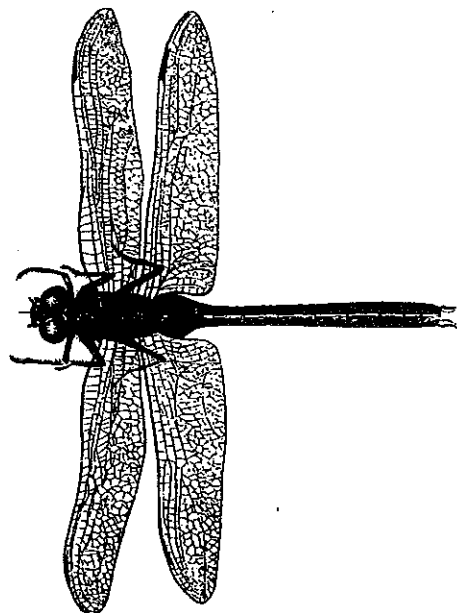


ZOOLOGICAL PHILOSOPHY

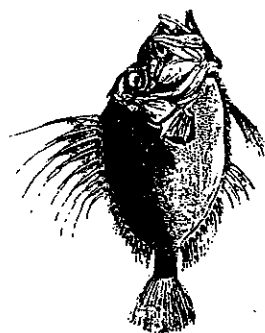
An Exposition with Regard to the Natural History of Animals

J. B. Lamarck



Translated by Hugh Elliot

With Introductory Essays by
David L. Hull and
Richard W. Burkhardt, Jr.



The University of Chicago Press
Chicago and London

was still almost negligible. It is continually being discredited for those who have seen much, who have long watched nature, and who have consulted with profit the rich collections of our museums.

Moreover, all those who are much occupied with the study of natural history, know that naturalists now find it extremely difficult to decide what objects should be regarded as species.

They are in fact not aware that species have really only a constancy relative to the duration of the conditions in which are placed the individuals composing it; nor that some of these individuals have varied, and constitute races which shade gradually into some other neighbouring species. Hence, naturalists come to arbitrary decisions about individuals observed in various countries and diverse conditions, sometimes calling them varieties and sometimes species. The work connected with the determination of species therefore becomes daily more defective, that is to say, more complicated and confused.

It has indeed long been observed that collections of individuals exist which resemble one another in their organisation and in the sum total of their parts, and which have kept in the same condition from generation to generation, ever since they have been known. So much so that there seemed a justification for regarding any collection of like individuals as constituting so many invariable species. Now attention was not paid to the fact that the individuals of the species perpetuate themselves without variation only so long as the conditions of their existence do not vary in essential particulars. Since existing prejudices harmonise well with these successive regenerations of like individuals, it has been imagined that every species is invariable and as old as nature, and that it was specially created by the Supreme Author of all existing things.

Doubtless, nothing exists but by the will of the Sublime Author of all things, but can we set rules for him in the execution of his will, or fix the routine for him to observe? Could not his infinite power create an *order of things* which gave existence successively to all that we see as well as to all that exists but that we do not see?

Assuredly, whatever his will may have been, the immensity of his power is always the same, and in whatever manner that supreme will may have asserted itself, nothing can diminish its grandeur.

I shall then respect the decrees of that infinite wisdom and confine myself to the sphere of a pure observer of nature. If I succeed in unravelling anything in her methods, I shall say without fear of error that it has pleased the Author of nature to endow her with that faculty and power.

The idea formed of species among living bodies was quite simple, easy to understand, and seemed confirmed by the constancy in the

shapes of individuals, perpetuated by reproduction or generation. Such are a great number of these alleged species that we see every day.

Meanwhile, the farther we advance in our knowledge of the various organised bodies which cover almost every part of the earth's surface, the greater becomes our difficulty in determining what should be regarded as a species, and still more in finding the boundaries and distinctions of genera.

According as the productions of nature are collected and our museums grow richer, we see nearly all the gaps filled up and the lines of demarcation effaced. We find ourselves reduced to an arbitrary decision which sometimes leads us to take the smallest differences of varieties and erect them into what we call species, and sometimes leads us to describe as a variety of some species slightly differing individuals which others regard as constituting a separate species.

Let me repeat that the richer our collections grow, the more proofs do we find that everything is more or less merged into everything else, that noticeable differences disappear, and that nature usually leaves us nothing but minute, nay puerile, details on which to found our distinctions.

