TWO HUNDRED YEARS SINCE THE PUBLICATION OF *PHILOSOPHIA ZOOLOGICA*: JEAN-BAPTISTE LAMARCK'S VISIONARISM

ORIANA IRIMIA-HURDUGAN

Abstract. *In 1809, Jean-Baptiste Lamarck (1744-1829) was publishing his Philosophia zoologica. It was the fruit of a mature reflection on the natural history as it was known by his contemporaries, as well as of the acquiescence of the necessity for a new theory that would explain the increasing complexity of the organisation of the living matter as well as the speciation. Father of the evolutionism, than called transformism, and of the term of "biology", Lamarck was time after time noticed, discarded and ignored for two hundred years. Never the less, some aspects of his theory are making a comeback, more fashionable than ever, highlighted by a new current in natural sciences and by breakthrough in epigenetics. An evolutionist ahead of his time and, most of all, before Darwin (The Origin of the Species will be published only in 1859), the man that was Lamarck deserves to be acknowledged for his assiduous and hard work, his discerning genius as well as for his survival as a scientist during the murky times of the French revolution.*

Keywords: *history of evolutionism, lamarckism, invertebrate taxonomy, epigenetic.*

Rezumat. Două sute de ani de la publicarea Philosophiei zoologica: vizionarismul lui Jean-Baptiste Lamarck. *Jean-Baptiste Lamarck (1744-1829) publică în 1809 Philosophia Zoologica. Aceasta era fructul unei mature chibzuinţe asupra istoriei naturale, aşa cum era ea cunoscută de contemporanii săi, precum şi al conştientizării necesităţii unei teorii noi, care să explice complexitatea crescândă a organizării materiei vii şi speciaţia. Părinte al teoriei evoluţioniste, numită de el transformistă şi al cuvântului «biologie», Lamarck a fost pe rând remarcat, refuzat şi ignorat timp de două sute de ani. Cu toate acestea, aspecte ale teoriei sale devin mai actuale ca oricând, în lumina unui nou curent în ştiinţele naturii şi de noile descoperiri ale epigeneticii. Evoluţionist «avant la lettre» şi, mai ales, înaintea lui Darwin (Originea speciilor apărea abia în 1859), omul Lamarck merită să i se recunoască activitatea asiduă şi aplicată, geniul pătrunzator precum şi supravieţuirea ca om de ştiinţă în perioada tulbure a revoluţiei franceze.*

Cuvinte cheie: *istoria evoluţionismului, lamarckism, clasificarea nevertebratelor, epigenetică.*

SHORT BIOGRAPHY OF THE SCIENTIST

Jean-Baptiste Pierre Antoine de Monet, knight of Lamarck was born at the 1st of August 1744 in an old noble family. He studies from 1755 to 1759 at the Jesuite School of Amiens and engages, between 1761 and 1765, in a short military career that would bring him, following the battle of Vilinghausen, the title of filed officer and knight of Saint-Martin. Following the accident that would end his military career in 1765, he will work as accountant for a while and then he will dedicate to his studies of medicine and botany, for which he develops a particular interest.

In 1778 he publishes *The French Flora* at the Royal Printings, using the dichotomic identification keys (Linnaeus' model) in an accessible and user friendly way. This work will make him notorious and will get him elected, in 1779, member of the French Academy of Sciences, with the help of Georges-Louis Leclerc, count of Buffon.

The Academy will receive him in full membership in 1783 and he will retire in 1790. That year, at the age of 46, he reconverts successfully from botany to invertebrate zoology, becoming the Insects and Worms Natural History professor at Jardin du Roi, in Paris. He will be involved, in 1793, in the conversion of the Royal Gardens to the Natural History National Museum, at Lakanal's proposal. In the new establishment he will teach the invertebrate zoology and he will innovate in the study of invertebrate palaeontology and general systematic biology.

