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## LAMARCK'S METHOD AND METAPHYSICS

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### 1. INTRODUCTION

It is well known that Lamarck's theory had a low impact and received little acceptance in his own time. It was generally regarded as speculative by Lamarck's coeval scientists, such as Georges Cuvier. Cuvier criticizes Lamarck's "evolutionary" theory in several of his works<sup>1</sup>. Another contemporary of Lamarck, Sonnini de Manocourt, regarded the *Recherches* as a bundle of meditations (see CORSI, *The age of Lamarck*, p. 170).

Charles Darwin seldom mentions Lamarck's name in his published works. In his correspondence, Darwin presents generic criticisms against Lamarck. He calls the *Philosophie zoologique* "absurd", "miserable" and other similar adjectives<sup>2</sup>, without caring to present arguments against Lamarck's work.

Later authors, such as Armand Quatrefages, provide a positive evaluation of some of Lamarck's contribution. However, Quatrefages regards several aspects of his theory as speculations, where mere possibility is taken for a proof and the unknown is used as argument (QUATREFAGES, *Charles Darwin et ses précurseurs Français* p. 71). Louis Trenchard More has the same view of Lamarck's work (see MORE, *The dogma of evolution*, pp. 163 and 166).

Several historians of science do also provide a negative evaluation of Lamarck's work. According to Richard Burkhardt, his work presents ambiguities and inconsistencies. He regards Lamarck as a speculator - at a time when the natural sciences in France were dominated by a strong empiricist methodology (see BURKHARDT, *The spirit of system*, pp. 144 and 218; see also his introduction to Lamarck's *Zoological Philosophy*, p. xvi). Another historian, Louis Magnier, includes Lamarck in the line of "evolutionary speculation", together with Benoît de Maillet, Maupertuis and Buffon (see MAGNER, *A history of life sciences*, p. 354). Magnier goes on to state that Lamarck can be regarded as the prototype of the "crackpot" scientist, with eccentric interests, sometimes bordering madness (see MAGNER, *A history of life sciences*, p. 363).

Most evaluations of Lamarck's work take as granted that he was an empiricist and that he belonged to the group of the *idéologues* - the followers of Condillac in the period following the French revolution<sup>3</sup>. The present work will analyse Lamarck's method. It will study his work in order to find whether Lamarck is indeed a follower of Condillac and whether his methodological discourse is coherent with his scientific practice.

This analysis will show that Lamarck's scientific practice usually conflicts with his empiricist methodological discourse. It will also show that Lamarck's point of departure is a physicalist and mechanist creed. His conception of nature provides strong limits to his scientific practice and his system derives from *a priori* principles. This kind of approach is incompatible with Condillac's views and conflicts with the views espoused by the *idéologues*.

Lamarck's strict physicalism requires that all natural phenomena be explained by natural laws and natural (physical) causes. This is an assumption accepted by the biological sciences nowadays, but it was new at that time. According to this requirement, Lamarck's work seems to be the best solution of his time to the main biological problems: the nature, structure, origin and transformation of living bodies.

## 2. LAMARCK'S METHODOLOGICAL DISCOURSE

How can one evaluate the work of an ancient scientist? It makes no sense to evaluate Lamarck's work from the point of view of some current methodology or from the epistemological doctrine of some current philosopher. One should study and discuss the method used by Lamarck in his own work.

The scientific method has a twofold aspect. On one side, there is usually an explicit "methodological discourse" presented by the scientist. It tells what he thinks should be done or what he thinks that he is doing. On the other side, there is the real scientific conduct of the researcher. From this conduct it is possible to abstract his *praxis* or practical methodology - the general description of his effective conduct. The practical methodology can be coherent with the methodological discourse or otherwise.

It is impossible to present a serious evaluation of Lamarck's work without taking into account those concepts. It is not fair to reproach him from a point of view at variance with his own. One can, however, criticize him if he does not act in the way accepted by himself as the sound scientific method.

Lamarck was deeply influenced by Étienne Bonnot, abbot of Condillac (1714-1780). One also finds an influence of Buffon on Lamarck. Buffon, as Condillac, recommended that one should stick to the facts, avoiding speculation. They proposed that the study of facts should be followed by their systematization and correlation to create a system - that is, what we nowadays call a theory (see CONDILLAC, *Traité des systèmes*, in: *Oeuvres philosophiques*, vol. 1, p. 207; BUFFON, *Oeuvres philosophiques*, p. 26). In several points of his work, Lamarck refers respectfully to Condillac (see, for instance, LAMARCK, *Discours d'ouverture de 1806*, p. 562). He states that Condillac's method should be followed. It will be shown that most of Lamarck's methodological discourse is similar to Condillac's discourse. In this sense, Lamarck can be regarded as an empiricist.

Several authors, as Picavet (see PICALET, *Les idéologues*, p. vii), include Lamarck among the *idéologues*<sup>4</sup>. This is not acceptable, since the *idéologues* misrepresent Condillac's thought, while Lamarck follows Condillac very closely (at least

in his methodological discourse).

