Taxa as types: Buffon, Cuvier and Lamarck

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Abstract

From a Darwinian point of view, taxonomic groups are understood as historical entities that arise at an evolutionary moment and that can always disappear. But these groups were also understood by many naturalists as natural kinds; in other words, as permanent, ahistorical types. I will explore some of the forms that this typological thought took, showing that this typological perspective neither depends on theological beliefs, nor obeys the adoption of an ontology that might contradict natural science. Thus I shall analyze Buffon's understanding of species and the ways in which Cuvier and Lamarck understood the higher taxonomic orders.

Keywords: Buffon (George-Louis Leclerc, comte de; 1707-1788); Georges Cuvier (1769-1832); Jean-Baptiste de Lamarck (1744-1829); individuals; natural kinds.

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Originally proposed by Ghiselin (1974; 1997) and Hull (1994; 1984), and accepted by authors such as Wiley (1980), Eldredge (1985), Sober (1993), Gould (2002) and Ruse (2009), the thesis according to which, in evolutionary biology, species and also the higher taxonomic groups are considered real individual entities rather than natural or artificial kinds may be seen as hegemonic in the philosophy of biology (Ereshefsky, 2007, p.406, 2008, p.102). In fact, I believe it perfectly captures the Darwinian understanding of taxonomic groups. I think that apart from some nominalist leanings which can certainly be found in the *Origin of Species* (cf. Ghiselin, 1983; Waizbort, 2000; Stamos, 2007; Makinistian, 2009), the Ghiselin-Hull thesis correctly states the ontology or onto-taxonomy seen not only in the work of Darwin but all current evolutionary biology.

Therefore, in this article, I shall simply restate the Ghiselin-Hull thesis clearly and briefly so as to be able to turn to what interests me here: determining, through reference to actual historical cases, what it means to understand taxonomic groups as 'types', or, in other words, as 'natural kinds'. In Darwinian terms, I start, therefore, with the following assumption: that all taxonomic groups are understood as historical entities that arise at a given moment of evolution and can, like any other individual entity, disappear forever. But those groups can also be understood as natural kinds; many naturalists have seen them as permanent, ahistorical types. I wish to show some of the forms of this typological thought. I shall analyze Buffon's understanding of species and Cuvier and Lamarck's concept of the higher taxonomic groups. But I do so with two clear goals in mind.

The most explicit is to show that the adoption of this typological perspective was not indebted to theology nor did it obey an ontology that opposed the development of natural science.[1] But my main goal is to contribute to a better understanding of the Darwinian approach to biological classification. So, although I recognize that the individual character Darwinism attributes to taxa is well-known and discussed, I shall attempt to provide a deeper understanding of this aspect of Darwinian thought by illustrating some of the typological approaches to those taxa. For, even though as philosophers or historians of biology we need to grasp what it means to think in Darwinian terms, it is vital for us to have a clear understanding of non-Darwinian modes of thinking.

I believe that in order to understand Darwinian thought and get a clear sense of how innovative it was in the development of natural history, we need to look at other ways of thinking about the field that were once dominant but were later refuted and displaced by the Darwinian revolution. I would even argue that without that exercise in hindsight, the Ghiselin-Hull thesis itself might be seen as nonsensical or, in the best-case scenario, as merely obvious. But their thesis demonstrates one of the many epistemological novelties implied by Darwinism; and the analysis of pre-Darwinian models for taxonomic groups, which is the immediate goal of this article, helps us better appreciate the nature of that novelty.

Individuality and taxonomic groups

To state that in evolutionary biology the species and other taxa are seen as individuals does not imply that they are therefore considered organisms or super-organisms. Organisms, after all, are not the only entities we recognize as individuals (Ghiselin, 1997, pp.37-38). We also recognize a stone, an island or a planet as being individuals or individual entities. All these things are individuals in the same way that species and other taxonomic groups are; and by stating this, we are fundamentally acknowledging that they do not constitute natural kinds (Ereschefsky, 2007, p.406, 2008, p.102).

We need, therefore, to be clear in our definition of what we understand by natural kinds, but I think that for the purposes of this article it is enough to cite Marzia Soavi's proposal (2009). According to her, natural kinds are "kinds whose instances are objects that share one or more properties that are fundamental from a certain theoretical point of view. For example, samples of the same chemical kinds share the same molecular composition or have the same atomic number." Thus, "natural kinds are characterized as kinds that strongly support induction, that is, they allow for the discovery of properties that are projectable over their instances;" and it is for that reason also that they are usually "contrasted with kinds whose instances do not share any theoretically relevant property." These ones "are sometimes called 'artificial kinds' or, alternatively, 'nominal kinds'" (p.185) Thus, while from the point of view of biology, domesticated animals in pre-Columbian America constitute a clear example of an artificial kind, categories designated by terms such as stratovolcanoes or water-soluble are good examples of natural kinds.

