"Authentic tidings of invisible things;—
Of ebb and flow, and ever-during power,
And central peace subsisting at the heart
Of endless agitation."—THE EXCURSION.

CHAPTER IV.

An extinct animal recognized by its tooth: how came this to be possible?—The task of classification.—Artificial and natural methods.—Linnæus, and his baptism of the animal kingdom: his scheme of classification.—What is there underlying all true classification?—The chief groups.—What is a species?—Re-statement of the question respecting the fixity or variability of species.—The two hypotheses.—Illustration drawn from the Romance languages.—Caution to disputants.

I WAS one day talking with Professor Owen in the Hunterian Museum, when a gentleman approached with a request to be informed respecting the nature of a curious fossil, which had been dug up by one of his workmen. As he drew the fossil from a small bag, and was about to hand it for examination, Owen quietly remarked:—"That is the third molar of the under-jaw of an extinct species of rhinoceros." The astonishment of the gentleman at this precise and confident description of the fossil, before even it had quitted his hands, was doubtless very great. I know that mine was; until the reflection occurred that if some one, little acquainted with editions, had drawn a volume from his pocket, declaring he had found it in an old chest, any bibliophile would have been able to say at a glance: "That is an Elzevir;" or, "That is one of the Tauchnitz classics, stereotyped at Leipzig." Owen is as familiar with the aspect of the teeth of animals, living and extinct, as a student is with the aspect of editions. Yet before that knowledge could have been acquired, before he could say thus confidently that the tooth belonged to an extinct species of rhinoceros, the united labours of thousands of diligent inquirers must have been directed to the classification of animals. How could he know that the rhinoceros was of that particular species rather than another? and what is meant by species? To trace the history of this confidence would be to tell the long story of zoological investigation: a story too long for narration here, though we may pause awhile to consider its difficulties.

To make a classified catalogue of the books in the British Museum would be a gigantic task; but imagine what that task would be if all the title-pages and other external indications were destroyed! The first attempts would necessarily be of a rough approximative kind, merely endeavouring to make a sort of provisional order amid the chaos, after which succeeding labours might introduce better and better arrangements. The books might first be grouped according to size; but having got them together, it would soon be discovered that size was no indication of their contents: quarto poems and duodecimo histories, octavo grammars and folio dictionaries, would immediately give warning that some other

arrangement was needed. Nor would it be better to separate the books according to the languages in which they were written. The presence or absence of "illustrations" would furnish no better guide; while the bindings would soon be found to follow no rule. Indeed, one by one all the external characters would prove unsatisfactory, and the labourers would finally have to decide upon some internal characters. Having read enough of each book to ascertain whether it was poetry or prose: and if poetry, whether dramatic, epic, lyric, or satiric; and if prose, whether history, philosophy, theology, philology, science, fiction, or essay: a rough classification could be made; but even then there would be many difficulties, such as where to place a work on the philosophy of history—or the history of science,—or theology under the guise of science—or essays on very different subjects; while some works would defy classification.

Gigantic as this labour would be, it would be trifling compared with the labour of classifying all the animals now living (not to mention extinct species), so that the place of any one might be securely and rapidly determined; yet the persistent zeal and sagacity of zoologists have done for the animal kingdom what has not yet been done for the library of the Museum, although the titles of the books are not absent. It has been done by patient *reading* of the contents—by anatomical investigation of the internal structure of animals. Except on a basis of comparative anatomy, there could have been no better a classification of animals than a classification of books according to size, language, binding, &c. An unscientific Pliny might group animals according to their habitat; but when it was known that whales, though living in the water and swimming like fishes, were in reality constructed like air-breathing quadrupeds—when it was known that animals differing so widely as bees, birds, bats, and flying squirrels, or as otters, seals, and cuttle-fish, lived together in the same element, it became obvious that such a principle of arrangement could lead to no practical result. Nor would it suffice to class animals according to their modes of feeding; since in all classes there are samples of each mode. Equally unsatisfactory would be external form—the seal and the whale resembling fishes, the worm resembling the eel, and the eel the serpent.

