneath.

4. TAPHOZOUS LEPTURUS.—SLENDER-TAILED WING-POUCHED BAT.

Syn. TAPHOZOUS LEPTURUS.—Geoffr. in Descrip. de l'Égypte, II. 126.—Cuv. Reg. Anim. I. 120.

VESPERTILIO LEPTURUS.—Schreb. I. 173.—Linn. Gmel. I. 50.—Slender-tailed Bat of Pennant and Shaw.

Icon. Schreb. Säugth. LVII.

SPECIFIC CHARACTERS.

THE HAIR grey above, and paler beneath.

THE TRAGUS very short and obtuse.

THE ALAR MEMBRANE folded near the tail.

This Slender-tailed Bat is about one inch and a half long; its muzzle is broad, and supplied with very fine bristles; the nostrils are tubular and approximate; the ears are large, obtuse, and rounded, with a very short and obtuse operculum; the four incisors are lobed, and the canines are long. The alar membrane is folded towards the tail, in such a way as to form a kind of pouch; the tail is prolonged beyond the interfemoral membrane. It is stated to be an inhabitant of Surinam; but this is doubtful. M. Geoffroy is inclined to think it has been procured from India.

5. TAPHOZOUS LONGIMANUS.—LONG-ARMED WING-POUCHED BAT.

Syn. et Icon. TAPHOZOUS LONGIMANUS.—Cuv. Reg. Anim. I. 120.—Fisch. Syn. Mam. 121.—Hardw. Linn. Trans. XIV. 525, pl. 17.

SPECIFIC CHARACTERS.

THE HAIR snuff-brown above, paler beneath. MEMBRANES black.

THE EARS ovate, rugous. THE TRAGUS broader above than beneath.

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THE ARMS and FINGERS remarkably long.
INHABITS Calcutta.

General Hardwicke, whose description and drawings are most accurate, informs us that this Bat is common in Calcutta, in dark storerooms, whence it issues at night, and intrudes into dwelling-houses, attracted by the light of the candles, and the numerous insects which buzz round them. Its head is depressed, broad between the ears, and suddenly tapering to the nose; the nostrils terminal, approximating; the margins tumid, the upper jaw longest. The ears are obliquely ovate, erect, transversal, plaited internally; the inward margins hairy inwardly; the posterior lobe elongated to the chin; the tragus oblong, broader upwards than below. The interfemoral membrane extends considerably beyond the toes; is supplied with long spurs, and is truncated. The tail is an inch long, hardly tapering. The body is wholly covered with a very soft hair: in the adult, it is of a snuff-brown colour; the legs and membranes are black; but the full sized young Bats are of a deep black all over. Total length, 5"; total breadth, 14½".

6. TAPHOZOUS RUFUS.—RED WING-POUCHED BAT.

Syn. TAPHOZOUS RUFUS.—Cuv. Reg. Anim. I. 120.—Fisch. Syn. Mam. 122.—Harl. Faun. Americ. p. 22.

VESPERTILIO RUFUS.—Warden, Descrip. of the United States, V. 608.

RED BAT OF PENNSYLVANIA.—Wilson's Amer. Ornith. VI. 60.

Icon. Wilson, loc. cit. pl. 50, fig. 4.

SPECIFIC CHARACTERS.

THE HAIR of a reddish-cream colour.

THE MEMBRANES of a dusky red.

THE TRAGUS slender, rounded at the extremity, situate internally.

INHABITS North America.

The length of this Bat, from the nose to the tail, is four inches, of the tail four, with the breadth across the wings twelve. The general colour is a bright iron-grey, the fur being of a reddish-cream colour at bottom, then strongly tinged with lake, and minutely tipped with white; the membranes are dusky, their shafts light-brown; the ears are scarcely half an inch long, the tragus small; the nostrils are somewhat tubular; the wings have a single hook each, and are so constructed that the animal may hang either with its head or tail downwards. I have several times, says Wilson, found two hanging, feet fast locked together, behind a leaf, the hook of one fixed in the mouth of the other. I once, he adds, found a number of them, in the depth of winter, in a cave not far from Carlisle, Pennsylvania; they were lying on the projecting shelves of rocks, and, when the fire-brand was held near them, they wrinkled their lips, showing their teeth; they soon became active when held in the hand, and, when carried into a stove-room, flew about as lively as ever.

An incident regarding the habits of this species we must not omit. The female, says Dr Harlan, has been known to manifest the strongest maternal affection: a young lad having taken two young Bats of this species, was in the act of carrying them to the museum at mid-day; being watched by the mother, she followed him through the streets, fluttering round the thoughtless urehin, in whose grasp was centred all her hopes, and eventually settled in his bosom, preferring captivity to freedom with loss of progeny.

7. TAPHOZOUS NUDIVENTER.—NAKED WING-POUCHED BAT.

Syn. et Icon. TAPHOZOUS NUDIVENTRIS.—Cretzelm. in Rupp. Atl. pl. 27 b.—Gray, Mag. of Zool. and Bot. II. 499.

SPECIFIC CHARACTERS.

THE HAIR, above, a greyish-brown; beneath, whitish.

THE MEMBRANES and FEET dark brown.

THE FACE, lower part of the abdomen, and inside of the extremities, naked, and flesh-coloured.

INHABITS Egypt and Nubia.

This Bat differs from the *Taphozous perforatus* of Geoffroy, not only in the dimensions of its body, which is larger by one third part, but also in the nakedness of the lower part of the body and extremities, both in the young and adult,—parts which, in *T. perforatus*, are thickly covered with hair.

The face is pointed, and naked from the nose to the region round the eyes; the nostrils small, directed forwards; the eyes middle-sized, and black. The colour of the upper part of the body is a light brown, speckled with grey, of the lower whitish. On the nail-joint of each toe there is a pencil of stiff and crooked hairs. M. Ruppell procured his specimen from the pyramids of Gizeh.

Note.—LE TAPHIEN FILET, (Geoffr. Descr. d'Egypte, pl. I. fig. 1.) does not appear to be specifically distinct from Taphozous perforatus.

GENUS XX. MORMOOPS.—MORMOOPS BATS.

Syn. LES MORMOOPS.—Cuv. Reg. Anim. I. 120.—Fr. Cuv. Dents des Mam. 52.

MORMOOPS.—Leach, Linn. Trans. XIII. 76.—Fisch. Syn. Mam. 124. Gray, Mag. Zool. and Bot. II. 491.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2+5M}{2+6M} = \frac{14}{16} = 30$. (See Leach.)

Or, $\frac{2+C+(3F+3)M}{2+C+(3F+3)M} = \frac{18}{18} = 36$, according to Fr.

Cuvier, who says he had it from Leach.

THE EARS large and coalescing; the tragus conspicuous. FOREHEAD abruptly elevated.

THE NOSE-LEAF single, erect, and conjoined to the ears.

THE TAIL not extending beyond two thirds of the interfemoral membrane; last joint free.

INHABITS Jamaica.

The Mormoops Bats have four incisors in each jaw, the upper being of considerable size, and the lower trilobed; their cranium is singularly elevated like a pyramid, above the muzzle; and from each side of the nose there projects a triangular membrane, which coalesces with the ear.

Though this Genus was established by Dr Leach with all due care, yet his materials were very scanty, and it evidently requires revision. As stated by Mr Gray, the genus described by M. F. Cuvier under this name appears quite different from that of Dr Leach. This gentleman's description is lucid, and the plate of the single species on which the genus was founded is excellent: it contains four figures; the face; a back view of the whole animal; the cranium; and the dental apparatus. The upper incisors are very unequal, the central being much the broadest, and having a deep notch in the middle; the outer ones are small, point

obliquely, and are sharp. The lower ones are uniform in size, and trilobed.

I. MORMOOPS BLAINVILLI.—DE BLAINVILLE'S MORMOOPS BAT.

Syn. Leach, in Linn. Trans. XIII. 76.—Fisch. Syn. Mam. 124.—Gray, Loc. Cit. et Annal.; Nat. Hist. IV. 3.

Icon. Leach, Loc. Cit. pl. 7.

SPECIFIC CHARACTERS.

THE HEAD nearly globular. THE NOSE rounded above, and obliquely truncated below.

THE EARS very large and broad, united on the forehead; the tragus lunated.

THE LIPS variously expanded, and tuberculous.

THE INTERFEMORAL MEMBRANE very large, truncated at the extremity.

THE HEEL-BONE very long, and marginal.

INHABITS Jamaica and Cuba.

Mr Macleay having lately sent home a specimen of this Bat from Cuba, Mr Gray has been enabled very considerably to add to the information respecting the animal previously possessed, and which was confined to Dr Leach's notice. Mr Gray states that it has scarcely a true nose-leaf, and that it is closely allied to the Taphozoi. The head is nearly globular, with a produced muzzle. The nose is rounded above, with three warts on each side, and obliquely truncated below, with a longitudinal central rib, and a transverse rib between the margin and nostrils. The lips are variously expanded, and so complicated that they can scarcely be described by words. The large ears are dependent over the face; the lower side is expanded, and continued into the folded lower lip. The tragus is lunate; the antetragus large and tubercular. The wings are long, rather wide, hairy beneath near the sides. The interfemoral membrane furnished with many transverse lines; the tail is long, with the last joint free.

Mr Macleay's specimen was killed in his bed-room. Dr Leach's was sent from Jamaica by Mr Lewis.

TRIBE IV.—MONOPHALANGIA ANISTIOPHORA.

Syn. ANISTIOPHORI, (in part.)—Spix, Sim. et Vespert. Bras.

VESPERTILIONINA.—Gray, in Mag. Zool. and Bot. II.—Less. Mam.

CHARACTERS OF THE TRIBE.

THE INDEX with only one ossified phalanx; the other fingers with two.

THE NOSE without any leafy appendage.

GENUS XXI. EMBALLONURA.—LONG-NOSED BATS.

Syn. EMBALLONURA.—Kuhl, in Ann. Weteraischen Gesellschaft I.—Temm. Mon. Mam. I. 18.

PROBOSCIDEA.—Spix, Vesp. Bras.—Gray, Mag. Zool. and Bot. II. 499.

VESPERTILIO, (in part.)—Pr. Max. Abbild.—Fisch. Syn. Mam. 115.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2+C+(F+4)M}{3+C+(F+4)M} = \frac{16}{18} = 34$

THE HEAD long and conical; FOREHEAD flat.

THE MUZZLE long; the UPPER-JAW the longest.

THE TAIL long, and partially involved in the interfemoral membrane.

INHABIT Brazil, and the Indian Archipelago.

That the small group of Bats included under the appellation Emballonura were entitled to a separate generic distinction, seems first to have been recognized by M. Spix, who applied to it the name of Proboscidea.

As the Baron Cuvier, however, had applied this same term to a family of the Pachydermata, this proposal could with no propriety be entertained; and hence, Kuhl, it would appear, was prompted to introduce another, and less objectionable one, which has been adopted by Temminck, though, in his published writings, nothing further than a mere indication is supplied. The upper incisors, it would appear, are very small, distant, and diverging; whilst the lower are lobed, and placed in a semi-circle.

I. EMBALLONURA SAXATILIS.—THE ROCK LONG-NOSE BAT.

Syn. et Icon. EMBALLONURA SAXATILIS.—Temm. Mon. Mam. I. 18.

PROBOSCIDEA SAXATILIS.—Spix, Sim. Bras. 62.—Gray, Mag. Zool. and Bot. II. 499.

VESPERTILIO NASO.—Pr. Max. Abbild.—Reise Nach Bras. Bd. I. 251.

SPECIFIC CHARACTERS.

THE HAIR brown above, streaked with grey; ash-coloured beneath.

THE NOSE with its tip prolonged; the spur is also long.

THE INTERFEMORAL MEMBRANE is truncated; THE TAIL somewhat free at its tip.

INHABITS Brazil.

Prince Maximilian informs us that this small Bat is very abundant in numerous districts of the Brazils. During the day it is usually seen hanging to the great trunks of the trees of the virgin forests, or to the sharp rocks which overhang the rivers, where it enjoys the freshness of the stream, and does not quit its retreat till the evening twilight.

2. EMBALLONURA RIVALIS.—THE RIVER LONG-NOSE BAT.

Syn. PROBOSCIDEA RIVALIS.—Spix, Vesp. Bras. p. 62.—Gray, Mag. Zool. and Bot. II. 499.

VESPERTILIO RIVALIS.—Fisch. Syn. Mam. p. 116.

Icon.

SPECIFIC CHARACTERS.

THE HAIR dark brown above, light brown beneath.

THE NOSE prolonged, pointed, and somewhat pendant.
THE WINGS projecting far before the head.
INHABITS the Brazils.

The information we possess of this species is very scanty. It is somewhat less than the preceding; and is found in numerous bands on the copse which skirts the banks of the River Amazon.

3. EMBALLONURA CANINA.—CANINE LONG-NOSE BAT.

Syn. VESPERTILIO CANINUS.—Pr. Max. Abbild. et Beitr. zur Naturg. Bras. Bd. II. p. 262.—Fisch. Syn. Mam. p. 112.
PROBOSCEIDA CANINA.—Gray, Mag. Zool. and Bot. II. 499.
Icon. Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE HAIR of a uniform deep brown colour, as are the membranes.
THE SNOUT prolonged, and somewhat turned up.
THE ALAR MEMBRANES ample; the interfemoral long and truncated.
THE TRAGUS very short. THE SPUR very long.
INHABITS Brazil.

The length of the head and body of this Bat is nearly three inches; of the tail not an inch; the extreme breadth is eleven. The fur throughout is dense, soft, and long. Prince Maximilian found it among old ruined edifices.

4. EMBALLONURA CALCARATA.—SPURRED LONG-NOSE BAT.

Syn. VESPERTILIO CALCARATUS.—Pr. Max. Abbild. et Beitr. zur Naturg. Bras. Bd. II. p. 269.
VESPERTILIO MAXIMILIANI.—Fisch. Syn. Mam. p. 112.
PROBOSCEIDA CALCARATA.—Gray, Mag. Zool. and Bot. II. 499.
Icon. Pr. Max. Abbild.

SPECIFIC CHARACTERS.

THE FUR reddish-brown.
THE MEMBRANES dark brown, and very ample.
THE MUZZLE somewhat pointed. THE TAIL short. THE FOOT small.
THE SPURS very long, so as almost to touch, making
THE INTERFEMORAL pointed.
INHABITS Brazil.

The length of the head and body of this species is about two and a half inches, and its extreme breadth somewhat more than twelve. The ears are long, pointed, and distinctly rugous externally. Prince Maximilian observed this animal in the small river Joucou, near the Santo Spirito.

5. EMBALLONURA MONTICOLA.—THE HILL LONG-NOSE BAT.

Syn. PROBOSCEIDA MONTICOLA.—Gray, Mag. Bot. and Zool. II. 500.
Icon.

SPECIFIC CHARACTERS.

THE FACE depressed. FOREHEAD rounded.
THE SPURS about four lines long.

A satisfactory account of this species has not hitherto, we believe, been published; at least, we have not been able to find it in any work of Kuhl to which we could refer. The animal, however, is preserved in the Leyden Museum, and is reported to have been received from Java. Mr Gray says that the wings are brown; expanse, six inches.

GENUS XXII. UROCRYPTUS.—CONCEALED-TAIL BATS.

Syn. UROCRYPTUS, (Chauve-souris à queue Cachée).—Temm. Mon. II. 144.

Although M. Temminck indicated the existence of this genus as far back as the year 1838, with the promise he would immediately publish the details concerning it, yet the work has hitherto been delayed. He states that this genus and the Emballonura form two small groups between the Taphozous and the True-Bats. In both groups the interfemoral is pierced by the tail as in Taphozous, but they differ from it in the dental apparatus, which corresponds to that of the Bats.

GENUS XXIII. NYCTICEJUS.—ROQUET-DOG BATS.

Syn. NYCTICEJUS.—Rafinesque, Journ. de Phys. LXXXVIII. p. 417.—American Month. Mag.—Cuv. Reg. Anim. I. 122.—Temm. Mon. Mam. II. 145.
ATALAPHA.—Rafinesque, loc. cit.
VESPERTILIO.—Auct. (in part.)
SCOTOPHILUS.—Gray, (in part.) Mag. of Zool. and Bot. II. 497.

GENERIC CHARACTERS.

THE DENTAL FORMULA $\frac{2I+C+4M}{3+C+5M} = \frac{12}{18} = 30$
More rarely $\frac{2I+C+(F+4)M}{3+C+5M} = \frac{14}{18} = 32$
In the young $\frac{2+C+4M}{3+C+5M} = 32$
More rarely $\frac{2+C+(F+4)M}{3+C+5M} = \frac{16}{18} = 34$

THE EARS small. THE MUZZLE simple.
THE CHANFRIN very broad. THE FOREHEAD narrow. THE OCCIPUT elevated.

THE INTERFEMORAL MEMBRANE pierced by the tail, which is usually long.

INHABITS all the Continents, except Europe.

The Roquet-Dog Bats, with the ears of moderate size, and the simple muzzle of the Proper Bats, have only two incisors in the upper jaw. The known species are of South America, [as well as of the Old World.]

This genus was instituted by M. Rafinesque, upon the examination of some of the numerous species of Bats which he discovered in the provinces of Ohio, Indiana, and Illinois, in North America; and it is a matter of regret that these have not subsequently been re-examined by any competent scientific Naturalist. The incisors always nearly approximate to the canines, and are invariably long, conical, and pointed like the eye-teeth. The intermaxillary bones are rudimentary, and firmly united to the maxillaries throughout their extent. The lower incisors are always more or less crowded. When the false molar is present, it is always extremely small, not in the range with the other teeth, and placed behind the heel of the canine. The enlarged form of the chanfrin, and the elevated occipital bone, confer on this genus a strong resemblance to many dogs, more especially the Roquet-Dogs. Their mouth and muzzle are large, and their head appears so from the ears being so far apart: these appendages are not complicated, but always short and round; their tragus, too, is short and obtuse. Their fur is generally short, and very smooth, and some species are partially naked, more especially on the abdomen, croup, and thighs.

The genus may be divided into two groups, those which belong to the Old World, and those found in the New. These latter have the fur usually longer, and the interfemoral membrane more or less clad with hair.

(A.) SECTION I. SPECIES BELONGING TO THE OLD WORLD.

1. NYCTICEJUS NIGRITIS.—SENEGAL ROQUET-DOG BAT.

Syn. VESPERTILIO NIGRITIS.—Linn. Gm. p. 49.—Geoff. Ann. du Mus. VIII. 201.—Desm. Mam. No. 217.
LA MARMOTTE VOLANTE.—Daubent. Mem. de l'Acad. 1759, 385.
CHAUVE-SOURIS ÉTRANGÈRE.—Buff. Hist. Nat. X. p. 82.
SENEGAL BAT.—Penn. Quad. No. 502.
NYCTICEJUS NIGRITIS.—Temm. Mon. II. 147.
Icon. Buff. loc. cit. pl. 18; copied in Schreb. No. 58.—Geoffr. loc. cit. pl. 47.—Temm. pl. 47, fig. 1 and 2, (heads.)

SPECIFIC CHARACTERS.

THE HAIR fawn brown above, and dark brown beneath. THE MEMBRANES black.

THE EARS are triangularly oval and short, being about one third the length of the head. THE TRAGUS short and obtuse.

THE two last joints of the tail extend beyond the membrane.
INHABITS Senegal.

This Bat is of large dimensions, extending, in extreme length, including the tail, measuring three inches, to more than seven; the extreme expanse is about twenty inches. The head is long; the ears wide apart; the lips also are long, but not warty, and the chanfrin projecting.

It was Adanson who sent this animal from Senegal; and it has long been preserved in the Paris Museum.

2. NYCTICEJUS HEATHII.—HEATH'S ROQUET-DOG BAT.

Syn. NYCTICEJUS HEATHII.—Horsf. Proceed. Zool. Soc. Aug. 1831, P. 1st, p. 113.—Temm. Mon. Mam. II. 149.
SCOTOPHILUS HEATHII.—Gray, Mag. Zool. and Bot. II. 498.
Icon.

SPECIFIC CHARACTERS.

THE HAIR on the upper parts of the body of a deep brown, with a rosy tint, the lower parts a greyish fawn.—Covering the whole body.

THE LIPS covered with hair. THE EARS shorter than the head.

THE TRAGUS short.

INHABITS India.

Heath's Bat is likewise remarkable for its large size; in total length being upwards of six inches, and breadth nearly twenty; the fur also is abundant, silky, and shining. The head is of medium length, depressed, somewhat flat above, and compressed on the sides; the muzzle is large and obtuse; the gape not very wide; the lips covered with hair; the ears much shorter than the head; the concha straight, and roundly oblong at the point, somewhat keel-shaped at its posterior margin; the tragus is linear, and leaf-shaped. The fur is smooth and short, and covers every part of the body. The colour of the upper part is of a deep brown, covered with a rosy hue; beneath it is a somewhat greyish-fawn colour. No part of the body is naked.

Mr Heath transmitted an individual of this species from Madras to the Zoological Society, where specimens are to be preserved; Dr Horsfield described it to that learned body. It has been received also from Calcutta.

3. NYCTICEJUS TEMMINCKII.—TEMMINCK'S ROQUET-DOG BAT.

Syn. NYCTICEJUS TEMMINCKII.—Temm. Mon. Mam. II. 149.

VESPERTILIO TEMMINCKII.—Horsf. Zool. Res. in Java.

SCOTOPHILUS TEMMINCKII.—Gray, Mag. Zool. and Bot., who identifies it with the *Vesp. Belangeri*.