These latter terms, designating natural kinds, are predicated on any object that we assume to possess certain properties and dispositions: 'stratovolcano' is predicated on any volcano that has a particular structure; and 'water-soluble' is predicated on any substance that we suppose capable of dissolving in water. The names of natural kinds are, in this sense, general ones; and that helps us understand the distinction between kinds and individuals. Individuals are or can be designated by proper names such as Vesuvius, the Malvinas or Neptune (Zink, 1963); and when taxonomic groups are said to be individuals it means that species designations such as *Panthera leo*, or genus names such as *Panthera*, are working as proper nouns and not as designations of kinds, whether natural or artificial.

But the difference between individuals and natural kinds is more than mere semantics; among other things, it has to do with a very important distinction between that which can undergo processes and that which, while regulating those processes, does not participate in them. The former belongs to individuals and the latter to natural kinds; so, to state that taxonomic groups are individuals is also to stress that they are real entities that undergo real processes (Wiley 1980, p.78; Ghiselin, 1997, p.302). They arise in a given moment, evolve – anagetically or cladogenetically – and eventually die out, as so many species have done, as well as higher taxa like the trilobites. Individual stones roll and break; individual volcanoes are formed and erupt; and all species, like other taxa, arise at a given moment, evolve and may die out.

Thus, re-using part of the distinction proposed by George Gaylord Simpson (1970, p.40) between the immanent and configurational properties of the universe, we can say that while natural kinds – such as volcano or water-soluble body – belong to the dominion of the immanent, particular processes and the individual entities that undergo them belong to the realm of the configurational. Individual volcanoes that form and may erupt belong in that latter group, as do the different bodies composed by soluble substances that can dissolve; and all the taxa that have arisen throughout the history of life belong to that dimension of the configurational: they can always split off into new taxonomic groups or die out.

The immanent, as Simpson stressed (1970, p.40), is the non-historical, the constant, the uniform, that which does not change but presides over change; so it can be said that the immanent does not undergo processes, it regulates them. The configurational, however, is historical and is made up of the individual entities that change and undergo processes such as dissolution, eruption and extinction. Such entities are temporary configurations that arise and dissolve in the history of the universe; and I think we need to place Ghiselin's opposition (1997, p.9) between crystal species and biological species in the framework of this distinction between the immanent and the configurational:

> The various "species" of crystals differ from the species of evolutionary biology in a most fundamental manner. There is nothing historical about them. To be sure, any given mineral crystal that you can pick up and hold in your hand has a history, a location, a beginning, and an end. But there is nothing fundamentally different about the crystals of calcite that formed in the Cambrian from those that are being formed today. The laws of nature that determine their structure have not changed in the least. Calcite is calcite, it always has been, and it always will be, for ever and ever, everywhere.

The possible forms the crystals may take, their different species, obey immanent, uniform, constant, unbreakable principles; therefore, these species themselves are immanent: they really are natural kinds. A particular crystal, on the other hand, is an individual that can grow and break apart – like biological taxa, which, while also individual, can evolve and become extinct. So those taxa belong, like individual crystals, particular volcanoes and all organisms, to the sphere of the configurational, the sphere of individual entities subject to time, that arise at a particular moment of the history of the universe, undergo processes and can eventually disappear forever without that fact changing anything in the constant sphere of laws and natural kinds that Simpson called 'the immanent'.

Species as crystals

But Darwinism is certainly not the only way of thinking about species. There are others, naturally. For Louis Agassiz (1857, p.8), species and other higher taxonomic groups were, literally, "categories of [the Divine Intelligence's] mode of thinking."

This implied that ascribing a specimen to a species meant treating it as an example, an instance, a case of that concept that was always present in the Creator's mind. Thus, famous horses such as Gato and Mancha would not be considered mere members of the species *Equus caballus* but as examples of horses: concrete entities that present characteristics that supposedly define what it is to be a horse and what it is to be a horse in God's mind.

So, from Agassiz's point of view, if all the horses alive today were to die without producing offspring and God decided to create new organisms with those characteristics, they would undoubtedly be horses. However, in Darwinian terms, if it so happened that the horses' extinction was followed by the evolution, possibly guided by natural selection, of a line of donkeys that eventually acquired all the characteristics we might consider distinctive of horses, we could not say for that reason that the animals were new horses: they would still be considered mere donkeys.