How many genera there are both among animals and plants, among which the number of species referred to them is so great that the study and determination of these species are well nigh impracticable! The species of these genera, arranged in series according to their natural affinities, exhibit such slight differences from those next them as to coalesce with them. These species merge more or less into one another, so that there is no means of stating the small differences that distinguish them.

It is only those who have long and diligently studied the question of species, and who have examined rich collections, that are in a position to know to what extent species among living bodies merge into one another. And no one else can know that species only appear to be isolated, because others are lacking which are close to them but have not yet been collected.

I do not mean that existing animals form a very simple series, regularly graded throughout; but I do mean that they form a branching series, irregularly graded and free from discontinuity, or at least once free from it. For it is alleged that there is now occasional discontinuity, owing to some species having been lost. It follows that the species terminating each branch of the general series are connected on one side at least with other neighbouring species which merge into them. This I am now able to prove by means of well-known facts.

I require no hypothesis or supposition; I call all observing naturalists to witness.

Not only many genera but entire orders, and sometimes even classes, furnish instances of almost complete portions of the series which I have just indicated.

When in these cases the species have been arranged in series, and are all properly placed according to their natural affinities, if you choose one, and then, jumping over several others, take another a little way off, these two species when compared will exhibit great differences. It is thus in the first instance that we began to see such of nature's productions as lay nearest to us. Generic and specific distinctions were then quite easy to establish; but now that our collections are very rich, if you follow the above-mentioned series from the first species chosen to the second, which is very different from it, you reach it by slow gradations without having observed any noticeable distinctions.

I ask, where is the experienced zoologist or botanist who is not convinced of the truth of what I state?

How great the difficulty now is of studying and satisfactorily deciding on species among that multitude of every kind of polyps, radiarians, worms, and especially insects, such as butterflies, *Phalaena*, *Noctua*, *Tinea*, flies, *Ichneumon*, *Curculio*, *Cerambyx*, chafers, rose-chafers, etc.! These genera alone possess so many species which merge indefinitely into one another.

What a swarm of mollusc shells are furnished by every country and every sea, eluding our means of distinction and draining our resources.

Consider again, fishes, reptiles, birds and even mammals; you will see that except for gaps still to be filled, neighbouring species and even genera are separated by the finest differences, so that we have scarcely any foothold for setting up sound distinctions.

Is there not an exactly similar state of affairs in the case of botany, which deals with the other series, consisting of plants?

How great indeed are the difficulties of the study and determination of species in the genera *Lichen*, *Fucus*, *Carex*, *Poa*, *Piper*, *Euphorbia*, *Erica*, *Hieracium*, *Solanum*, *Geranium*, *Mimosa*, etc., etc.

When these genera were constituted only a small number of species belonging to them were known, and it was then easy to distinguish them; but now that nearly all the gaps are filled, our specific differences are necessarily minute and usually inadequate.

Let us see what are the causes which have given rise to this undoubted state of affairs; let us see if nature affords any explanation, and whether observation can help us.

We learn from a number of facts that, according as the individuals of one of our species change their abode, climate, habits, or manner

of life, they become subject to influences which little by little alter the consistency and proportions of their parts, their shape, properties and even their organisation; so that in course of time everything in them shares in these mutations.

In the same climate, very different habitats and conditions at first merely cause variations in the individuals exposed to them; but in course of time the continued change of habitat in the individuals of which I speak, living and reproducing in these new conditions, induces alterations in them which become more or less essential to their being; thus, after a long succession of generations these individuals, originally belonging to one species, become at length transformed into a new species distinct from the first.

Suppose, for example, that the seeds of a grass or any other plant that grows normally in a damp meadow, are somehow conveyed first to the slope of a neighbouring hill where the ground although higher is still rich enough to allow the plant to maintain its existence. Suppose that then, after living there and reproducing itself many times, it reaches little by little the dry and almost barren ground of a mountain side. If the plant succeeds in living there and perpetuating itself for a number of generations, it will have become so altered that botanists who come across it will erect it into a separate species.

The same thing happens in the case of animals that are forced by circumstances to change their climate, habits, and manner of life: but in their case more time is required to work any noticeable change than in the case of plants.

The idea of bringing together under the name of species a collection of like individuals, which perpetuate themselves unchanged by reproduction and are as old as nature, involved the assumption that the individuals of one species could not unite in reproductive acts with individuals of a different species.

Unfortunately, observation has proved and continues every day to prove that this assumption is unwarranted; for the hybrids so common among plants, and the copulations so often noticed between animals of very different species, disclose the fact that the boundaries between these alleged constant species are not so impassable as had been imagined.

