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«THE BURNING QUESTION OF PHYSICOCHEMICAL SCIENCE». PHILOSOPHICAL REMARKS ABOUT THOMAS HUXLEY'S READING OF CARTESIAN PHYSICS

di
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> J'espère que nos neveux me sauront gré, non seulement des choses que j'ai ici expliquées, mais aussi de celles que j'ai omises volontairement, afin de leur laisser le plaisir de les inventer.
>
> René Descartes

> There are some men who are counted great because they represent the actuality of their own age, and mirror it as it is. […] But there are others who attain greatness because they embody the potentiality of their own day, and magically reflect the future. They express the thoughts which will be everybody's two or three centuries after them. Such a one was Descartes.
>
> Thomas H. Huxley

1. *Introduction*

The aim of this paper is to investigate the path that led Descartes' philosophy to have a special place in the works of Thomas H. Huxley (1825-1895). Actually, in an age where British idealism believes that materialism and mechanism are harmful to philosophy and to science, Huxley, instead, shows the need to reconcile these two approaches with biological sciences, stressing that they cope only with methodological, and not teleological, issues. To do this it is necessary to come back to the father of modern philosophy and to better investigate his position about the life sciences.

By means of a philological investigation, Huxley proves that Descartes' works on physics and *automata* provide important suggestions for the philosophy and science of the 19th century. According to Huxley, the most important paths that Descartes pointed out were the foundations of rational cosmogony and physiological psychology. In Huxley's opinion, the fact that all reality (physical and organic) is subordinate to identical scientific laws proves that Descartes was right.

I suppose that thanks to the influence of Descartes, Huxley's intellectual operation strives to undermine Comtean positivism and to preserve the British *New Philosophy*. To this end I think that Huxley considers the presence of Cartesian rationalism in the 19th century as necessary to strengthen the methodological assertions of science.

2. *The Cartesian Physiology*

Huxley's opinion on Descartes moves from a clear assumption: he was not only a great mathematician or philosopher, but also a 'great and original physiologist', insofar as he did for the «physiology of motion and sensation» what Harvey did for blood circulation, «opening up that road to the mechanical theory of these processes, which has been followed by all his successors»[1].

Through Huxley's works, it is not difficult to understand that Huxley studied Descartes for a long time and that the French philosopher was always in his mind, especially regarding the question of the relationship between «brute matter» and «organic matter», and generally about the mind-body topic[2]. This «physiologist of the first rank» – as Huxley addresses Descartes, – two centuries after his death, seemed to him to be not so much physically alive but present matters. His latent but active presence can be testified in conjunction with philosophers of the 18th century like David Hartley (1705-1757) or Albrecht von Haller (1708-1777), who influenced Huxley on issues concerning the sensitive nature of man[3].

In Huxley's works, the quotations about Descartes are numerous, and the English Naturalist dedicates to him at least two important essays[4]. In his other works, the French philosopher is quoted at length, for instance in the monograph on Hume[5] or in the first ever-written article on 'Evolution' – in the *Encyclopedia Britannica*[6] – in which «Darwin was nonplussed to find himself the culmination

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[1] T.H. Huxley, *On the Hypothesis that Animals are automata, and its History* (1874) (henceforth in brackets: date of first publication), in Id., *Collected Essays* (Voll. IX) (henceforth *CE*), I, London, Macmillan & Co., 1893-94, p. 201; Id., *The Progress of Science* (1887), in *CE*, I, pp. 48-49.

[2] Id., *Hume* (1878), in *CE*, VI, *passim*. In particular: pp. 59 sgg., 72-120.

[3] A first theoretical framework about Descartes and physiology is by A. Georges-Berthier, *Le Mecanisme Cartesien et la physiologie au XVII^e siècle*, in «Isis», 2 (1914), pp. 37-89.

[4] See T.H. Huxley, *On Descartes' Discourse Touching the Method of Using One's Reason Rightly and of Seeking Scientific Truth* (1870), in *CE*, I, pp. 166-198; Id., *On the Hypothesis that Animals are automata, and its History* (1874) cit., *passim*.