But it is not necessary to point to theological thinkers like Agassiz to find a typological way of thinking about species. Earlier, in the 18th century, Buffon sketched out a materialist explanation of the origin of species which saw them as natural kinds or types (Ghiselin, 1997, p.10; Caponi, 2008a, p.8). According to this theory, clearly formulated in *Les époques de la nature* (The Epochs of Nature) of 1778 (Buffon, 1988), all species of living beings that people the Earth today, both the noble ones that he believed do not degenerate (Buffon, 1761, p.571) and the primitive ancestors of families produced by degeneration (Buffon, 1988, p.27), as well as an indeterminate number of extinct species, were created by successive waves of agglomeration of organic molecules that, far from giving rise to tiny, simple creatures, instead produced the first prototypes of animals as large and complex as the elephant and the hippopotamus (Caponi, 2009, p.692).

Buffon did not, however, see these phenomena of molecular organization as fortuitous and accidental. As Peter Bowler explains (1998, p.135), Buffon saw the "form of each species" as built into the "very fabric of Nature," representing "a potentially stable organization of material particles that will achieve physical manifestation whenever the physical conditions are suitable." Thus, Buffon said (1775, p.509), "In all places where the temperature is the same, one finds not only the same species of plants, the same species of insects, the same species of reptiles without their having been taken there, but also the same species of fish, the same species of quadrupeds, the same species of birds without their having gone there."[2] Further still: considering that temperature conditions on some planets in the solar system and various of their satellites resembled those on Earth, Buffon (p.509) went so far as to declare that "one may believe that all these vast bodies are like the terrestrial globe, covered with plants, and even peopled with sentient beings, somewhat similar to the animals on earth."[3] Like crystals that take on one shape or another depending on the conditions they are formed in, living beings are shaped in one way or another by the conditions presiding at the time of their constitution; and those possible forms of organization, which may or may not occur depending on whether the right conditions arise, are what we call species (Caponi, 2008a, p.8).

So, for Buffon, both the main or noble species and the original ancestors of families affected by degeneration constituted natural types analogous to species of crystals (Ghiselin, 1997, p.9). They were what Simpson meant by immanent forms, exemplified by individual organisms any time the right physical conditions arose for organic molecules to cluster together in a particular way; and it is from that materialist viewpoint, not a theological one, that Buffon (1765) declares that species are perpetual beings, as permanent as nature itself (cf. Caponi, 2008b, p.190). A species, we might therefore say, is not simply a succession of generations of individuals capable of reproducing amongst themselves; it is firstly a type of amalgamation of organic molecules that always happens when a particular set of conditions occurs. Thus, according to Buffon, the same species of birds, reptiles, insects and plants can be found in different places, even on different planets, without that necessarily involving a kinship relation between the populations in those places; and this is where the difference between Buffon's and Darwin's thinking about species emerges most clearly. From the Darwinian point of view, membership of the same taxonomic group, whatever the level, always depends on common descent. Therefore, if there were bacteria on Mars whose organization and ecology were identical to ones on earth, but there was no evidence that they both descended from the same stock, we would not say that they were the same bacteria (Mayr, 1988, p.343). This would be true even if genome sequencing showed the Martian bacteria to be indistinguishable from the earthly ones.

For evolutionary biology, the concept of species is purely genealogical and never typological (Wiley, 1985, p.31; Mayr, 1988, p.345; Gayon, 1992, p.477; Hull, 1998a, p.226). Thus, if the entire remaining population of *Panthera leo persica* began to descend on the food chain, becoming a carrion eater, and in that ecological downturn its morphology, physiology and behaviors transformed to the point that this subspecies of lion became somewhat similar to a hyena, we would not stop considering it part of the species *Panthera leo*. We would still say that this small, slow-moving animal with short back legs that does not hunt or roar, whose males do not have manes and are even smaller than the females, was a lion. Unless, of course, it became clear that all those changes had erected a reproductive barrier between it and the African lion. In that case, even though the barrier that separates the lion from all other species of the genus *Panthera* (tigers, jaguars and leopards) is so fragile and permeable, we would say that *Panthera leo* had stopped existing and there were now two new species.

In Buffon's typological viewpoint, 'being a lion' means having a particular type of organization. Any animal that has such an organization will be a lion: no matter where it comes from and regardless of where, when and how this animal was formed. Being a lion demands a certain morphological and physiological organization: whatever possesses that organization will be a lion and whatever does not will be something else. In Darwinian thought, on the other hand, such considerations are irrelevant; ascribing an individual to a species does not imply anything about its form or organization. Taking them into account, can, of course, make it easier to ascribe a species (Ghiselin, 1997, p.199); but when you say an animal is a lion you are simply saying it is or was an integral part of a cluster of populations derived from one that, a million years ago, began an evolutionary digression from the direction taken by the populations of *Panthera pardus*.