Two things were necessary: first, that the structure of various animals should be minutely studied, and described—which is equivalent to reading the books to be classified;—and secondly, that some artificial method should be devised of so arranging the immense mass of details as to enable them to be remembered, and also to enable fresh discoveries readily to find a place in the system. We may be perfectly familiar with the contents of a book, yet wholly at a loss where to place it. If we have to catalogue Hegel's *Philosophy of History*, for example, it becomes a difficult question whether to place it under the rubric of philosophy, or under that of history. To decide this point, we must have some system of classification.

In the attempts to construct a system, naturalists are commonly said to have followed two methods: the artificial and the natural. The *artificial method* seizes some one prominent characteristic, and groups all the

individuals together which agree in this one respect. In Botany the artificial method classes plants according to the organs of reproduction; but this has been found so very imperfect that it has been abandoned, and the *natural method* has been substituted, according to which the whole structure of the plant determines its place. If flying were taken as the artificial basis for the grouping of some animals, we should find insects and birds, bats and flying squirrels, grouped together; but the natural method, taking into consideration not one character, but all the essential characters, finds that insects, birds, and bats differ profoundly in their organization: the insect has wings, but its wings are not formed like those of the bird, nor are those of the bird formed like those of the bat. The insect does not breathe by lungs, like the bird and the bat; it has no internal skeleton, like the bird and the bat; and the bird, although it has many points in common with the bat, does not, like it, suckle its young; and thus we may run over the characters of each organization, and find that the three animals belong to widely different groups.

It is to Linnæus that we are indebted for the most ingenious and comprehensive of the many schemes invented for the cataloguing of animal forms; and modern attempts at classification are only improvements on the plan he laid down. First we may notice his admirable invention of the double names. It had been the custom to designate plants and animals according to some name common to a large group, to which was added a description more or less characteristic. An idea may be formed of the necessity of a reform, by conceiving what a laborious and uncertain process it would be if our friends spoke to us of having seen a dog in the garden, and on our asking what kind of dog, instead of their saying "a terrier, a bull-terrier, or a skye-terrier," they were to attempt a description of the dog. Something of this kind was the labour of understanding the nature of an animal from the vague description of it given by naturalists. Linnæus rebaptized the whole animal kingdom upon one intelligible principle. He continued to employ the name common to each group, such as that of *Felis* for the cats, which became the *generic* name; and in lieu of the *description* which was given of each different kind, to indicate that it was a lion, a tiger, a leopard, or a domestic cat, he affixed a *specific* name: thus the animal bearing the description of a lion became *Felis leo;* the tiger, *Felis tigris;* the leopard, *Felis leopardus;* and our domestic friend, *Felis catus*. These double names, as Vogt remarks, are like the Christian- and sur-names by which we distinguish the various members of one family; and instead of speaking of Tomkinson with the flabby face, and Tomkinson with the square forehead, we simply say John and William Tomkinson.

Linnæus did more than this. He not only fixed definite conceptions of Species and Genera, but introduced those of Orders and Classes. Cuvier added Families to Genera, and Sub-kingdoms (*embranchements*) to Classes. Thus a scheme was elaborated by which the whole animal kingdom was arranged in subordinate groups: the sub-kingdoms were divided into classes,

LORD LUFTON AND LUCY ROBARTS.

the classes into orders, the orders into families, the families into genera, the genera into species, and the species into varieties. The guiding principle of anatomical resemblance determined each of these divisions. Those largest groups, which resemble each other only in having what is called the typical character in common, are brought together under the first head. Thus all the groups which agree in possessing a backbone and internal skeleton, although they differ widely in form, structure, and habitat, do nevertheless resemble each other more than they resemble the groups which have no backbone. This great division having been formed, it is seen to arrange itself in very obvious minor divisions, or Classes—the mammalia, birds, reptiles, and fishes. All mammals resemble each other more than they resemble birds; all reptiles resemble each other more than they resemble fishes (in spite of the superficial resemblance between serpents and eels or lampreys). Each Class again falls into the minor groups of Orders; and on the same principles: the monkeys being obviously distinguished from rodents, and the carnivora from the ruminating animals; and so of the rest. In each Order there are generally Families, and the Families fall into Genera, which differ from each other only in fewer and less important characters. The Genera include groups which have still fewer differences, and are called Species; and these again include groups which have only minute and unimportant differences of colour, size, and the like, and are called Sub-species, or Varieties.