Lamarck presents a rigid distinction between *fact* and *theory*. According to him, facts can be established in a completely safe way. Theories, on the other hand, can never be secure - they are always doubtful. In order to emphasize the safety of facts, Lamarck used the phrase "positive fact" - an expression that is usually regarded as typical of positivism, but that was used before the rise of Comte's or Mill's positivism<sup>5</sup>.

This is what Lamarck regarded as "positive knowledge":

I am convinced that the only positive knowledge that we can attain are those acquired by observation; and being aware that nothing can be observed but nature, natural objects and the phenomena presented by those objects, I have imposed myself the rule that, in the study of nature, I should only develop my research when the means are not lacking (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 138).

Lamarck describes what he means by "positive truths" in the *Philosophie zoologique*<sup>6</sup>:

The only real positive truths for mankind (that is, those one can firmly trust) are the facts one can observe - but not the consequences drawn from them. Only the existence of nature that presents those facts and the laws that govern the motions and changes of its parts [can be known]. Beyond this, everything is doubtful - although some consequences, theories, opinions, etc., may be much more probable than others (LAMARCK, *Philosophie zoologique*, vol. 1, p. xxij).

According to this view, there is a realm of complete certainty that corresponds to positive facts and laws; and a realm of probability and uncertainty, corresponding to theories and opinions. "Positive facts" are definitive:

Those are positive facts, truths that have nothing to fear from a deeper examination (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 61).

As to theories, there is always uncertainty and doubt:

One can never rely on any argument, inference or theory, since the authors of those acts of intelligence can never be certain that they have employed the true elements that should ground it. [They can never be sure] that they have introduced nothing but those elements and all those elements. There is nothing positive for us but the existence of the bodies that can affect our senses, the real qualities that belong to them, and finally the physical and moral facts that we can know. Therefore, the thoughts, arguments and explanations found in this work should be regarded as mere opinions that I propose, with the aim of announcing what seems to me to be true and what may have actually happened (LAMARCK, *Philosophie zoologique*, vol. 1,

In those and several other points of his work, Lamarck acknowledges the existence of both positive truths and "mere opinions". The realm of positive knowledge encompasses "physical and moral facts"- that is, whatever can be directly known about the external (physical) or the internal (psychological) worlds.

Although Lamarck ascribes much value to facts, he also states that science should not limit itself to a fact description. Facts can be explained by laws - and those laws are also positive facts. Condillac also claims that observation and experiment should be guided by clear questions, leading to progressively more general laws that should be able to explain a larger and larger number of phenomena (see CONDILLAC, *La logique, in: Oeuvres philosophiques*, vol. 2, p. 412 and CONDILLAC, *De l'art de raisonner, in: Oeuvres philosophiques*, vol. 1, p. 637).

Lamarck applies the recognition of the unsafe character of theories to his own work:

I do not intend to nullify the opinions I rejected. However, as most of them seem incompatible with the consequences I have reached, I simply offer here their collection, for whatever value they may have. All that I can say is that, if those consequences are as well founded as they seem to me, all the opinions they reject are erroneous; otherwise, my theory should be rejected as groundless. However, while no rigorous demonstration is to require its rejection, I will follow its principles - although I will not allow myself to blame those who prefer to reject them (LAMARCK, *Système analytique des connaissances positives de l'homme*, p. 3).

Although Lamarck trusts his own theory, he does not declare it as the final scientific word. He accepts that it should be rejected as groundless, if it is possible to prove that its consequences are false.

### **3. LAMARCK'S METHODOLOGICAL PRACTICE**

#### **3.1 Instances of positive facts accepted by Lamarck**

Among positive facts, Lamarck includes: all living beings have the same kind of origin; they all have limits for their existence; they all have necessities that must be satisfied in order to remain alive (see LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 48). Another positive fact is the observed progression found in the composition of the organization of living beings (see LAMARCK, *Philosophie zoologique*, vol. 2, p. 127-162, specially p. 128; and *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 111). On this particular point, Lamarck assembles a huge mass of facts in order to substantiate the existence of a real progression among animals. In this part of his work he is certainly following Condillac's requirements: he undertakes to provide a factual foundation for his theory (see CONDILLAC, *Essai sur l'origine des connaissances humaines e Traité des systè-*

mes). This progression, it is true, is just one of the elements of his theory<sup>7</sup>, but it is essential in his general argument.

In the second [part of the Introduction of this work], I will establish the existence of a progression in the composition of the organization of the different animals, and also in the number and importance of the faculties derived from it. This fact, established from observation, will be decisive in favour of the proposed theory (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 31).

In other cases, one might doubt that Lamarck has correctly distinguished between fact and theory. See, for instance, this "positive fact" claimed by Lamarck:

[...] It is a positive fact that, in many animals, an *expansive caloric* is constantly produced within them and it is this invisible penetrating fluid that maintains the *orgasm and irritability of their soft parts*, while in other animals *the orgasm and irritability* are chiefly the result of the *caloric* of the environment.

To refuse to acknowledge the *orgasm* of which I have just spoken, and to regard it as a supposed fact - that is, as a product of imagination - would be equivalent to deny the existence of the *tone* that the bodies have during their life. But only death annihilates this *tone* and the *orgasm* that constitutes it (LAMARCK, *Philosophie zoologique*, vol. 2, p. 36-37).