Icon. VESPERTILIO TEMMINCKII.—Horsf. loc. cit., 5 figures.

NYCTICEJUS TEMMINCKII.—From the living animal; loc. cit. Temm. Mon. pl. 47, 4 figures.

SPECIFIC CHARACTERS.

THE HAIR often varying in colour, (see description 1,) very short and shining.

THE EARS wide asunder, broad, round at the tip. THE TRAGUS oblong, round at the point; inclined forwards.

INHABITS Java and surrounding Archipelago.

Dr Horsfield states that the entire length of this Bat is four inches and six lines, its extreme width is about eleven. The muzzle is full and obtuse; the ears very widely separated, broad, round at the point; the operculum is somewhat oblong, inclined forwards, and roundish at the extremity. The cranium is capacious, the occiput high, the chancfin broad and flat. The fur is very short, abundant, and shining, with a brush of hairs on the lower part of the alar membranes. The colours of the robe are very variable, often party-coloured, so as to excite the suspicion that it sometimes changes. The examination of more than a hundred individuals has led M. Temminck to the conclusion that the following are the most common:—*a.* All the upper parts of the body bright and shining chestnut, all the lower parts a beautiful red. *b.* Upper parts a shining olive brown; lower parts a yellowish-grey brown. *c.* Upper parts of a shining red brown; the lower, a fawn red. In the *young* the most common liveries are, *d.* olive, or dull russet above, a fawn red beneath; and, *e.* in some individuals, the upper parts are party-coloured, chestnut and brown, whilst the lower are spotted, white, fawn coloured, and red.

Dr Horsfield first described this Bat, and the Belgian Naturalists have captured many of them in the Eastern Archipelago, especially in Java. They congregate in great bands of many hundreds in the roofs and trunks of trees, whence they issue about dusk. Their chief nourishment consists in the white ants, (*Termites*.)

4. NYCTICEJUS BELANGERII.—BELANGER'S ROQUET-DOG BAT.

Syn. NYCTICEJUS BELANGERII.—Temm. Mon. Mam. II. 151.

VESPERTILIO BELANGERII.—Isid. Geoff. in Voy. de Belang. p. 87.

Icon. VESPERTILION BÉLANGER.—Voy. ut sup. pl. 3.

SPECIFIC CHARACTERS.

THE FUR olive chestnut above.

THE MUZZLE, cheeks, arm-pits, and groins, naked.

INHABITS India.

The ears of this species are wide asunder, roundish, short, their external border approximating to the lips; the tragus narrow and straight. The muzzle is short, broad, obtuse; the nostrils wide apart. The teeth exhibit that formula which is more rarely observed. The fur is of me-

dium length, smooth, bi-coloured above, and uniform beneath: above, they are brownish-yellow at their root, and chestnut at their point; beneath, fawn coloured. The membranes are naked above, but are somewhat elad beneath along the arm and fore-arm. The total length is nearly five inches. The expanse fourteen. In the *young*, the hair is shorter, and not so scanty, and is brown above, and light yellow beneath, almost white on the throat and chest. It is frequent on the coast of Comandel, and neighbouring parts of India; abounding in dwelling-houses.

5. NYCTICEJUS NOCTULINUS.—NOCTULINE ROQUET-DOG BAT.

Syn. NYCTICEJUS NOCTULINUS.—Temm. Mon. Mam. II. 226.

VESPERTILIO NOCTULINA.—Isid. Geoff. in Voy. de Belang. p. 92.

Icon.

SPECIFIC CHARACTERS.

THE FUR of a rosy fawn colour above, yellowish beneath.

THE BODY in no part naked. THE MEMBRANES of a light brown.

INHABITS India and Singapore.

This Bat, in general appearance, corresponds to the preceding, but is of smaller dimensions, nor is any of its body devoid of hair. The muzzle is prolonged and naked at its point and sides. The ears are triangular, terminating in an oval shape; the inferior lobe is remarkably long; the tragus is long and straight, terminating in a blunt point. The tail is of medium length. The upper part of the head, the sides of the neck, and the upper parts of the body, are covered with short hair of a rosy fawn colour; the under parts are of a yellowish fawn, the sides of the chest being somewhat red; the lower side of the interfemoral membrane appears naked, till examined with a glass, when a few fine white hairs are discovered. The membranes are of a light brown, their edges white, and there is no difference in the sexes. The total length is three inches and three lines; the width about nine. It has been found at Bengal and at Singapore.

6. NYCTICEJUS BORBONICUS.—BOURBON ROQUET-DOG BAT.

Syn. NYCTICEJUS BORBONICUS.—Temm. Mon. Mam. II. 153.

VESPERTILIO BORBONICUS.—Geoff. Ann. Mus. VIII. 301.—Desm. Mam. No. 216.

Icon. Geoff. loc. cit. pl. I. tête; copied in Temm. pl. 47, fig. 7.

SPECIFIC CHARACTERS.

THE FUR red above, pale beneath. THE EARS oval, triangular.

THE TRAGUS long, and demi heart-shaped.

INHABITS the Island of Bourbon.

The head of the Bourbon species is short and broad; the muzzle obtuse; the ears wide asunder, short, scarcely higher than the head, and triangular; the tragus long, leaf-shaped, bent towards the head. The fur is short, shining, and bi-coloured on the superior parts, being yellowish at the base, and shining red towards the tip; the under parts of the body are pure white, the tips of the hairs having a slight rosy tint. All the membranes are naked, and of a dull brown colour. The total length is nearly five inches, the breadth thirteen. M. Macé sent home specimens which are now to be found in Paris and Leyden.

7. NYCTICEJUS LEUCOGASTER.—WHITE-BELLIED ROQUET-DOG BAT.

Syn. NYCTICEJUS LEUCOGASTER.—Temm. Mon. Mam. II. 153.

Icon. Cretschmar in Atlas Voy. de Rüpp. Tab. XXVIII. fig. 11.—1, 2, Heads.

SPECIFIC CHARACTERS.

THE FUR olive brown above; yellowish-white beneath.

THE FACE naked and flesh-coloured. THE EARS large and roundish. TRAGUS long.

INHABITS Kordofan.

In this species the head is short; the muzzle broad; the nostrils wide apart; the face and cheeks naked, and flesh-coloured; the ears distant from each other, large, roundish, having the inferior lobe distinct; the tragus long, leaf-shaped, and curved forwards; the abdomen of the male showing the skin, though covered with hair. The fur short and smooth; all the upper parts are of an olive brown colour; the lower are white, with a yellowish tinge. The total length is somewhat more than four inches; the extreme expanse twelve.

Specimens are to be seen in the museums of Francfort, and the Low Countries. M. Ruppell discovered this species at Kordofan.

(B.) SPECIES BELONGING TO THE NEW WORLD.

8. NYCTICEJUS PRUINOSUS.—HOARY ROQUET-DOG BAT.

Syn. VESPERTILIO PRUINOSUS.—Say, in Long's Exped. to the Rocky Mount. I. 331.—Harlan. Faun. Amer. p. 21.

HOARY BAT.—Godman, Amer. Nat. Hist. I. 50.

VESPERTILIO VILLOSISSIMUS?—Geoff. Ann. Mus. VIII. 204.

Chauve-Souris Septieme, d'Azara.—Quadr. II. 234.

NYCTICEJUS PRUINOSUS.—Temm. Mon. Mam. II. 154.

SCOTOPIHILUS PRUINOSUS.—Gray, Mag. Zool. and Bot. II. 498.

Icon. Godman, l. c. fig. 3.

SPECIFIC CHARACTERS.

THE FUR dark grey on the back, ferruginous near the tail; dark beneath.

THE MEMBRANES extensively covered with fur.

INHABITS the banks of the Missouri, North America.

The ears of this species are short, and broader than high, not so long as the head, and clad exteriorly throughout half their length; the tragus is leaf-shaped, and inclined towards the head; the muzzle short and obtuse; nostrils wide apart. The fur is long, and very abundant, extending on the alar membrane along the arms and flanks, and being very abundant on both sides of the interfemoral. "The hair on the back is black-brown at the base, then yellowish-brown, then blackish, and then white; towards the rump dark ferruginous takes the place of the brownish-yellow on the fur; beneath, the colours are similar to those of the back, but, on the anterior portion of the breast, the fur is not tipped with white, and on the throat is dull yellowish-white."—*Say*. The total length is four and a half inches. Mr Say states it is common in the Missouri; it has also been found in Philadelphia, and other parts of the United States.

9. NYCTICEJUS LASIURUS.—ROUGH-TAILED ROQUET-DOG BAT.

Syn. NYCTICEJUS LASIURUS.—Temm. Mon. Mam. II. 156.

VESPERTILIO LASIURUS.—Linn. Gmel. I. 50.

SCOTOPIHILUS LASIURUS.—Gray, Mag. Zool. and Bot. II. 498.—Geoffr. Ann. Mus. VIII. 200.—Desm. Mam. No. 215.—Penn. II. 315.

Icon. Schreb. I. t. LXII. B.—Geoff. l. c. pl. 2; copied in Temm. pl. 47, fig. 8.

SPECIFIC CHARACTERS.

THE FUR reddish-yellow above, paler beneath. See description.

THE HEAD very small. THE MEMBRANES well covered with hair.

INHABITS the United States and South America; common at Cayenne.

This Bat is remarkable for the smallness of its head; its ears are short and oval; the tragus, too, is short, and curved forwards; its large interfemoral membrane is uniformly clad above, and extensively, as is the alar membrane beneath. It has a spot of pure white on each side of the chest. The fur, in *summer*, differs from that of winter. During the former season, the hair on the head and neck is red, tipped with yellow; the rest of the upper parts of the body have the hairs yellow at the root, and tipped with cinnamon-red; the points in some are pure white: underneath the chin is bright red; the chest, with the exception of the white spots, yellowish red; and on the other parts red predominates. During *winter*, and in *the young*, the colour is a bright yellow, with a red tint; the neck is bright red, and the white spots at the origin of the wings are conspicuous; the abdomen is rosy white, the membranes red. The total length, including the tail, is somewhat more than four inches,—the expanse eleven inches; the size is seldom more considerable. The specimens from Cayenne are usually larger than those from the United States.

10. NYCTICEJUS NOVÆBORACENSIS.—NEW YORK ROQUET-DOG BAT.

Syn. NYCTICEJUS NOVÆBORACENSIS.—Temm. Mon. Mam. II. 158.

VESPERTILIO NOVÆBORACENSIS.—Penn. Quadr. II. 313.—Linn. Gmel. I. 50.—Geoffr. l. c. 203.

ATALAPHA AMERICANA.—Desm. Mam. No. 227, from Rafinesque.

SCOTOPIHILUS NOVÆBORACENSIS.—Gray, Mag. Zool. and Bot. II. 498.

Icon. Penn. l. c. pl. CIV. fig. Encycl. Méthod. pl. 34, fig. 5.

SPECIFIC CHARACTERS.

THE FUR of a uniform reddish-brown colour, with small white spots at the origin of the wings.

THE MUZZLE short and obtuse. THE EARS short, broad, and round.

INHABITS New York, and the Northern States of the Union.

This species differs but little from the preceding two, except in the colour, which is uniform throughout, with the exception of small white spots at the origin of the wings. The muzzle is short and obtuse, the ears short, broad, and roundish; the whole of the upper part of the interfemoral membrane is clad, and a portion of the under. The fur is long, copious, soft, and silky; the upper and under parts, and the interfemoral, have all the same light rosy brownish colour, with a small spot at the insertion of each wing. Its total length is about three and a half inches, its expanse nearly twelve.

11. NYCTICEJUS BONARIENSIS.—BUENOS-AYRES ROQUET-DOG BAT.

Syn. NYCTICEJUS BONARIENSIS.—Temm. Mon. Mam. II. 158.

VESPERTILIO BONARIENSIS.—Lcscs. Voy. de la Coq. I. 137.

Icon. Lesson, loc. cit. pl. 2, fig. 1, A, B, C, (cran. and teeth.)

SPECIFIC CHARACTERS.

THE FUR yellowish on the back; yellowish-brown on abdomen.

THE EARS short and oval. THE MEMBRANES dark red, the interfemoral clad above, naked below.

INHABITS South America.

We supply a description of this species in respect to M. Lesson, though we agree with M. Temminck, it will probably turn out to be only the *Nycticejus lasiurus*. Its muzzle is short and conical; the ears short, roundish, and wide apart. The face is clad with a few hairs; long and silky hairs cover the under part of the side membranes, and extend along the fore-arm; the interfemoral membrane is clad above, and naked beneath: the fur is abundant, and of many colours throughout; the muzzle is yellowish-red, the back a light fawn, each hair ending in first a black and then a white part; the upper part of the interfemoral membrane is of a deep dark red; the throat, chest, and abdomen, are light brown. The total length is about three inches, the expanse about nine. The individual just described was captured in a vessel lying at anchor in the River La Plata.

DOUBTFUL SPECIES.

In this category we place two species, upon which Rafinesque originally founded the genus, but which have not since been seen, or at least described, by any Naturalist, American or European.

1. NYCTICEJUS HUMERALIS.—The *Blackshoulder Bat* of Rafinesque, and noticed by him in Kentucky, North America. It is about three and a half inches long, including the tail; the ears are oval, longer than the head, and blackish, as is the muzzle; the eyes are small, and hid by the hair. The fur is a deep brown colour above, grey beneath, with black shoulders; the membranes are very dark.

2. NYCTICEJUS TESSELLATUS.—The *Netted Bat* is about four inches long, one half of which is occupied by the tail, terminating in a projecting tubercle; the nose is bi-lobed; the ears almost hid in the fur, which is bay-coloured above, fawn beneath, with a narrow yellow collar, and white arm-pits; the wings are netted, and tipped with red. Like the former, it inhabits Kentucky.

IMAGINARY GENUS.

ATALAPHA.—The genus *Atalapha* of Rafinesque, which has been adopted by Desmarest, Lesson, and others, having been founded upon an aged individual of the New York species which had lost its incisors, must, of course, be blotted out from our systems.

GENUS XXIV. VESPERTILIO.—BATS PROPER.

Syn. VESPERTILIO, (in part.)—Linn. Gmel. I. 45.—Geoffr. in Ann. Mus. VIII. 187.—Fischer, (in part.) Syn. Mam. 100.—Desm. et Auct. VESPERTILIO et PLECOTUS.—LES OREILLARDS.—Cuv. Reg. Anim. T. I. 120, 121.—Geoffr. loc. cit. et Cours de l'Hist. Nat. Lec. 14, 23, et alia.

VESPERTILIONINA, (in part.)—Gray, Mag. Zool. and Bot. II. 494.—Lesson, et al.

GENERIC CHARACTERS.

$$\begin{array}{l} \text{THE DENTAL FORMULA } \frac{2\frac{1}{2} + C + 4M}{3 + C + (2F + 4)M} = \frac{14}{18} = 32 \\ \text{Or, } \frac{2\frac{1}{2} + C + (2F + 4)M}{3 + C + (2F + 4)M} = \frac{18}{20} = 38 \end{array}$$

And also, according to the number of false molars, 34 and 36.

THE TAIL is invariably included in the interfemoral membrane.

THE NOSE without nose-leaf, ridges, tubes, &c.

THE MIDDLE FINGER has three phalanges. THE RING and LITTLE ONE two. THE INDEX one.

PREY solely on insects.

INHABIT all countries of the world, with the exception of Australia.

The Common Bats have the muzzle devoid of a nose-leaf, and of any other distinctive mark; the ears are (generally) separated; they have four incisors above, of which the two mesial are somewhat separated, and six below, which are cutting and indented; the tail is included within the membranes. This subgenus is the most numerous of all, and species are found in every part of the world; there are six or seven in France alone. Some have the tragus awl-shaped.

Differing from what we have seen in so many genera, the incisors are, in the Bats Proper, at all periods of their life regularly four above and six below: if ever wanting, it is the result of accident, or extreme old age. The four upper ones are arranged in pairs, and are always at some little distance from the canines; the inner ones are the larger. The intermaxillary bone, though rudimentary, is larger than in the *Nycticeji*, and is to more than half its extent ossified with the maxillary. The six inferior are always crowded, and bi-lobed or tri-lobed. The canines are strong, often triangular, and always smooth, and without a head. Great differences occur as to the number of false molars, chiefly from the intrusion of the other teeth: in the upper jaw there are sometimes none, sometimes two, and they vary from one to two in the lower, and are both sometimes exceedingly small. The true molars are invariably four, both above and below, so that the difference in the number of molars arises solely from the varieties in the false molars. The cranium of the Bats Proper is more compressed and elongated than that of the *Nycticejus*; their muzzle is less obtuse, and the chanfrin more compressed; these circumstances, along with the greater narrowness of the zygomatic arches, causes their whole physiognomy greatly to differ.

All the species of *Vespertilio*, without scarcely an exception, are, like the *Rhinolophi*, and some other of the frugivorous Bats, provided with odoriferous glands, which distil an unctuous fluid more or less disagreeable, according to the species; these glands, unlike what occurs in the *Roussettes*, are found in both sexes, and are placed sometimes before the eyes, sometimes above them, or near the muzzle; sometimes they are numerous, and cover most of the side of the head. The intolerable smell is sometimes so powerful as to direct us from a great distance to the place of their retreat. Referring to the particulars stated in the introductory remarks on the Insectivorous group, (p. 15,) respecting the singular fact of the males, the females, and the young, isolating themselves for a great part of the year, we have only to add, that the European Bats usually associate again together towards the period of their hibernation, which often continues throughout the winter, though sometimes interrupted by a few days of mild weather, and that then, whole families, or rather great masses of individuals, link themselves confusedly together in retreats, where they are protected from the intensity of the cold.

According to M. Temminck, these Bats Proper present a somewhat anomalous circumstance in respect to their reproduction. Whilst the frugivorous Chiroptera produce but one at a birth, some species of these Bats have generally two, whilst others have only one, and others either periodically or accidentally, all produce sometimes the former number and sometimes the latter, which last observation has been made especially upon our first species, *V. Noctula*. When engaged in rearing their young, the females fix their arm-hook, and bind the tail under the abdomen; thus the interfemoral membrane forms a sac, and supplies a nest for the young, in which it is carried about in all the flights of the mother. In some of the frugivorous Bats we have previously noticed a not less curious or effective provision made for the care of the young.

Another trait we must mention of these Proper Bats, which is also seen in the *Rhinolophi*, and probably in all the Insectivorous Chiroptera with a long tail; it is, that they employ this member as we should do our finger, to introduce their prey into their mouth, or rather their throat, when it is at all of large dimensions, and by its exertions might otherwise escape; they approximate it to the head, bend their neck, and thus secure their victim. Thus, the tail has considerable influence on the habits of the different groups, and in the true Bats it is always formed on but one model, though it is different in those which really form distinct genera.

The number of species in the Genus *Vespertilio* is so great, that, even with the help of a somewhat minute description, (good figures being wanting,) there is a risk of their being confounded, and it is no longer possible to distinguish them according to the laconic Linnæan method. At the same time, regard must be had to the patience of the reader and the expense of publication; and, accordingly, we have determined, by some trifling alterations and curtailments, considerably to reduce the space

occupied in description, without infringing on the information absolutely required for the distinguishing of species. Moreover, to avoid the confusion which might arise from the multitude of ascertained species, we shall, after the example of Temminck, subdivide the present genus according to the four great geographic divisions of the globe, and admit a fifth, if any of the group are discovered, as has not hitherto been the case, in the regions of Australasia. It is incontestible that species of this genus are found in all countries of the globe, with the exception of Australia, and that they are common to all climates, a result evidently contrary to the law of Zoological Geography indicated by Buffon, and admitted by many modern Zoologists.

Of the seventy-eight species that are now unexceptionably ascertained, twenty-eight belong to Europe, nine to Africa, to which we must add two common to it and Europe; twenty-four to Asia and India, to which two must also be added as found in Europe; and seventeen well known in America. To these, many unsatisfactorily described are still to be enjoined, so that the number of indicated species will be about 100. The genus *Plecotus*, as founded merely on the comparative length of the Ear, we altogether reject.

SECTION I. THE EUROPEAN SPECIES.

First, Those which belong to the British Fauna.

1. VESPERTILIO NOCTULA.—THE NOCTULE BAT.¹

This species was first described by M. Daubenton in the *Mem. de l'Acad.* 1759, and has since been noticed by all systematic authors, foreign and domestic. The ears are ovato-triangular, and shorter than the head; the tragus small and incurvate; the head large and round, fur short, reddish brown all over; membranes dark coloured.

The fur of this species is of medium length, silky and shining, covering underneath a portion of the side membrane. The upper parts of the body are of a beautiful lively and shining red colour in both sexes; beneath the red is lighter, and that on the wing brown. On the Continent the length is about five inches, including the tail, and the expanse upwards of fifteen; in Britain the size is less.

This species is very widely spread abroad, and is more common in the central parts of Europe than in the extreme north and south. It is probably distributed over all the temperate parts of Asia, and it is impossible to recognize any distinction between those of Japan and Holland. It lives in towns and the country, in old buildings and trees. Pennant mentions that under the eaves of Queen's College, Cambridge, 185 were taken one night, sixty-three the next, and two the next. They huddle together by hundreds during their winter hibernation, and have a very disagreeable odour.—(Figured in Bonap. *Fam. Ital.*)

2. VESPERTILIO LEISLERII.—LEISLER'S BAT.

Although there is a specimen of this species in the collection of the British Museum, yet, as its origin is doubtful, it does not clearly appear that it is indigenous in Britain. On the Continent it exclusively inhabits the country, and appears to be solitary in its habits, rarely associating with other species; its habitual retreat is the hollows of forest trees, and the neighbourhood of stagnant pools. It is common in Germany, but has not been noticed either in Holland or France.