Whoever looks at the immensity of the animal kingdom, and observes how intelligibly and systematically it is arranged in these various divisions, will admit that, however imperfect, the scheme is a magnificent product of human ingenuity and labour. It is not an arbitrary arrangement, like the grouping of the stars in constellations; it expresses, though obscurely, the real order of Nature. All true Classification should be to forms what laws are to phenomena: the one reducing varieties to systematic order, as the other reduces phenomena to their relation of sequence. Now if it be true that the classification expresses the real order of nature, and not simply the order which we may find convenient, there will be something more than mere resemblance indicated in the various groups; or, rather let me say, this resemblance itself is the consequence of some community in the things compared, and will therefore be the mark of some deeper cause. What is this cause? Mr. Darwin holds that "propinquity of descent—the only known cause of the similarity of organic beings—is the bond, hidden as it is by various degrees of modification, which is partially revealed to us by our classifications"*—"that the characters which naturalists consider as showing true affinity between any two or more species are those which have been inherited from a common parent, and in so far all true classification is genealogical; that community of descent is the hidden bond which naturalists have been unconsciously seeking, and not some unknown plan of creation, or the enunciation of general pro-

* Darwin: *Origin of Species*, p. 414.

positions, and the mere putting together and separating objects more or less alike."*

Before proceeding to open the philosophical discussion which inevitably arises on the mention of Mr. Darwin's book, I will here set down the chief groups, according to Cuvier's classification, for the benefit of the tyro in natural history, who will easily remember them, and will find the knowledge constantly invoked.

There are four Sub-kingdoms, or Branches:—1. Vertebrata. 2. Mollusca. 3. Articulata. 4. Radiata.

The VERTEBRATA consist of four classes:—Mammalia, Birds, Reptiles, and Fishes.

The MOLLUSCA consist of six classes:—Cephalopoda (cuttlefish), Pteropoda, Gasteropoda (snails, &c.), Acephala (oysters, &c.), Brachiopoda, and Cirrhopoda (barnacles).—N.B. This last class is now removed from the Molluscs and placed among the Crustaceans.

The ARTICULATA are composed of four classes:—Annelids (worms), Crustacea (lobsters, crabs, &c.), Arachnida (spiders), and Insecta.

The RADIATA embrace all the remaining forms; but this group has been so altered since Cuvier's time, that I will not burden your memory just now with an enumeration of the details.

The reader is now in a condition to appreciate the general line of argument adopted in the discussion of Mr. Darwin's book, which is at present exciting very great attention, and which will, at any rate, aid in general culture by opening to many minds new tracts of thought. The benefit in this direction is, however, considerably lessened by the extreme vagueness which is commonly attached to the word "species," as well as by the great want of philosophic culture which impoverishes the majority of our naturalists. I have heard, or read, few arguments on this subject which have not impressed me with the sense that the disputants really attached no distinct ideas to many of the phrases they were uttering. Yet it is obvious that we must first settle what are the facts grouped together and indicated by the word "species," before we can carry on any discussion as to the origin of species. To be battling about the fixity or variability of species, without having rigorously settled *what* species is, can lead to no edifying result.

It is notorious that if you ask even a zoologist, *What* is a species? you will almost always find that he has only a very vague answer to give; and if his answer be precise, it will be the precision of error, and will vanish into contradictions directly it is examined. The consequence of this is, that even the ablest zoologists are constantly at variance as to specific characters, and often cannot agree whether an animal shall be considered of a new species, or only a variety. There could be no such disagreements if specific characters were definite: if we knew *what* species meant, once and for all. Ask a chemist, What is a salt? What an acid?