[5] See Id., *Hume* (1878), in *CE*, VI.

[6] See Id., 'Evolution' lemma, in *Encyclopaedia Britannica*, 1875[9].

of Cartesian Philosophy and biological discovery»[7] – or in the address *The Progress of Science*, where Descartes is indicated as proponent of «a schema of evolution, as a hypothesis of what might have been the mode of origin of the world, while professing to accept the ecclesiastical scheme of creation, as an account of that which actually was its manner of coming into existence»[8].

Huxley wrote the lemma "Evolution" for the *Encyclopaedia Britannica* (1875, 9th edition) in the Section "Science-Biology". The third part regards "The Evolution of the Sum of Living Beings" in which he espoused the ideas of forerunners about evolution. By expounding a summary of different theories, Huxley considers Descartes' philosophy of the greatest importance. Hereafter, the entire passage of the third part is quoted:

«The notion that all the kinds of animals and plants may have come into existence by the growth and modification of primordial germs is as old as speculative thought; but the modern scientific form of the doctrine can be traced historically to the influence of several converging lines of philosophical speculation and of physical observation, none of which go farther back than the 17th century. These are:

1. The enunciation by Descartes of the conception that the physical universe, whether living or not living, is a mechanism, and that, as such, it is explicable on physical principles.

2. The observation of the gradations of structure, from extreme simplicity to very great complexity, presented by living things, and of the relation of these graduated forms to one another.

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[7] A. Desmond, *Huxley. From Devil's disciple to Evolution's high Priest*, Reading MA, Perseus Books, 1994, p. 486.

[8] See T.H. Huxley, *The Progress of Science* (1887) cit., p. 98. Nevertheless, it is important to evaluate the entire paragraph, in order to consider the place of Descartes in the history of Evolution: «The growth of a plant from its seed, of an animal from its egg, the apparent origin of innumerable living things from mud, or from the putrefying remains of former organisms, had furnished the earlier scientific thinkers with abundant analogies suggestive of the conception of a corresponding method of cosmic evolution from a formless "chaos" to an ordered world which might either continue for ever or undergo dissolution into its elements before starting on a new course of evolution. It is therefore no wonder that, from the days of the Ionian school onwards, the view that the universe was the result of such a process should have maintained itself as a leading dogma of philosophy. The emanistic theories which played so great a part in Neoplatonic philosophy and in Gnostic theology are forms of evolution. In the seventeenth century, Descartes propounded a scheme of evolution, as an hypothesis of what might have been the mode of origin of the world, while professing to accept the ecclesiastical scheme of creation, as an account of that which actually was its manner of coming into existence. In the eighteenth century, Kant put forth a remarkable speculation as to the origin of the solar system, closely similar to that subsequently adopted by Laplace and destined to become famous under the title of the "nebular hypothesis"» (ivi, pp. 97-98).

3. The observation of the existence of an analogy between the series of gradations presented by the species which compose any great group of animals or plants, and the series of embryonic conditions of the highest members of that group.

4. The observation that large groups of species of widely different habits present the same fundamental plan of structure; and that parts of the same animal or plant, the functions of which are very different, likewise exhibit modifications of a common plan.

5. The observation of the existence of structures, in a rudimentary and apparently useless condition, in one species of a group, which are fully developed and have definite functions in other species of the same group.

6. The observation of the effects of varying conditions in modifying living organisms.

7. The observation of the facts of geographical distribution.

8. The observation of the facts of the geological succession of the forms of life»[9].

In other terms, for Huxley, Descartes has described the same issues of the physiology of the 19th century, using old conceptual (physical) categories.

If the general idea about an evolution of life has always been in philosophical systems, only since Descartes can it be conceivable by means of well-grounded scientific principles. If in an immediate future, the Cartesian viewpoint would represent the turning point for physics in the 17th century, for the biology of the 19th century, it was its latent substratum.