Leisler's Bat is about a third less in size than the foregoing species; the ears are very round, and the forehead and chanfrin depressed; the toes of the feet are very short, and the short tail is without a free point; there are glands conspicuous on the sides of the muzzle. The total length is about four inches; the expanse extends to about twelve. The fur is bicoloured throughout, long, and freely covering the side membranes and origin of the interfemoral, especially beneath. The hair of the upper part is brown at the root and reddish at the point; beneath it is blackish brown at the root, and brownish grey at the tip.

3. VESPERTILIO DISCOLOR.—THE PARTI-COLOURED BAT.

Dr Natterer discovered this species in the south of Germany, and considers it the most beautiful of European species. It abounds in the southern and eastern parts of the Continent, but is very rare in Britain and the northern parts. The specimen in the British Museum was taken in Plymouth, and M. Temminck informs us it is never found in Holland. The dimensions are about a fourth less than the Noctule. The forehead is very hairy, the muzzle broad, long, and tumid; the nose thick and broad; the lip thick, the upper furnished with small hairs; the ears broad, roundish, but triangular, bent outwards, and extending to the angle of the mouth, and half covered with thick fur; the tip of the tail is free. The fur is short and lustrous. The upper parts of the adult are veined longitudinally,

¹ Considering the immense number of species in this genus, our readers will excuse us for curtailing the lists of Synonyms, and altering our style of typography.

white or yellowish upon a chestnut ground; the under parts appear pure white.—(Fig. by Kuhl in *Neue Ann. Wett. Gesellsch.* pl. 25, fig. 1.)

4. VESPERTILIO SEROTINUS.—THE SEROTINE BAT.

This is a very common European species, and is widely distributed from the north to the south over the Continent; in Britain it has hitherto been found only in the vicinity of London. It lives in cavities of old trees, piles of wood and ruins, prefers the neighbourhood of water, flies slowly in dim twilight, and utters a piercing cry. The muzzle is long and nearly naked at the point; the ears are wide asunder, of medium size, and clad at their external base; the tragus is leaf-shaped and arched, with a round point; the tip of the tail projects beyond the membrane about a line and a half. There are odoriferous glands at the side of the muzzle of a pale yellow colour. The fur is of medium length, fine and silky. The *male*, above, is chestnut brown, beneath dull ash brown. The *female*, rosy brown above, and yellowish-grey beneath; the muzzle, ears, and membranes, black. Extreme length about five inches, breadth fourteen.—(Fig. in *Bonap. Faun. Ital.*)

5. VESPERTILIO AURITUS.—THE LONG-EARED BAT.

The ears of this species are nearly as long as the body, reaching to an inch and a half; they are inclined to the side, and have a longitudinal fold reaching almost to the lips; the tragus is straight, long, and pointed, with an external lobe at its base; the head is depressed; the snout long and pointed, and almost naked; the odoriferous glands on each side yellowish. The fur is long, black at the base; the membranes are naked, and those of the ears brownish-grey. Both sexes have the superior parts of a reddish ash grey, the inferior of a pale yellow-grey. The extreme length is about three and a half inches, the expanse ten, though those of the south of Europe are somewhat larger than our northern specimens. This species is one of the most widely distributed over the temperate and warmer regions of Europe; it is common in most parts of England, and in many parts of Scotland; it is also found in the north of Africa. It frequents great towns and villages rather than wooded districts, flying with a steady motion along narrow streets and alleys, and hibernating in towers and steeples. Mr Bingley says they have no peculiarly offensive smell.—(Fig. in *Magaz. de Zool.* II. pl. 2 and 3.)

6. VESPERTILIO NATTERERI.—NATTERER'S BAT.

The Bat denominated Natterer's by Kuhl and Temminck is the reddish-grey Bat of Mr Bell and some other English authors. It is found in Germany and Britain, in Holland, and the shores of the Adriatic. It has been found in Norfolk, Cambridgeshire, and Kent, but we believe not in Scotland. Mr Bell received three individuals from a shaft in a chalky cavern seventy feet deep, together with some of the preceding species, and the Barbastelle and Whiskered Bat still to be described. Its extreme length is about three inches, its breadth nine. Its muzzle is very short, scarcely extending beyond the bushy hairs of the face. The ears longer than the head, and without any distinct lobe; the tragus is long, filiform, and pointed; and there is a range of hairs at the margin of the interfemoral. The fur is very bushy and long, especially about the head and neck. Above, the hairs are brown at the base, and mouse-coloured at the tip; the tint of the neck is rosy, and of the under parts white.—(Fig. in *Temm. Mon.* II. pl. 50.)

7. VESPERTILIO DAUBENTONII.—DAUBENTON'S BAT.

We owe our first acquaintance with this species to M. Leisler, and it has been subsequently noticed by Kuhl and Desmarest. Temminck says, that its habitat is the centre and south of Europe, and that it is never seen in the north. According to Mr Bell, however, the *Emarginatus* of Mr Jenyns is the species now under consideration, and it has been captured by Mr Yarrell in Middlesex, as well as in Northamptonshire; and in Scotland by Dr Fleming in Fifeshire, and by Sir William Jardine in Dumfriesshire. Its total length is about three and a half inches, its extreme breadth about 10. The muzzle is short; the gape small; the ears nearly oval, and the tragus shaped like the willow leaf; the tail is very long, and free at the point to the extent of about two or three lines; the flank membranes are clad, and that of the fore-arm surrounded with *very fine hairs*. Odoriferous glands, of a white colour, are visible below the eyes. The fur is short, felt-like, and smooth; the membranes are clad both above and below, and hairs so small as to be scarcely visible to the naked eye cover the leg, and form a border to the interfemoral membrane. The superior parts are of a reddish-brown colour, the inferior parts of a greyish-white. To this species MM. Keyserling and Blaisius refer the *V. Aedilis*, a species lately proposed to be introduced by Mr Jenyns.—(Fig. in *Bonap. Faun. Ital.*)

8. VESPERTILIO MYSTACINUS.—THE WHISKERED BAT.

The head of this Bat is very small, and covered, like the rest of the body, with ample fur, a tuft of woolly hairs forming a striking moustache along the upper lip, which covers the under one. The ears are oval and not notched, the tragus lancet-shaped, but blunt at the point; the odoriferous glands in front of the eyes are of a citron yellow colour. The colour of the whisker is blackish-brown; the superior parts of the body are covered with long black hair, rufous tipped, the under are whitish; the membranes are much covered with the fur. Its extreme length is about three inches, and its breadth eight. Temminck states this species as rare. Leisler discovered it in Germany; Mr Gray pointed it out as British, and both Messrs Jenyns and Yarrell have seen it in England. Its winter abode is said to be in old houses, hollow trees, and caverns; it has a preference, too, it is said, for limpid waters, near which its flight is rapid, skimming along near the surface.—(Fig. in *Temm. Mon.* II. pl. 51.)

9. VESPERTILIO EMARGINATUS.—THE NOTCHED-EAR BAT.

The size and general form of this species, which was first described by M. Geoffroy, very nearly approximate to those of the preceding, with which therefore it may very readily be confounded. The distinguishing characters are the notch upon the external margin of the ear, the want of the moustache, and the reddish robe of the Notched ear. The ears are oblong, and as long as the head; the tragus long, awl-shaped, and pointed; they are well clad near the base. The colour of the head and upper parts is red, clouded with yellow and brown; all the under parts are ash-coloured, with a reddish tint, the ears and membranes dull brown. The entire length is three inches three lines; the breadth nine and a half inches. This species has been found in England, Holland, France, and Italy, but not in Germany. During the day it keeps its retreat; with the twilight it appears ranging with rapid wing for its food along lakes and stagnant waters.—(Fig. in *Bonap. Faun. Ital.*)

10. VESPERTILIO PIPISTRELLUS.—THE PIPISTRELLE, OR COMMON BAT.

This Pipistrelle of Daubenton and Schreber is the common Bat of Pennant; this last a name which was long given in this country to the *Murinus*, but which is thus much better merited by the present species. It is, according to Mr Jenyns, the most common kind in England, and according to Mr Macgillivray, who has given a minute description of it, (*Nat. Lib.*) it is very abundant in Scotland; it is widely spread over all the northern parts of Europe, but is rare in the south; it probably also inhabits Asia, M. Temminck having received many specimens from Japan. It lives in great bands, associating with other small species. The female has usually two young ones;—Kuhl says one. This latter author states that its hibernation is often interrupted. Its head is small; nostrils wide; ears small, distant; tragus leaf-shaped; odoriferous glands oblong. The fur is abundant and of medium length; the membranes quite naked. The superior parts are coffee-coloured, the inferior lighter, but not white, a character which distinguishes this species from the Whiskered Bat. The entire length is about three inches, the extent of wings between eight and nine.—(Fig. *Geoff. Ann. Mus.* VIII. pl. 47 and 48.)

The *V. Pygmaeus* of Leach, (*Zool. Journ.* I.) and *V. Minutus* of Montagu, (*Linn. Tr.* IX.) are but the young of the Pipistrelle.

11. VESPERTILIO BARBASTELLUS.—THE BARBASTELLE BAT.

Seeing no occasion, as already stated, to adopt Mr Gray's new genus, *Plecotus*, still less will we, with Mr Bell, follow him in introducing another new genus, *Barbastellus*. The Barbastelle Bat inhabits the temperate and warmer regions of Europe, including Italy, but seems common in none of them. Mr Sowerby first detected it in England (*Brit. Miscel.*) Mr Montagu mentions (*loc. cit.*) its occurrence in Devonshire, Mr Jenyns in some of the Midland counties, and Mr Bell in Kent. The muzzle is extremely short, slender, and obtuse, and the head completely overshadowed by the ears, which are united by the base in front. These appendages are very much developed and wide; a tuft of hair covers the middle of the auricle, which is naked at the sides; tragus wide at the base, and slender at the point; the odoriferous glands are triangular. The fur is very long, fine, and silky, and the membranes partially clad on both sides. All the superior parts are black, the abdomen is pure white, the flanks light brown, as are the membranes. The entire length is between three and four inches, the width between nine and ten.—(Fig. *Geoff. Ann. Mus.* VIII. pl. 46 and 48.)

12. VESPERTILIO BECHSTEINI.—BECHSTEIN'S BAT.

This species, which was discovered by the late Dr Leisler, seems to be very rare in Britain, the only specimens having been taken in the New Forest, by Mr Millard; in France, too, it is rare, but more abundant to-

wards the south than the north; it is also found in Germany and Hungary; its sojourn is the trunks of trees, and it is said not to associate with its congeners. It is nearly the size of the Long-eared Bat, (No. 5,) but the ears are shorter, not united, and without a lobe; the membranes, likewise, are quite naked, and the tip of the tail free. The muzzle is rather long, pointed, and naked, the odoriferous glands, very large and whitish, are oblong; the teeth very white. The fur is long and copious. The markings, in which the sexes agree, are reddish-brown above, and silvery white beneath: in the young, silvery-grey above, and shining white beneath; the membranes are yellowish-brown and diaphanous; the ears dull yellow. The entire length is between three and four inches, the width about eleven.—(Fig. in Temm. Mon. II. pl. 50.)

13. V. MURINUS.—THE MOUSE-EARED BAT.

The *Murinus* of Linnæus, Geoffroy, and many others, is the *Myotis* of Bechstein and Kuhl; Pennant designated it the Common Bat of this country in his Synopsis, not in his British Zoology, and, as we have already stated, the *Pipistrelle* is the most common amongst us, for the English name of the *Murinus* we translate Bechstein's appellation. This Mouse-eared Bat is, in fact, very rare in Britain, having been found only, we believe, in the gardens of the British Museum. It is the largest, not only of British, but also of European species. Its face is nearly quite naked, the nostrils open laterally, and the upper lip overhangs on each side. The ears incline backward, are very distant, lobeless, perfectly oval, and naked; the tragus shaped like the willow leaf, but broad at the base: the odoriferous glands are of a citron yellow colour. The fur is long, smooth, and bicoloured throughout. The superior parts of the body are brownish-grey, reddish-grey, and pure grey, according to the age of the animal; the hairs being black at the root; all the inferior parts are pure white or yellowish-white, no difference occurring in the sexes. The entire length of the large animals is somewhat more than five inches, and the expanse nearly sixteen. The *adult of the first year*, with the fur shorter, and rarer, especially about the neck, and the markings less distinct, constitutes the *Murinus* of many modern authors. This animal is found in the temperate parts of Europe, and in North Africa. The female has usually two young ones, and they are not sociable; they bite cruelly, not sparing one another; they persecute the smaller kinds, and prefer a town to a country life; they seldom show themselves till it is nearly dark.—(Fig. in Bonap. Faun. Ital.)

Second, European Bats, unknown in Britain.

14. V. BRACHYOTOS.—THE SHORT-EARED BAT.

This Short-eared Bat, not that of Pennant, (British Zoology,) was found dead in the streets of Abbeville by M. Baillon, all of whose subsequent endeavours to discover another like it have been fruitless. Its forms are interesting, and have been detailed by M. Temminck in his monograph. Its muzzle is obtuse and naked, its forehead depressed; the ears are very small, much broader than high, triangular, about a line and a half; the tragus is very short, obtuse, and hid under the fur; the tail is short. The four upper incisors are in pairs; there are four molars above and five below, pointed. The fur is soft, silky, and of medium length, of a very vivid fawn colour above, the root of the hairs at the same time being quite black; the forehead, crown, nape, and upper part of the neck, marked with a broad black patch, the hair being shorter than elsewhere; the muzzle is naked, as also the upper part of the ears, their base hid in the fur. The inferior parts are less red than the upper, but the roots of the hair are quite black. The membranes are naked, tail of medium length, and white. Length, two inches seven lines; expanse, seven and a half inches.

15. V. SCHREIBERSII.—SCHREIBERS' BAT.

This Bat was discovered by M. Schreibers in the subterranean cavities of the mountains of Banat in Hungary, and is thus described by M. Kuhl. The head is small, the forehead elevated, the muzzle full; the ears small, and shorter than the head, broad, straight, roundish at the point; tragus lance-shaped. The fur of the superior parts is ash-grey, of the lower light grey, often yellowish-white; the thumb-nail is white. Entire length, three and a half inches; width, eleven; the measurements, however, were taken from a single individual.

16. V. LIMPAPHILUS.—THE NIGHT-BAT.

The muzzle of this Bat is very short, broad, obtuse, and nearly wholly covered on both lips with long diverging radiating hairs; the ears of medium size, quite oval, with a lobe or prolongation forwards; the tragus is short, straight, broad, and rounded at the point; the tail short, its tip free; the interfemoral membrane supplied underneath with very fine hairs. The odoriferous glands are large, yellow, and placed above the eyes.

The fur is soft and silky; in the male, the superior parts of the body, and most of the sides of the neck, are mouse-coloured; in the female, inclined to russet; the chin, front of the neck, and inferior parts, are white at the point, and black at the base; the abdomen pure white. The white tip of the hairs is prolonged according to the age of the individual. When a year old they are both indifferently clad, and are above of a dull brown colour, below bluish-black; abdomen whitish. The total length is about four inches, width eleven. This species was introduced to notice by M. Temminck in his recent monography, and he accounts for its remaining so long unknown from its habits, appearing only when the night has set in, and flying with extreme velocity. It flies generally also over the surface of the water near the overhanging trees and brushwood. It is common in Holland.

17. V. ORSINI.—ORSINI'S BAT.

To the Prince of Musignano we are indebted for our acquaintance with this Bat, which was found in the caverns of Mont Corno 8000 feet above the level of the sea. From its dental formula he proposed to form a new subgenus of it; but from the great variability to which the teeth are subject, we deem it preferable, following M. Temminck, to maintain it in a situation at once more simple and suitable. The head of this species is short and very globular; the nose obtuse; the nostrils approximated; the forehead prominent; the eyes are hid under the fur, and are placed near the ears. These appendages are small, and nearly as broad as long, roundish, and more than a third shorter than the head; though so wide apart, they are united by a membrane; the tragus is slender, filiform, and one-half the size of the auricle. The mouth is cleft to the angle under the eye, and the face is clad with hair, which inclines upwards. The wings are very long, the thumb-nail very small. The tail, which is much longer than the body, is exceedingly stout, and enveloped in the membrane at its tip. The teeth are precisely the same as in the *auritus*. The fur is soft, cottony, abundant, and nearly of a uniform colour over the body; above it is of a marron brown, beneath of a light-grey. The entire length is four inches, two of them being occupied by the tail; the extreme width thirteen. This animal is the *Minioptero dell' Orsini* of the Prince.—(Fig. in Temm. Mon. II. pl. 49.)

18. V. CORNUTUS.—THE HORNED BAT.

The Horned Bat is smaller than the long-eared, but the ears are proportionably longer, and the body smaller in comparison of the extent of wings. The muzzle is short, broad, and obtuse; the nostrils somewhat tubular; the mouth large; the ears conical; one incl four lines long; precisely the length of the body, and united in front; the tragus is half the length of the ear, lance-shaped, and so disposed that the two look like a pair of ears. There is a fringe of fine hairs along the external edge of the interfemoral membrane. The fur is long and more abundant than in most other European species; a white moustache ornaments the lip. The superior parts are of a brownish-black colour, the lower bluish-black; the abdomen appears bluish-grey, from the tips of the hair being white; the membranes are blackish. The length is three inches and one line, the breadth nine and a half inches, (Danish measure.) This species was discovered by the celebrated Naturalist Faber, who captured an individual in Jutland.

19. V. CAPACCINI.—THE CAPACCINI BAT.

The Prince of Musignano describes this new species, which was caught in Sicily, in nearly the following terms. The tragus is slender; the thumb-nail large and strong; the feet robust, enveloped in a thick interfemoral membrane, well clad, though not very extensive. Its head is large, the muzzle conical and obtuse; the eyes are almost three times nearer the ears than the nostrils; the mouth is not remarkably large; the ears are about once and a half longer than they are broad, and are about two-thirds the length of the head; their form is oval lance shaped; the muzzle and lips are supplied with scattered hairs, which are abundant between the eyes. There is a great gland under the chin. The interfemoral membrane is cut obliquely in form of a triangle, leaving the feet free, as is also the point of the tail; it is clad, to half its extent, both above and below, with long hairs; the feet also are covered with hairs, which are white, as are the nails. The fur is soft and bushy, and of a cinnamon colour: the under parts are yellowish-red; the skin is reddish-brown. The total length is three inches two lines, the breadth ten inches.—(Fig. in Bonap. Faun. Ital.)

20. V. MEGAPODUS.—THE LARGE-FOOTED BAT.

The habitat of this Bat is Sardinia, whence M. Cantraine has sent many specimens to Leyden. It is remarkable for its feet, which, like

the preeding, are quite free above the spur, the membranes taking their origin near the extremity of the tibia. Its muzzle is very short and obtuse; the ears of medium size, and not much sloped; the tragus long, like the willow leaf; the interfemoral membrane short, and covered above and beneath with scattered hairs. The fur is short, smooth, and bi-coloured. The upper parts are of a greyish-brown colour, the lower whitish; the membranes are brown, and there are no conspicuous differences between the sexes. The total length is about three inches, the breadth nine.

21. V. HUMERALIS.—BLACK-SHOULDERED BAT.

This Bat was procured by M. Baillon, in the neighbourhood of Abbeville, and was there examined by M. Temminck. It has not been seen out of France. It might be readily confounded with the *mystacinus* and *emarginatus*; it differs, however, from the former, by its smaller size, larger and more sloped ears, its longer tail, and the complete nudity of the membranes; and from the latter, by the *emarginatus* being larger, having its ears more sloped, and its fur always of a more or less red hue. This Bat is distinguished from all its congeners, by a large black spot on the shoulders, at the base of the humerus, and its long and sloping ears. The fur is long and cottony; it has a considerable beard, which is black; the tragus is long and lance-shaped; the membranes are blackish and naked, the tip of the tail free. As to colour, the superior parts have the hair black at the base, and then ash-brown; the inferior also black at the base, but whitish towards the point; the black spot covers the insertion of the wings. The entire length is near three inches, the expanse seven.

22. V. VISPISTRELLUS.—THE VISPISTRELLE BAT.

The Vispistrelle Bat has received its name from its close resemblance to the Pipistrelle. Inhabiting Italy, and the southern countries of Europe, they seem, remarks the Prince of Musignano, to maintain the same relation that the Cisalpine sparrow bears to our common domestic one, and their habits are scarcely distinguishable. The present species is, however, always somewhat larger than the other, perhaps a sixth, and wants a false molar in the upper jaw, which the other possesses; the marking, too, is somewhat different. The fur is long and silky, each hair on the upper parts of the body having a brown base, and a reddish-ash point, which assumes a yellowish hue on the forehead and base of the ears; on the inferior parts the hairs are throughout of a brown tint, but their tip is light red. The cutaneous system is fulvous brown. In the young the tints are somewhat darker. The entire length is three inches, three lines (French), the breadth eight inches and a half.—(Fig. in Bonap. Faun. Ital.)