* DARWIN: *Origin of Species*, p. 420.

and his reply will be definite, and uniformly the same: what he says, all chemists will repeat. Not so the zoologist. Sometimes he will class two animals as of different species, when they only differ in colour, in size, or in the numbers of tentacles, &c.; at other times he will class animals as belonging to the same species, although they differ in size, colour, shape, instincts, habits, &c. The dog, for example, is said to be one species with many varieties, or races. But contrast the pug-dog with the greyhound, the spaniel with the mastiff, the bulldog with the Newfoundland, the setter with the terrier, the sheepdog with the pointer: note the striking differences in their structure and their instincts: and you will find that they differ as widely as some genera, and as most species. If these varieties inhabited different countries—if the pug were peculiar to Australia, and the mastiff to Spain—there is not a naturalist but would class them as of different species. The same remark applies to pigeons and ducks, oxen and sheep.

The reason of this uncertainty is that the *thing* Species does not exist: the term expresses an *abstraction*, like Virtue, or Whiteness; not a definite concrete reality, which can be separated from other things, and always be found the same. Nature produces individuals; these individuals resemble each other in varying degrees; according to their resemblances we group them together as classes, orders, genera, and species; but these terms only express the *relations of resemblance*, they do not indicate the existence of such *things* as classes, orders, genera, or species.* There is a reality indicated by each term—that is to say, a real relation; but there is no objective existence of which we could say, This is variable, This is immutable. Precisely as there is a real relation indicated by the term Goodness, but there is no Goodness apart from the virtuous actions and feelings which we group together under this term. It is true that metaphysicians in past ages angrily debated respecting the Immutability of Virtue, and had no more suspicion of their absurdity, than moderns have who debate respecting the Fixity of Species. Yet no sooner do we understand that Species means a relation of resemblance between animals, than the question of the Fixity, or Variability, of Species resolves itself into this: Can there be any *variation in the resemblances* of closely allied animals? A question which would never be asked.

No one has thought of raising the question of the fixity of varieties, yet it is as legitimate as that of the fixity of species; and we might also argue for the fixity of genera, orders, classes; the fixity of all these being implied in the very terms; since no sooner does any departure from the type present itself, than *by* that it is excluded from the category; no sooner does a white object become gray, or yellow, than it is excluded from the class of white objects. Here, therefore, is a sense in which the phrase "fixity of species" is indisputable; but in this sense the phrase has never been disputed. When zoologists have maintained that species

* CUVIER says, in so many words, that classes, orders, and genera, are abstractions, *et rien de pareil n'existe dans la nature*; but species is *not* an abstraction!—See *Lettres à Pfaff*, p. 179.

are variable, they have meant that *animal forms are variable;* and these variations, gradually accumulating, result at last in such differences as are called specific. Although some zoologists, and speculators who were not zoologists, have believed that the possibility of variation is so great that one species may actually be *transmuted* into another, *i.e.*, that an ass may be developed into a horse,—yet most thinkers are now agreed that such violent changes are impossible; and that every new form becomes established only through the long and gradual accumulation of minute differences in divergent directions.

It is clear, from what has just been said, that the many angry discussions respecting the fixity of species, which, since the days of Lamarck, have disturbed the amity of zoologists and speculative philosophers, would have been considerably abbreviated, had men distinctly appreciated the equivoque which rendered their arguments hazy. I am far from implying that the battle was purely a verbal one. I believe there was a real and important distinction in the doctrines of the two camps; but it seems to me that had a clear understanding of the fact that Species was an abstract term, been uniformly present to their minds, they would have sooner come to an agreement. Instead of the confusing disputes as to whether one Species could ever become another Species, the question would have been, Are animal forms changeable? Can the descendants of animals become so *unlike their ancestors*, in certain peculiarities of structure or instinct, as to be classed by naturalists as a different species?

No sooner is the question thus disengaged from equivoque, than its discussion becomes narrowed within well-marked limits. That animal forms *are* variable, is disputed by no zoologist. The only question which remains is this: *To what extent* are animal forms variable? The answers given have been two: one school declaring that the extent of variability is limited to those trifling characteristics which mark the different Varieties of each Species; the other school declaring that the variability is indefinite, and that all animal forms may have arisen from successive modifications of a very few types, or even of one type.