Cuvier's types

It is clear, also, that just as when ascribing a specimen to a species from a Darwinian standpoint, ascribing a species to a genus or a genus to any of the higher orders does not depend on typological considerations (Rosemberg, McShea, 2008, p.42). The reason why the leopard is put in the genus *Panthera* and not in the genus *Neofelis,* which is composed of two species of what are commonly known as panthers, is not the fact that the leopard is formed such a way as to make it closer to the lion and further from panthers. The leopard is considered *Panthera* along with the tiger, the lion and the jaguar because it shares with them a closer common ancestor than the one shared by the species belonging to the genus *Neofelis*. There is not a form type of *Panthera* that would justify this classification: it is justified only by the closer genealogical relationship between the species of the genus *Panthera* (Ghiselin, 1997, p.198).

Thus, even if a species of panther, in the common sense of the word, were morphologically and behaviorally closer to species of the genus *Panthera* than those of the genus *Neofelis*, that fact would not change its taxonomic place because taxonomy only expresses ancestry relationships. Taxonomic orders are monophyletic groups of species that, regardless of any morphological, functional or behavioral similarity, all derive from a common ancestor (Sober, 1992, p.203). To illustrate this we can point to the case of the panda *Ailuropoda melanoleuca* (p.277). Although it is fundamentally a herbivore, there is no paradox in the fact that the panda belongs to the order Carnivora. The species *Ailuropoda melanoleuca* belongs to that order not because it possesses some organizational peculiarity, such as being primarily a meat-eater, but simply because it is descended from a species presumed to be the common ancestor of all the species in the suborders Feliformia (to which the family Felidae belongs) and Caniformia (to which the family Ursidae belongs).

In Darwinian terms, there is no carnivorous essence: there is only a group of species that share a common ancestor and therefore form a monophyletic group that is conventionally named Carnivora. So even though the name is conventional, the group it designates is not an arbitrary one: it is a natural group, a real, individual, historical entity, made up of species that are presumed to share real phylogenetic relationships (Wiley, 1985, p.71). So, if we discovered that seals, *Phocidae,* are not descended from that hypothetical common ancestor shared by the order Carnivora but from the common ancestor of the order Cetacea, we would say that seals are whales without that implying any re-conceptualization of the physiology or morphology of those species. But what would be implied by that name-change is a new hypothesis of the evolutionary history of that group; and here it can be very helpful to distinguish between the phylogenetic or genealogical way of thinking about taxonomic order and the way proposed by Cuvier at the beginning of the 19th century.

For Cuvier, the genealogical perspective was of course excluded from consideration. But that does not mean that, for him, ascribing a living creature to a taxonomic category was merely a question of naming. He differed from classical taxonomists in his view that taxonomic categories were not simply "sorts of regions of similarities, groupings of analogies that could be established either arbitrarily upon a system of signs, or broadly following the general configuration of plants and animals" (Foucault, 1994, p.33).[4]

For Cuvier, putting a living creature in one of those categories was the same as formulating a characterization of physiological organization; it meant assigning it a mode of organization (Appel, 1987, p.45; Bowler, 1996, p.45; Caponi, 2008c, p.36). In other words, if the systematics proposed by Hennig (1968) is, as Darwin believed (1859, pp.128 and ff., pp.413 and ff.), strictly phylogenetic, (Crowson, 1966, p.29; Santos, 2008, p.192; Ruse, 2009, p.159), the kind Cuvier was proposing was strictly physiological; and this has both theoretical consequences concerning the type of knowledge implied by the systematics and also epistemological consequences for the status assigned to the taxonomic orders.

A cladogram is, or at least it implies, a phylogenetic reconstruction (Santos, 2008, pp.191-192; Ruse, 2009, pp.160-161); a Cuverian determination is a physiological thesis centered on the idea that structures and organic functions are hierarchically related according to their organizational importance (Caponi, 2008c, p.37). Some are more important than others and they determine how the less important can and should be; and this is, in fact, what the principle of subordination of characters formulated by Cuvier affirms (1817, pp.10-11) in *Le règne animal*:

> There are some traits of conformation that exclude others; there are some that, on the contrary, need them; therefore, when we perceive this or that trait in a being, we can calculate those which coexist with others, or those which are incompatible with them; the parts, properties or traits of conformation that have the greatest number of relations of incompatibility or coexistence with others, or, in other words, that exercise the most marked influence upon the whole being, are what are called *important characteristics*, *dominant characteristics*, the others are subordinate characteristics, which exist in different degrees. [5]

Given two successive levels of dominance or importance of organic conformation, those belonging to the higher level defined a margin of variation possible for those on the lower level; and the natural method, thought Cuvier, should respect and reflect those relationships of determination and subordination. The higher taxonomic orders would be defined by characteristics of greater dominance; and the lower orders would be defined according to the particular conformations of subordinate characteristics. Thus, ascribing a species to any taxonomic order meant that its physiological economy was determined by certain dominant characteristics shared by all other species in that order; and ascribing that same species to a sub-order within that order meant that the organizational norm took a particular form by virtue of the possession of certain subordinate features that were shared with only part of the species in that order.