23. V. KUHLII.—KUHLS' BAT.

M. Natterer conferred its name upon this Bat, which he captured at Trieste; it has also been found in Dalmatia and Central Italy, and is probably common throughout the Levant. Kuhl's Bat is about the size of the *Pipistrelle*, with which it may very readily be confounded. The head is large, the muzzle obtuse, the eyes surmounted by a bunch of hairs, the ears completely triangular, regular at their external margin, and large at their base; the tragus is wide, leaf-shaped, round at the point; the cutaneous system is black; the alar membranes, and half of the interfemoral, are clad. The upper incisors are in pairs, most unequal in size, the internal pair being large, and those next the canines very small. The entire length is three inches, the expanse eight and a half. The fur is bi-coloured throughout, more abundant, and somewhat longer than in the *Pipistrelle*, and a broad riband of hair goes round the whole body; the half of the interfemoral membrane is covered. Above, the colour is reddish-brown, ochre-like; and beneath it is somewhat lighter than in the *Pipistrelle*; the riband above alluded to is greyish; the membranes are very smooth, and wholly black; there are a few hairs on the thumb and toes.—(Fig. in Temm. Mon. II. pl. 51, fig. 5 and 6.)

24. V. SAVII.—SAVI'S BAT.

Savi's Bat is accurately depicted in the *Icon. del. Faun. Ital.* by the Prince de Musignano, and had previously been sent to Leyden by M. Cantraine. It has been found on the eastern shores of the Adriatic, in Dalmatia, and Sardinia. Its body is somewhat more robust than that of the two foregoing species, but the expanse is less; the tail is very long, and has a fine free point; the muzzle is broad and obtuse. The ears broad, with a fold forwards, triangular, but round at the point, and clad to about a half; the tragus short and wide. The fur is bi-coloured, and not unlike that of the *parti-coloured* Bat. The superior parts of the body are of a lively maroon colour; the cheeks and chin brown; the inferior parts are blackish-brown; the interfemoral membrane is quite naked. The dimensions, taken from one specimen, were three inches entire length, breadth eight.

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25. V. ALCYTHOE.—THE ALCYTHOE BAT.

This, and the two succeeding species, have lately been introduced to notice by the Prince de Musignano, with coloured portraits, and detailed descriptions; they all belong to the south of Europe. The cranium of this one is depressed; its incisors unequal, the ears pointed, and the fur bi-coloured. The nose is depressed at the point, and slightly indented between the nostrils; the orbital region is naked, and the eyes surmounted with long and silky eye-brows; the ears are small, terminate in a round point, and their breadth is equal to half their length; the tragus is half as long as the auricle; the tail quite included in the interfemoral membrane. The fur is long, bushy, and of two colours. The muzzle and forehead is of a greyish isabelle colour; the hairs are blackish from their base to half their extent, and then of an isabelle tint; those of the abdomen are the same at their base, but cinnamon coloured at the tip. The membranes are reddish, and clad along the flanks and thighs with tufted hair, of a reddish-grey colour. The total length is about three inches, the breadth somewhat more than eight. It inhabits Sicily.—(Fig. in Bonap. Faun. Ital.)

26. V. LEUCIPPE.—THE LEUCIPPE BAT.

This species is to be distinguished by the beautiful silvery tint of its inferior parts, and the cinnamon colour of the back. The muzzle is large, wide, and roundish, describing nearly a semicircle; the commissure of the lips reaches to the ear. This appendage is a fifth less in length than the head, and a third less wide than long; it is roundish, and somewhat sloped away at its upper parts; the tragus is a third shorter than the cochlea, and of a semi-orbicular form. The interfemoral membrane is polygonous in shape, and has no tiny bristles, nor lobule. The fur is long, bushy, and bi-coloured throughout; on the upper parts of the body it is black at the root, and light-cinnamon at the tip; on the lower, of a deep grey at the base, and silvery-white at the points. The membranes are sooty black; the lips, nose, and ears black, with the external margin flesh coloured, a character which is constant. The entire length is three inches, the breadth nine.—(Fig. in Bonap. Faun. Ital.)

27. V. ARISTIPPE.—THE ARISTIPPE BAT.

Its pointed muzzle serves to distinguish this species from the Leucippe Bat, to which it has a great resemblance in its general forms and dimensions; there is also a slight difference in the ears, the external border being scooped out at the base in our present animal, and towards the point in the other. The muzzle, which is straight, and somewhat angular, has a slight furrow between the nostrils, which are small and narrow. The ears are small. The interfemoral membrane is provided with an external lobule, and terminates in a free point. The feet are small; the nails slender, and adorned with slender hairs.—(Fig. in Bonap. Faun. Ital. fasc. 21, fig. 3.)

28. V. MARGINATUS.—THE EMBROIDERED BAT.

The Embroidered Bat is common in Sardinia, and therefore is to be classed with the European species. It is not less so, however, in Africa, being very common at Tripoli, and also in Nubia and Arabia. Here it was found by Rüppell, and has been described by him and figured in his atlas, though not, according to M. Temminck, very correctly. It is about the size of the *Pipistrelle*, though it has not the same expanse across the wings; the tail is much larger, and the interfemoral membrane very ample; the spur is also very long, carrying the interfemoral externally with it. All the edges of the membranes are bordered with pure white. The muzzle is naked, the ears small, triangular, and rounded at the point; the tragus is long, leaf-shaped; a third of the interfemoral membrane is clad. The fur is soft, cottony, short, and of two colours. On the head and upper parts of the body, the hairs are half black at the root, and pure isabelle-coloured at the tip; on the chest the points are a light isabelle, and on the abdomen, pure white. The membranes are blackish-grey, and diaphanous. The total length is a trifle above three inches, the expanse a little above eight.—(Fig. in Temm. Mon. pl. 52, figs. 3 and 4.)

SECTION II. AFRICAN SPECIES.

29. V. LEUCOMELAS.—THE BLACK AND WHITE BAT.

This Bat was discovered by Rüppell, on the shores of the Red Sea, on the coast of Abyssinia, and Arabia Petrea, frequenting old ruins. Its size and forms are not unlike those of our *Barbastelle*. The muzzle is very slender, and overshadowed by the aural appendages, which are very large, and united by their bases in front, then diverging to the point, and falling over to each side, after the fashion of the Dog's Cap; their

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external membrane is deeply scooped, and abuts at the commissure of the lips; the tragus is long and pointed; the posterior parts of the ears are clad. The cutaneous system is highly developed, very thin, and diaphanous: the tail is very long, and the interfemoral membrane wide. The fur is very long, bushy, fine, and silky, bi-coloured throughout. The superior parts of the body are black, somewhat grizzly, from the tips of the hair being light brown; the inferior parts are also black, but more grey, the tips being white; the whole of the pubis and the base of the flanks and interfemoral membrane, are pure white. The ears are black, the membranes diaphanous, ash-grey colour veined with white. Their entire length is nearly three and a half inches, their expanse ten.—(Fig. in Rüpp. Zool. Atl. p. 73.)

30. V. D'ASYTHRIX.—THE BUSHY-HAIRED BAT.

This new species has been transmitted from the interior of Caffraria, by M. Verreaux, of Paris, and now forms a part of the Leyden Museum. It is remarkable for the great development of its membranes, its broad, obtuse muzzle, its great ears, and its woolly fur. Its great muzzle is covered with abundant fur to the very point, and two braids of hair are conspicuous, arrayed like moustachios; the ears are broader than high, orbicular, and somewhat angular at their points; a fold projects to the commissure of the lips, and externally they are half covered with fur; the tragus is short and roundish. The articulation of the foot, with the metatarsus, is quite free. The tail is very long, with the membrane developed. The fur is of medium length, but extraordinarily bushy, cottony, and heavy; the face is also remarkably hairy; the base of the interfemoral membrane is clad only on the upper side, while the alar is only below, with transparent hairs. The membranes are very ample. The colour of the upper parts of the body, the head and whiskers, is a dull black, [that of the lower smoke-black; the membranes are a light black. The total length is nearly four inches, the breadth ten.

31. V. ISABELLINUS.—THE ISABELLE BAT.

This is another new species which has been sent to the Leyden Museum, by the Dutch Consul, M. Clifford van Breugel, from Tripoli, where it abounds. It is about the size of the *Parti-coloured* Bat of Europe, with forms nearly resembling the *murinus*. The muzzle is obtuse, the ears broad, ovoide, with a longitudinal and salient fold at the anterior margin; a distinct lobe terminates the posterior border, and extends to the commissure of the lips; the tragus is short and leaf-shaped, the tail free at the point. All the membranes are naked, and very distinctly veined. The two central incisors are bilobed in the young, and pointed in the adult. The fur is of medium length, fine and silky. The superior parts in the adult are of a beautiful isabelle tint; the point of the muzzle and lips are black; all the inferior parts of a very light isabelle hue; the external base of the ear is covered with hair; the membranes are blackish-brown, abundantly veined with yellowish lines; a considerable portion of the tail is free at the tip. The total length is about four and a half inches, the expanse twelve.—(Fig. in Temm. Mon. II. pl. 52. Figs. 1 and 2.)

32. V. MEGALURUS.—THE LARGE-WINGED BAT.

The body of this Bat is slender, with a depressed head, the muzzle pointed, and the nostrils approximated, whilst the membranes are exceedingly developed. The ears are moderate, distant, pointed at the extremity. The tragus very long, shaped like the willow-leaf; the tail is very long, and the extremity free; the internal incisors are long and converging, the external scarcely visible. The fur is long, smooth, silky, and bi-coloured throughout; above, blackish at the base, and olive-brown at the point, and brown at the root, beneath; the colour of the neck and abdomen is ash-brown, of the flanks, isabelle, of the pubis, white. The entire length is about four inches and three lines, the breadth twelve. The *V. Capensis* of Mr Gray, (Zool. Journ. IV. p. 435.) M. Temminck suspects to be the young of this species. This animal was sent to Leyden from Central Africa, but nothing is known of its habits.

33. V. TRICOLOR.—THE TRI-COLOURED BAT.

An account of this species was supplied in the *Fauna Capensis* of M. Smuts, (p. 106.) Its head is longer than it is broad; the muzzle is obtuse, and the mouth not much cleft; the ears are long, turned over at the point, and cut out externally; the tragus is long, leaf-shaped, inclined outwards; the hair is smooth, short, tri-coloured above, bi-coloured below. The fur on the upper parts of the body is black, brown at the root, yellowish-white in the middle, and a beautiful red at the point, so that, on the whole, these parts appear of a very yellow hue; all the inferior parts have the fur brown at the base, and yellowish-white towards the tip; a slight rosy tint is distributed over the sides of the neck and chest;

the membranes are dark brown. The length is nearly four inches, the breadth between twelve and thirteen.

34. V. EPICHRYSUS.—THE GOLDEN BAT.

The Golden Bat is described in M. Smut's *Fauna*, (p. 106,) and is regarded as new by M. Temminck. Its habitat is the environs of the Cape. The total length is about four inches, the expanse twelve. The ears are of medium length, straight, pointed, and much scooped out at their upper external margin; the tragus is straight, and lance-shaped; the muzzle somewhat obtuse, the nostrils approximated, the tail very long. The fur is abundant, short, and smooth; the hairs parti-coloured; those on the upper part of the body brown at the root, yellowish-white in the middle, bright red and shining at the tip; underneath, they are brown at the base, and of a light rosy hue at the point; the membranes are brown and perfectly naked.

35. V. PLATYCEPHALUS.—THE FLAT-HEADED BAT.

As expressed by the name, the head of this Bat is extremely depressed, and the chanfrin flattened; the face is obtuse, very broad, and the mouth has a large gape; the ear extends laterally, and is as broad as high, half clad above, rounded towards the point; it is prolonged beneath, and abuts at the commissure of the lips in a large membranous appendage; the operculum turns inwards. The fur is bushy, woolly, and parti-coloured; above, blackish at the base, and very brown at the tip; beneath, blackish-brown at the root, and a brownish-white at the point; the pubic region is white; the interfemoral membrane is half clad above and naked beneath. The entire length is three inches, breadth nine. It is common in the neighbourhood of the Cape, and has been described by M. Smuts.—(*Diss. Zool. Cap.* 107.)

36. V. MINUTA.—THE PIGMY BAT.

Dr Horstok, of Cape Town, has transmitted several specimens of this Bat to Leyden, from which its celebrated professor has supplied the description. In its habits it resembles our *Pipistrelle*, preferring woody districts supplied with water, in the southern regions of Africa. Though smaller than the *Pipistrelle*, it much resembles it in its general forms. The ears are oval, and as broad as high; the tragus, leaf-shaped, round at the point, and half the length of the auricle. The muzzle is naked, studded with a few transparent hairs. The fur is short, bi-coloured throughout, being, above, black at the root, and dark-brown at the point; and beneath, black at the base, and light-brown at the tip; the membranes black, the outer incisors are in close apposition with the canines, and very small; the inner are long and bifid. The entire length is two and a half inches, the breadth seven.

37. V. TEMMINCKII.—TEMMINCK'S BAT.

It will be noted that this is not *Vespertilio Temminckii* of Dr Horsfield and others, which has been described in a former page as a Roquet-dog Bat, (see p. 44.) This animal was discovered by Rüppell in a woody district in Nubia; seven were captured near Dongola, and are now in the Francfort and Leyden Museums. The muzzle is obtuse; the ears large, nearly round, and without any distinct lobe; the tragus leaf-shaped, round at the point, and inclined towards the head; the membranes totally naked and diaphanous; the interfemoral alone slenderly clad on the upper side. The external incisors are so small that they scarcely rise above the gum; the others are like canines. The fur is short, but abundant and smooth. The head, round the ears, part of the neck, and all the superior portion of the body, is light grey; the lower part of the neck, and inferior part of the body, are pure and shining white, the hair being white from the root to the tip; the membranes are grey, and have no borders. The markings do not differ either in the sexes or young. The length is three inches, the breadth seven. (Fig. in Rüpp. Zool. Atl. p. 17, pl. 6.)

38. V. HESPERIDA.—THE EVENING BAT.

Although not represented in Rüppell's Atlas, this Bat seems to have been procured by that able Naturalist: it was found on the shores of the Red Sea, near the coast of Abyssinia, and specimens are found in the German and Dutch Museums. The cutaneous system is not greatly developed in proportion to the animal's size, which is nearly three inches long. The muzzle is short and obtuse; the ears also short, and as broad as high; the tragus leaf-shaped, and curved, with a round point; the interfemoral membrane veined lozenge-wise, slenderly clad at its base, and all the limbs naked. The fur is short, smooth, and abundant, bi-coloured throughout, being, above, black at the base, and rosy-brown at the tip; and beneath, black at the root, and rosy-grey at the point; the end of the

muzzle is very hairy, and black; the membranes brown, and veined with lines of a lighter brown colour.

SECTION III. ASIATIC SPECIES.

39. V. MOLOSSUS.—THE DOG-MOUTHED BAT.

This is a new species, which has been lately sent to Holland, from Japan, by M. Bürger, and which will be represented in the forthcoming *Fauna Japonica*. The muzzle is extremely obtuse, large, and broad, similar to the snout of the Bull-dog Bats, and is clad to the nostrils, which are wide apart. The cheek-bones are high; the ears large, and nearly round, and a fold extends from them to the commissure of the lips; the tragus is short, and lance-shaped, and the external half of the auricle is covered with hair. The wings, which are far from broad, are abundantly clad beneath, along the flanks; the interfemoral membrane is large, and has a jutting out lobe at the heel. The inner pair of the incisors are canine shaped, and the external quite resemble a strong and short canine; the six lower ones are tricuspid. The fur is silky, smooth, and lustrous, and of one colour throughout. The *male*, above, is of a deep rosy-brown, beneath, of the shade of a decayed leaf. The *female*, above, is of a lively rust-colour, beneath, like the male; the membranes are brownish-black. The length is five inches, the breadth fourteen.

40. V. NOCTULINA.—THE NOCTULINE BAT.

This species is described by M. Is. Geoffroy in Belanger's *Voyage aux Indes*, and a specimen was sent by M. Duvaucel to the Paris Museum from Bengal. The size of this individual was three inches two lines (French) long, and eight inches six lines of expanse. It approximates in characters to the *Noctule* Bat, and hence its name. Its dimensions are nearly those of the *Pipistrelle*. The upper parts of the head and body are of a russet-fawn colour, the under of a very light fawn, all the hairs being lighter nearer their root than at the point. The alar membranes are almost entirely naked, but the base of the interfemoral, on its upper side, is covered with a few hairs of the same colour as those on the back. The ears are of a triangular form, somewhat rounded; the tragus is straight, and elongated. The muzzle is naked at the point and sides.

41. V. BLEPOTIS.—THE EAR-SEEING BAT.

M. Temminck is the first who described this Bat, of which a great many have been captured in the Indian Archipelago by the Netherland Naturalists. It is characterized by the spheroid development of its external ear, which nearly surrounds the orbit, and has led to its appellation, for it may truly be said to be a Bat whose eye is comprehended within its ear. Its livery is different, at different periods of the year, the result, it would appear, of a double moult. A great many have been examined, and they are wonderfully constant in their markings. The face of this animal is obtuse, the ears very short, quite round, and not united, with their external margin directed forwards nearly to the commissure of the lips, and having a few short hairs within; the tragus is leaf-shaped, and inclined inwards. The head is small and short, and the eyes nearly hid by the ears; the body is stout; and the tail as long as it and the head put together; the membranes very ample. The fur is bushy, very short, close, cottony, smooth, and shining above, crisp beneath. The *adult*, in both sexes, has the head, neck, and shoulders, of a deep marone colour, and the remaining superior parts perfectly black and shining; the chin, throat, and chest, are rosy-brown; and the under part of the body is a dull black; the abdomen is a light brown, and the alar membranes are clad underneath: this is their livery in the *spring*. In *autumn*, all the upper parts are sooty-black, without a trace of the marone-tint, and below greyish-black. In the month of January the fur is parti-coloured, being of the marone-shade on the neck, and brown on the chest. The entire length is between four and four and a half inches; the expanse twelve. This Bat is very common in Java, where, however, it rarely appears in the plains, but in rocky and woody regions. It is also noticed in the neighbouring islands, as far as Japan; its retreats are in caverns and clefts of the rock, and hence its capture is difficult.—(Fig. in Temm. Mon. II. pl. 53, figs. 1 and 2.)

42. V. CIRCUMDATUS.—THE EDGED BAT.

We owe the discovery of this new species to MM. Boie and Macklot, who have transmitted many specimens from Java to Leyden. The tail and interfemoral membrane are short, and the latter is clad above, near its base; the muzzle is very short and obtuse; the ears are broad, black,

and edged with a white margin, whence its name; they are more broad than high, and scooped out at their external margin. The fur is long, bushy, and very lustrous. The hairs are bicoloured: its robe above is deep black, the tips being reddish-marone; beneath the chest is black, with red tips; the abdomen black, with ash-coloured tips; the base of the ears is yellow, their edges yellowish-white; the rest of the ears, and all the membranes, are quite black. The length is four and a half inches, the breadth twelve.—(Fig. in Temm. Mon. II. pl. 53, figs. 3 and 4.)

43. V. BRACHYPTERUS.—THE SHORT-WINGED BAT.

The individual which supplied M. Temminck with the characters of this Bat was captured at Padang, in Sumatra. The dimensions of this animal were in length 3". 3", in breadth 8". (French.) It is remarkable for the shortness of its wings in relation to the size of its body. The muzzle is obtuse, and remarkably broad; the nostrils apart; the ears are large, and developed sidewise; they would be perfectly round save for the scooping out on the external margin. The tragus is like an oval leaf, of which the point is bare, and the base well clad. All the four upper incisors are remarkably small. The fur is short and smooth, and extends along the upper part of the flanks, and round the coccyx, with the appearance of a ribbon. The colour, above, is nearly a black-brown, beneath, amber-brown, with the membranes black.—(Fig. in Temm. Mon. II. pl. 53, figs. 5 and 6.)

44. V. IMBRICATUS.—THE IMBRICATED BAT.

This Java species, there called *Lou-o-lescar*, is a striking representation of the European *Pipistrelle*, and hence M. Kuhl transmitted many to Europe, under the name of the *Pipistrelloid* Bat; as, however, Dr Horsfield had the right of priority, (*Zool. Research. Sp. 51.*) the name he affixed should, of course, be retained. One of the specimens in the Leyden Museum is pie-bald, having the cutaneous system pure white, irregularly marked with large brown spots, and is probably an albino. The entire length of this species is about 3"; the expanse 9"; the ears are broad, short, and nearly round; the muzzle obtuse; nostrils apart; the tragus short, obtuse, round; a band of small and very fine hairs runs the whole length of and underneath the vertebrae of the tail, hence the animal's name. The fur, short, smooth, and abundant, is differently coloured in the two sexes. The *male*, above, is black-brown, or *bistre*-coloured; beneath, is black, tipped reddish, giving the parts a falcon cast. The *female* is, above, reddish-brown, and beneath, redder than in the male; the young is generally fawn-coloured.—(Fig. in Temm. Mon. II. pl. 54, figs. 1, 2, 3.)

45. V. PACHYPUS.—THE THICK-FOOTED BAT.

The size of this species is less than the common Bat of this country—the *Pipistrelle*—and the expanse, especially, is less; the thumb nail is remarkably short, and supplied with a callosity. The head is very depressed; the muzzle obtuse; the ears broader than high, and the lower lobe large; the tragus is short and roundish. The feet are remarkable, the metatarsus being very long, and the toes very short; the point of the tail is free; the cranium, likewise, and chanfrin, are depressed. The fur is bicoloured, and without any apparent difference in the sexes; above, it is of a beautiful marone-colour, more or less shining, the points of the hair being of this colour, and their base golden red; on the chest the hairs are brown, tipped with red; the abdomen is dull brown. The entire length is about 3", the expanse 7". This animal is well known in Java and Sumatra, whence M. Van Hasselt has sent many to Europe.—(Fig. in Temm. Mon. II. pl. 54, figs. 4, 5, 6.)