Now, I would call your attention to one point in this discussion, which ought to be remembered when antagonists are growing angry and bitter over the subject: it is, that both these opinions are necessarily hypothetical —there can be nothing like positive proof adduced on either side. The utmost that either hypothesis can claim is, that it is more consistent with general analogies, and better serves to bring our knowledge of various points into harmony. Neither of them can claim to be a truth which warrants dogmatic decision.

Of these two hypotheses, the first has the weight and majority of authoritative adherents. It declares that all the different kinds of Cats, for example, were distinct and independent creations, each species being originally what we see it to be now, and what it will continue to be as long as it exists: lions, panthers, pumas, leopards, tigers, jaguars, ocelots, and domestic cats, being so many *original stocks*, and not so many *divergent forms of one original*

stock. The second hypothesis declares that all these kinds of cats represent divergencies of the original stock, precisely as the Varieties of each kind represent the divergencies of each Species. It is true that each species, when once formed, only admits of limited variations; any cause which should push the variation *beyond* certain limits would destroy the species,—because by species is meant the group of animals contained *within* those limits. Let us suppose the original stock from which all these kinds of cats have sprung, to have become modified into lions, leopards, and tigers—in other words, that the gradual accumulation of divergencies has resulted in the whole family of cats existing under these three forms. The lions will form a distinct species; this species varies, and in the course of long variation a new species, the puma, rises by the side of it. The leopards also vary, and let us suppose their variation at length assumes so marked a form,—in the ocelot,—that we class it as a new species. There is nothing in this hypothesis but what is strictly consonant with analogies; it is only extending to Species what we know to be the fact with respect to Varieties; and these Varieties which we know to have been produced from one and the same Species are often more widely separated from each other than the lion is from the puma, or the leopard from the ocelot. Mr. Darwin remarks that "at least a score of pigeons might be chosen, which, if shown to an ornithologist, and he were told that they were wild birds, would certainly, I think, be ranked by him as well-defined species. Moreover, I do not believe that any ornithologist would place the English carrier, the short-faced tumbler, the runt, the barb, the pouter and fantail in the same genus! more especially as in each of these breeds several truly-inherited sub-breeds or species, as he might have called them, could be shown him."

The development of numerous specific forms, widely distinguished from each other, out of one common stock, is not a whit more improbable than the development of numerous distinct languages out of a common parent language, which modern philologists have proved to be indubitably the case. Indeed, there is a very remarkable analogy between philology and zoology in this respect: just as the comparative anatomist traces the existence of similar organs, and similar connections of these organs, throughout the various animals classed under one type, so does the comparative philologist detect the family likeness in the various languages scattered from China to the Basque provinces, and from Cape Comorin across the Caucasus to Lapland—a likeness which assures him that the Teutonic, Celtic, Windic, Italic, Hellenic, Iranic, and Indic languages are of common origin, and separated from the Arabian, Aramean, and Hebrew languages, which have another origin. Let us bring together a Frenchman, a Spaniard, an Italian, a Portuguese, a Wallachian, and a Rhætian, and we shall hear six very different languages spoken, the speakers severally unintelligible to each other, their languages differing so widely that one cannot be regarded as the modification of the other; yet we know most positively that all these languages are offshoots from the Latin, which was once a living language, but which is now, so to speak, a fossil.

The various species of cats do not differ more than these six languages differ: and yet the resemblances point in each case to a common origin. Max Müller, in his brilliant essay on *Comparative Mythology*,* has said:—

"If we knew nothing of the existence of Latin—if all historical documents previous to the fifteenth century had been lost—if tradition, even, was silent as to the former existence of a Roman empire, a mere comparison of the six Roman dialects would enable us to say, that at some time there must have been a language from which all these modern dialects derived their origin in common; for without this supposition it would be impossible to account for the facts exhibited by these dialects. Let us look at the auxiliary verb. We find:—

	Italian.	*Wallachian.*	*Rhætian.*	*Spanish.*	*Portuguese.*	*French.*
I am	sono	sum sunt	sunt	soy	sou	suis
Thou art	sei	es	eis	eres	es	es
He is	e	é (este)	ei	es	he	est
We are	siamo	sùntemu	essen	somos	somos	sommes
You are	siete	sùnteti	esses	sois	sois	êtes (estes)
They are	sono	sùnt	eân (sun)	son	são	sont.