In the context of that classification, "belonging to a genus, an order, a class, does not mean sharing with other species fewer such characteristics than the specific ones, it does not mean having a generic characteristic or a class characteristic, it means having a particular organization" (Foucault, 1994, p.33).[6] Therefore, far from being metaphysical archetypes, Cuvier's four types – Vertebrata, Mollusca, Articulata and Radiata – must be understood as physiological or organizational types (Ghiselin, 1983, p.127; Papavero, Llorente-Bousquets, 1994, p.129; Guillo, 2003, p.38); they are the four fundamental modes of the animal economy (Cuvier, 1817, pp.57 and ff.). Any animal that can really exist, or have existed, can only be a variation on one of those four fundamental themes (Cassirer, 1948, p.162) and the exhaustive classification of all beings that have ever existed would constitute a repertory of all the possible variations within those basic planes (Caponi, 2008c, p.39).

For Cuvier, by saying that an animal is a mammal, we are formulating a characterization of its physiology. We are saying something about how that animal carries out its fundamental physiological functions. 'Being a mammal', therefore, implies belonging to a particular type of organization. Something that, analogous to what happens with Buffon's concept of species, is also similar to what it means to say that a molecule is a molecule of water; in this case it has a particular atomic structure and in the case of a mammal it has certain specific organizational features that distinguish those animals from other vertebrates. For a Darwinian biologist, on the other hand, saying that a given species is a mammal simply means saying that it belongs to a particular monophyletic group; and thus, if we discovered that monotremes evolved from theriodonts independently of placentals and marsupials, we would have to change our way of classifying and naming them.

An alternative would be to conclude that the class Mammalia, which is not a monophyletic group, is not a natural group and should be discarded in the pile of unmasked chimera, as occurred with the class of reptiles (Crowson, 1966, p.39); another possibility would be to reformulate the extension granted to that class. We could restrict it to placentals and marsupials, leaving monotremes, despite the fact that they have fur and are warm-blooded, in the company of animals with reptilian physiology; or we could widen it to include the closest common ancestor of the three groups. But it must be pointed out that this last option would lead us to include in the class Mammalia all the species derived from that ancestor; and that would include at least one species of theriodont whose physiology was closer to what we used to call reptiles than to what we usually call mammals. All in all, whatever the fate of the term Mammalia, there would always be a margin for arbitrariness, and, clearly, taxonomy would have to be reformulated to reflect not the organizational similarities on which Cuvier said we should focus, but the phylogenetic connections that effectively exist between the different taxa.

But while this discovery about monotremes would lead us to revise the whole class of Mammalia, the discovery of a sister species of right whale lacking mammary glands whose young feed on krill from birth would have no further taxonomic consequences. The species would be classified as Cetacea and consequently as part of the class Mammalia. A mammal without breasts would, in this sense, be no more problematic than a herbivorous bear like the panda; and this is because, from the perspective of evolution, taxonomic orders, as I said earlier, do not designate types of organism or modes of organization, but simply monophyletic groups, delimited groups of species, of varying breadth.

Cuvier is not dead

Of course, if we insist on thinking about taxonomic orders like physiologists, 'à la Cuvier', we might find this unsatisfactory. We could argue that accepting the theory of evolution does not oblige us to abandon general physiological typifications of living creatures. After all, the fact that birds and mammals do not make up a monophyletic group cannot make us forget that something like homeothermia exists and that it demands certain organizational characteristics; as does gill respiration, even though fish are not a monophyletic group either. But even though these facts might support a taxonomic program based on organizational considerations, this would not be enough to deny that systematics nowadays obeys a genealogical or phylogenetic perspective, and that within this framework, ascriptions to taxonomic groups do not make any typological claims. Being a mammal or a bird does not mean having this or that characteristic or organization, but merely being part of a group of species, a particular branch of species that share a common ancestor.[7]

We can always talk of warm-blooded animals or gill-breathing animals, as of predators or parasites or animals with sexual or asexual reproduction (Sober, 2003, p.278); and we might even attempt to construct parallel taxonomies to the phylogenetic ones, based on physiological, ecological, developmental or purely morphological types, which, following Simpson, we might characterize as immanent, analogous to the species of crystals. And this would give rise to ahistorical, typological classifications like the ones postulated, but never sketched out, by Hans Driesch (1908, p.245) at the beginning of the 20th century and Brian Goodwin (1998a, p.191; 1998b, p.161) at the end of it (Webster, Goodwin, 1996; Hull, 1998b). But, clearly, the legitimacy of the phylogenetic perspective that orients systematics nowadays is independent of the viability and extent of those other taxonomic initiatives.