His works on invertebrates represent a great advance over existing classifications; he was the first to separate the Crustacea, Arachnida, and Annelida from the "Insecta." His classification of the mollusks was far in advance of anything proposed previously; Lamarck broke with tradition in removing the tunicates and the barnacles from the Mollusca. In 1809 he publishes *Philosophia zoologica* and from 1815 to 1822, he publishes *Histoire naturelle des Animaux sans vertèbres*. These two works made him the founder of the transformism, latter known as Lamarckism, the early versions of the evolutionism.

He died in Paris, the 18th of December 1829, at 85 years old, after being blind for the last ten years. For more than a century several authors, quoted by HUMBERT, 1946, and later by JAUSSAUD & BRYGOO, 2004, considered that Lamarck died in extreme poverty at his residence at the Museum, after he had to sell his plant collection to the German botanist Johannes August Christian Roeper. Michel Guédès' study on Lamarck's incomes (1982) is though proving a comfortable lifestyle as he cumulated several incomes: his professor salary at the Museum, his Academy pension, incomes from the sale of his different works etc., up to 9500 old francs, a very reasonable and sustainable sum at the time. Nevertheless, his human remains were buried in a rented grave, having a very poor and modest ceremony, and three years later they were exhumed and reburied in a common grave at the Montparnasse cemetery. This fact seems to be due not to the lack of money, but mostly to the "lack of filial piety" of his son, Auguste (LAURENT, 2001).

LAMARCK AND THE SCIENTIFIC CONTEXT OF HIS TIME

Since the Antiquity it was considered that the simplest forms of life appear directly from the inanimate matter and one form of life can transform into another. This idea was still part of the popular belief in the 19th century. Only at the end of the 18th century several scientists as Erasmus Darwin (*Zoonomia or Laws of the Organic Life*, 1794-1796) in England, Alberto Fortis (*Viaggio in Dalmazia*, 1774) in Italy, Jean-Claude de la Méthérie, Philippe Bertrand (*Théorie de la Terre*, 1797), Eugène-Melchior-Louis Patrin (*Histoire Naturelle des Minéraux*, 1801), and Bernard-Germain-Etienne de Lacepède in France were formulating the hypothesis of the gradual transformation of the life forms accompanying the successive transformations of the Earth's crust. At the same period there were undertaken the first rigorous scientific studies of palaeontology, bringing proof of some species evolution in geological eras.

Besides the theoretical discoveries, New Zealand was being discovered and the South America's geography, fauna and flora were being systematically researched by Humboldt and Bonpland (HUMBOLDT, 1968). Brisson had published the birds systematic, Linnaeus' binomial taxonomy was being adopted by every naturalist and Fabre was inspired describing the insects' behavior.

Studying the mollusk fossils at the National Museum of Natural History, Lamarck noticed that during the geological eras, their external morphology changed and he was the first scientist to wonder about the reasons for these modifications. He hypothesized that the individuals are adapting all the long of their existence mostly by using more or less certain organic functions that develop or decrease according to organ's use or disuse. Lamarck is also the one who gave the first modern definition of biology, in 1802, in *Système des animaux sans vertèbres*: « all that is generally common to plants and animals as well as all the characteristics of each of these beings with no exception, must form the only and vast object of a special science, not yet founded nor named, that I will call Biology».

Carefully studying the differences between living beings and inanimate objects studied by Physics, Lamarck was the first to understand that the evolution is a theoretical necessity in the explanation of the complexity of the living beings, which are not only the product of a temporary conjecture of some physical and chemical phenomena (as the theory of the spontaneous generation, embraced by most of his contemporans, stated), but also the product of a historical elaboration and construction of these phenomena in more and more complex and differentiated organizations.

Nevertheless, the inheritance of acquired characters theory or the soft inheritance theory was already being hypothesized, in other forms, even in Aristotle's' work, but it was Lamarck that integrated and adapted the principles of this theory in his own evolution theory: the transformism. The latter had many supporters, as Geoffroy de Saint-Hilaire for example, until the experiments of the German evolutionist August Weismann in 1868-1876 (CHURCHILL, 1968) when the transformism was discarded. On the contraire, Lamarck was not able to prove his theory by experiments. Although considered the main detractor of soft inheritance, Darwin wrote, in the *Origin of Species*, that the vestigial eyes of moles and of cave-dwelling animals are "probably because of a gradual reduction from disuse, although aided perhaps by the natural selection."