46. V. MACROTIS.—THE GREAT-EARED BAT.

This remarkable species may be easily distinguished, at the first glance, from all its congeners, by the large size of the ears, compared to that of the body, and by its cutaneous system, which is delicate, diaphanous, and much veined. The face is obtuse; the nostrils apart; the ear is large, and prolonged to the cheek; the tragus is also large, like a curved leaf. The inner pair of incisors are broad and bifid, the outer short and pointed; the six below are very small, fine, and smooth. The fur is of mean length, smooth, and of one colour over the whole body, being a bistre-brown, like the peel of the onion; the muzzle is black. The membranes are very diaphanous, somewhat brownish near the body, and elsewhere of a pale white, covered throughout with numerous brown veins; the ears and all the toes are brown, and there is no difference in the markings of the sexes. The entire length is 3", the expanse a trifle more than 8".—(Fig. in Temm. Mon. II. pl. 54, figs. 7, 8.)

47. V. HARPYIA.—THE HARPY BAT.

The Harpy Bat is remarkable for the shape of its snout, which, though very obtuse, yet appears elongated, owing to its two nasal tubes, which separate from each other, advance beyond the lips, and exhibit precisely the configuration we have before described in the formation of Pallas', Tube-nosed Roussette, *Harpyia Pallasii*. It is, moreover, distinguishable from all others, by its feet being clothed to the very nails, and from its interfemoral being clad with transparent hairs above, and painted below with numerous diagonal and concentric lines, formed by small papillæ, whence the diverging hairs arise. The incisors above are of unequal length, those below are crowded, and bi-lobed. The fur is abundant, long, and frizzled, cottony, and bi-coloured above, of one colour beneath. The head, neck, and body, are of a beautiful whitish-grey, but the points of the hair being of a lively red, confers on these parts a rosy ash tint; the alar membrane above, and the feet and toes, are covered with bright red hair. Underneath the marking is reddish-grey, the sides of the chest being red. The female is somewhat paler than the male. The total length is four and a half inches, the width thirteen. Its habitat is Java, where, however, it appears to be scarce, residing in caverns.—(Fig. in Temm. Mon. II. pl. 55, figs. 5, 6.)

48. V. PAPILLOSUS.—THE PIMPLED BAT.

The body of this Bat is slim in proportion to the great expanse of the wings; the cutaneous system is much developed, and there is a row of very small pimples, forming a border, which runs all along the interfemoral membrane, and distinguishes this species from any other. The ears are very distant, and broader than high, nearly round, and internally provided with a marked fold of the skin; there is, moreover, a longitudinal fold, whereby the organ may be closed; the tragus is very long, filiform, and book-like. The forehead is elevated, and the cranium round. The fur is abundant, very bushy, soft, cottony, and frizzled; above it is of a deep brown colour, with a rosy tint at the point, all the rest, to the root, being silvery-grey. The neck, chest, and coccyx, are reddish; the flanks are brown; and the abdomen red. The membranes are very diaphanous, and much veined; the row of pimples is whitish, and not supporting any hair. Total length, nearly four inches, breadth, twelve. This animal has been procured both from Java and Sumatra, but appears scarce, M. Temminck informing us that, whilst MM. Kuhl and Van Hasselt sent home hundreds of others, they have only transmitted two specimens of this.—(Fig. in Temm. Mon. II. pl. 55, figs. 1, 2, 3, and 4.)

49. V. ADVERSUS.—THE CROSS-TOOTHED BAT

This species is described by Dr Horsfield, in his Zoological Researches, (No. viii. 2.) but must be rare, as M. Temminck has never received a specimen of it. The teeth come within the usual formula, but the upper incisors, though they have plenty of room, have such diverging points, that the lobes of the teeth, on both sides, cross each other. The head is conical; the chanfrin oblong; elevated at the back part; the muzzle is broad; the ears straight, obtuse, as long as the head, bent backwards, and terminating by a small basal lobe. The interfemoral membrane is irregularly veined, and marked with obscure points. Its length is three inches, three lines; its breadth ten inches.

50. V. HARDWICKII.—HARDWICK'S BAT.

General Hardwick's Bat was also first introduced to notice by Dr Horsfield. It is not very common in Java; nor in Sumatra, where it has also been found, does it appear to abound. In size it is somewhat less than our *Pipistrelle*; the ear is broader than high, scooped out in the middle, furnished with a lobe, and abutting near the commissure of the lips. This Bat, like the *pimpled* one, has a longitudinal fold, whereby the organ is closed, the external border folding over the internal; the tragus is very long, and filiform. The muzzle is short and pointed; the membranes diaphanous; the fur soft, cottony, and somewhat frizzled; above, it is of a light brownish-grey colour, and beneath, of a brownish-grey, with the points of a rosy hue. The entire length is three inches, breadth, eight.—(Fig. in Temm. Mon. II. figs. 7, 8, and 9.)

51. V. PICTUS.—THE STRIPED BAT.

The *Pictus* of Linnæus, Pallas, Horsfield, and others, the *Striped Bat* of Pennant, seems to be widely spread over the Continent of India; it also abounds in Java, Borneo, and Sumatra, although its existence in Ceylon is more doubtful. During the day it finds a retreat at the foot, and hides under the great leaves of the *Musa sapientium*. The ears are large, oval, and slightly cut out at the external margin; the operculum is long and oval-shaped; a border of short hairs runs along the edge of the interfemoral membrane; the feet are well covered with fur; the forehead is elevated, and the cranium rounded. The fur is cottony, and much

frizzled; above, it is of a very shining golden-red colour, below, reddish, the sides of the neck and flanks more decidedly so. The alar membranes, as far as the fingers, and the whole of the interfemoral, are more or less reddish, and are especially red near the flanks, and at the coccyx; between the fingers they are of a dull black; a tinting which, though conspicuous on the living animal, cannot be perceived on the preserved one. The length is three inches, the width, nine.—(Fig. in Temm. Mon. II. pl. 56, figs. 1, 2, and 3.)

52. V. SUILLUS.—THE SWINE BAT.

This singular little Bat is most readily distinguished from its congeners by many peculiar characters. Its small head terminates in a prominent snout, in which there are two prominent tubes. Its ears, at their outer margin, have a projection, which is furnished with a longitudinal fold; the tragus is long, filiform, and pointed; the alar membranes are very ample, and take their attachment from the feet, not at the first articulation of the metatarsus of the external toe, but at its ungual phalanx. The tail is short, and the membrane cut transversely, so that its point extends somewhat beyond it. The fur is bushy, long, woolly, and bi-coloured; the whole of the interfemoral membrane, having edges curved, as are the toes, with transparent hair. The upper parts of the body are bright-red, the under, a pale isabelle-colour, the flanks ash-coloured, the skin reddish. The total length is two and a half inches, the breadth, seven and a half. This new species has been sent from Java, by the Netherland Naturalists: it flies very rapidly, and, during the day, conceals itself under the *Musa sapientium*. It is also found in Sumatra.—(Fig. in Temm. Mon. II. pl. 56, figs. 4, 5, and 6.)

53. V. HASSELTII.—HASSELT'S BAT.

This remarkable species is distinguished by a dark fur, which is cottony, and a very diaphanous cutaneous system; the alar membrane takes its attachment from the apophysis of the tibia, leaving the metatarsus free; the muzzle is somewhat long; the ears larger than wide, round at the points; the tragus is lance-shaped, and obtuse at the extremity. The very short fur is cottony throughout; above, the colour is light mouse-coloured, grey at the point, the roots being black, beneath, white; the interfemoral membrane has a fringe of transparent hairs, the nails are white. The entire length is a trifle above 3", the width 9". This species was captured by M. Van Hasselt in Java, and sent to Leyden.—(Fig. in Temm. Mon. pl. 56, figs. 7 and 8.)

54. V. HORSFIELDII.—HORSFIELD'S BAT.

Horsfield's Bat is a new species, which has recently been sent from the neighbourhood of Buitenzorg, in Java, to Leyden, and which the distinguished Professor has designated after the able Naturalist whose labours have added so much to our knowledge of the Natural History of Java. Its size corresponds to that of the *Barbastelle*. Its muzzle is pointed, and its nostrils somewhat tubercular. The ears of mean length, are narrow, and somewhat inclined backwards, round at the end, and scooped in the margin; the tragus is straight, lance-shaped; the toes are long and strong; the alar membrane takes its attachment from the base of the metatarsus, and some very minute white bristles are studding over the lower part of the interfemoral; the point of the tail is free. The odoriferous glands are large; they commence beneath the nasal tubes, and completely go round the orbits. The fur is of mean length, and smooth, extending over the base of the interfemoral. In the *male*, all the superior parts are black, the sides of the neck and the chest brown; the flanks dark grizzly; there is a whitish streak along the medial line of the abdomen; the *female* is somewhat more grey above. The length is somewhat above 3", the width, 10".—(Fig. in Temm. Mon. pl. 56, figs. 9, 10, and 11.)

55. V. TRALATITIUS.—THE TRALATITE BAT.

The Tralatite Bat of Dr Horsfield, the *Low-manir* of the Malays, is very common in Java, and is also found in Sumatra. The females have one, and sometimes two, at a birth; its habits are not unlike those of the *Pipistrelle*. Its muzzle is very short, somewhat pointed; the ears oblong, and much scooped at their external margin; the tragus is shaped like the willow-leaf, with a round point; the toes are very short, and the membrane rises from the outer one. The interfemoral membrane is chagrined beneath, and very fine, small, grey bristles rise in transversal lines from the projecting points. The odoriferous glands are placed on each side of the muzzle, near the nostrils, and extend above the eyes, without surrounding the organ, their colour being light yellow. The fur is cottony, very abundant, though short and smooth; above, it is quite black, with a drab-brown tip; beneath, it is also black, with the tips white. The length is three inches, the width about eleven.—(Fig. in Temm. Mon. II. pl. 57, figs. 1, 2, 3, and 4.)

56. V. TENUIS.—THE SLENDER BAT.

The Slender Bat, though nearly resembling, and very difficult to distinguish from, the preceding, (*Tralatite*), nevertheless, presents a few constant characters, on which the specific differences are based. These are—a shorter and more obtuse muzzle; form generally more slender; ears decidedly shorter, less wide, and more pointed. The cranium also presents this difference, that the maxillaries are shorter, the cranial cavity is also smaller, and less projecting, and the claufrin shorter and wider. The similar characters, on the other hand, are, the length and dimensions; a similar tragus; very short toes; the attachment of the membranes; and the same appearance of the under face of the interfemoral. But besides, this animal has only one false molar in each side, which is strong, whilst the *Tralatite* has two of very unequal sizes. The Slender Bat thus has five molars, both above and below; the other has six above and six below. The nature of the fur and the markings are the same in both. They likewise inhabit the same localities in Java and Sumatra; but this species has also been discovered in Borneo.—(Fig. in Temm. Mon. II. pl. 57, figs. 5, 6, and 7.)

57. V. MACELLUS.—THE TINY BAT.

This is another new species, which has been discovered in Borneo by the Dutch travellers, who have sent four specimens to the Leyden Museum. Like the preceding, it may most readily be confounded with the *Tralatite*, but is distinguished from it not only by slight modifications in the forms, but by one striking character. The feet of the *Tralatite*, as of the *Slender Bat*, are extremely small, with very short toes, and with the metatarsal bones comprised within the attachment of the membranes; whilst in our present species the feet are strong, the toes are long, and the claws crooked, with the metatarsal bones quite free; the muzzle, too, is stouter; the wings not so long; the interfemoral membrane less ample, and the tail shorter. In the two preceding, the tail is quite enveloped, whilst in this one the point is free, and the ears are a trifle longer. There is also a difference in the dental formula; the *Tralatite* has six molars above and beneath, the *Tenuis* has five above and below, and the *Macellus* has four above, without any trace of a false molar, and five below. The only difference in the robe is, that in this animal the fur is short and shining: the colours and size are nearly the same.

58. V. OREIAS.—THE OREIDE (OR MOUNTAIN) BAT.

This beautiful species, strongly characterized, and easily distinguished from its numerous congeners, has been received by M. Temminck from India. The size and forms are like the *Pipistrelle* of Europe, but the membranes are larger and more developed, rising from the toes: the thumb is armed with a strong crooked claw; the ears are distant, broad, and long, with a round point, of a clear or yellowish colour at their base, and quite naked; the narrow tragus is long, straight, and filiform. The muzzle is short and compressed, terminating in a point; the upper lip has a double row of moustachios on it, the lower one short, the other long, with the hairs turned upwards; there are also a few transparent ones on the lower lip. The fur is every where abundant and long; the membranes are naked, with the exception of a few hairs at the base of the upper surface of the interfemoral. It is bi-coloured throughout; above, blackish at the root, the rest umber-brown, and shining; the moustachios are black; beneath the roots are dull black, the lips grey; the membranes and ears are blackish-brown. Length about 3"; width 9".

59. V. MACRODACTYLUS.—THE LARGE-TOED BAT.

This is one of the Japanese species of Bats, which the natives found under the appellation of *Komuli*, and which has been distinguished in Europe. It is about the size of Daubenton's Bat; the muzzle is somewhat long and pointed; the ears are long and straight, not wide, and lobeless, scooped on the outer margin, and pointed at the extremity; the tragus is long, narrow, awl-shaped, and pointed. The feet and toes are very long, and the latter are studded with a few hairs; the claws are strong and whitish; the tail very short, and free at the tip. The fur is short, cottony, and abundant; the base of the upper side of the interfemoral is clad. The colour, above and below, is that of smoke-black, the points of the hair beneath being grizzly, so that the abdomen appears whitish. The cutaneous system is a deep brown. The length is 3", the breadth between 9" and 10".—(Fig. in Tem. Mon. II. pl. 58, figs. 3, 4, and 5.)

60. V. ABRAMUS.—THE ABRAME BAT.

The Abrame Bat of the Japanese, whose name is here retained, has been sent to Leyden by M. de Siebold. It is somewhat less than the *Pipistrelle*; the ears are oval, and round at the point, the outer margin

being prolonged by a great lobe, to the commissure of the lips; the tragus is leaf-shaped, somewhat curved. The muzzle is very short, and slightly pointed; the feet too are short; the side membranes, and the base of the interfemoral, being clad. The fur of the superior parts of the body is black, with fawn-coloured tips, the stripe along the flanks, and at the base of the interfemoral, being fawn. Underneath, the colour is black, tipped with whitish-grey. The length reaches to 3", the expanse to 8".—(Fig. in Temm. Mon. II. pl. 58, figs. 1 and 2.)

61. V. AKOKOMULI.—THE AKOKOMULI BAT.

This new species, like the preceding, has been discovered in Japan by MM. de Siebold and Bürger. It is a trifle larger than the preceding, and has a longer and broader muzzle, and larger ears; the feet and toes are very short; strong and long moustachios adorn the lips; the tragus is leaf-shaped, round at the point. The base of the interfemoral membrane is clad above. The fur of the *male* is mouse-coloured above, the tips having a reddish fawn tint; beneath black, with light grey points, the flanks and abdomen white. The *female* is of a russet-brown above; beneath, black tipped with light red. The length is 3", the width 9".—(Fig. in Temm. Mon. II. pl. 57, figs. 8 and 9.)

SECTION IV. AMERICAN SPECIES.

62. V. PHÆOPS.—THE BLACK-FACED BAT.

This is probably the *Phaiops* of Rafinesque, which is alluded to in a note in Desmarest's *Mammalogie*, (p. 135, nt. 5;) but M. Temminck has taken his description from individuals he has himself received from Tennessee. It is about the size of the *Murinus*, but the tail is not at all free, and all the membranes are smooth; the ears are of medium length, much scooped out at their exterior margin, so that a lobe is formed at their base, and the rounded point is bent backwards; the tragus is shaped like the willow-leaf. The fur is short, uniform in colour throughout, and smooth; above, it is bay-coloured or brown, strongly tinted with red; beneath, a lighter bay; the face and membranes are black. The length is 4½", the breadth 13".

63. V. PULVERULENTUS.—THE POWDERED BAT.

The Powdered Bat, which derives its name from the appearance of its coat, was discovered by Prince Maximilian de Wied, during his journey in the Rocky Mountains of North America, on the banks of the Missouri. It closely resembles our *Parti-coloured Bat*, in its general form, and in the markings of the upper parts of the body; but is specifically different from the European species, by its being smaller in size, by its interfemoral membrane being clad all over on both sides, and by the under part of its body being differently coloured. Its muzzle is broad and obtuse; the ears are broader than high, roundish, and clad half way up; the tragus is hatchet-shaped; the tail short; the interfemoral membrane abundantly clad above, though less at the edge than the origin; clad also beneath, but with white transparent hair, and in concentric lines; the toes are also clad on their upper surface. The fur is long, silky, and bi-coloured throughout, and yet the animal is all of one uniform colour. The hair is of a very deep marone colour, tipped with white, so that the whole surface appears as if besprinkled with white powder. The length is 3½", the breadth 10".

64. V. URSINUS.—THE URSINE BAT.

This is another new species which was discovered by the Prince de Neuwied, on the banks of the Missouri, and the description of which has been supplied by that eminent individual to M. Temminck; it is based on the examination of seven individuals. The head is large; the muzzle long, broad, and somewhat depressed; the nostrils are large, opening cross-shaped at the side, and separated by a groove; the ears are oval, and much higher than the summit of the head, vertical on their posterior margin, and somewhat scooped near the point; the tragus is long, and lance-shaped, blunt at the point; the concha is clad at the base externally, the thumb of the strong wings is armed with a very crooked claw. The tail is long, with its tip free, and the membrane is marked beneath, with parallel rays, which give origin to a few fine bristles. The toe nails are very long, strong, and curved. The four incisors above are close set; the six below are tri-lobed. The fur is long, silky, and shining; above, of a lustrous umber-brown, beneath lighter; each hair is grey near its root. The membranes and ears are black. The total length about 4", the expanse about 11".

65. V. CAROLINENSIS.—THE CAROLINA BAT.

The Carolina Bat of Geoffroy, Godman, and others, has its ears as long as its head, oblong, and half clad externally; the muzzle is somewhat pointed; and the nostrils approximate; the tragus shaped like a

willow leaf, and half the length of the concha; the point of the tail is free. The fur is bi-coloured throughout, the upper parts being of a marone-brown, the roots being dark ash-colour; the inferior parts are ash-yellow, having the roots brown. The total length about $2\frac{1}{2}$ "', the expanse 10 ". This species is frequently captured at Charlestown.—(Fig. in Temm. Mon. II. fig. 1.)

66. V. CAROLII.—PRINCE CHARLES' BAT.

The Prince of Musignano has presented many specimens of this Bat to the Leyden Museum, which, not having been previously described, M. Temminck has affixed his name to: it has been captured in the neighbourhood of Philadelphia and New York. It is of the size and forms of the *Pipistrelle*, but with longer ears. The face is obtuse; the nostrils wide apart; the ears of medium size, oval, somewhat scooped out at the external margin, without lobe or anterior prolongation. The fur is everywhere bi-coloured. The checks, sides of the neck, and all the upper parts of the body, are of a russet-brown, the roots of the hair being black; beneath, the colour is yellowish-white at the point, and deep brown at the root, so that, on the whole, the tint is yellowish-ash. When a year old, the wing is more sombre. The total length is nearly $3\frac{1}{2}$ "', the expanse 9 ".

67. V. ERYTHRODACTYLUS.—THE RED-TOED BAT.

It is to the same distinguished Naturalist we are indebted for the discovery and first description of this Bat, which has been procured in the neighbourhood of Philadelphia. It is less than the *Pipistrelle*. All the fore-arm, the base of the fingers, and the interdigi-tal membrane of the first finger, are red, the other parts of the membranes are black. The ears are clad from their base to more than a half of their extent; they are small and oval; the tragus is willow-shaped; the tail is very long, and has the tip exclusively free; the interfemoral membrane is about half clad above, and radiated beneath, in lozeng-shaped veins, whence very short bristles arise, somewhat distant from each other. The fur is long, fine, and silky above; tri-coloured, and bi-coloured below. All the superior parts have a reddish-brown tint, somewhat yellowish about the head and neck, the hairs being black at the base, then yellowish, and lastly, reddish-brown; the upper part of the interfemoral membrane is abundantly clad; beneath, it is deep brown at the base, and reddish-brown towards the margin. The length reaches to 3 "', the breadth to 8 ".

68. V. FERRUGINEUS.—THE FERRUGINOUS BAT.

This species has been sent to Leyden from Dutch Guiana. It is about the size, and has the general appearance of Daubenton's Bat; the muzzle is short and obtuse; the ears narrow, scooped out at the posterior margin, and towards the point; the tragus short, and shaped like the willow leaf; the tail very long, with a free point, with a part of the root covered with hair; the toe nails of a yellow-white colour. Of the four upper incisors, the two internal are long, broad, and sharp edged, the external short and bifid. The fur is short and smooth, and bi-coloured throughout. Above, the colour is of a dead leaf, or reddish, more or less pure, the base being blackish-brown; beneath, all the hairs at the root have a reddish-black hue, and are pure white towards the tip. These two tints in a short fur form a medley of black and white. The membranes and ears, in the specimens kept in spirits-of-wine, are reddish-brown. The total length is somewhat above 4 "', the expanse about 12 "'.—(Fig. in Temm. Mon. II. pl. 58, fig. 2.)