This is an instructive example of Lamarck's practice. The irritability and tone of animal tissue are directly observable. The "orgasm"<sup>8</sup>, according to Lamarck's theory, is the cause of those phenomena. Therefore, although it is not directly observable, Lamarck claims that it is as well grounded as its effects. Lamarck's argument could be reconstructed in this way: there are no effects without a cause; if there exists a tone and irritability of tissues, there must be a cause for those effects; and this cause is the vital *orgasm*. Therefore, if the existence of the irritability cannot be denied, the *orgasm* cannot be denied either. Within this reconstruction, one might accept (at least in part) Lamarck's use of the phrase "positive fact" as applied to unobservable or hypothetical causes.

### 3.2 Use of hypothesis that cannot be grounded upon observation

In several parts of his work, Lamarck seems to intermingle the realms of opinion and certainty. In the *Philosophie zoologique*, he states that "a large amount of known facts **prove** that the repeated use of an organ contributes to its development, makes it stronger and even makes it greater; while the habitual lack of use of some organ leads to its deterioration, progressive reduction and ultimately to its disappearance, if the lack of use remains for a long time in all individuals that succeed one another by generation [...]" (see LAMARCK, *Philosophie zoologique*, vol. 1, p. v; see also vol. 1, pp. 239-40). We all know that there is no such factual **proof**

of the inheritance of use-disuse acquired characteristics.

Another instance: Lamarck, reflecting about the power of the motion of the bodily fluids in the soft parts of the animals, *convinced himself* that the acceleration of those fluids lead to a modification of the cellular tissues where they move, opening ways, creating several channels and even creating different organs. This belief is presented by Lamarck as a certainty:

From those two principles, I consider **as certain** that, first, the *movement of the fluids* inside the animals - a movement that has progressively accelerated itself with the greater composition of organization - and the *influence of new circumstances* to which the animals were exposed when they spread throughout all habitable places, were the two general causes that have brought the different animals to the state in which they are found now (LAMARCK, *Philosophie zoologique*, vol. 1, pp. vj-vij).

In the former case, one could say that Lamarck is arguing from observation and from a large number of known facts related to "use and disuse". Lamarck's explanation seems just one among several possible explanations. However, Lamarck neither presents other possibilities, nor looks for any evidences that could be contrary to his explanation. Lamarck presents some facts that corroborate his ideas about the influence of circumstances, but it would be problematic to describe his conclusions as **certain**. Anyhow, in this part of his work he is studying "positive facts" that can be subjected to observation and experimentation. The second case is completely different. It is highly problematic to consider as **certain** that the acceleration of the motion of fluids led to the transformation of the animals. Indeed, it is impossible to observe those "fluids", their acceleration or their effect upon the animal tissues. This is beyond any possible observation and experimentation and, therefore, beyond the realm of positive facts. It is a mere hypothetical explanation and it could only be presented as a *possibility*. The misuse of the metascientific term "**certain**" shows an epistemological negligence by Lamarck. He is indeed transgressing his own distinction between what is certain and what is doubtful. He is also acting against the prescriptions of Condillac, who stressed that one should never accept as certain a mere possibility (see CONDILLAC, *Traité des systèmes*, in: *Oeuvres philosophiques*, vol. 1, p. 203).

It is relevant to point out that Lamarck himself perceived the existence of limitations of knowledge of the deeper recesses of living beings. He states that living beings possess a special structure that allows the development of phenomena such as growth, etc. However, he warns the reader: "This state of the parts that allows the execution of the vital motions is so difficult to determine that mankind cannot imitate it. Analysis and synthesis are able to destroy and reproduce at leisure several inorganic bodies or substances; but it is impossible for mankind to build a single living being or even a single of its parts" (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 61). Here and in other similar points, Lamarck clearly perceives the limits of human knowledge about the unobservable inner structure of living matter.

### 3.3 Uncertainty in the study of natural processes

In Lamarck's work one can find several instances similar to the former ones. However, in several points Lamarck clearly perceives that he is entering the theoretical realm. One example is his discussion about the sequence of appearance of the several groups of animals and their progressive complexity. The comparison between the different classes of animals had allowed him to establish distinctions from the point of view of the several systems or organs. Which came first, which came later? The facts did not answer this question. Lamarck himself states:

I believe that I have good grounds to conclude from those considerations that the formation of the *muscular system* is posterior to that of the *nervous system* in its simplest composition; but that the power of motion and locomotion through muscles precedes in animals the power of sensation (*Philosophie zoologique*, vol. 2, pp. 143).

The terminology employed by Lamarck shows a doubt, an uncertainty about the order followed by nature in its chronological progression. In the *Histoire naturelle* Lamarck clearly point out this general uncertainty:

Animals, as any other natural bodies, receive from nature all their powers. I will take this as my point of departure for my researches concerning the means that it [nature] can have employed to produce upon those beings all that observation teaches us about them. However, our determination of the means employed by nature are not always as positive as the proposition that ascribes to it the power to produce so many diverse things (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 139).