200 years ago, in 1809, Lamarck expressed in a systematized and logical fashion, in *Philosophia zoologica*, his theory, the transformism, according to which the organisms are evolving over long periods of time. This would have not been possible in the scientific context of 1700-1750, but 1789 brings the French Revolution and, with it, the extreme secularization of the society as well as science's liberation from the restrictions in its expression. Although longtime considered a certain fact, the French Revolution was not atheist but merely anticlerical, and this conjecture contributed, 20 years later, to the freedom of expression necessary for Lamarck in order to elaborate his theory.

PHILOSOPHIA ZOOLOGICA

Philosophia zoologica is the reviewed and much developed and enlarged version of an earlier lamarckian work: *Recherches sur les corps vivans.* It is structured in three main parts, each subdivided in seven to nine chapters. Fortunately for us, his modern readers, Lamarck's vast opera was written entirely in French, one more thing that we probably owe to the French Revolution, as the hermetic Latin of the scholars was replaced by the national language, thus allowing any citizen who could read access to knowledge.

Following the title and the short description of the contents, the author begins, as that period's customs imposed it, with a *Warning* and a *Preliminary Speech*, each near four pages long.

In the first part, presenting "essential observed facts and the general principles of the natural sciences", he first describes the terms employed by "the mentioned sciences, the importance of considering the ratios and the idea we must have on what is called species amongst the living beings". He then develops the generalities regarding the animals and presents on one hand "the proof of degradation in organisation from one extremity to an other of the animal scale, the most perfect animals being placed on the anterior extremity of this scale", and on the other hand he demonstrates "the influence of circumstances and habits on animal organs, as a source of the causes favouring or stopping their development". He ends this first part by presenting the "natural order of animals", their distribution and reviewed classification.

In the second part the author proposes his ideas on the order and on the state of things composing the essence of the animal life and presents the essential conditions for life existing in nature while the third part theorises on intelligence and senses as engine of action in animals.

From his own observations of the individual anatomical parameters within the same species, Lamarck deducted that the individuals adapt themselves to the environmental conditions of their habitat. If the climatic and geological conditions change for a sufficiently long period of time, the living beings are changing their morphology but not in a controlled manner. An organ may change in order to answer a necessity or need, as the author calls it, and this change can be inherited by that animal's descendents (the soft inheritance). For Lamarck, these changes take place gradually, over long periods of time, and are inaccessible to the human perception scale.

"Dimensions, both in space and time, are relative: if one would indulge to represent this truth, one will see that one must be circumspect regarding the *stability* [Tr.N.: As immobility] that one will attribute, in nature, to the state of the object of his observation. […] I will have the chance to prove with the help of some well known facts the changing power of circumstances in granting animals new needs and pushing them into new actions; of repeated new action in becoming new habits and new tendencies; finally the power of the more or less frequent use of an organ to modify that organ, either by strengthening it, developing it and enlarging it, or by weakening it, shrinking it and attenuating it to the point of disappearance."

„Regarding life, nature made everything little by little and successively, there is no doubt about it. In deed, [...] I will try to prove, citing only well known facts, by composing and complicating more and more the animal organisation, nature progressively differently specialized organs as well as the faculties the animals posses.

The author largely theorises on the animal systematics, adopting the binomial taxonomy of Linnaeus and demonstrating his evolution theory *in spe* with zoomorphological and systematic arguments. "Long time it was considered that there is a scale or gradual chain of life bearing bodies. Bonnet developed this opinion but did not prove it with facts extracted from the organisation itself, although this was necessary, especially concerning the animals. He could not have done it since in his time the necessary means were not yet present.

By studying animals of all classes, there are more things to notice in the increasing composition of the animal organisation. The result of circumstances as cause of new needs, the result of needs that engender actions, that of the repeated actions that create habits and tendencies, the results of the increased or decreased use of one organ or an other, the means of nature to perfect what it was achieved by organisation etc., etc., are objects of main importance for the rational philosophy".