His intuitions were more profound than they seemed to be to his contemporaries and all that is necessary to do for the physiology of the 19th century is to «make them coincide with […] present physiology in form», in a way that they are able «to represent the details of the working of the animal machinery in modern language, and by the aid of modern conceptions»[10].

Huxley admits that the reappraisal of Descartes is done not only by himself, but also by other philosophers, for instance Herbert Spencer. In this respect, Huxley points out: «The profound and vigorous writings of Mr. Spencer embody the spirit of Descartes in the knowledge of our own day, and may be regarded as the 'Principes de la Philosophie' of the 19th century»[11].

I would argue that Huxley performed this conceptual *transfer* through two different scientific strategies.

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[9] See Id., 'Evolution' lemma, in *Encyclopaedia Britannica* cit.

[10] Id., *On Descartes' Discourse Touching the Method of Using One's Reason Rightly and of Seeking Scientific Truth* (1870) cit., p. 185.

[11] Id., 'Evolution' lemma, in *Encyclopaedia Britannica* cit.

i) The first program consists in strengthening the epistemological issues of the physiology through the assumptions of Cartesian physics; that is, by applying the ideas of 'force' and of 'movement' as basic elements of living-matter.

ii) The second program consists in building a weak (or soft) reductionism into the fields of the life sciences, by using an antithetic view to that of positivism, which in general stresses the idea of a prevalence of physics on biology.

iii) Finally, a third point links these two issues into a cohesive cultural perspective, whose goals are both social and educational. Huxley states that «[…] It is because the body is a machine that education is possible. Education is the formation of habits, a superinducing of an artificial organisation upon the natural organisation of the body; so that acts, which at first required a conscious effort, eventually became unconscious and mechanical. If the act which primarily requires a distinct consciousness and volition of its details, always needed the same effort, education would be an impossibility»[12].

According to this outlook one could affirm that, apart from the influence of cultural ideas (volitions, ideas, external *stimuli* etc), an appropriate study of the body is possible thanks only to a pure and simple naturalistic vision, without any external influence of a metaphysical sort.

Thus, in Huxley's opinion, Descartes represents the type of scientist who is able to catch the drift of separation of the two spheres – mental and physical, scientific and humanistic – since he has reserved for them an equal but separate inquiry in which the mental structure can justify even the logical existence of consciousness, but never explain that physical laws depends on its structure.

Hence, culture is artificial in the sense that it – in the case of humans – may model a natural structure to help it acquire patterns of behaviour that, as they are habits, could become subconscious, that is 'mechanical'. This kind of mechanism, however, is deeply different from that which Nature shows within itself. Mechanism is a natural property of nature; on the contrary, habits are artificial properties originating from external *stimuli* (e.g. culture), and they appear to an observer to be mechanical qualities only in their performance and not in their natural constitution.

3. *A new model for Science and Philosophy*

For Huxley, Descartes, more than any other philosopher, has laid the foundations of the rational cosmogony and physiological psychology' of the 19th

[12] Id., *Hume* (1878) cit., p. 188.

century[13]. But the importance of the analysis of Descartes' works made by Huxley aims to stress not only its scientific purposes *strictu sensu*; it also tries to underline in a special way the ideal break that Descartes has established in the history of the methodology of science and of philosophy. Because of this, «the essence of modern, as contrasted with ancient, physiological science appears to me to lie in its antagonism to animistic hypotheses and animistic phraseology. It offers physical explanations of vital phenomena, or frankly confesses that it has none to offer. And, so far as I know, the first person who gave expression to this modern view of physiology, who was bold enough to enunciate the proposition the vital phenomena, like all the other phenomena of the physical world, are, in ultimate analysis, resolvable into matter and motion, was René Descartes»[14].

In this respect, in the same essay Huxley points out that we 'owe' to Descartes «both the spiritualistic and the materialistic philosophies' of the XIX century»[15]. This separation does not mean the origin of a simple dualism, but is the evidence that – through the parting of the two phenomena (material and mental) – Descartes was really up to «seek for the explanation of the phenomena of the material world within itself»[16], by pointing out that «our certain knowledge does not extend beyond our states of consciousness»[17].