It is true that often nothing results from these strange copulations, especially when the animals are very disparate; and when anything does happen the resulting individuals are usually infertile; but we also know that when there is less disparity these defects do not occur. Now this cause is by itself sufficient gradually to create varieties, which then become races, and in course of time constitute what we call species.

To assist us to a judgment as to whether the idea of species has any real foundation, let us revert to the principles already set forth; they show:

(1) That all the organised bodies of our earth are true productions of nature, wrought successively throughout long periods of time.

(2) That in her procedure, nature began and still begins by fashioning the simplest of organised bodies, and that it is these alone which she fashions immediately, that is to say, only the rudiments of organisation indicated in the term *spontaneous generation*.

(3) That, since the rudiments of the animal and plant were fashioned in suitable places and conditions, the properties of a commencing life and established organic movement necessarily caused a gradual development of the organs, and in course of time produced diversity in them as in the limbs.

(4) That the property of growth is inherent in every part of the organised body, from the earliest manifestations of life; and then gave rise to different kinds of multiplication and reproduction, so that the increase of complexity of organisation, and of the shape and variety of the parts, has been preserved.

(5) That with the help of time, of conditions that necessarily were favourable, of the changes successively undergone by every part of the earth's surface, and, finally, of the power of new conditions and habits to modify the organs of living bodies, all those which now exist have imperceptibly been fashioned such as we see them.

(6) That, finally, in this state of affairs every living body underwent greater or smaller changes in its organisation and its parts; so that what we call species were imperceptibly fashioned among them one after another and have only a relative constancy, and are not as old as nature.

But objections may be raised to the allegation that nature has little by little fashioned the various animals known to us by the aid of much time and an infinite variation of environment. It may be asked whether this allegation is not refuted by the single fact of the wonderful variety observed in the *instinct* of various animals, and in the marvellous *skill* of all kinds which they exhibit.

Will anyone, it may be asked, venture to carry his love of system so far as to say that nature has created single-handed that astonishing diversity of powers, artifice, cunning, foresight, patience and skill, of which we find so many examples among animals? Is not what we see in the single class of insects far more than enough to convince us that nature cannot herself produce so many wonders; and to compel the most obstinate philosopher to recognise that the will of the Supreme Author of all things must be here invoked, and could alone suffice for bringing into existence so many wonderful things?

No doubt he would be a bold man, or rather a complete lunatic, who should propose to set limits to the power of the first Author of all things; but for this very reason no one can venture to deny that this infinite power may have willed what nature herself shows us it has willed.

This being so, if I find that nature herself works all the wonders just mentioned; that she has created organisation, life and even feeling, that she has multiplied and diversified within unknown limits the organs and faculties of the organised bodies whose existence she subserves or propagates; that by the sole instrumentality of *needs*, establishing and controlling habits, she has created in animals the fountain of all their acts and all their faculties, from the simplest to instinct, to skill, and finally to reason; if I find all this, should I not recognise in this power of nature, that is to say in the order of existing things, the execution of the will of her Sublime Author, who was able to will that she should have this power?

Shall I admire the greatness of the power of this first cause of everything any the less if it has pleased him that things should be so, than if his will by separate acts had occupied itself and still continued to occupy itself with the details of all the special creations, variations, developments, destructions and renewals, in short, with all the mutations which take place at large among existing things?

Now I hope to prove that nature possesses the necessary powers and faculties for producing herself that so much excite our wonder.

The objection is still raised however that everything we see in living bodies indicates an unchangeable constancy in the preservation of their form. It is held that all animals whose history has come down to us for two or three thousand years have always been the same, and neither lost nor acquired anything in the perfection of their organs and the shape of their parts.

Not only had this apparent stability passed for an undoubted fact, but an attempt has recently been made to find special proofs of it in a report on the natural history collections brought from Egypt by M. Geoffroy. The authors of the report express themselves as follows:

"The collection has in the first place this peculiarity, that it may be said to contain animals of all periods. It has long been asked whether species change their shape in the course of time. This question, apparently so futile, is none the less necessary for the history of the world, and consequently for the solution of innumerable other questions which are not foreign to the gravest subjects of human worship.

"We have never been in so good a position to settle this question,

in so far as concerns a large number of remarkable species and some thousands that are not remarkable. It appears as though the superstition of the ancient Egyptians were inspired by nature for the purpose of leaving a record of her history."