The author presents the second and the third parts of this work as particularly dear to him, as he speaks of the apparition of irritability, sense and intelligence in animals with different degrees of complexity, as the nervous system follows the general complication of the animal morphology in phylogeny.

Most certainly, *Philosofia zoologica* would have not ever been published unless its author had not studied so arduously the invertebrates and their fossils. In this paraphyletic group the speciation reaches its maximum and the phylogeny is easily traceable, step by step, due to the organisms' great diversity.

"Thus, this *Zoological Philosophy* presents the results of my studies on animals, their general and particular characteristics, their organisation, the causes of their development and diversity and of the characteristics they achieve from it; in order to put it together I used the main materials I gathered for a projected work on the living bodies, under the name of *Biology*, that will remain, as far as I am concerned, unfinished. […]"

REDESCOVERING LAMARCK IN THE PRESENT SCIENTIFIC CONTEXT

The soft inheritance makes a comeback in fashion among the scientists of our time, under the weight of the logical and experimental arguments as well as under the irrefutability of the present epigenetically studies.

A study made by the research team of the University of Umea, Sweden, published in the *European Journal of Human Genetics* (VAN DER LUGT, 2006) on the inhabitants for several generations of a small village in Sweden (320 individuals), stressed out the fact that a predecessor that suffered from malnutrition (during famine episodes) in his teenage years will provide his descendents with an increased protection against cardiovascular disease and against diabetes. The vice versa is also valid, a grandfather having a rich alimentation during adolescence would have a descendance four times more exposed to mortality causes related to diabetes than the population average. The unusual discovery was that this inheritance was made on paternal line, thus excluding any pregnancy related environmental factors that would have affected the individual *in utero*.

As an explanation, the Swedish team prudently advances an analogy to the epigenetic soft inheritance theorized by Lamarck, but the international scientific community demands further proof in the replication of the Swedish results by other studies. Voices of the medical community are already rising, stating that the epigenetic phenomena could serve as rheostat in the rapid adaptation of the species to a given environment, unlike the Darwinian like natural selection (Junien Claudine, Genetics professor at Necker Hospital, Paris, France, in an interview to Le Monde journal).

As other tendencies in science before this, the new opening on Lamarck's soft inheritance was appropriated by the pompously named «Intelligent Design» current, a sort of creationism in evolutionist clothes, supported by some self proclaimed "Christian" circles in the United States, whose pseudoscientific speaker is the Discovery Institute, thus discrediting any new related findings and contaminating them with ridicule by mere association with the name of these circles.

As the climate changes faster and faster, we are about to witness the veracity of the acquired characteristics inheritance during our lifetime. If this phenomenon is real at least some species will survive the global warming…

CONCLUSIONS

An avanguardist evolutionist, armed with irrefutable logical reasoning and common sense showing a scientist responsible for his allegations, Lamarck leaves us, in his extended work, the modern invertebrate systematics principles, the taxonomy, applying the principles of the compared anatomy, as well as an innovating analysis of the influence of environmental changes on the physiology and morphology.

Jean-Baptiste Lamarck's writings are visionary for their time, setting the theoretical bases for an evolutionary step in the history of the biological sciences. Although logically argued and exemplified, the theory of the achieved characters inheritance was discredited by some, rejected by Lamarck's fixist contemporans as well as by his Darwinist successors due to the lack of experimental proof. But in the end the history gives him justice, geneticians bringing new evidence and arguments, sometimes against their will, in favour of the scientist's statements of 200 years ago. Certainly, in the light of the actual state of the biological research, Lamarck's original thesis will not be embraced by the scientific community, but the principles he stated at that time are valid and most likely provable.

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Irimia Oriana
"Al. I. Cuza" University Iaşi,
Faculty of Biology, bd. Carol I, no. 20A, Iaşi, Romania, cod 700505
E-mail: ohurdugan@yahoo.com

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