It is clear, even from a short consideration of these forms, first, that all are but varieties of one common type; secondly, that it is impossible to consider any one of these six paradigms as the original from which the others had been borrowed. To this we may add, thirdly, that in none of the languages to which these verbal forms belong, do we find the elements of which they could have been composed. If we find such forms as *j'ai aimé*, we can explain them by a mere reference to the radical means which French has still at its command, and the same may be said even of compounds like *j'aimerai*, i.e. *je-aimer-ai*, I have to love, I shall love. But a change from *je suis* to *tu es* is inexplicable by the light of French grammar. These forms could not have grown, so to speak, on French soil, but must have been handed down as relics from a former period—must have existed in some language antecedent to any of the Roman dialects. Now, fortunately, in this case, we are not left to a mere inference, but as we possess the Latin verb, we can prove how, by phonetic corruption, and by mistaken analogies, every one of the six paradigms is but a national metamorphosis of the Latin original.

"Let us now look at another set of paradigms:—

	Sanskrit.	*Lithuanian.*	*Zend.*	*Doric.*	*Old Slavonic.*	*Latin.*	*Gothic.*	*Armen.*
I am	ásmi	esmi	ahmi	ἐμμι	yesmĕ	sum	im	em
Thou art	ási	essi	ahi	ἐσσι	yesi	es	is	es
He is	ásti	esti	asti	ἐστί	yestŏ	est	ist	ê
We (two) are . . .	'svás	esva	...	.....	yesva	...	siju	...
You (two) are . .	'sthás	esta	stho?	ἔστόν	yesta	...	sijuts	...
They (two) are . .	'stás	(esti)	sto?	ἐστόν	yesta	...	...	...
We are	'smás	esmi	hmahi	ἐσμές	yesmŏ	sumus	sijum	emq
You are	'sthá	este	stha	ἐστέ	yeste	estis	sijup	êq
They are	sánti	(esti)	hĕnti	ἐντί	somtĕ	sunt	sind	en

* See *Oxford Essays*, 1856.

"From a careful consideration of these forms, we ought to draw exactly the same conclusions; firstly, that all are but varieties of one common type; secondly, that it is impossible to consider any of them as the original from which the others have been borrowed; and thirdly, that here again, none of the languages in which these verbal forms occur possess the elements of which they are composed."

All these languages resemble each other so closely that they point to some more ancient language which was to them what Latin was to the six Romance languages; and in the same way we are justified in supposing that all the classes of the vertebrate animals point to the existence of some elder type, now extinct, from which they were all developed.

I have thus stated what are the two hypotheses on this question. There is only one more preliminary which it is needful to notice here, and that is, to caution the reader against the tendency, unhappily too common, of supposing that an adversary holds opinions which are transparently absurd. When we hear an hypothesis which is either novel, or unacceptable to us, we are apt to draw some very ridiculous conclusion from it, and to assume that this conclusion is seriously held by its upholders. Thus the zoologists who maintain the variability of species are sometimes asked if they believe a goose was developed out of an oyster, or a rhinoceros from a mouse? the questioner apparently having no misgiving as to the candour of his ridicule. There are three modes of combating a doctrine. The first is to point out its strongest positions, and then show them to be erroneous or incomplete; but this plan is generally difficult, and sometimes impossible; it is not, therefore, much in vogue. The second is to render the doctrine ridiculous, by pretending that it includes certain extravagant propositions, of which it is entirely innocent. The third is to render the doctrine odious, by forcing on it certain conclusions, which it would repudiate, but which are declared to be "the inevitable consequences" of such a doctrine. Now it is undoubtedly true that men frequently maintain very absurd opinions; but it is neither candid, nor wise, to assume that men who otherwise are certainly not fools, hold opinions the absurdity of which is transparent.

Let us not, therefore, tax the followers of Lamarck, Geoffroy St. Hilaire, or Mr. Darwin with absurdities they have not advocated; but rather endeavour to see what solid argument they have for the basis of their hypothesis.

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