Lamarck accepts as safe or "positive" that nature produced all the powers of animals. However, one cannot be sure about the precise way of this production. Notwithstanding this difficulty, Lamarck regards the search for those means and the suggestion of possible means as valid, since the ways actually followed by nature could not be completely different from those suggested by him:

Indeed, we lack the means for establishing safe foundations for our determinations concerning this subject. However, since our principle or point of depart is safe, and since it requires that we limit our ideas to the field allowed by it, it is sufficient to show that things could be as I am going to present them - and, if they are different, they must have followed similar paths (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 139).

Given the principle that everything was produced by the power of nature (without supernatural causes), it is possible, within those limits, to search for the mediate, hidden causes. This search will not lead to certainty - it will only lead to possibilities.

However, truth could not be completely different from those plausible possibilities.

It is possible to find this careful and sensible attitude in several points of Lamarck's work, such as this:

The continuous observation of the operations of nature, guided by those considerations, will doubtless teach us many things that we still ignore about those interesting subjects. Maybe it will lead us to find out that nature began the establishment of the muscular system in the radiolaria, but the worms, that come after them, are devoid of it.

If this consideration is well grounded, it will confirm that one formerly presented about the *worms*, that is: that they seem to constitute a particular branch of the animal chain, beginning again by direct generation (*Philosophie zoologique*, vol. 2, p. 145).

Let us also consider this sentence:

**Following the probabilities** about the origin of the different animals, **one cannot doubt** that, due to circumstances, the *reptiles* gave rise to two different branches, leading for one side to the formation of *birds* and, on the other side, to the *amphibian* mammals; from these came, in turn, all *mammals* (LAMARCK, *Philosophie zoologique*, vol. 2, p. 458-9).

In all those points, Lamarck is careful and employs expressions such as "I believe I am grounded", "it seems", "probability", etc. However, there are cases - such as the previous citation - where one finds some ambivalence: "Following the probabilities (...) one cannot doubt". Even when his epistemological knowledge teaches him that he should not be sure about his conceptions, Lamarck seems to be led to a psychological certainty that overturns his prudence.

Lamarck himself acknowledges this, in the following citation. He admits that, even when he wanders away from pure facts, the "force of things" constrains him to admit some conclusions:

Perhaps it will be objected that all that seems to me so just, so well grounded, is nothing but the product of my judgment, according to the sum of my knowledge. It could even be added that the result of our judgment is always vulnerable and that only the facts provided by observation are really safe.

I will answer to this that all those philosophical considerations, that are in general entirely just, have their own limits and even exceptions.

Our judgments are doubtless very vulnerable. Indeed, although they are always related to the elements introduced by us - and, under this point of view, they are rarely unjust - we seldom can be sure that we have employed in each of our intellectual operations all the elements that should have been introduced.

However, there are cases in which our judgments are not the mere result of our way of looking at the observed facts; because they can also be the result of the *force of*

*things* that constrains us against our will, when we regard those facts, whenever we are able to collect them. This *force of things* that dominates us when we feel it, is a power to which one does not pay much attention but that leads to exceptions to the excessively general considerations cited above. Hence, there are cases in which our conclusions are coercive and allow no arbitrariness (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, pp. 3-4).

Lamarck tells his readers that the "force of things" gradually lead him to the development of his theory. This argumentation is psychological - not epistemological. In other words, Lamarck is telling that **he is unable** to imagine an alternative to his theory. He could not, however, state that **there is not** a good alternative - since it is always possible to devise different hypotheses to explain the same set of facts. Hence, he can only state his certainty, the lack of arbitrariness of his concepts and the impossibility of an alternative theory in a psychological sense. This seems to be the meaning of the following statements:

Is this theory (...) well grounded? It doubtless seems to me to be so, since I publish it, and my observations seem always to confirm it. If someone concludes the opposite, he will probably endeavour to replace it by another [theory] as general as this, with the aim of attaining a better concordance with all observed facts; and I do not believe that this is possible (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 3).

Here, again, we observe a duality in Lamarck's thought. He is aware of the limitations of scientific knowledge and perceives that when he strides away of observable facts, he enter the realm of conjectures and probabilities. However, he feels "constrained" to admit his own theory as true - an unjustifiable step, incompatible with his own epistemological beliefs.

#### **4. LAMARCK'S CONCEPT OF NATURE AS A LIMIT TO SCIENTIFIC THOUGHT**

The analysis presented above might lead to the conclusion that Lamarck's work is ungrounded: indeed, according to his own methodological discourse, his scientific practice is not satisfactory. However, it is necessary to analyse other aspects of Lamarck's work.

Let us consider another relevant aspect. Lamarck's theory of the progression of animals is part of a wider theory. Indeed, Lamarck intended to build a complete science of life - *biology*, as he called it. Not every part of a theory requires a direct empirical foundation. It is necessary to analyse the wider aspects of Lamarck's thought, in order to check this point.

When one takes into account Lamarck's wider theory, it is possible to perceive that several aspects of his theory of progression of animals do not require a direct empi-

tical support. There are some very general principles accepted by Lamarck as starting points. They impose severe limits upon the kind of theory he was to develop - not from the epistemological point of view, but from an ontological or metaphysical point of view.