Huxley's aim is to stress that Descartes was a materialist, not because of an ideology, but because he strongly believed in physical issues as being the basis of the structure of the world, and in an «active scepticism» as a means to achieve scientific truth[18].

The explanation of Huxley about these statements is remarkable. The metaphor that he uses is the same adopted by Descartes: «All the actions which are common to us and the lower animals depend only on the conformation of our organs, and the course which the animal spirit take in the brain, the nerves, and the muscles; in the same way as the movement of a watch is produced by nothing but the force of its springs and the figure of its wheels and other parts»[19].

In other words, force and «its subsequent movement» are the only possible explanations for a body, just as for a clock. For all this, the body of a living man and the body of a dead man differ from each other in the same way as a watch or other «*automaton* (that is to say, a machine which moves of itself) differs in it-

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[13] Id., *The Progress of Science* (1887) cit., p. 49.

[14] Id., *The Connection of Biological Science with Medicine* (1881), in *CE*, III, p. 358.

[15] Ivi, p. 359.

[16] *Ibidem*.

[17] Id., *Science and Morals*, in *CE*, IX, p. 130.

[18] Id., *On Descartes' Discourse Touching the Method of Using One's Reason Rightly and of Seeking Scientific Truth* (1870) cit., p. 170.

[19] Id., *The Connection of Biological Science with Medicine* (1881) cit., p. 360.

self when it works or when it is broken»[20]. Both the body and the watch show the tenets of their working, even in the case of non-functioning! In fact, the *absentia* of both movement and force reveal that life and death are nothing but biological and physiological states in which the principle that support them has stopped.

I wish to remark that Huxley does not think to establish a simple symmetry between the structure of matter and the pattern of life-matter. His philosophical project is to demonstrate how important Descartes was in announcing the resolution of the *dilemma* concerning the differences between the realm of the organic and that of the non-organic. Because of this he sees Descartes as a forerunner of scientific reductionism, but without breaking the vision of nature as a whole.

In Huxley's mind, the boundaries of Descartes' thought lie only in the limited scientific knowledge of his time. From this point of view, Giovanni Alfonso Borelli's treatise *De Motu Animalium*, or the physiology and the pathology of Herman Boerhaave, are nothing but *developments* of Descartes' fundamental conception of the English scientists[21]. On the contrary, Huxley pays a tribute to results reached from Descartes as regards the medical experiments he carried out in the last part of his life: «[…] With the origin of modern chemistry, and of electrical science, in the latter half of the eighteenth century, aids in the analysis of the phenomena of life, of which Descartes could not have dreamed, were offered to the physiologist. And the greater part of the gigantic progress which has been made in the present century is a justification of the prevision of Descartes. For it consists, essentially, in a more and more complete resolution of the grosser organs of the living body into physico-chemical mechanisms»[22].

This quotation represents Huxley's clearest statement about both Descartes' philosophy and his science. Thus, the reading of Descartes' physics is to be regarded as special. In Huxley's vision it would be about a physics 'subjected' to physiology, since the Cartesian physics, as scientific matter, does not distinguishes itself much from the empirical observations made by Aristotle[23].

Keeping a distance from spiritual ideas to explain living beings, Huxley finds the best results from Cartesian physics. From this viewpoint, he analyses it not so much in its detail but for its innovative scientific framework. To put his argument more forcefully, Huxley turns to the well-known Cartesian example of the clock: «I shall try to explain our whole bodily machinery in such a way, that it will be no more necessary for us to suppose that the soul produces such movements as are not voluntary, than it is to think that there is in a clock a soul which

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[20] Ivi, p. 220.
[21] *Ibidem*.
[22] Id., *The Connection of Biological Science with Medicine* (1881) cit., p. 362.
[23] Id., *The Progress of Science* (1887) cit., p. 78.

causes it to show the hours' [*De la Formation du Fœtus.*]. These words of Descartes might be appropriately taken as a motto by the author of any modern treatise on physiology»[24].