"It is impossible," continue the authors of the report, "to control our flights of imagination, on seeing still preserved with its smallest bones and hair, perfectly recognisable, an animal which two or three thousand years ago had in Thebes or Memphis its priests and altars. But without giving rein to all the ideas suggested by this approach to antiquity, we shall confine ourselves to the announcement that this part of M. Geoffroy's collection shows that these animals are exactly similar to those of to-day." (*Annales du Muséum d'Histoire Naturelle*, vol. i. pp. 235 and 236.)

I do not refuse to believe in the close resemblance of these animals with individuals of the same species living to-day. Thus, the birds that were worshipped and embalmed by the Egyptians two or three thousand years ago are still exactly like those which now live in that country.

It would indeed be very odd if it were otherwise; for the position and climate of Egypt are still very nearly what they were in those times. Now the birds which live there, being still in the same conditions as they were formerly, could not possibly have been forced into a change of habits.

Furthermore, it is obvious that birds, since they can travel so easily and choose the places which suit them, are less liable than many other animals to suffer from variations in local conditions, and hence less hindered in their habits.

Indeed there is nothing in the observation now cited that is contrary to the principles which I have set forth on this subject; or which proves that the animals concerned have existed in nature for all time; it proves only that they inhabited Egypt two or three thousand years ago; and every man who has any habit of reflection and at the same time of observing the monuments of nature's antiquity will easily appreciate the import of a duration of two or three thousand years in comparison with it.

Hence we may be sure that this appearance of stability of the things in nature will by the vulgar always be taken for reality; because people in general judge everything with reference to themselves.

For the man who forms his judgment only with reference to the changes that he himself perceives, the eras of these mutations are stationary states which appear to him to be unlimited, on account of the shortness of the existence of individuals of his own species.

Moreover, we must remember that the records of his observations, and the notes of facts which he has been able to register, only extend back a few thousand years; which is a time infinitely great with reference to himself, but very small with reference to the time occupied by the great changes occurring on the surface of the earth. Everything seems to him to be *stable* in the planet which he inhabits; and he is led to repudiate the signs which exist everywhere in the monuments heaped up around him, or buried in the soil which he tramples underfoot.

Magnitudes are relative both in space and time: let man take that truth to heart, and he will then be more reserved in his judgments on the stability which he attributes to the state of things that he observes in nature. (See the Appendix, p. 141, of my *Recherches sur les corps vivants*.)

In order to admit the imperceptible changing of species, and the modifications which their individuals undergo according as they are forced to change their habits and contract new ones, we are not reduced to a mere consideration of the very short spaces of time comprised in our observations; for, in addition to this induction, a number of facts collected many years ago throw enough light on the question to free it from doubt; and I can now affirm that our observations are so far advanced that the solution sought for is patent.

Indeed not only do we know the results of anomalous fertilisations, but we also now know positively that a compulsory and sustained alteration in the habitats and manner of life of animals works after a sufficient time a very remarkable mutation in the individuals exposed to it.

Consider the animal which normally lives in freedom in plains where it habitually exerts itself by swift running; or the bird which is compelled by its needs to pass incessantly through large spaces in the air. When they find themselves imprisoned, the one in the dens of a menagerie or in our stables, the other in our cages or back yards, they undergo in course of time striking alterations, especially after a succession of generations in their new state.

The former loses a great part of his swiftness and agility; his body thickens, the strength and subtleness of his limbs diminish, and his faculties are no longer the same; the latter becomes heavy, can scarcely fly, and takes on more flesh in all his parts.

In Chapter VI. of this Part I., I shall have occasion to prove by well-known facts the power of changes of conditions for giving to animals new needs, and leading them on to new actions; the power of new actions when repeated to induce new habits and inclinations;

finally, the power resulting from the more or less frequent use of any organ to modify that organ either by strengthening, developing and increasing it, or by weakening, reducing, attenuating it, and even making it disappear.

With regard to plants, the same thing may be seen as a result of new conditions on their manner of life and the state of their parts; so that we shall no longer be astonished to see the considerable changes that we have brought about in those that we have long cultivated.

Thus, among living bodies, nature, as I have already said, definitely contains nothing but individuals which succeed one another by reproduction and spring from one another; but the species among them have only a relative constancy and are only invariable temporarily.

Nevertheless, to facilitate the study and knowledge of so many different bodies it is useful to give the name of species to any collection of like individuals perpetuated by reproduction without change, so long as their environment does not alter enough to cause variations in their habits, character and shape.

OF THE SPECIES ALLEGED TO BE LOST.

I am still doubtful whether the means adopted by nature to ensure the preservation of species or races have been so inadequate that entire races are now extinct or lost.

Yet the fossil remains that we find buried in the soil in so many different places show us the remains of a multitude of different animals which have existed, and among which are found only a very small number of which we now know any living analogues exactly alike.