Those principles permeate Lamarck's whole work. However, they are explicitly and systematically presented only in his later books. In the introduction of the *Histoire naturelle des animaux sans vertèbres*, Lamarck states the general conditions that should be satisfied by any theory of living beings. Those general conditions are a consequence of his concept of nature. They are not hypotheses or facts, but pre-theoretical requirements about what is admissible or not. Lamarck clearly states that those principles set limits to research and restrict its arbitrariness:

Here, I should clarify all those considerations, showing that the admitted precepts are inappropriate and proving that those I want to put in their place are not new hypotheses, but clear, evident truths, that do not admit the least doubt, when one is willing to examine them.

However, it is important, before anything else, to present the following fundamental principles, in order to hinder any arbitrariness in the consequences that can be drawn from the known facts:

*Fundamental principles*

*1st. Principle:* Any fact or phenomenon that can be known by observation is essentially physical and its existence is due to bodies or to relations between bodies.

*2nd. Principle:* Any movement or change, any force that acts and any and each effect observed in a body, necessarily spring from mechanical causes, ruled by laws.

*3rd. Principle:* Any fact or phenomenon observed in a living body is at the same time a physical fact or phenomenon, and a product of its organization.

[...]

Without those principles, that are protected against any solid contention, *zoology* would be devoid of a foundation (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, pp. 19-20).

Notice that those principles belong neither to the theory of progression of animals, nor to Zoology or to Biology. They are **completely general principles** that, according to Lamarck, should guide any "physical" study - that is, any natural study. It is a materialistic, physicalist (and, more specifically, mechanistic) creed that can neither be demonstrated nor refuted by facts, but are to guide the study of all phenomena.

[...] it is easy to recognize that all the diverse phenomena offered by living bodies are truly physical and that their causes are determined, although difficult to grasp [...] (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 60).

Would Lamarck admit any miracle or divine interference as an explanation of natural facts? Not at all. According to his principles, this would be contrary to "physics",

that is, the study of nature. God created nature; but the study of nature does not include the study of God.

As a naturalist and physicist, I should only busy myself, in my studies about nature, on the bodies that we know and that have been observed, the qualities and properties of those bodies, their mutual relations in different circumstances and the sequence of those relations and the several motions scattered and continuously kept between them.

Following this way - the only one that is within our reach - it is possible to glimpse the causes of this multitude of phenomena offered by the several parts of nature and even to perceive those of the admirable phenomena presented by living bodies (LAMARCK, *Philosophie zoologique*, vol. 1, p. 361-2).

In his works, Lamarck presents his concept of "nature"<sup>9</sup>:

Nature - this word frequently uttered as describing a particular being, should be regarded merely as the *set of objects* the include: 1st all existing physical bodies; 2nd the general and particular laws that rule the changes of state and position that those bodies can suffer; and 3rd the motion distributed in several forms among them, perpetually preserved or reviving from its source, infinitely varied in its products and from which result the admirable order of the objects that are presented by this set (LAMARCK, *Philosophie zoologique*, vol. 1, p. 359).

In the *Système analytique*, Lamarck elucidates that nature is neither an intelligence nor a being, but an order of things, completely ruled by laws (LAMARCK, *Système analytique des connaissances positives de l'homme*, p. 43).

Natural phenomena should be explained by natural laws. This requirement imposes severe restrictions upon Lamarck's theory of animals. If everything should be understood according to natural forces, it is forbidden to envisage the creation of living beings, through divine miracle.

Organization and life are the product of nature and at the same time the result of the powers it received from the *Supreme author*<sup>10</sup> of all things, and of the laws that constitute its own essence. We could not doubt this nowadays. Hence, the organization and life are nothing but natural phenomena [...] (LAMARCK, *Philosophie zoologique*, vol. 2, p. 61) .

[...] *nature* is power - in some sense, mechanical - that gave rise to the several animals and made them necessarily what they are (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 31).

It might seem obvious that natural beings should be studied only within the context of natural laws. However, **this was not the case**, in Lamarck's time. Living beings - and particularly men - were regarded as a direct divine production. Georges

Cuvier, for instance, believed that each species had been created by God (see MARCHANT, *Lettres de M. Cuvier à C. M. Pfaff sur l'histoire naturelle, la politique et la littérature*, p. 178). Another contemporary of Lamarck, Jean Joseph Virey, regarded nature as the result of the action of a supreme being who directs and causes all changes (see VIREY, 1803, p. 347). Virey believed that it was impossible to understand the organization of animals and plants without the assumption of an infinitely intelligent, supreme cause (see VIREY, 1803, p. 412). Due to this hostile intellectual environment, Lamarck repeatedly calls the attention of his readers to this point:

Notice that, although the name *natural products* be generally accepted to designate the beings that compose each realm, it seems that no positive idea is associated to this phrase. It seems that a prevention of a particular origin<sup>11</sup> hinder the recognition that nature itself has the power and all the means to provide the existence to so many different beings, to vary unceasingly - but very slowly - the breeds of those beings endowed with life, and to maintain everywhere the general order that we observe (LAMARCK, *Philosophie zoologique*, vol. 1, pp. 90)

In the *Histoire naturelle*, Lamarck compares living bodies to inorganic ones and states: "Both, however, are truly products of nature. They result from its resources, from the motions distributed among its parts, from the laws the rule all its kinds; from the small or large affinities found among the several matters that it employs for its operations" (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 55).