Thus, even though a physiologist might come to formulate a general characterization of reptiles that saw chelonians, lizards, serpents and crocodiles as specific subtypes of that organizational norm, it would not affect the tracing of phylogenies any more than the fact that the Komodo dragon occupies an analogous place in its ecosystem to the lion (Santos, 2008, pp.192-193). Therefore, so as not to get lost in possible sterile ramifications of the discussion of the ontological status of entities designated by taxonomic categories, we need to assume that it cannot be undertaken without accepting a certain ontological relativism (Ghiselin, 1997, p.181). Deciding whether the word mammal designates an individual entity, something about configuration, or a natural kind stuck in the sphere of the immanent, is not possible without determining our theoretical frame of reference: phylogenetic systematics and evolutionary biology as a whole; or, for example, a purely functional or physiological perspective inherited from Cuvier. Because, from this latter perspective, it is still plausible to think of a typological characterization of what it is to be a mammal.

But we can point to another, even clearer example: the term animal. If we think 'à la Hennig', 'animal' either designates a monophyletic group – an individual historical entity that excludes any species not derived from the group's founding species – or it designates nothing. But we could also consider that 'animal' simply designates any heterotrophic, diploid, multicellular organism (Margulis, Schwartz, 2001, p.205), without examining the phylogenetic question of whether those characteristics are synapomorphies of Metazoa. And in that case, in order to determine whether a living creature is an animal, we would not wait to find out about its phylogenics; we would only need to determine whether it had those characteristics or not.[8] Here, contrary to current systematics, we would think typologically and not genealogically, like Cuvier and not Darwin; but this would be neither scandalous nor anachronistic.

What would indeed be scandalous would be to forget about Lamarck. In one way or another, his ghost keeps coming back as the possible precursor to everything Darwin thought. It is said that myths never die; and that cliché is also true of the myth of the precursor. Thus it is inevitable that we ask ourselves if his *Zoological Philosophy* was indebted to typological thought like the work of two of his contemporaries, his patron Buffon and his critic Cuvier, or whether it shows some of the taxonomic individualism promoted by Darwinism. Whatever the case, we might say, Lamarck was an evolutionist and for him species and higher taxa were the product of a history of nature. I will now show, however, that this is not necessarily true; rather than products of a history of nature, for Lamarck the higher taxonomic orders were the unchanging norm of regular, repeated processes; and species, in a sense, could be the similarly repeatable result of the perturbations suffered by that process. Despite what Mayr (1976b, p.243), Hull (1967, p.331) and Martins (2007, p.165) argue, Lamarck's taxonomy was a typology and not a genealogy.

Lamarck's masses

Lamarck's real battle was always the rather belated defense of serial classification, both in the field of botany and in zoology (Daudin, 1926, pp.202-204 and 1927, pp.111-118; Martins, 2007, pp.134-136). Lamarck (1802, p.18, 1994, p.136, 1815, p.128) proposed, in effect, a hierarchical or serial idea for classifying living creatures; and he argued that such a taxonomy broadly expressed what he characterized as a natural order (Lamarck, 1994, p.137): a hierarchy of forms that, far from being a methodological artifice, described a real, necessary sequence going from simpler, more imperfect forms to more complex, perfect ones (Lamarck, 1802, p.15, 1994, p.139, 1815, p.133). This sequence, which Lamarck called 'the march of nature', was not understood, however, as a unique phenomenon. It was, as I have just said, a recurring, constant phenomenon. Every day, Lamarck said, nature forms 'the simplest organized bodies' (1994, p.107); and with each one of those insignificant beginnings of life, nature begins again, methodically, the progressive growth of complexity that, over generations, starts rising up predetermined steps in the zoological and botanical series (Lamarck, 1815, p.134). And it is as determined steps or pre-established levels of organizational complexity that we must interpret the big categories, the "large masses" (p.128) of Lamarckian taxonomy (Martins, 2007, pp.137 and ff.). In it, the categories of polyps, radiates, worms, insects, arachnids, crustaceans, annelids, molluscs, fish, reptiles, birds and mammals (Lamarck, 1802, pp.34-37) did not designate particular groups, unique productions of nature, as they would for a Darwinian naturalist. For Lamarck, those orders were successive levels of complexity through which the offspring of every new life-form must necessarily pass.

