

## ESSAY

## The actuality of Lamarck: towards the bicentenary of his *Philosophie Zoologique*

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### Abstract

Lamarck, a son of the age of natural philosophy and revolutionary ideas, turned to zoology, the field in which he made his major impact, in his old age. By then, the world had already shifted towards a different intellectual atmosphere and, due to this anachronism, he was snubbed and even ridiculed by the mainstream neo-Darwinists. Yet his basic ideas about the active role of organisms in and the progressive unraveling of evolution stubbornly survived along the academic fringes and, more importantly, among the humanistic writers. Recent developments in genetic inheritance, embryology, immunology and behavioral studies vindicate, at least in part, the 200-year-old vision of Lamarck.

**Key words:** Lamarck, new genetics, progressive evolution, role of behavior.

### INTRODUCTION

With the approaching bicentenary of Lamarck's *Philosophie Zoologique*, I want to open again an ample discussion about the role and the importance of the father of the evolutionary theories. The forthcoming XXth International Congress of Zoology convened in Paris, could provide an excellent framework for this. The literature on Lamarckianism being waste, I perused here mainly the more recent studies by Burckhardt (1995) and by Corsi (2001), the edition of *Philosophie Zoologique* presented by Aron (1968), as well as several contributions in the commemorative volume edited by Laurent (1997).

### THE ANACHRONISTIC LAMARCK

Born in France in 1744, Jean Baptiste de Lamarck was a true child of the century of the philosophers. Patronized

by Georges Buffon, the father of "natural history," he was encouraged towards botany while herborizing in the company of Jean Jacques Rousseau. Lamarck was an adept of the philosophy of nature put forth by his older contemporary, Denis Diderot. He was a loyal supporter of the French revolution, and fitting the spirit of the age, Lamarck advanced audacious, if often incorrect, views in all fields of natural history, from meteorology and chemistry to geology and the life sciences. A late-bloomer, he turned to zoology when he was more than 50 years old. It was unlucky for this republican free-thinker that he published his evolutionary ideas during the first decades of the 19th century, at a time when the society in which he lived was already under influence of the Empire, the Bourbon restoration and conservative-Catholic ideologies.

Ever since then, the wide progressivist sweep of Lamarck's evolutionary ideas has remained unpopular in professional circles. Reductionist and experimentalist approaches in life sciences on the one hand, and Victorian prudence and individualistic anti-progressivist skepticism on the other, kept the lid on his philosophy. Indeed, his ideas were only kept alive by a few natural philosophers, including Spencer, Haeckel, Bernard Shaw,

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Walt Whitman, Julian Huxley, Arthur Koestler, and by some low-key critics of neo-Darwinism.

## BOTANIST TURNED ZOOLOGIST

After having published the first *Flore Francaise* in 1778, Lamarck was elected to the Royal Academy of Sciences. Before this learned body, he first demonstrated the use of dichotomic keys, his discovery, by inviting a passerby to identify a plant. As the Botanist Royal of the Jardin des Plantes, Lamarck, in the name of the Republic, then oversaw the transformation of this institution into the Musée d'Histoire Naturelle. This was the world's first modern national museum. In 1793, from among the five chairs he had proposed for the Museum, Lamarck chose to occupy that of the Professor of Insects and Worms. It was only then, after the age of 50, that the botanist became a zoologist. In a way to define his own interdisciplinary career, Lamarck first used the term "biology." There are even fragments of a manuscript for a comprehensive text, which Lamarck planned to publish, called *La Biologie*.

## INVERTEBRATE NATURAL HISTORY

It is not clear if Lamarck purposely chose what is arguably the least attractive of all chairs. However, he worked assiduously on existing and new collections and saw the invertebrates, as he was the first to call the group, as the connecting link between the infusorians and the vertebrates. Lecturing annually on this topic, he published several volumes of *a Histoire Naturelle des Animaux Invertébrés* between 1815 and 1822. By the time it was finished, he was 78 years old. Throughout the years, Lamarck kept adding to and improving his evolutionary branching tree. First, he created separations in the seemingly homogenous world of the worms, and then he separated insects from arachnids and crustaceans. He also authored several phyla and classes, including the Polychaeta. Strangely, his first listing of the major phyla is still followed in most zoology curricula and, since it gives the impression of an Aristotelian scala naturae, our students often ask "what came first, the arthropods or the mollusks?"

## PHILOSOPHIE ZOOLOGIQUE AND PROGRESSIVE EVOLUTION

In his major book, *Philosophie Zoologique ou Exposition des Considérations Relatives à l'Histoire Naturelle des Animaux* published in 1809, Lamarck wrote "It is well known that every science needs a philosophy." Without a

philosophy, the naturalists would use all their time "in order to increase the immense number of described species." Lamarck considered that, in nature, there has been a "progression in the composition of organization." By advocating this view as the central point of his 30 years as a creative zoologist, he became the first evolutionist, although he never used the word "evolution." Far from considering evolution to be a linear, one-dimensional ladder of life, an idea for which he is unjustly accused, Lamarck saw parallelism and branching at every evolutionary level of organization. Recently, in 1999, Stephen Gould "discovered" this and, very belatedly, made amends to the memory of Lamarck (Gould 1999).