Within a purely naturalistic prospect, if living beings exist, they are either eternal or produced by nature. Lamarck denies the eternity of living beings or of the present state of the Earth. This idea appears and is discussed in several of his works, such as *Hydrogéologie*. In this book, Lamarck discusses both geological transformations (the form, nature, structure and localization) that occur in the Earth and changes of all things that are found in it. Neither man, nor the animals, nor plants, nor life itself seem eternal. They are part of a gradual development and progress. Mankind is the most recent result of this progression, but it is impossible to envisage its end (see LAMARCK, *Hydrogeology*, pp. 61-2 e 77). According to Lamarck's creed, there is only one possibility: all forms of life must be a result of physical forces and of the laws of nature.

Animals are natural products. Therefore, it is from nature that they derive their existence and the powers they have. It formed both the most perfect and the least perfect ones. It produced the different organizations that are observed among them. With the help of those several organizations and the particular system of organs, it endowed animals with their several powers that we recognize. Therefore it [nature] has the means to produce those things. [...]

I believe that I can safely assert that if it really produced those things, it doubtless did it by physical means. All its means are purely physical and one cannot ascribe to it any other means (LAMARCK, *Histoire naturelle des animaux sans vertèbres*,

vol. 1, 140).

Although this great subject of research [the source of life and the origin of the several living beings] is very difficult, the difficulty that it presents are not insurmountable, since all those are purely *physical* phenomena (LAMARCK, *Philosophie zoologique*, vol. 1, p. 363).

If living beings are natural bodies, nature is able to produce all living beings. But how could this happen? Could the several living bodies be produced each by itself, at the same time, independently of one another? Could nature produce directly, from lifeless matter, a bird, a whale, a tree? Lamarck answers that perhaps this could be possible, but that it is implausible. The powers of nature are always the same - it is rule by eternal laws. And we do not observe, nowadays, the direct production of complex animals from lifeless matter: they all spring from similar parents, through generation. But some living bodies must have been produced from inorganic matter:

If living bodies are really natural products, it is necessary that it has produced and still has the power to produce directly some of them, in such a way that, endowing them with the [power] of growth, multiplication, the possibility of changing and progressively compounding a diversified organization, according to circumstances, its power and means might produce all those [living bodies] that we observe now (LAMARCK, *Philosophie zoologique*, vol. 1, p. 368).

Lamarck rejects the direct natural production of a lion, an eagle, a butterfly or an oak-tree. All of them are generated from individuals similar to themselves. By exclusion, Lamarck concludes that those directly produced by nature must be the most simple ones, those that have no observable reproductive means.

Lamarck accepts another general principle: nature always proceeds from the simplest to the more complex (LAMARCK, *Système analytique des connaissances positives de l'homme*, p. 135). Perhaps he would also use the old principle of continuity: "nature never makes jumps". However, he avoids this principle - perhaps because it could be used against his own ideas, since he denied a gradation between the three realms of nature.

Indeed, if it is true that all living beings are natural products, we cannot refuse to believe that it only could produce them successively and not all of them simultaneously, in a single time without duration. If it formed them successively, it occurs to us that it began by the simplest ones, only later producing the highly composed organizations - whether of the animal or of the vegetable realms (LAMARCK, *Philosophie zoologique*, vol. 1, p. 271).

Part of Lamarck's theory has a **deductive** character: he draws many conclusions from his general principles, from his ontology - not from observation. Observation merely shows us that living beings exist now and that there was a time when the

Earth was devoid of living beings. The general principles require that the existence of living beings should be explained by natural powers. It is therefore necessary to admit the possibility of natural production of living beings from lifeless matter. In some stage, there must have been a direct ("spontaneous") production of life.

Although Lamarck does not explicitly present his metaphysical principles as the foundation of his work, in his previous books, one can observe that they are indeed used in many arguments that are found, for instance, in the *Philosophie zoologique*:

Since all living bodies are natural products, nature itself necessarily organized the simplest of those bodies, gave them directly life and the powers that are common to those that have life.

Through those direct generations formed in the beginning of the animal or vegetable scales, nature was progressively able to produce all other living beings (LAMARCK, *Philosophie zoologique*, vol. 2, p. 468<sup>12</sup>).

If we recognize that all natural bodies are really productions of nature, it must become evident that, in order to produce the several living beings, it must have formed first the simplest of all - that means, to create those that are really just sketches of organization and that we only dare to regard as organized and living beings (LAMARCK, *Philosophie zoologique*, vol. 2, p. 68).

This instance shows that it is from general principles and not from an empirical study that Lamarck establishes the necessity of accepting spontaneous generation. This is confirmed by the analysis of several points of his work. In the *Philosophie zoologique*, after provide several presumed instances of spontaneous generation - including intestinal worms, mushrooms and mould, Lamarck himself presents doubts about those instances. He states that he is not sure whether they come directly from inorganic matter:

I have not, nowadays, a settled opinion whether the *direct generations* that are the subject of this chapter really occur or not. It is certain, I think, that nature does really produce them in the beginning of each realm of living bodies and that without this way it could never have produced the vegetables and animals that inhabit our globe (LAMARCK, *Philosophie zoologique*, vol. 2, p. 89-90).