The attempt to explain the link between 'actions', as the consequence of will, and 'movements', as the final result of the coordination of different parts of the body, proves much more important for Huxley than finding a valid reason to explain what 'will' or 'thought' are in themselves. The methodological connection that Descartes suggests in Huxley's arguments (or that he believes to read in Descartes' arguments) is to avoid having recourse to external causes, as one does when one thinks about the mechanism of a clock.

For Huxley, the mechanism stated by Descartes is the key to solve a puzzle: Why can organic matter not be regarded as consisting of the same elements and principles that make up the non-organic? Huxley thinks that only a «robust faith» in the universal applicability of the principles laid down by Descartes will help to show that the 'actions' that science defines as 'vital' are nothing but «changes of places of particles of matter»[25].

Huxley thinks that this *rapprochement* is made possible thanks to his new (flawed) theory about protoplasm. In any case, his attempt to put forward a project to find a new place for physics and biology among the sciences is evident.

Therefore, there is no reason to accept Marie François Xavier Bichat's extreme vitalism or the softer view from Christian Wolff. The path cleared by Descartes is the only one that science can take, after solving the problem of brute matter[26].

Huxley defines this issue as «the burning question of physicochemical science», whose project he thinks could be parallel to that for finding the better scientific strategies to have an understanding of the evolution of life, starting from chemical basis and not only looking at a comparative or morphological approach[27].

In Huxley's works it is possible to find a clear example of this design, with useful and practical outcomes, in his essay entitled *The Connection of Biological Science with Medicine*[28]. Actually, Huxley presumes that by moving the argumentation from the traditional themes of medicine, concerning only the phase of treatment, to that of the inquiry, that involves the relationship between physiology and biology, it will be possible to cure diseases better[29].

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[24] Id., *The Connection of Biological Science with Medicine* (1881) cit., p. 221.
[25] *Ibidem*.
[26] *Ibidem*.
[27] Id., *The Connection of Biological Science with Medicine* (1881) cit., p. 221.
[28] *Ibidem, passim*.
[29] Ivi, p. 227.

4. *The reaction to Positivism and Descartes' materialism*

In conclusion, from Huxley's point of view, the progress of science depends on the epistemological framework in which the particular sciences are placed; and from this viewpoint, Huxley's project is the opposite to that stated by August Comte's positivism.

To this regard, after having been falsely accused of talking about his philosophy without having read his works, Huxley's position against Comte is illustrative[30]. The opinion about Comte had been really negative. Having defined Comte's philosophy as «Catholicism *minus* Christianity»[31], Huxley had attacked the heart of positivism head-on, by accusing it to be a sort of dogmatism. And he opposed it through a vision of science, clinging to what he defined as a 'materialism' on the level of scientific explanations, but remaining closed to a materialistic philosophy on the ground of scientific ideology. In this respect, Huxley explained his viewpoint in 1868: «I, individually, am no materialist, but, on the contrary, believe materialism to involve grave philosophical error»[32].

Thus, we can conclude our argument by stating that Huxley entrusts the future of science with the task of reflecting about the two following issues, which for him are literally axioms:

i) the demand to remain anchored to matters, without thinking that they must obey laws organized according to criteria following aprioristic schemes;

ii) the certainty to use terms in the scientific field as simple 'types' for filing systems, adequate to «imaginary substrata of groups of natural phænomena»[33], but without constructing an ontology or a new metaphysics through them.

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[30] Id., *The Scientific Aspects of Positivism*, in «The Fortnightly Review», 5 (1869), pp. 128-150.

[31] Ivi, p. 132.