Lamarck's masses, unlike the higher taxa of Darwinian taxonomy, are not individuals, but natural kinds. Far from being a precursor to Darwinian phylogenies – as Hull (1967, p.332) mistakenly claims – Lamarck's taxonomy is really a scale of organizational types that simultaneously shows the necessary steps that the recurring march of nature must always follow. Thus, in Lamarckian terms, the ascription of a particular species to one of those categories, rather than implying a hypothesis about the history of that species, implies first a basic characterization of its level and type of organization. On this last point, Lamarck is not very far from Cuvier; and he is certainly closer to him than to Darwin.

This organizational characterization will, of course, permit something similar to a phylogenetic hypothesis. Every mammal – Lamarck might say – must necessarily have a reptile ancestor. However, it is not its ancestry that justifies its ascription to the class of mammals, but rather form and organizational level. The mammals of today, on the other hand, may be the result of independent, parallel sequences of progressive growth of complexity that began in different places and circumstances. Lamarck's masses are not and never were monophyletic groups. But that, in Lamarckian terms, does not make them any the less real; because classification, thought of as a hierarchical typology, does not reflect a history but instead a scale of complexity whose steps are natural kinds.

It is debatable, however, what happens at the species level. Lamarck, as we know (1815, p.128), recognized that once a species is ascribed to a mass like reptiles or mammals, it was impossible, or very difficult, to classify it hierarchically within the group. So, supposing himself possessed of arguments and reasons to consider mammals superior to birds, Lamarck acknowledged that he lacked criteria to compare two particular species of birds, such as the crested caracara (*Polyborus plancus*) and the black vulture (*Coragyps atratus*), when deciding which of them should occupy a higher rung on the zoological ladder (cf. Caponi, 2006, p.13); and the reason lay in the fact that the comparison between these two birds would have to be based not on the organizational type of both species, which was the same, but on particular organs considered in isolation (Lamarck, 1802, p.39).

For, according to Lamarck (1802, p.39, 1815, p.133), different organs did not follow such a regular scale from lower to higher in their particular conformations as the organizational types that permitted the distribution of the higher taxonomic orders; and that irregularity became more pronounced as the organs under consideration became less physiologically important. These, said Lamarck (1802, pp.39-40), "are not always congruent amongst themselves in perfection or degradation."[9] Therefore, "if one follows all the species of a class, one will see that a given organ, in one species, enjoys its highest degree of perfection; whereas another organ, which in that same species is extremely impoverished or extremely imperfect, is highly perfected in another species."[10] But "these irregular variations in the perfection and degradation of non-essential organs"[11] were not without an explanation.

These organs, argued Lamarck (1802, p.40), "are more subject than others to the influence of external circumstances,"[12] their variations are closely linked to the diversity of circumstances in which living creatures' existence unfolds. These circumstances, therefore, are what cause living matter to produce divergent, singular variations in the profiles of organisms (Lamarck, 1815, p.134); and that permanent transformation and retransformation of forms, he believed, generated the diversity of species that appear as ramifications that separate out from masses and evade classification in "a single, simple, linear series, formed like an evenly-spaced stairway" (Lamarck, 1802, p.40).[13] Insofar as for Lamarck, the names of species do not designate different levels of complexity within hierarchical levels of the great taxonomic masses, but particular forms that organization takes according to circumstance, we may conclude that, in his system, particular species are single, contingent or circumstantial productions of nature, and not natural kinds.

In Simpson's words (1970), species, according to this possible interpretation of Lamarck, would be more on the side of the configurational than the immanent, which is where the great taxonomic masses in fact lie. I believe, however, that the correct way to think about this is as follows. As I see it, in Lamarckian grammar, a word like lion does not designate merely a single or contingent form, or an unrepeatable configuration. As I see it, the word lion designates the particular form a line of mammals must take if it undergoes a particular set of circumstances. It may, of course, be unlikely that these circumstances will be repeated.

But if they did, they would produce new lions as infallibly as, after enough generations had passed, the power of life produced reptiles after it produced fish: and what is repeated is no longer an individual.

I do not believe, in other words, that Lamarck would have insisted that in order to call the Indian lion *Felis leo* it was necessary to determine that its subspecies conformed to a monophyletic group along with the African subspecies. I would posit that, for Lamarck, morphological analysis would have been enough; not only to say that the Indian lion was a mammal, but also to say that it was sufficiently similar to the African lion to call it *Felis leo*, the denomination that was given then to the lion. And I also believe that his explanation of that similarity would not have been based on common descent, which is doubtful because of the geographic separation between the two subspecies, but in the similarity between conditions of life. On the other hand, it is important to stress that if it were discovered today that the Indian lion, now called *Panthera leo persica*, evolved independently of the African lion from a common ancestor of *Panthera leo* and *Panthera pardus*, the phylogenetic logic of today's taxonomy would lead us not to classify it as *Panthera leo*, despite its resemblance to the African lion and despite the fact that, like the leopard, it can be crossed with African lions.