## EFFECTS OF USE AND DISUSE

According to Lamarck, animals respond to new needs required by the novel circumstances of a changing environment by adaptive efforts. These efforts lead to changing habits and functions and, over time, they translate into new forms and structures. The resulting enforced use and disuse are inherited. By default, the existence of vestigial organs is proof that function created form. In other words, an organism reacts, as a whole, to the needs imposed upon it by its environment. The organism subsequently transmits the changes acquired during its lifetime to the next generation. The "lowest" animal forms react by simple irritability, whereas "higher" ones respond instinctively, and the "highest" animals respond with intelligent actions. This idea is far from the much ridiculed caricature of the giraffe lengthening its own neck, but, unfortunately, today this caricature is typically all that our students know about Lamarck.

In his "pangensis" hypothesis of 1883, Darwin, too, spoke of the "direct action of changed conditions on the organization and of the increased use or disuse of parts." (Darwin 1883). In modern words, the environment is not only selective, but also creative.

Lamarck assumed that the vectors of change within the organisms were the so-called "fluids." He hypothesized that the "subtle fluids," emitted by the sense organs and circulating through the nerves influenced and caused modifications of the "ponderable fluids" and, ultimately, modifications of the body structures. Although today this may seem to be a nebulous and crude hypothesis, more than half a century after Lamarck, in his provisional hypothesis of pangensis, Darwin also assumed that subtle "gemmulae," passing freely through tissues and between cells, were the vectors of change within organisms. In fact, it was only when the giant chromosomes in the chironomid midge salivary glands were discovered half a century later that the

vectors of change were localized.

## LAMARCK'S UNIFORMITARIANISM

In 1801, Lamarck wrote: "[a] universal upheaval...is a very convenient means for those naturalists who wish to explain everything and do not take the trouble to study nature's way." This admonition should still resound today as neo-catastrophists take up the views of Lamarck's arch-adversary, Cuvier. In Lamarck's views, catastrophes and sudden changes had no place in evolution. Even in his much ridiculed scenario, the development of webbed feet in aquatic birds "requires time, immense and incommensurable time." Evolution is so smooth that, in his opinion, even species are somewhat artificial and transient entities in the flow of evolution. In his conchological studies, he tried to persuade his peers that fossil mollusk species were not extinct but that they were probably still living somewhere, in uncharted waters or lands, under more propitious conditions.

In the same vein, Lamarck considered that life is still arising from lifeless matter. It should be noted, to his defense, that the subject of ongoing "biogenesis" was still hotly discussed in Darwin's time. He also had the same consequently uniformitarian view regarding the other basic epistemological question, that of the origin of humans. According to Lamarck, the quadrumanous mammals, the apes, gave rise to the bimanous humans when, under certain circumstances, they were forced to use only their hind-legs for locomotion. Thus, humans are just a race of quadrumanous mammals that acquired their present anatomy and their mastering of the surrounding environment due to "constant habitudes" of the bipedal posture and gait. Darwin, half a century later, was much more prudent than Lamarck, and, after the publication of *The Origin of Species*, it still took him years to openly advocate the smooth transition from apes to humans. But then, Darwin lived in a conservative society and times have indeed changed.

## THE VILIFICATION OF LAMARCK

Lamarck died blind and destitute in 1829 at the respectable age of 85. Posterity has been unkind to Lamarck, to say the least. The anti-Lamarck sentiment started with a barbed eulogy speech delivered by Cuvier. Charles Darwin, who was always prudently pondering, often mixed criticism of Lamarck with praise. Unlike Darwin himself, the champions of the emerging neo-Darwinist dogma did everything they could to stigmatize Lamarck. Weissman, in order to test his germ/soma dichotomy thesis, crudely cut the tail of hundreds of mice. Kammerer's attempt to prove

Lamarck right by forcing poor midwife toads under water in order to develop copulation pads was equally crude.

Mendel was posthumously forgiven for skewing some experiments and De Vries for not dealing with rigorous mutations. However, no lenience was shown towards Lamarck. Respected authors of Lamarckian corollaries to Darwinism, such as Baldwin or Waddington, were shoved aside. Lamarck continued to be the straw man put up in order to be demolished. The neo-Darwinian "central dogma," like every dogma, needed an anathema.