Does this fact really furnish any grounds for inferring that the species which we find in the fossil state, and of which no living individual completely similar is known to us, no longer exist in nature? There are many parts of the earth's surface to which we have never penetrated, many others that men capable of observing have merely passed through, and many others again, like the various parts of the sea-bottom, in which we have few means of discovering the animals living there. The species that we do not know might well remain hidden in these various places.

If there really are lost species, it can doubtless only be among the large animals which live on the dry parts of the earth; where man exercises absolute sway, and has compassed the destruction of all the individuals of some species which he has not wished to preserve or domesticate. Hence arises the possibility that animals of the genera *Palaeotherium*, *Anoplotherium*, *Megalonix*, *Megatherium*, *Mastodon*, of M. Cuvier, and some other species of genera previously known,

are no longer extant in nature: this however is nothing more than a possibility.

But animals living in the waters, especially the sea waters, and in addition all the races of small sizes living on the surface of the earth and breathing air, are protected from the destruction of their species by man. Their multiplication is so rapid and their means of evading pursuit or traps are so great, that there is no likelihood of his being able to destroy the entire species of any of these animals.

It is then only the large terrestrial animals that are liable to extermination by man. This extermination may actually have occurred; but its existence is not yet completely proved.

Nevertheless, among the fossil remains found of animals which existed in the past, there are a very large number belonging to animals of which no living and exactly similar analogue is known; and among these the majority belong to molluscs with shells, since it is only the shells of these animals which remain to us.

Now, if a quantity of these fossil shells exhibit differences which prevent us, in accordance with prevailing opinion, from regarding them as the representatives of similar species that we know, does it necessarily follow that these shells belong to species actually lost? Why, moreover, should they be lost, since man cannot have compassed their destruction? May it not be possible on the other hand, that the fossils in question belonged to species still existing, but which have changed since that time and become converted into the similar species that we now actually find. The following consideration, and our observations throughout this work, will give much probability to such an assumption.

Every qualified observer knows that nothing on the surface of the earth remains permanently in the same state. Everything in time undergoes various mutations, more or less rapid according to the nature of the objects and the conditions; elevated ground is constantly being denuded by the combined action of the sun, rain-waters and yet other causes; everything detached from it is carried to lower ground; the beds of streams, of rivers, even of seas change in shape and depth, and shift imperceptibly; in short, everything on the surface of the earth changes its situation, shape, nature and appearance, and even climates are not more stable.

Now I shall endeavour to show that variations in the environment induce changes in the needs, habits and mode of life of living beings, and especially of animals; and that these changes give rise to modifications or developments in their organs and the shape of their parts. If this is so, it is difficult to deny that the shape or external characters of every living body whatever must vary imperceptibly, although that variation only becomes perceptible after a considerable time.

Let us then no longer be astonished that among the numerous fossils found in all the dry parts of the world, and constituting the remains of so many animals which formerly existed, there are so few of which we recognise the living representatives.

What we should wonder at, on the contrary, is finding amongst these numerous fossil remains of once living bodies, any of which the still existing analogues are known to us. This fact, proved by our collections of fossils, suggests that the fossil remains of animals whose living analogues we know are the least ancient fossils. The species to which each of them belongs doubtless has not had time to undergo variation.

Naturalists who did not perceive the changes undergone by most animals in course of time tried to explain the facts connected with fossils, as well as the commotions known to have occurred in different parts of the earth's surface, by the supposition of a universal catastrophe which took place on our globe. They imagined that everything had been displaced by it, and that a great number of the species then existing had been destroyed.

Unfortunately this facile method of explaining the operations of nature, when we cannot see their causes, has no basis beyond the imagination which created it, and cannot be supported by proof.

Local catastrophes, it is true, such as those produced by earthquakes, volcanoes and other special causes are well known, and we can observe the disorder ensuing from them.

But why are we to assume without proof a universal catastrophe, when the better known procedure of nature suffices to account for all the facts which we can observe?

Consider on the one hand that in all nature's works nothing is done abruptly, but that she acts everywhere slowly and by successive stages; and on the other hand that the special or local causes of disorders, commotions, displacements, etc., can account for everything that we observe on the surface of the earth, while still remaining subject to nature's laws and general procedure. It will then be recognised that there is no necessity whatever to imagine that a universal catastrophe came to overthrow everything, and destroy a great part of nature's own works.

I have said enough on a subject which presents no difficulty. Let us now consider the general principles and essential characters of animals.