Conclusion

The differences between Buffon, Cuvier, Lamarck and Darwin are not metaphysical. Each of them shares, as do we, the distinction between individual entities and natural kinds that philosophy has struggled to formulate clearly since Plato's time. Darwinism demolished many things, but not that distinction. Thinking of taxa as individual entities does not deny that other things, even in biology, can be seen typologically; just as a typological vision of taxa does not deny that organisms and volcanoes were individuals.

That Darwin, as the Ghiselin-Hull thesis argues, might have considered, or led us to consider, taxa as individuals, does not mean that he thought in a less essentialist or less Platonic way than his predecessors. The reasons are much more complex, having to do with the complex web of theories, problems and methodological maxims that led him to formulate certain questions and glimpse certain answers for them that presupposed and demanded a true history of nature. A history that was barely hinted at, in different ways, in the natural history of Buffon, Lamarck and Cuvier. Not because their natural history was short-sighted; but because their questions, which were very far from Darwin's central questions, and the resources they possessed to answer them, which differed from Darwin's, did not call for the complete establishment of that truly historical perspective.

NOTES

[1] For an opposing view, see Hull, 1967, p.326 and Mayr, 1976a, p.27.

[2] "Dans tous les lieux où la température est la même, on trouve non seulement les mêmes espèces de plantes, les mêmes espèces de insectes, les mêmes espèces de reptiles sans les y avoir portées, mais aussi les mêmes espèces de poissons, les mêmes espèces de quadrupèdes, les mêmes espèces d'oiseaux sans qu'ils y soient allés." All quotations in other languages have been freely translated.

[3] "On peut croire que tous ces vastes corps sont comme le globe terrestre, couverts de plantes, et même peuplés d'êtres sensibles, à peu-près semblables aux animaux de la terre."

[4] "Des sortes de régions de ressemblances, des groupements d'analogies qu'on pourrait établir soit arbitrairement sur un système de signes, soit en gros suivant la configuration générale des plantes et des animaux."

[5] "Il est tels traits de conformation qui en excluent d'autres ; il en est qui, au contraire, en nécessitent; quand on connaît donc tels ou tels traits dans un être, on peut calculer ceux qui coexistent avec ceux la, ou ceux qui leur sont incompatibles; les parties, les propriétés ou les traits de conformation qui ont le plus grand nombre de ces rapports d'incompatibilité ou de coexistence avec d'autres, ou en d'autres termes, qui exercent sur l'ensemble de l'être, l'influence la plus marquée, sont ce que l'on appelle les *caractères importants*, les *caractères dominateurs*, les autres sont les caractères subordonnés, et il y en a ainsi de différents degrés."

[6] "Appartenir à un genre, à un ordre, à une clase, ce n'est pas porter en commun avec d'autres espèces tels caractères moins nombreux que les caractères spécifiques, ce n'est pas avoir un caractère générique ou un caractère de classe, ce sera avoir une organisation précise."

[7] This does not mean ignoring that morphological analysis is fundamental to justify and discover a taxonomic ascription; homology is clearly the *ratio cognoscendi* of common descent. But the latter is the *ratio essendi*, the foundation, of the former.

[8] If, some day, on another planet, heterotrophic, diploid, multicellular organisms are discovered, it is quite possible that they would be considered animals without there being any phylogenetic relation at work. Meaning that such an expression would not, in that context, have any phylogenetic connotation. In that case, the word animal would be closer to the way we use the word predator than to the way we use the word Mammalia in modern systematics. We would use it to designate a type of living creature and not the name of a monophyletic group.

[9] "Ne sont pas toujours en rapport les uns avec les autres dans leur perfectionnement ou leur dégradation."

[10] "Si l'on suit toutes les espèces d'une classe, on verra que tel organe, dans telle espèce, jouit de son plus haut degré de perfection; tandis que tel autre organe, qui dans cette même espèce est fort appauvri ou fort imparfait, se trouve très perfectionné dans telle autre espèce."

[11] "Ces variations irrégulières dans le perfectionnement et dans la dégradation des organes non essentiels."

[12] "Sont plus soumis que les autres aux influences des circonstances extérieures."

[13] "Une série unique, simple et linéaire, sous la forme d'une échelle régulièrement graduée."

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