## LAMARCKIANISM AND POLITICS

Lamarckianism stands for evolutionary progress and neo-Darwinism for aimless diversification. The first part of the statement echoes the social optimism of earlier generations, whereas the latter responds to the present cynical disenchantment. The first speaks of a persistent and smooth progress, whereas the other has recently acquiesced to catastrophism and blind contingency. In theological terms, Lamarckianism could stand for the importance of free will and neo-Darwinism for predestination. In the service of social and political aims, neo-Darwinism has often been misused to justify racial segregation and intra-specific competition. Lamarckianism, on the other hand, although much more humanistic and optimistic in social terms, has also been misused by politics. The crude and dictatorial Lamarckianism of Lysenko, proclaimed in 1948, did much disservice to the philosophy, despite the fact that, in practice, it never left the field of agro-botany. Two courageous Russian botanists wrecked Lysenkoism a couple of years later. However, despite this, in 1983, the Medawars still wrote of "evidence of the tragic consequences of fanaticism that so often accompanies Lamarckian beliefs." (Medawar & Medawar 1983). Distorted Darwinism has caused infinitely more tragedy.

## THE ACTUALITY OF LAMARCKIANISM

In 1963, Ernst Mayr wrote that "with habitat and food selection, behavioral phenomena, playing a major role in the shift into new adaptive zones, the importance of behavior in initiating new evolutionary events is self-evident." (Mayr 1963). Lamarck would have entirely agreed with this statement. A quarter of a century later, Plotkin (1988) also considered behavior to be both a product and a cause in the process of evolution.

In recent years, mechanisms that annihilate the strict genotype-phenotype separation and provide information about the feedback influence of the phenotype on the genotype have been found. The reign of reductionist molecular

biology is now being questioned (Woese 2004).

A bewildering array of “replicators,” besides the DNA genes, and a variety of alternative hereditary pathways have been found. In addition to more classical cases of cytoplasmic inheritance and maternal imprinting, there are plasmids, transposons, retroviruses, prions and other regulatory proteins. Further, horizontal gene transfer is now seen as an important mechanism in evolution. Immunologists revert to Lamarckian mechanisms and even computerized models of evolution admit these mechanisms on theoretical grounds (Hayes 1999).

Recent advances in the study of epigenetic mechanisms, the new field labeled “Evo-Devo,” have shown the importance of phenotypically methylated genes in developmental differentiation, or of the somatic genesis of antibodies during development. The so-called epigenetic inheritance system (Jablonka *et al.* 1992; Csaba & Miklós 1999) is reminiscent of Lamarckian acquired inheritance. This system, considered as being extremely important in early multicellular organisms, later coexisted with the classical genetic inheritance system. It was supplemented in the latter by behavioral traits and inheritance of learned abilities in higher vertebrates and social insects, and finally by the symbolic language inheritance systems of humans. According to Jablonka *et al.* (1999), “natural selection leads...to the evolution of new evolutionary rules” and to “new levels of individuality.” This is Lamarckian progress without the prudent inverted comas.

The two major theses of Lamarck, that of the inheritability of properties that result from the interaction of the organism with the environment, and that of the progressive unraveling of the organism’s capabilities, are corollary. First, the organisms react to the changes in their environment and implicitly modify their future offspring. Secondly, as the history of the global environment takes its course, the organisms evolve in accordance, by increasing in complexity, achieving more functional homeostasis and maximizing behavioral freedom. The living beings are not mere vehicles of their genomes, passive pawns at the mercy of an abstract natural selection, they are also interactors (Hull 1988), both adapting to the environment and shaping selection by capitalizing on each achievement of their precursors.

New data vindicating Lamarck are now surfacing at an increasing rate. For example, Palmer (2004) has studied the genesis and inheritability of asymmetric features in bilateral organisms, such as crabs and other animals, and demonstrates the genetic assimilation of phenotypic changes in a model that is much more informative than the previous attempts to prove phenotypic inheritance. After present-

ing additional instances, other than the ones he studied extensively, Palmer states that “genetic assimilation is much more widespread than currently believed.”

Quite recently, Woese (2004) considered that the reigning molecular biology theories of the last decades chose to ignore evolution and the nature of biological form. Accordingly, he suggested that the task for 21st century biologists should be “to resynthesize biology; put organism back into its environment; connect it again to its evolutionary past.”

Without a zoological philosophy, without considering the levels of animal complexity and the different levels of information transmission, the theory of evolution regresses into a mere descriptive and arbitrary transformism that reduces the living world to its lowest common denominator. After all, the very roots of the science of evolution are in zoological research, and its most spectacular expressions are found in the animal world. The long neck of the giraffe does not serve to reach the high foliage as Lamarck thought. Rather, it enables the giraffe to scrutinize the surrounding savannah environment, as did our bipedal African ancestors. The organisms themselves, especially the higher animals, are not passive pawns, but instead, they are the ones analyzing the environmental chessboard and participating in shaping the world. From the blue-green bacteria that oxygenated the globe, to the plants and animals that conquered the oceanic wastes and the continents, to the birds that regularly migrate across the globe, and finally to the humans who change the climate of the planet and fatefully manipulate organic evolution itself, there is a whole Lamarckian progression. This is, in great part, the significance of the legacy that Lamarck bequeathed to us two centuries ago.

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