It seems that Lamarck perceives that the empirical evidence is weak. However, it is **certain** that nature can produce life from lifeless matter - otherwise, life could not exist.

In a similar argument, if one accepts that superior animals exist, that they have not existed always and that they are not produced directly from lifeless matter, there is only one alternative compatible with a naturalist view: they were indirectly produced by nature. Therefore, nature must have the power of transforming living beings and progressively endowing them with a greater perfection and complexity. Lamarck de-

scribes as one of the "zoological axioms or principles":

In all its works, nature could only proceed in a gradual way. Hence, it could not produce all animals at the same time. It initially formed only the simplest ones. Then, passing from those to the more compounds, it successively established in them different systems of particular organs; it multiplied them, increased their energy and, assembling them in the most perfect ones, gave rise to all known animals, with the organization and the powers we observe. **Either it [nature] did nothing at all, or it did it this way** (LAMARCK, *Histoire naturelle des animaux sans vertèbres*, vol. 1, p. 105 ).

The emphasized sentence in this citation shows that Lamarck is quite certain of his conclusion. It is not grounded on **facts**, since he did not observe the successive formation of animals at all. His conclusion is grounded on his **principles**.

Most descriptions and discussions of Lamarck's theory have focused on his famous "laws" proposed to explain the progression of animals. If those laws are regarded as the **principles** of Lamarck's theory, it is impossible to regard this theory as well founded. Those laws are neither evident nor grounded upon facts. According to the present reconstruction, however, one should focus the attention upon the most general metaphysical principles of Lamarck's work. From this approach, it is possible to perceive that many of Lamarck's arguments **require** those general principles as premises. It is also possible to grasp that many of his basic conclusions are indeed quite certain, if those general principles and a few basic facts are accepted. Interpreted from this point of view, Lamarck's theory is much stronger than when analysed from the point of view of the requirements of empiricism.

## 5. FINAL REMARKS

Lamarck's methodological discourse shows that he was, doubtless, a conscious follower of Condillac. **In this sense**, he could be described as an "ideologue". However, he does not share the restricted empiricism of Destutt de Tracy, Cabanis and other authors of this group. Lamarck's methodological discourse is closer to Condillac's original thought. Indeed: the search for general laws and principles, as well as the building of a **system** were demanded by both Condillac and Lamarck, but denied by the *idéologues*.

Lamarck allowed himself the use of unobservable processes as explanatory hypothesis. Condillac admitted the use of such suppositions, on the condition that they were not mistakenly regarded as facts. The *idéologues* completely rejected this kind of explanation.

The analysis of his *praxis* shows that Lamarck sometimes acts accordingly to Condillac's (and his own) methodological discourse, but many times clashes with it. There is, of course, a lot of empirical data in Lamarck's works and he tries to provide a good empirical basis for a few central points - for instance, when he describes the

progression of the animal scale (see *Discours de 1806*, p. 566, and *Philosophie zoologique*, vol. 2, p. 128), one should accept his use of the phrase "positive fact" as a nice description of his results. However, in many cases Lamarck confounds the realms of certainty and opinion. This is the case in most of his descriptions of the unobservable inner processes envisaged as explanations of the powers and transformations of animals. Such is the case of his description of the movement of fluids inside animal tissues to open ways, to form several channels, to create new organs, etc. (see *Philosophie zoologique*, vol. 1, pp. vj-vij). Lamarck describes those hypotheses as **certain** and transgresses his own methodological discourse.

Sometimes Lamarck is careless - but not always. He is usually cautious and remarks that his theory is not certain, that the processes he suggests are only opinions, and that his considerations should be regarded as probable but not as true. For instance: when he discusses the origin of the several groups of animals, in the *additions* of the *Philosophie zoologique* (Vol. 2, p. 462), he stresses that his considerations are to be regarded as *probable conjectures*.

If Lamarck's work is to be evaluated from an empiricist point of view, it should be rejected. Indeed, many important points of his theory - such as his explanation of the origin of the first living beings, by spontaneous generation - have a very poor empirical basis.

It is possible, however, to regard Lamarck's work from another point of view. His later works clearly stress the importance of a set of general *a priori* principles as basic foundations of his theory. Those metaphysical principles form a naturalistic and physicalist creed that is not a mere appendage to Lamarck's work: they are basic premises in many scientific arguments presented by Lamarck. It was shown that Lamarck's belief in the direct (or "spontaneous") generation of lower animals and plants was a *necessary conclusion* from a few general facts and from his metaphysical principles.

From this point of view, Lamarck's theory can be accepted as stronger and much better founded than when it is analysed from the point of view of empiricism. This interpretation makes acceptable many of Lamarck's "certainties" that were unacceptable from the empiricist point of view.

There is, however, one great difficulty. Lamarck's methodological discourse does not vindicate the building of a theory grounded upon abstract, metaphysical principles. This kind of system was strongly attacked both by the *idéologues* and by Condillac (see CONDILLAC, *Traité des systèmes*, in: *Oeuvres philosophiques*, vol. 1, p. 121; and PICAUVET, *Les idéologues*). And Lamarck himself never stated that he was developing a new method: he regarded himself as a follower of Condillac.