69. V. VELATUS.—THE VEILED BAT.

This is the *Plecotus Velatus* of M. Isidore Geoffroy, (Ann. des Scien. Nat. III. p. 446,) but as the ears are not united in the front, it could, with no propriety whatever, be so placed. It is somewhat less than the Long-eared Bat of Europe, (No. 5,) and the ears are not so long, but broader, and more developed; the two ears, without being united, touch each other, on the menial line of the cranium, through means of a lateral prolongation; they have two longitudinal folds, one internal, running from the base to the point, and the other forms the sloping prolongation. The tragus is half the length of the ear, and is shaped like a long leaf; the muzzle is long, the nostrils approximate, and are tubular; a part of the face is naked; the interfemoral membrane is broad, and supported to half its extent by the metatarsal spurs. The fur is short, but fine and soft. The superior parts are of a shining blackish-brown hue; the inferior are of an ash-brown colour, shaded with grey near the pubis, and becoming whitish-grey on the fur of the posterior extremities. The interior incisors are long, strong, and converging; the external so small as to be scarcely visible. The entire length is about 4 "', the expanse 12 ". This species is common in Brazil.—(Fig. in Temm. Mon. II. pl. 58, fig. 3.)

70. V. HILARII.—ST. HILAIRE'S BAT.

The size of this Bat does not quite equal that of the Serotine of Europe. The ears are small, triangular, nearly as broad as high, but little scooped out at the external margin, and clad at their base; the tragus is of a prolonged form. The body is nearly as long as the arm and fore-arm put together; the tail as long as the fore-arm, and supporting an interfemoral membrane, which is quite naked. The fur is variable, passing above, from a black-brown to a marone-brown, and below, from grey to reddish-brown. The total length, according to M. Geoffroy, (Ann. des Scien. III. 441,) is $4\frac{1}{2}$ "', and the expanse $11\frac{1}{2}$ "', (French.) This species, which was captured in the Brazil missions, requires further elucidation.

71. V. NIGRICANS.—THE DARK-COLOURED BAT.

Prince de Wied Neuwied, who was the first to take notice of this species, (Natur. Brasil, p. 267,) states, that captured near the river Iritiba, it has resemblance to the *Obscure Brown*, the 12th Bat of D'Azara, and indicated by M. Geoffroy (Ann. du Mus.) as the *V. Albescens*. It is a very small species, with a very small head and short snout; the ears are of medium length, roundish at their internal edge, straight at their external, and with a round point turned outwards; the tragus is nearly half the size of the concha, very narrow, linear, and pointed; the tail is half the length of the body, and wholly engaged in the membrane. The alar membranes are straight and long. The fur, over the whole body, is a very deep greyish-brown, approaching to black, although the abdomen is a trifle lighter than the back. The total length is nearly 3 "', the expanse 9 ".

72. V. LEUCOGASTER.—THE WHITE-BELLIED BAT.

It is to the Prince de Wied Neuwied that we are also indebted for our knowledge of this Bat, which was discovered on the banks of the Mucuri, in the forests which bordered the streams, where it hooked itself during the day to old trees, after almost touching the water. The head is short, the muzzle very short, and obtuse, with the nostrils apart; the ears are long, straight, with the terminating edge round, and not sloped; the tragus of medium size, straight, slender, and pointed; the delicate point of the tail is free. One-third of the interfemoral membrane is covered with hair; the claws of the toes are strong, and covered with hair. The fur is bushy and silky, especially over the muzzle, and the former is covered with hair. The superior parts are of a blackish-brown colour, the tips of the hair being yellowish-grey; the throat and sides of the chest are blackish-brown; the middle of the chest is pale brownish-grey, and the abdomen greyish-white. The hairs of the sides which cover the alar membrane are whitish. The total length is 3 "', the width 10 ".—(Fig. in Atlas Beiträg. Natur. Brazil, 13 livraison.)

73. V. ALBESCENS.—THE HOARY BAT.

This is the Bat, No. 12, of D'Azara, (Quad. du Parag. II. 294,) which cannot with any propriety be identified with the *Nigricans* dwelt upon above. M. Natterer likewise found it in the Brazils, and has supplied specimens to many of the European Museums. It is nearly of the same dimensions of the most common Bat of this country, the *Pipistrelle*; the expanse, however, and the ears, are somewhat larger; the ear is rather long, pointed, and curved backwards; the tragus is straight, awl-shaped, pointed; the muzzle, too, somewhat prolonged and pointed, the nostrils tubular and divided. The fine points of the hair of the back are brown, those of the coccygeal region brownish-grey, often whitish. The fur is long and abundant. The entire length is little more than 3 "', the width than 8 ".

74. V. LACTEUS.—THE MILKY BAT.

This is a new species introduced to notice, like many others, by M. Temminck. It possesses the size and general appearance of the *Pipistrelle*; but the flying apparatus is scrimp and feeble in relation to the size of the animal's body; the base of the interfemoral is clad; the ears are short; the tragus very short, and lance-shaped. The fur is long, very bushy, and smooth, and pure white all over. All the hairs on the upper parts of the body are of two colours, blackish-brown at the base, and pure white near the point; on the inferior parts they are reddish-brown at the base, and pure white at the points; the membranes are yellow. The robe, therefore, is completely white when the hairs are lying down, but parti-coloured when the hair is disturbed. The total length is nearly 3 "', the expanse 7 ". It is clear that this species should not be regarded as an Albino, two individuals in every respect similar having been observed. Another and stronger reason also opposes this idea, namely, that if these individuals were Albinos, the whiteness of the hairs

would be general, whereas the hair generally is black, and it is only the points that are white. Their habitat is far from being ascertained, though it is probably South America, as the individuals in the Leyden Museum were discovered in a collection which was made in that part of the world. The examination of those which have come to hand proves that they were young, and probably the adult will be of much larger dimensions.

75. V. PARVULUS.—THE LITTLE BAT.

M. Natterer, of Vienna, captured this Bat in the Brazils, and deposited specimens in Austria and Holland. M. Temminck considers it as new. It is less than the *Pipistrelle* of Europe. The ears are small, straight, pointed, with a very distinct lobe at the lower part; the tragus too is straight, shaped like the willow-leaf, with an external leaf at its base; the muzzle is very short and obtuse, and there is a very large wart on the lower lip: the interfemoral membrane is clad both above and below. The fur is bushy, but not very long; the superior parts are of a dull black; the sides of the neck, and lateral parts of the chest, are more dingy than the back; the front of the neck, and the mesial line of the abdomen, and the sides, have the points of the hair brown; an isabelle hue towards the limbs. The total length is $2\frac{1}{2}$ "', the expanse 7'''.

76. V. AENOBARBUS.—THE RED-BEARDED BAT.

The size of this animal is much less than the *Pipistrelle* of Europe, and the expanse, especially, is very limited. The muzzle is short; the ears as broad as long, round at the point; the tragus is curved towards the head. The tail is very short, and its delicate point is free; the base only of the upper surface of the interfemoral membrane is clad. The fur is long, and bi-coloured throughout. Above, it is reddish-brown, the base of the hair being black; the forehead, cheeks, and chin, are red; the sides of the neck reddish; the pubic region pure white; the abdomen whitish, the flanks light reddish, but in all these places the roots of the hair are black. The total length is $2''\ 3'''$, the breadth $6\frac{1}{2}'''$, (French.) The habitat of this species is not ascertained, being grounded on a single female specimen which was sent from South America.—(Fig. in Temm. Mon. II. pl. 58, fig. 4.)

77. V. ARSINOE.—ARSINOE'S BAT.

M. Temminck regards this as a new species, an old female having reached Leyden from Surinam. It has the same dimensions and forms as the Whiskered Bat of Europe. (See No. 8.) Its head is short and depressed; its muzzle obtuse; its ears conical, with a round point, and no scooping out; the tragus straight, and lance-shaped. There are six molar teeth above and below, two of which, in each jaw, are false. The fur is very short, smooth, and spare, and the membranes are totally naked. The upper parts of the body are perfectly black and shining; the lower of a blackish-brown, the tips being fawn-coloured. The robe on the flanks, and round the coccyx, are larger than on the chest, of a blackish brown, tipped with white; this marking forms, round the body, a kind of whitish grey. The total length is upwards of $2\frac{1}{2}$ "', the expanse more than 8'''.

78. V. POLYTHRIX.—THE POLYTHRIX BAT.

This, and the preceding species, were transmitted by M. Auguste St Hilaire from the Brazils, and were described by his brother, M. Isidore, in the *Ann. des Scien. Nat.* t. 3. They are unaccompanied, however, with figures, which is a great deficiency, so much so, as to leave some doubt as to their being distinct from those described by the Prince de Wied. However, they probably are. The size of this one is somewhat greater than that of the *Pipistrelle*. Its ears are small, larger than they are broad, and scooped out at their external margin; the body is nearly as long as the arm and fore-arm; the tail as long as the fore-arm only. The interfemoral membrane is sparingly covered on its upper face with hair; the face is much clad, being covered with very long hair; and only the end of the snout is left naked. The superabundance of fur gives it a remarkable and hideous appearance. The fur is soft, abundant, and substantial; above, it is of a very deep marone colour, and below, a marone, slightly verging to grey. The total length is $3\frac{1}{2}$ "', and width 9'', (French.) There is a specimen in the Paris Museum.

79. V. LEVIS.—THE SWIFT BAT.

This second species, described by M. Isidore Geoffroy, from the Brazils, is smaller than the *Pipistrelle* of Europe, but is not less remarkable for the large development of all its membranes. Its ears are nearly twice the size of those of the preceding species, and its tragus is prolonged in nearly the same proportions, at the same time resembling them in shape. The tail is as long as the body, and the interfemoral membrane is greatly developed, almost equalling the length of the fore-arm. The face is sen-

sibly less covered with hair than the *Polythrix*, and the interfemoral membrane is scarcely at all clad. The colours are nearly the same as the preceding. The total length is $2''\ 9'''$, the expanse 9'''.

80. V. CHILOENSIS.—THE CHILOE BAT.

This species was discovered by Mr Darwin, in the recent expedition of the *Beagle*, and has been described by Mr Waterhouse, in the "Zoology of that voyage." The colours and size of this species likewise resemble the *Pipistrelle*; whilst, at the same time, the wings are broader, the fore-arm, leg, and tail, are longer, and the tragus is also longer and straighter. The snout is obtuse, and supplied with numerous small bristles. The forehead is concave; the ears narrow and pointed, margined externally, and supplied with four transversal folds; the tragus is long, filiform, pointed, and notched externally. A small protuberance is placed on the chin, from which proceed a few radiating hairs; the tail is free at its point. The fur is of medium length, and of a beautiful uniform brown colour; it extends to the base of the interfemoral, both above and below; the rest of this membrane is naked and black, as are also the wings. The total length is $2''\ 1\frac{1}{2}'''$, the expanse is $8''\ 3'''$. This species was captured in the island Chiloé.—(Fig. in Zool. Voy. of the *Beagle*, pl. 3.)

These eighty species, which we have now discussed as amply as our limits admit, include the whole number of those which M. Temminck, in his late Monograph, considers as established on sufficient and satisfactory grounds. To these he adds a short notice of many other species, of which the original notices have been more superficial, and somewhat incomplete; and as this information may be useful, under certain circumstances, to many inquirers, we shall here give an abridgment of his valuable remarks. To these, still following his guidance, we shall subjoin an account of ten species, of which there are specimens in the Paris Museum, and which were recently described by the late M. F. Cuvier, in the first vol. of the *Nouvelles Annales du Mus. d'Hist. Nat.* And this accomplished, we believe we have omitted nothing whereby we may bring our account of this genus, as of those which have gone before, up to the level of the most recent intelligence which has been accumulated upon this very extensive order.

DOUBTFUL SPECIES.

(European.)

We adduce first the five European species which M. Brehm of Reuthendorf *pretends* (we use M. Temminck's expression) to have discovered in his immediate neighbourhood. He describes them in his *Ornis*, 3d No., in these terms. The measurements are upon the scale of the Rheinland foot:—

1. VESPERTILIO SUBMURINUS.—The ears are much shorter than the head; the upper canine has no conspicuous edge behind, so that the first false molar is isolated, the second false is most conspicuous; the two false molars are tolerably long and pointed. The expanse is from seventeen to eighteen inches. The upper parts of the body are brownish, the lower light grey, passing into white; the muzzle dark grey. It delights in the hollows of fruit trees. This animal, M. Temminck says, may be a variety of the *Murinus*.

2. V. WIEDII.—Ears very small; the free part of the tail $2\frac{1}{2}'''$ long; breadth of the wings medium size; the fur long and silky; expanse from $15\frac{1}{2}''$ to $16''$. The upper parts of the body of a deep brownish-grey; the lower, light grey; the muzzle greyish-black; the membranes above blackish-grey; beneath, greyish-black. M. Brehm says, that this species is very rare in his locality. It is not much smaller than the *Myotis*, but is distinguished from it by its small ears, its narrower wings—by its long fur, and peculiar marking.

3. V. OKENII.—Ears small; teeth large; wings of medium size: tip of the tail $3'''$ free; fur of medium length, and soft; above, brownish-black, beneath, schistè colour. Expanse from $14\frac{1}{2}''$ to $15''$. This is stated to be somewhat less than the preceding; the free tip of the tail is longer, and the marking different. M. Brehm says it is rare.

4. V. FERRUGINEUS.—The ears short, and roundly oval; fur short, rust coloured; the wings very narrow; expanse from $15''$ to $15\frac{1}{2}''$. This appears to be only the *Noctula*, with a slight variation in the colouring.

5. V. SCHINZII.—The ears are $6'''$ long, and $2'''$ shorter than the head; the tragus is long, and lance-shaped; tip of the tail free, only $\frac{1}{2}'''$; wings broad; so long and soft, that the very short muzzle is entirely hid; the expanse from $9''$ to $10''$; above, it is brownish-black,

beneath, whitish, or blackish-ash. This is, unquestionably, according to M. Temminck, a new European species. Its distinguishing characteristics are its very long and bushy fur; the hair 3''' or 4''' long, which so completely covers the muzzle, that its point only is visible; the black ears are of medium length, inclined outwards, and scooped out externally; the tragus is long, awl-shaped, and pointed: the membrane brownish-black, lighter beneath. The marking above is blackish-brown, each hair being black at the root, and brown at the point; beneath, it is greyish-black, the tips of the hair being greyish-white. It appears to be very rare.

(Asiatic.)

6. V. TIMORENSIS.—This species is described by M. Geoffroy, (Ann. du Mus. t. 8.) and was discovered by MM. Peron and Lesueur. Its ears are broad, the length of the head, and united by a small membrane; the tragus shaped like a half heart; its fur is blackish-brown above, ash-brown on the abdomen; the fur is very bushy, and long, and soft to the touch. The dimensions are, body, 2'' 7''; tail, 1'' 5''; expanse, 10''. It was procured at Timor.—(Fig. in Temm. Mon. II. pl. 56, fig. 10.)

7. V. DE PERON.—The *Oreillard de Timor* of M. Isid. Geoffroy, (Etudes Zoolog.) It approaches the Long-eared Bat of Europe, resembling it generally in size, form, and marking. It is, however, distinguished by the size of the tragus: in the European species, this part, far from reaching the half of the concha, scarcely surpasses the third; whilst in Peron's it exceeds the half. There is also a difference in the marking, the fur being lighter, especially beneath, where it is nearly quite white; the hairs being black at the root, and white for half their length towards the point; the hairs beneath, and on the sides of the head, are indeed wholly white. In two individuals, a male and female, which M. Geoffroy examined, their markings were precisely the same. The habitat is not ascertained.—(Fig. in Temm. Mon. II. pl. 56.)

8. V. MALAYANUS.—It was M. Alfred Duvaucel who transmitted this species to the Paris Museum. M. F. Cuvier describes it as not unlike the *Murinoides*; the ear is funnel-shaped; the tragus petal-like. The body throughout is of a light fawn colour, the superior parts somewhat darker than the inferior; the membranes are light brown, and moustachios are conspicuous. The length is 3'', the expanse near 9''.

9. V. NOCTULA of Sumatra.—Under this title M. A. Duvaucel has sent home another Bat, very like its European namesake, but somewhat smaller;—very likely to be, in M. Temminck's apprehension, the *V. Noctulina* previously described.

10. V. JAVANE.—M. Busseuil, Surgeon of the *Thétis* Corvette, captured this animal in Java. It is very like the *Noctulina*, the ears scooped, and the tragus knife-shaped. The colour above is uniform brown, below, whitish, all the hairs being black at the root. Its length is 2'' 8'', its width 7''. M. Temminck thinks it extremely probable this is the young of the *V. Imbricatus*.

11. V. CONOMANDELLI.—This species has been transmitted by Lesnault from Pondichery, and is unknown to M. Temminck. Its head is like the *Noctulina*; its ears notched; its tragus knife-shaped. The upper parts of the body are of a yellowish-grey brown, the lower, whitish; the hairs are black three-quarters of their length, and of a yellowish-white at their extremity. The total length is 2'' 5'', the expanse 6'' 6''.

(American.)

12. V. MAXIMUS.—This Great Bat of Geoffroy, (Ann. Mus. t. 8.) and of Desmarest, (No. 218,) is the *Great Serotine* of Buffon. (Suppl. t. 7.) and the *Nesutus* of Dr Shaw. Its ears are described as oval, shorter than the head; the tragus awl-shaped; the muzzle long and pointed; the hair on the back four lines long; of the belly, very short; marking, marone-brown above, light yellow on the flanks, white on the abdomen; the nails white, and hooked; membranes blackish. The total length, 5'' 8'', the expanse, 17'' 9''. It inhabits Guiana.—(Fig. in Buff. Suppl. pl. 32, fig. 1.)

13. V. RUBEN of Geoffroy, (loc. cit.) is the *Canelle* of Azara, (II. 292.) The ear is very acute, 5''' high; the tragus awl-shaped; the muzzle pointed; the upper jaw surpassing the under; the membranes arising from the metatarsal articulation. The fur is short, cinnamon coloured, a bright red above, pale yellow, with a rosy tinge beneath. The length is 3'' 1'', the expanse 9'' 2'', (Fr.) It inhabits Paraguay.

14. V. MAUGEL.—This species, as we are informed by Desmarest, (No. 225.) was discovered in Porto-Rico by M. Mangé, and is described as somewhat larger than the *Barbastelle* of Europe. The ears are very large, united, and scooped externally towards the point, which is round;

tragus pointed half the length of the ear; the muzzle is short, slender, pointed, forming a right angle with the ears; muzzle broad; nose separated by a cartilage, lyre-shaped; the eyes small, situate at the base of the tragus. The inner incisors are the largest, somewhat distant and bifid. The fur is long, silky, blackish-brown above, lighter beneath, chiefly near the interfemoral membrane, where it is almost white; membranes dull grey; the tail almost as long as the body.

15. V. ARCTATUS.—The *Arcuated Bat* of Say (Long's Exp. Rocky Mount. I. 168,) and Godman, (Ann. Nat. Hist. I. 70,) is described as having a large head, and ears somewhat shorter, round at the point, and hairy at the base; the posterior margin is doubly notched, and the anterior base is distant from the eyes; the tragus is arched, and obtuse at the point; the interfemoral membrane is naked; the point of the tail free. Length 5'', expanse 13''.

16. V. SUBULATUS.—This North American Bat, mentioned by Godman, (Ann. Nat. Hist. I. 71,) has its ears larger than they are wide, and nearly as long as the head; they are half-clad, bulging at their anterior margin, and extending below the eyes; the tragus is long and awl-shaped. The hairs above are black at the root, and ash-coloured at the point; the interfemoral is clad at its base; some scattered hairs are found in the other part, and along its margins. The fur below is yellowish, the base blackish; the feet are long; the point of the tail free. The length nearly 3''.

17. V. GRYPHUS.—This is one of the Bats which has been recently noticed, as already hinted, by M. F. Cuvier, and which was received from the neighbourhood of New York. It has the head of the *Murinoides*, and has two false molars on each side of each jaw; the ear is scooped out, and the tragus knife-shaped. All the upper parts of the body are yellowish-white, the under grey; all the hairs, however, being black at the root. The naked parts of the body are violet-coloured; there are mystacial bristles on the upper lip and chin. The total length is 2'' 11'', the expanse 7'' 11''.

18. V. SALARII.—M. Milbert sent this species also from the neighbourhood of New York to Paris. According to M. F. Cuvier, its head resembles that of the *Murinoides*, and it has two false molars on each side of each jaw; the ear is scooped out, and the operculum knife-shaped. All the upper parts of the body are of a greyish marone-brown, and the lower parts whitish-grey. Where the fur is brown, the hairs are darkish near their root, and they are black where grey. The unclad parts are brown, and there are moustachios and a slender beard. The total length is 2'' 1'', the expanse 7'' 7''.

19. V. GEORGIANUS.—It was Major Leconte who sent this Bat from the State of Georgia to the Paris Museum. The head is like that of the *Murinoides*, the ear scooped out, and the tragus awl-shaped. The upper parts of the body are coloured with a mixture of black and yellowish-white, the black prevailing, on account of the shortness of the white points; the lower parts are, from the same cause, grey; there are mystacial bristles on the upper lip and chin. The total length is 2'' 8'', the expanse 7'', (French.)

20. V. SUBFLAVUS.—The habitat of this Bat, according to Major Leconte, is the same as the last, and the head and ears much resemble it. The tragus is shaped like half a heart; the superior parts of the body are a light greyish-white, variegated with brown, the inferior are yellowish-white; the hairs above being, at their root, black, then white, and brown at the tip, and below, being first black, and then yellowish-white; mystacial bristles occur as in the last species. Total length 2'' 9'', expanse 7''.

21. V. CREEKS.—This Bat is also from Georgia. Its head is like that of the *Serotinoides*; it has no false molar above, and only one below; the ear is scooped; the tragus knife-shaped. The upper parts of the body are yellowish-brown, the under dull grey; the hairs throughout being black at the roots. Mystacial bristles are present, as in the preceding. Total length 2'' 6'', expanse 9''.

22. V. CRASSUS.—M. Lesneur transmitted this species from New York to Paris. Its head resembles the *Murinoides*; there are two false molars on each side of both jaws; the ear is obtuse; the tragus knife-shaped. The upper parts of the body are of a greyish marone-brown, the lower flaxen, the hairs being darker near the root than at the points. The same mystacial bristles are present. The total length is 3'' 8'', the expanse 8'' 8''.

M. RAFINESQUE very superficially indicates six other species, which he describes in nearly the following terms. They all belong to the United States:—

23. V. CYANOPTERUS.—The *White-winged Bat* of Desmarest, (Mon-

p. 133, note 1.) The whole length 3", one half being allowed for the tail; the ears are longer than the head, and have a tragus; the fur, dark grey above, is blueish-grey beneath; the alar membranes are of a deep bluish-grey; the toes are black.

24. V. MELANOTIS.—Rafin. Total length $4\frac{1}{2}$ ", tail occupying one half, the expanse $11\frac{1}{2}$ "; the tragus roundish; the fur blackish above, whitish beneath; the membranes dark grey; the toes black.

25. V. CALCARATUS.—Rafin. Total length 4", expanse 12"; it has a kind of spur on the inner side of the first phalanx; the fur is blackish-brown above, and deep fawn-colour beneath. The wings are black; the toes rose-coloured; the feet are black.

26. V. MONACHUS.—Rafin. The size of the preceding; the tail equal to a third of the length, clad above, and wholly enveloped in the membrane; the ears are small, and hid under the hair, which is very long; the fur above is deep reddish-fawn, and beneath fawn; the feet are black; the membranes dark grey, and the toes and nose rose-coloured. This is probably the *Red-toed Bat* already described, (No. 67.)

27. V. PHAIOPS.—Rafin. Total length $4\frac{1}{2}$ ", expanse 13", that of the tail 2" 3"; the external pair of upper incisors are larger than the interior, and bi-lobed; the fur is dull bay-brown above, and paler beneath; the face, ears, and alar membranes, are blackish. This seems the identical animal already described, (No. 62.)

28. V. MEGALOTIS.—Rafin. Total length 4", expanse 12"; tail somewhat less than 2". The fur is of a deep grey colour above, and of a pale grey beneath; the ears, very large and double, are provided with a tragus as long as themselves. This is probably our *Long-eared Bat* already described, (No. 5.) also found in North America.

SOUTH AMERICA will probably yet supply many new species of Bats. M. D'Orbigny has indicated one, which is a RED BAT, in his beautiful work, *Voyage dans l'Amer. Merid.* (pl. II. fig. 5.) As the descriptive letter-press has not yet been published, we of course cannot more particularly describe it.

GENUS XXV. FURIA.—THE FURY BATS.

Syn. FURIA.—Fr. Cuv. Mem. Mus. XVI.—Fisch. Syn. Mam. 552.—Temm. Mon. Mam. II. 363.

GENERIC CHARACTERS.

$$\text{THE DENTAL FORMULA } \frac{2+C+(2F+3)M}{3+C+(3F+3)M} = \frac{16}{20} = 36$$

THE CRANIUM rises nearly at a right angle from the face.

THE UPPER JAW is exceedingly depressed. The face is flat-nosed, and bristled with hairs.

THE NAIL only of the thumb projects from the membranes.

This Genus, established by M. Fr. Cuvier, and subsequently adopted

by others, is based upon a single individual Bat which the French Naturalists received from M. Leschenault, who captured it in his first journey in America. There is no difference, as will be perceived, in the number of teeth, from what is found in many of the Genus *Vespertilio*; their form, however, materially differs. The upper incisors are of the same size, and are pointed, and are not in contact with the canines. The lower incisors, again, are placed regularly upon the arc of a circle, but in pairs, trident-like, at three different parts of it. The upper canines are much stronger than the lower, tricuspid, one point anterior, the other posterior, and the central one by much the largest, and conical. The lower ones have the same shape; and the false molars appear much more associated with them than with the true molars, on which we have no remark to make. M. Cuvier conferred the name *Fury* upon this genus, on account of its singular appearance. It is very small, flat-nosed, and bearded; the frontal and parietal bones rise almost at a right angle from the face, and the other parts of the cranium follow in their train. The zygomatic arch is not horizontal, but rises high in projecting backwards; the height of the upper jaw is nothing almost when compared with the Proper Bats, and the ascending branch of the lower jaw is very great. The organs of motion present nothing particular, with the exception regarding the thumb already specified.

FURIA HORREUS.—THE RUGGED FURY.

Syn. et Icon. FURIA HORREUS.—Fr. Cuv. Mem. Mus. XVI. p. 150, pl. 9.—Temm. Mon. Mam. II. 264.—Fisch. (loc. cit.)

SPECIFIC CHARACTERS.

THE MUZZLE very flat, and studded with hairs. THE EARS large, and as broad as long. THE FUR of a uniform black colour.

INHABITS South America.

The eyes of this Bat are very prominent, and remarkable for a size which is not often witnessed in this order. The nostrils are terminal, and are separated from each other only by a margin which surrounds them, and which forms a furrow at their upper part. The lips are entire, but, along the upper, there are four or five warts, and, upon the lower, eight similar ones, which are the more conspicuous, as they are white, and situated amidst the black hair. The ears are large, nearly as broad as long, simple in structure, and provided with a tragus of a particular structure, having three points, which are arranged in the form of a cross. The fur is soft and thick, except at the muzzle, where it is longer, stiffer, and more shaggy than in the other parts of the body. The colour is a beautiful uniform black. The total length is only an inch and a half; the expanse six inches. The individual possessed by M. Cuvier was a male, which was discovered at Mona, by M. Leschenault, during his first journey in America.

LIST OF THE PLATES

OF THE

ANIMALS REPRESENTED IN VOLUME II. OF THIS WORK.

DIVISION I. VERTEBRATA.—CLASS I. MAMMALIA.

Plate.	Genus.		Figures.	Plate.	Genus.		Figures.			
I. B.	HYLOBATES,	Gibbons,	5	VIII. B.	GYMNURA,	Oriental Hedge-Hogs,	1			
I. D.	CERCOPITHECUS,	Guenons,	6			} CLADOBATES,	Tupaia,	3		
I. E.	do.	do.	6	} MACROSCELIDES,	Long-Snouted Shrews,		2			
VII.	PTEROPUS,	Roussette Bats,	12		XXIII.	} PHOCA,	Seals,	4		
		do.	do.	3			} OTARIA,	Eared Seals,	4	
VII. B.	} PACHYSOMA,	Stout-Bodied Roussettes,	3	XXVIII.	} PHALANGISTA,	Couscoos,		6		
		MACROGLOSSUS,	Great-Tongued do.	2		✓ XXX. B.	SCIURUS,	Squirrels,	5	
		HARPYIA,	Tube-Nosed do.	5		✓ XXXI.	DIPUS,	Jerboas,	7	
VII. C.	} CEPHALOTES,	Cephalotes,	1	✓ XLVI.	EQUUS,	Horses,	2			
		DYSOPES,	Bull-Dog Bats,	14	✓ XLVI. B.	do.	do.	2		
VII. D.	} DICLIDURUS,	Box-Tailed Bats,	3	✓ LIII. B.	} ANTILOPE,	Antelopes,	3			
		NOCTILIO,	Hare-Lipped do.			4	} CATOBLEPAS,	Gnoos,	1	
		VAMPYRUS,	Vampyre Bats,			3		✓ LXX.	Whales, &c.	5
		PHYLLOSTOMA,	Javelin Bats,			5				
ERINACEUS,	Hedge-Hogs,	3								
VIII.	} ERICULUS,	Tendraes,	2							
		CENTETES,	Tenrees,	3						
				17 Plates.			Total, 125			

DIVISION I. VERTEBRATA.—CLASS II. AVES.

Plate.	Genus.		Figures.	Plate.	Genus.		Figures.
IV. D.	CARACARA,	Caracara Eagles,	4	✓ CVII.	RAMPHASTOS,	Toucans,	5
V.	MORPHNUS,	Eagle-Hawks,	4	✓ CIX.	TROGON,	Trogons,	5
XX.	} CORACINA,	Fruit-Crows,	2	✓ CXI.	PALAEORNIS,	Ring-Parakeets,	6
		CASMARHYNCHUS,	Summer-Birds,	5	✓ CXXVI.	PERDIX,	Partridges,
LXVI.	ICTERUS,	Troopials,	6	✓ CL.	IBIS,	Ibises,	5
LXXXIII.	CORVUS,	Crows,	5	CLXXXVI.	DIOMEDEA,	Albatrosses,	5
LXXX.	PARADISEA,	Birds of Paradise,	4	CLXXXVI.	CYGNUS,	Swans,	5
XCVI.	ALCEDO,	King-Fishers,	6				
✓ XCIX.	BUCEROS,	Hornbills,	6	15 Plates.			Total, 77

	Figures.	Plates.
Total of Mammalia represented.....	355	52
of Birds	379	63
of the Mollusca	35	2
of the Insecta	32	2
In all,	801	119

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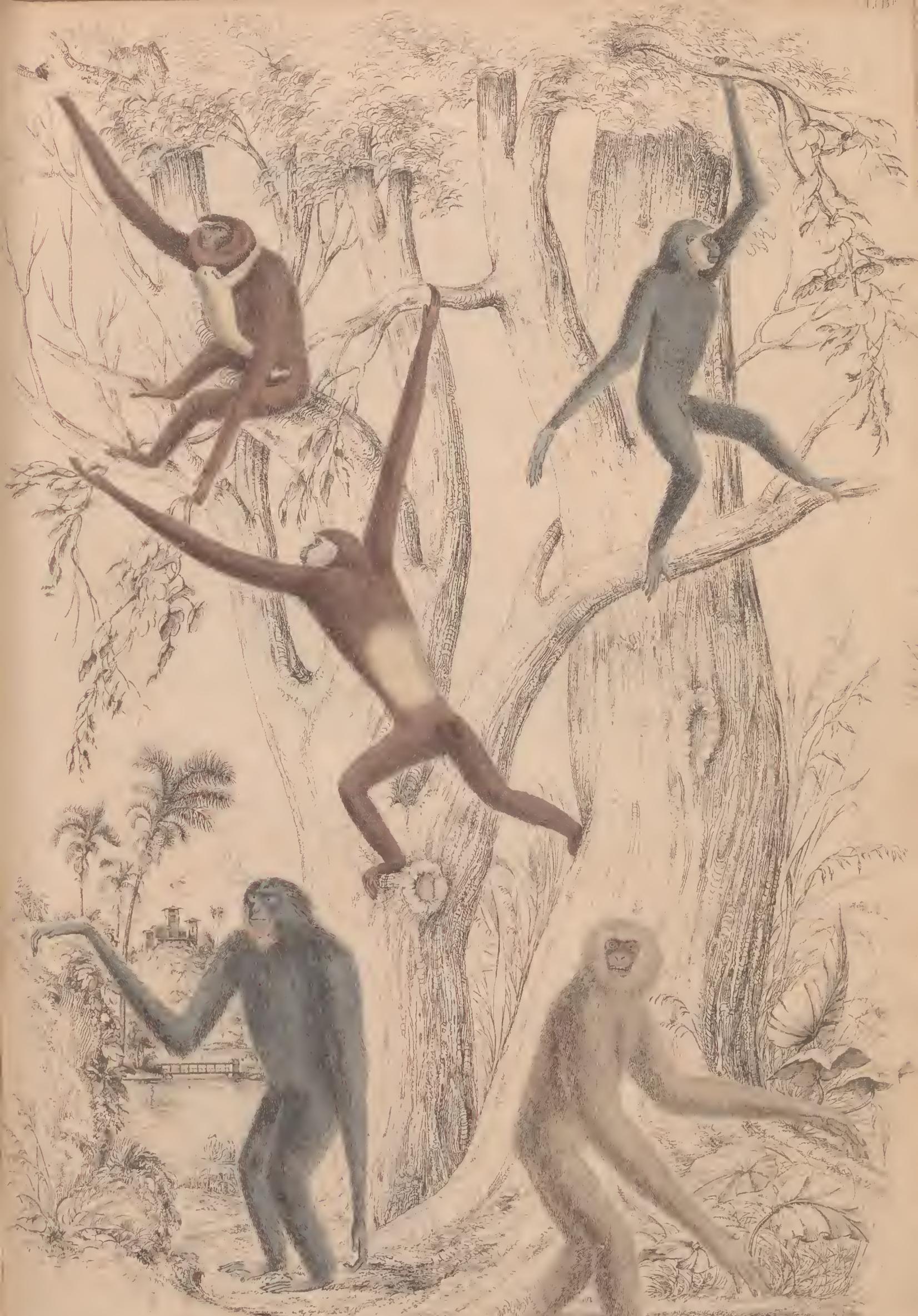
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- I. TITLE OF THE JOURNAL.
- II. THE EDINBURGH JOURNAL OF NATURAL HISTORY, AND OF THE PHYSICAL SCIENCES.
- III. INDEX OF THE JOURNAL, with the LIST OF WOODCUTS.
- IV. TITLE OF THE ANIMAL KINGDOM.
- V. THE ANIMAL KINGDOM OF THE BARON CUVIER.
- VI. LIST OF THE PLATES.
- VII. The PLATES, arranged according to the List.



HYLDEBATES	GIBBONS
<i>H. variegatus</i>	Varied G.
<i>H. leucurus</i>	Fem. & young,
<i>H. rafflesii</i>	Ash grey
<i>H. syndactylus</i>	Raffles' Gibbon
	Syndactylous

Fig. 311. 2c.

London, 1831.



PROPTHEUS QUENON'S.
 1. *ruber* Red G.
 2. *Ethiops* Collared Mangabey G.
 3. *Baldwinii* Collarless Mangabey G.
 4. *Sabini* Green G.
 5. *Favus* Malbrouck G.
 6. *phylicornis* Linnberg's G.



PRIMATES. GUENON.
 1. *Erythropus* Vervet G.
 2. *geiso veridis* Grivet
 3. *cephus* Monstach.
 4. *dialemtus* Diadem.
 5. *Talapou* Talapou.
 6. *biana* Spotted.



IPPHRODITS, KOTSSETTES.

- | | | | |
|-------------------------|---------------|-------------------------|---------------|
| 1. <i>Edulis</i> | Edible R. | 6. <i>Purpurinus</i> | Ursine R. |
| 2. <i>Amurensis</i> | Funereal | 7. <i>Tonganus</i> | Tonga |
| 3. <i>Phaeops</i> | black faced | 8, 9. | skull & teeth |
| 4. <i>Chrysoproctus</i> | Golden backed | 10. <i>griseus</i> | grey |
| 5. <i>Macklotii</i> | Macklot's | 11, 12. <i>labiatus</i> | Long lipped |

London: Curry del.



PTEROPUS.	ROUSSETTES
1 <i>Pamplexicaudatus</i>	Long tailed R
2 <i>marginatus</i>	Bordered
3 <i>Whitei</i>	White
PACHYSOMA	STOUT BODIED ROUSSETTES
1 <i>Ptilochoetum</i>	Wart tipped S
5 <i>melanocephalum</i>	Black headed
6 <i>brevicaudatum</i>	Short tailed
MACROGLOSSUS	GREAT TONGUED ROUSSETTES
7 <i>Minimus</i>	Kidote
8	Sick ton
HARPIS	THICK NOSED ROUSSETTES
9 <i>H. Pallasii</i>	Pallas T
10 <i>H. L. IN</i>	Blanc (with C. Cramm)
PTERALOTES	EMERALD OPS
11 <i>Peroni</i>	Peroni S



DYSOPES, BULL DOG BATS.

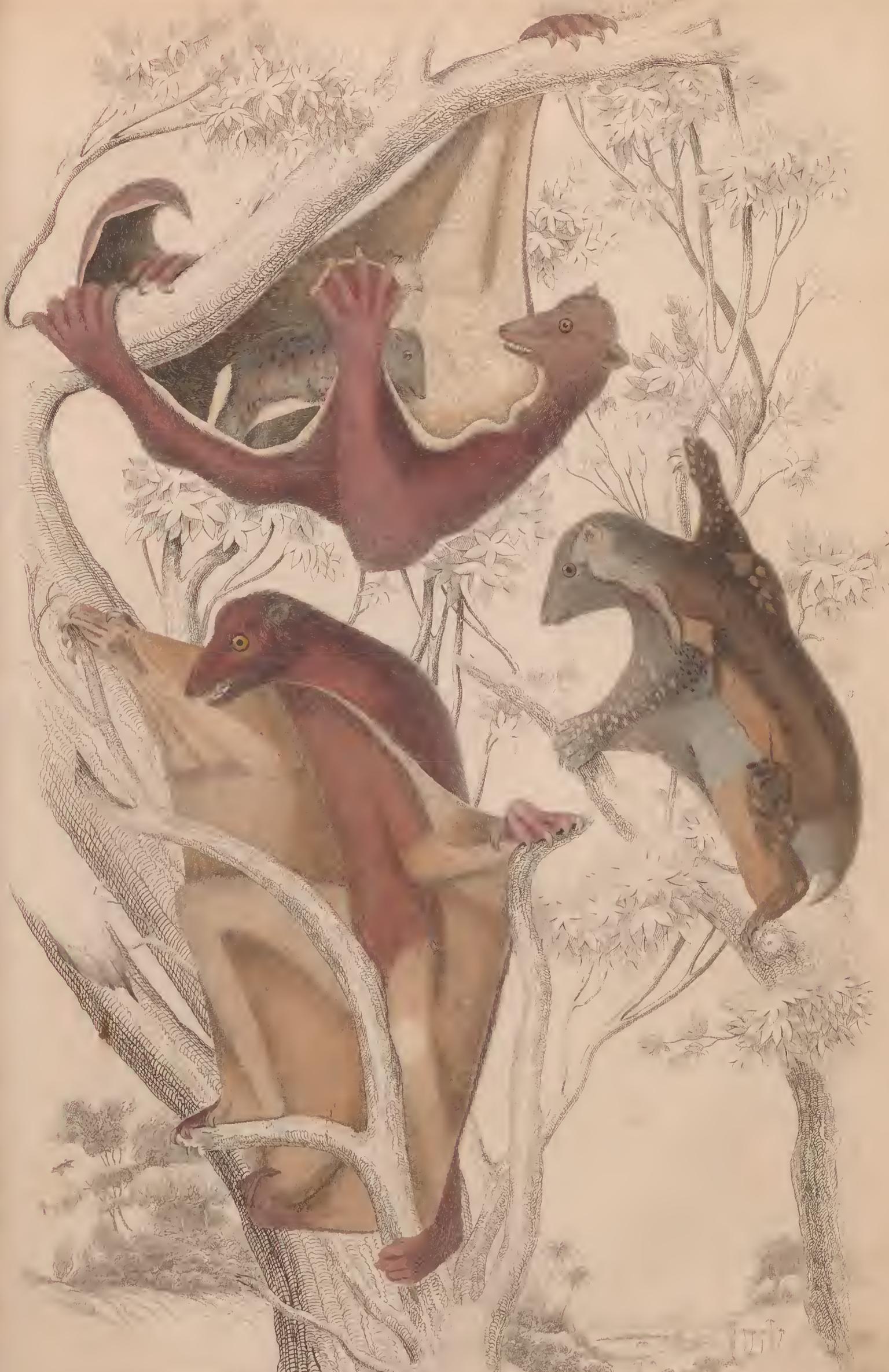
- | | |
|--------------------------|-------------|
| 1, 2. <i>D. rufus</i> | Rufous |
| 3. <i>vector</i> | Long Winged |
| 4. <i>obscurus</i> | Sooty |
| 5, 6, 7. <i>Mexensis</i> | Notcheared |
| 8, 9. <i>tenuis</i> | Slender |
| 10. <i>Esquiacus</i> | Geoffroy's |
| 11, 12. <i>Cestoni</i> | Cestoni's |
| 13. <i>torquatus</i> | Collared |
| 14. | foot |

E. M. Colver del.



DICLIDURUS, BOX-TAILED BATS.
 12 *D. albus* white
 3 tail
SCOTILLID, HARE-LIPPED BATS.
 4 *V. leporinus* Rufous II
 5 *rufipes* Red footed
 6 7 skull

VAMPIRUS, VAMPIRE BATS.
 8 *V. Spectrum* Common V.
 9 10 skull & teeth
PHYLLOSTOMA, JAVELIN BATS.
 11 *P. hastatum* Common J.
 12 *perspicillatum* Spectacled
 13 *arenulatum* Notched
 14 15 *elongatum* Short tailed



GLABROTHRIBES, FLYING SQUIRRELS.
 1. *volans* male
 2. female
 3. young *an. variegatus*



- ERINACEUS HEDGE HOGS**
- 1. *E. europæus* Common H
 - 2. *auritus* Long eared -
 - 3. *frontalis* White fronted
- BRIDLEB** TENDRACE
- 4. *E. nigræscens* Swarthy T
 - 5. *spinosus* Feckly (doubtful sp.)
- TESTES** TESTERS
- 6. *E. schauinslandi* Silky T
 - 7. *armatus* Armed
 - 8. *conspinosus* Half spined (Young)





GYMNURUS ORIENTAL HEDGEHOGS.
 1 *G. Rafflesii* Raffles O.H.
 UROSAURUS TUPAIAS
 2 *C. Tana* Tana T.
 3 *Javanicus* Bangsing
 4 *Ferrugineus* Press
 MACROSCOLIDES LONG-SNUITED SHREWS



PHOCID SEALS.
P. vitulina Common Seal
P. anellata Ringed Seal
P. mediana Smaller Sea Lion
P. carnifera Great Carnivorous L.