It is likely that Lamarck did not perceive that his work required a new method. One might guess how would his work be received in his own time, if it was presented as founded upon metaphysical principles and as a denial of Condillac's methodology. Perhaps it would have received a still worse criticism. However, from the philosophical point of view, this would increase the value of Lamarck's work. He would not incur the charge of violating his own method. It would become clear that some of his conclusions were necessary consequences of general facts and of his basic princi-

ples.

Besides that, it is relevant to remark that Lamarck's main metaphysical principles were regarded, later, as the basis of all biological research. Charles Darwin never admitted that he received any influence from Lamarck's work. However, in the "historical sketch" published as an introduction to later editions of the *Origin of species*, Darwin states:

[Lamarck] was the first one who made the eminent service of calling the attention to the probability that all changes in both the inorganic and organic worlds are the result of laws and not that of a miraculous intervention (DARWIN, *The origin of species*, p. 1).

This is the essence of Lamarck's metaphysics and the basis of his method.

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Anmerkungen

<sup>1</sup> See, for instance, CUVIER, *Rapport historique sur le progrès des sciences naturelles depuis 1789 e sur leur état actuel*, pp. 234-5; the introduction of the *Recherches sur les ossements fossiles des quadrupèdes*, vol. 1, p. 28; and the *Discours sur les revolutions du globe terrestre*, where Cuvier compares Lamarck to the authors who proposed "fantastic" doctrines, such as Robinet and De Maillet. See also Cuvier's *Éloge* produced at the death of Lamarck. Here he states that Lamarck's work, from the *Recherches sur l'organisation des corps vivants* onwards, is grounded upon arbitrary assumptions - conf. CUVIER, 1835, pp. ii-iii.

<sup>2</sup> The relevant references are provided by LANDRIEU, *Lamarck, le fondateur du transformisme*, pp. 435-6.

<sup>3</sup> See, for instance, PICAVET, *Les idéologues*, p. vii and SYFMAN, *Lamarck et son époque*, chap. IV -

specially p. 57, and chap. XIX. See also: RICKEN, 1986, p. 39.

<sup>4</sup> According to Picavet, the group of the *idéologues* (Volney, Ginguené, Garat, Destutt de Tracy, Cabanis and others) was profoundly influenced by Condillac and by the spirit of the *Encyclopédie* of Diderot and D'Alembert. Most of the *idéologues* worked at the *École Polytechnique* and at the *Institut* (see PICALET, *Les idéologues*, p. vii). Lamarck was part of the *Institut* (Botanic section) and for this reason Picavet includes him in the group of the *idéologues*, without specifying other criteria for this classification. We disagree with Picavet and accept Le Roy's opinion (see LE ROY, "Introduction à l'oeuvre philosophique de Condillac", in: CONDILLAC, *Oeuvres philosophiques*, vol. 1, p. xxxii): the ideologues have adopted only part of Condillac's attitude to science. They defend a very limited empirism and imposed restrictions to knowledge that were not accepted by Lamarck. Some important ideologues, such as Destutt de Tracy, distort Condillac's thought. They state that Condillac reproached the building of systems (see Destutt de Tracy, *apud* PICALET, *Les idéologues*, p.22). What Condillac really criticized was the building of systems grounded on abstract principles or upon hypotheses. On the other side, he argued for the construction of systems grounded upon general facts (laws). In this aspect, Lamarck does not follow the ideologues. His methodological discourse is very similar to Condillac's. Lamarck proposes the building of a system (theory) grounded upon positive facts. The very title of his last work - *Système analytique des connaissances positives de l'homme* - exhibits his acceptance of systems.

<sup>5</sup> Auguste Comte's "classical" positivism was strongly influenced by the school of the French ideologues.

<sup>6</sup> The introduction of Lamarck's *Philosophie zoologique* contains a description of the methodological assumptions accepted by him.

<sup>7</sup> In this part of his work, Lamarck tries to establish from observation the existence of a progression among known animals. He then assumes that the same sequence represents the chronological succession of animals successively produced by nature - but this is only an assumption that cannot be proved by his data.

<sup>8</sup> Lamarck speaks about the "vital orgasm" in several of his works. See, for instance, *Recherches sur l'organisation des corps vivants*, pp. 61-4, *Philosophie Zoologique*, vol. 2, pp. 20-40 and *Histoire naturelle des animaux sans vertèbres*, vol. 1, pp. 90-109.

<sup>9</sup> Lamarck wrote an entry on "Nature" for Dérerville's *Nouveau dictionnaire d'histoire naturelle*. It is reproduced in the second chapter of his last book, *Système analytique des connaissances positives de l'homme*.

<sup>10</sup> The "Supreme author" of nature, or God, is accepted by Lamarck as a reality, but it is excluded from science. He states that it is only possible to "positively" assert about God that he exists and is all-powerful (*Système analytique des connaissances positives de l'homme*, p. 8). He should be excluded from the study of Nature, because he cannot be known.

<sup>11</sup> Lamarck carefully avoids to elucidate the nature of this "prevention" - a religious one, of course.

<sup>12</sup> This citation was taken from the summary of the second volume, chapter VI - On direct or spontaneous generation. The text of the chapter does not exhibit such a clear and synthetic statement.

<sup>13</sup> In this article, all references to this work are to the second edition.