Milne & Farley del.



PHALANGISTA COUSCOOS.

1 *P. macrurus* Great-Tailed C

3 *P. vulpina* Vulpine C

5 *P. cavifrons* Rapouna C

6 *P. cookii* Cook's C



SCIURUS. SQUIRRELS

- | | |
|-----------------------|-------------|
| 1. <i>Alpinus</i> | Alpine S |
| 2. <i>vulgaris</i> | Common |
| 3. <i>capistratus</i> | Masked |
| 4. <i>pyropus</i> | Fire footed |
| 5. <i>erythropus</i> | Hottentot |



2



3

4

5



6

7

DIPUS, JERBOAS.

- | | | |
|-------------------------|--------------|----|
| 1. <i>D. Egyptianus</i> | Egyptian | J. |
| 2. <i>hirtipes</i> | Hairy footed | |
| 3. <i>Flater</i> | Ass eared | |
| 4. <i>Spiculum</i> | Broad tailed | |
| 5. <i>platyrus</i> | Flat tailed | |



EQUUS. HORSES.
 1. E. Burchelli Datw. Hem
 2. E. asinus Dziggtai



EQUUS HORSES.
1. Quagga
2. Zebra



ANTILOPES, ANTELOPES.

- 1. *Antelope Bata* Antelope
- 3. *Cephalopis Gemma* Gemma
- 4. *Troglodytes scabra* Hamstead

ANTILOPES USQUE



CETACEA. WHALE-TRIBE.

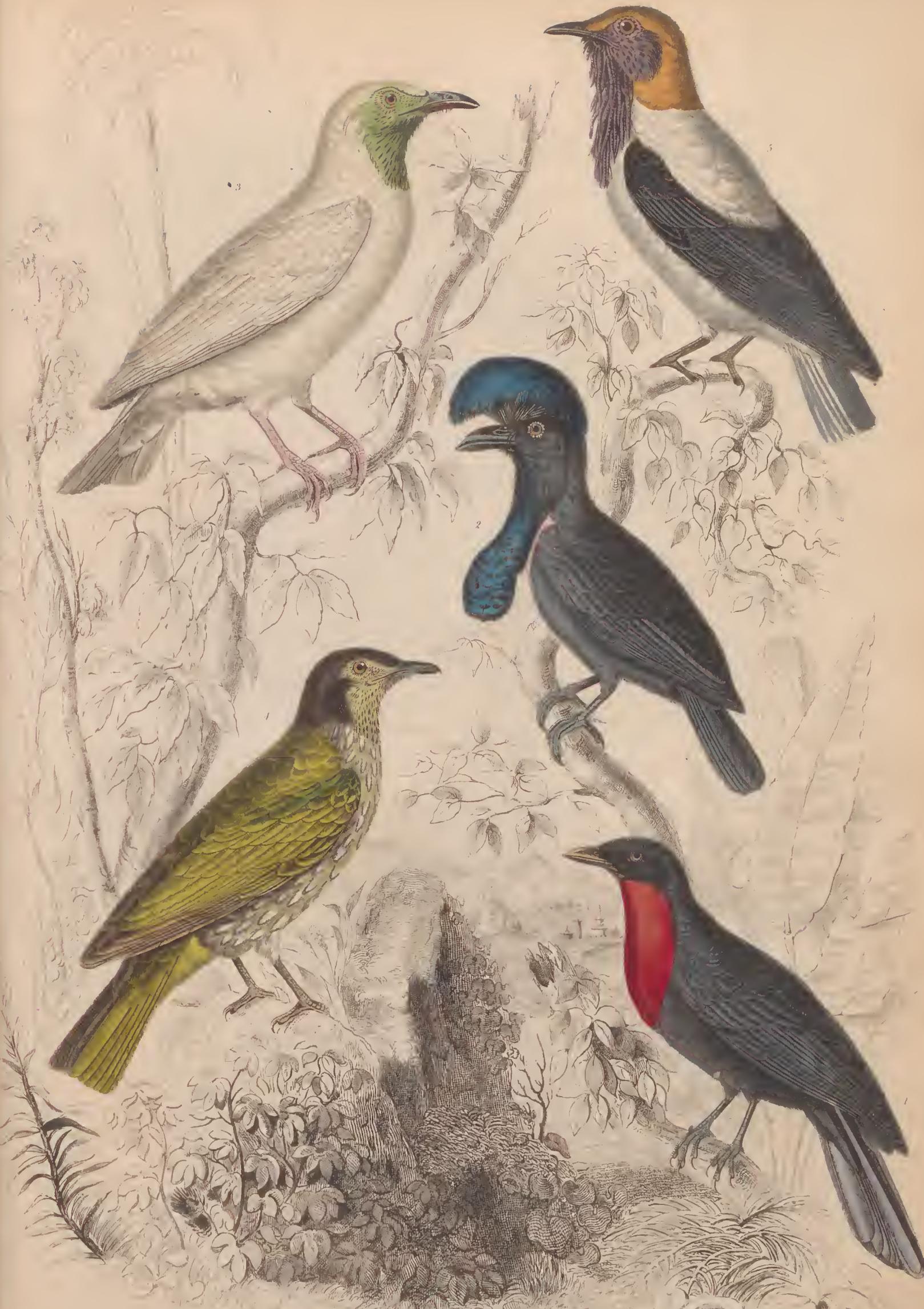
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|---|--------------------------------|------------------------|
| 1 | <i>Phocaena communis</i> | Common Porpoise |
| 2 | <i>Globicephalus Beductor</i> | Casing Whale |
| 3 | <i>Beluga Arctica</i> | White Whale |
| 4 | <i>Narwhalus monocerphalus</i> | Narwhal or Sea Unicorn |
| 5 | <i>Balaena Mysticetus</i> | The true Whale |



CARACARA, THE CARICARIS.
 1 C. *aterimus* The Black Caracara of Middle Age
 2 C. *Novae Zelandiae* New Zealand C.
 3 C. *Novae Zelandiae* New Zealand C.
 4 C. The Young

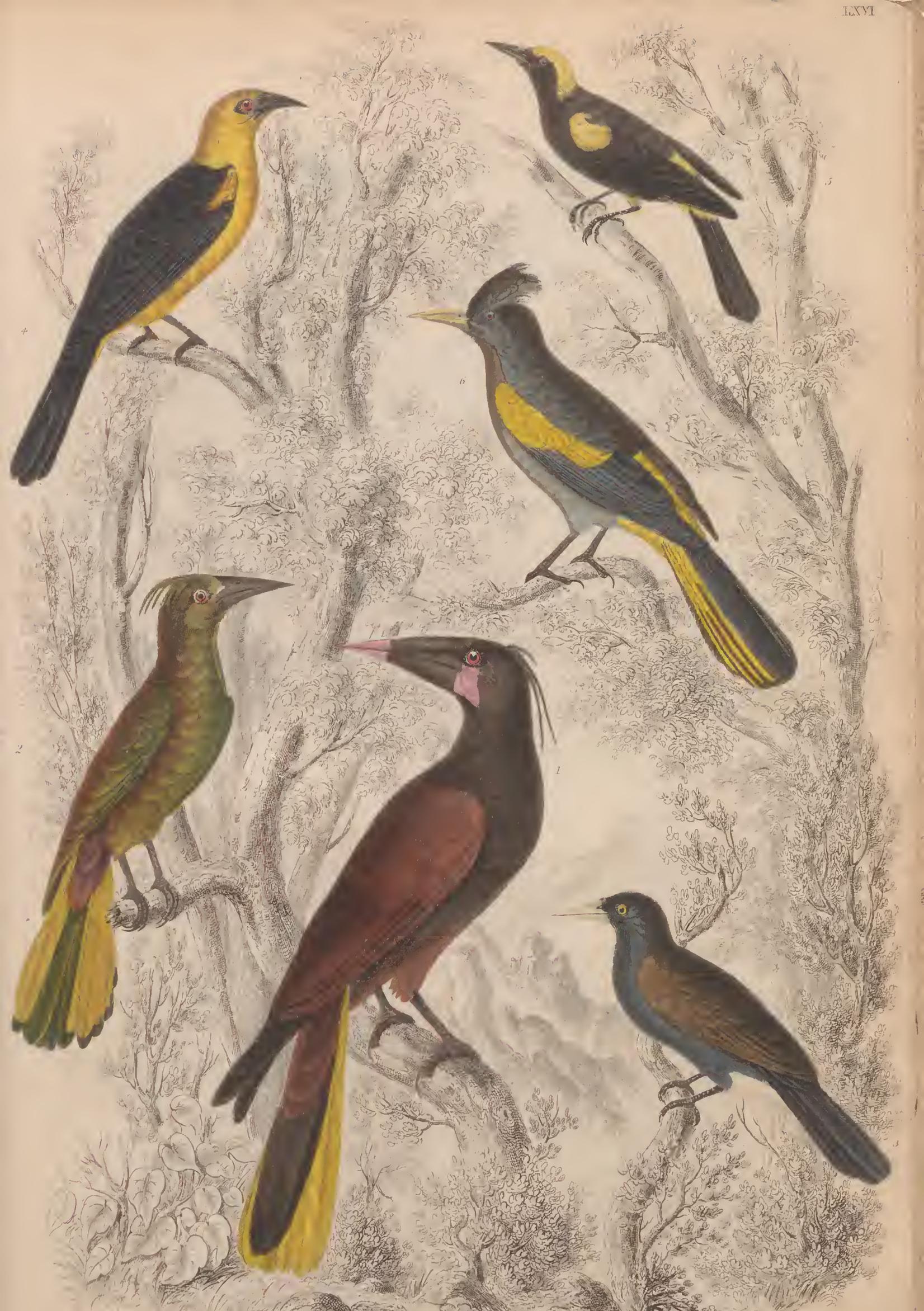


MORPHNUS BARRER HAWKS.
 1. *Tyrannus* Tyrant E.
 2. *cristatus* Singalese (nearly adu
 3. *ornatus* Superb
 4. *niveus* Snowy



CORACINA. PRUIT-CROWS
 1 *E. scutata* Red breasted T
 2 *Cephaloptera* Royal
CERAMBYCINUS. BIRMER BIRDS
 3 *C. caudirostris* Arapougu B
 4 *C. f.* Fem
 5 *C. variegatus* Avornu





TROOPIALS	
1. <i>Myiarchus cinerascens</i>	Band beaked Cassin
2. <i>Myiarchus cinerascens</i>	Green
3. <i>Myiarchus cinerascens</i>	Dusky
4. <i>Myiarchus cinerascens</i>	Naked eye Baltimore
5. <i>Myiarchus cinerascens</i>	Golden headed Bang nest
6. <i>Myiarchus cinerascens</i>	Bruden

J. L. G. Linn



CORVUS, CROWS.

- | | | |
|---|------------------|------------------------|
| 1 | <i>Corvus</i> | Raven |
| 2 | <i>Corvus</i> | Hooded or Royston Crow |
| 3 | <i>Corvus</i> | Carion Crow |
| 4 | <i>Frugileus</i> | Rook |

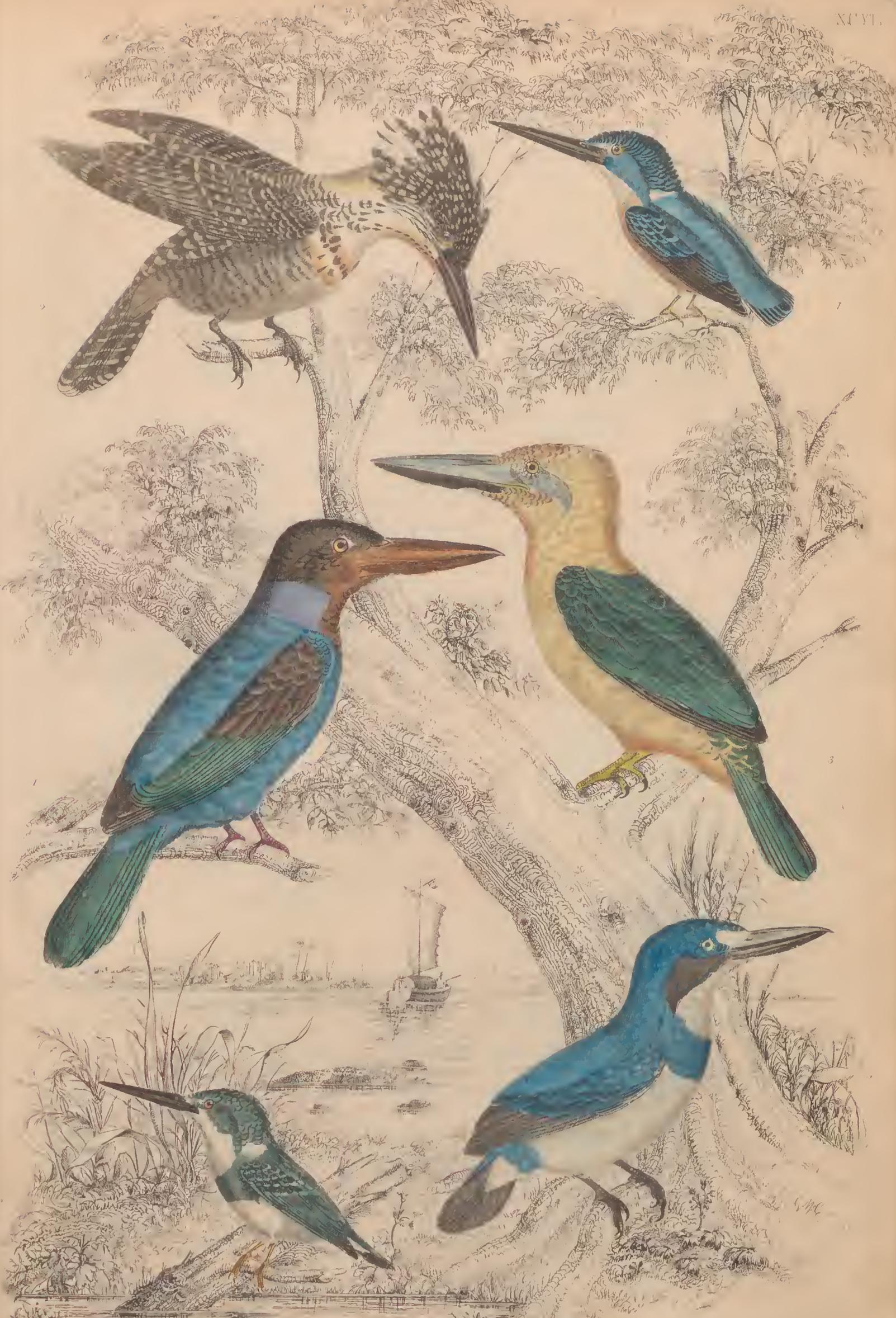


PARADISEAL BIRDS OF PARADISE

- 1. *P. major* Greater B. of P.
- 2. fem
- 3. *rubra* Red
- 4. fem.

Paradisea major *Paradisea rubra*





JACQ. K. KINGFISHERS

- 1. *Montana* Indian K.
- 2. *limbata* Diney
- 3. *metamorphosus* Tem Black-billed
- 4. *orniculata* Varied
- 5. *Diaps* Double-eyed
- 6. *Rufa* Blue



<i>B. anthracinus</i>	HORN-BILLS
<i>B. cornutus</i>	Mourning II
<i>B. gracilis</i>	White-breasted
<i>B. sulcatus</i>	Yellow-billed
<i>B. galericulus</i>	Red-billed
<i>B. ruficollis</i>	Large-billed
	Red-necked



AMPHISTOS. THE TOUCANS.

- 1 *R. toco* Toco Toucan
- 2 *s. vittatus* Blue billed
- 3 *toconuco* Toco
- 4 *erythrorhynchus* Red billed



- TROGON TROGONIDAE
- | | |
|-------------------|-------------|
| 1 Golden Coucouon | T. Pavoanus |
| 2 Reinwardt's do | Reinwardti |
| 3 Black-necked do | Atricollis |
| 4 Mexican do | Mexicanus |
| 5 Flower do | Naxini Male |
| 6 do | Femate |

Drawn by Eschschart, L. Reinold & Capé Brown

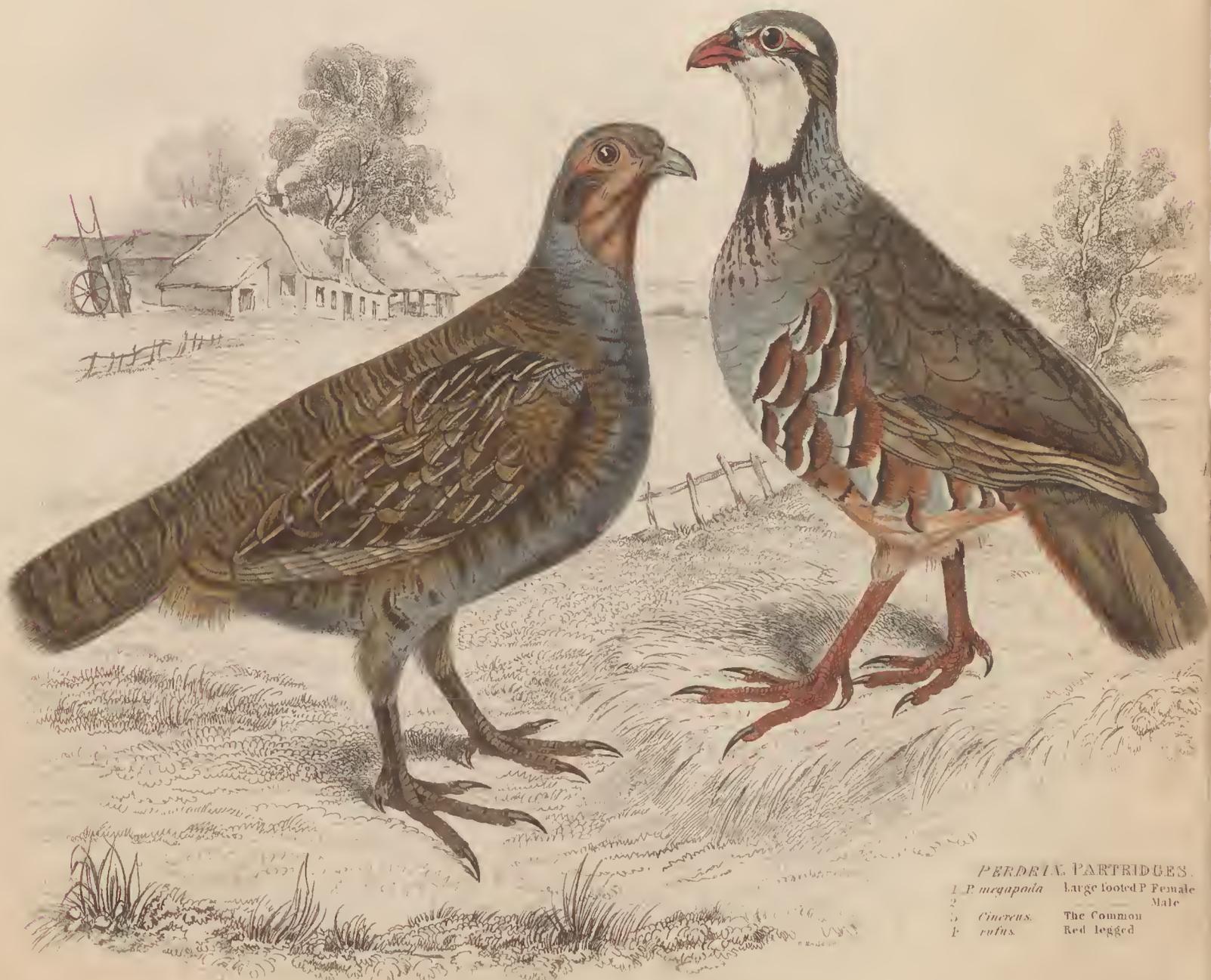


TROGON. TROGONS.
 1. *Dunquethi* Duvaco's T.
 2. *Reinwardti* Reinwardt's
 3. *Narina* Narina
 4. *Temminsi* Cuba
 5. *ardens* Rosy breasted T.



UROLONCHA, KING PARAKEETS.

- U. Alexandri Alexandrine R
- U. Boninensis Rose-headed
- U. ... Red-throated
- U. ... Yellow-collared
- U. ... Papuan

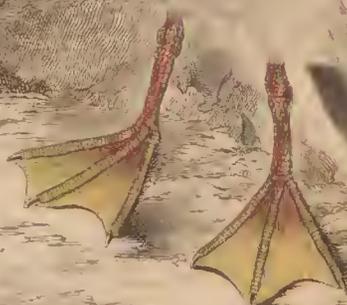


PERDIA. PARTRIDGES.
 1. *P. megapoda* Large footed P Female
 2. ———— Male
 3. *Cinereus* The Common
 4. *fulvus* Red legged



16. *Landse Turvey sc*

- | | |
|-----------------------------|------------|
| 1. <i>Ardeotis maculosa</i> | Sacred I |
| 2. <i>papillosa</i> | Papillated |
| 3. <i>plumbea</i> | Lead-color |
| 4. <i>alba</i> | White |
| 5. <i>chalcoptra</i> | Metallic |



DIDYMEDIA ALBATRO

- 1. *D. exulans* Common
- 2. *Irishiana* Short tail
- 3. *chlororhynchus* Yellow r
- 4. *melanopygia* Black