[32] Id., *On the Physical Basis of Life* (1870), in *CE*, I, p. 154. Pay also attention to the entire section: «Past experience leads me to be tolerably certain that, when the propositions I have just placed before you are accessible to public comment and criticism, they will be condemned by many zealous persons, and perhaps by some few of the wise and thoughtful. I should not wonder if "gross and brutal materialism" were the mildest phrase applied to them in certain quarters. And, most undoubtedly, the terms of the propositions are distinctly materialistic. Nevertheless two things are certain: the one, that I hold the statements to be substantially true; the other, that I, individually, am no materialist, but, on the contrary, believe materialism to involve grave philosophical error. This union of materialistic terminology with the repudiation of materialistic philosophy I share with some of the most thoughtful men with whom I am acquainted. And, when I first undertook to deliver the present discourse, it appeared to me to be a fitting opportunity to explain how such a union is not only consistent with, but necessitated by, sound logic» (Id., *A liberal Education; and where to find it* [1868], in *CE*, III, pp. 154-155).

[33] Ivi, p. 161.

One more element: in the epistemological field, another difference that distinguishes Huxley from Comte is relative to the systematic classification of the sciences.

Despite Huxley's refusal to consider Comtean philosophy as being scientific, because of the «unscientific spirit» of his work and of «no adequate acquaintance with the physical sciences even of his time»[34], I think that an additional reason was due to the different conception of science used for social purposes.

Unlike Comte, Huxley does not believe that Science has a pyramid-shaped structure depending on the relevance that each particular science has for the building of knowledge. To him, all of them are important for humankind. Since he states that science crosses the boundaries of observation by understanding nature only through empirical and causative criteria, for him this represents a contradiction when one states that only some particular kinds of science can plausibly help human welfare[35]. In addition to these criticisms, Huxley tries to join the concept of evolution to that of education. According to his definition contained in his speech *The University of Nature*[36], humankind grows according to the perfect harmony of natural laws.

The knowledge of those laws and the building of a theory of scientific knowledge have the advantage of recognizing the impassable boundaries of phenomenal knowledge, without making facts sacred.

With respect to this, the lesson of Descartes was capital. The use of 'doubt' as methodological structure opened doors to Kantian philosophy and to Huxleyan agnosticism.

Thanks to Cartesian materialism, Huxley is able to contrast Comtean materialism.

Unlike in the thought of the French positivist, Physics and Physiology in Huxley's conception are the symmetric pillars of two connected sciences, and it is possible to establish analogies between these two sciences and their related disciplines in order to bridge the gap that the science of the 16th and the 17th centuries believed to be irremediable. If the principle on which matter or, generally speaking, reality is founded is unique, then equally, the epistemological boundary of science in all its branches can only be one. From this point of view, in my opinion, the doctrine of Huxley's epiphenomenalism and the idea concerning the evolution of mind represent the clearest effect of the influence of Descartes over him.

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[34] Id., *The Progress of Science* (1887) cit., p. 103; Id., *The Scientific Aspects of Positivism* cit., pp. 128-150.

[35] Ivi, p. 60.

[36] Id., *A liberal Education; and where to find it* (1868) cit., p. 83.

ABSTRACT

A Descartes, Thomas H. Huxley (1825-1895) riserva un posto particolare nelle sue opere. Le sue concezioni fisiche e metafisiche costituirebbero la prova che il Francese sarebbe il precursore sia dell'idealismo sia del materialismo del suo tempo e perciò Huxley rinviene nei suoi lavori sulla fisica importanti suggerimenti tanto per la filosofia quanto per la scienza ottocentesche. Le strade più significative che Descartes avrebbe percorso riguardano «la fondazione di una cosmogonia razionale e di una psicologia fisiologica». Il fatto che il mondo (fisico e organico) è subordinato alle medesime leggi della scienza proverebbe che Descartes si trovasse nel giusto. Per questo motivo riteniamo che Huxley attraverso la sua operazione intellettuale miri sostanzialmente a combattere il Positivismo difendendo il valore della New Philosophy. Sosteniamo la tesi che Huxley consideri necessaria una ripresa del razionalismo cartesiano all'interno della filosofia del XIX secolo: i) per rafforzare le asserzioni della scienza in ambito metodologico; ii) per sostenere la tesi che le leggi di natura sono solo astrazioni matematiche e non descrizioni noumeniche della realtà naturale. Riguardo al primo punto, Huxley si avvale della fisica cartesiana come se si trattasse della porzione di un nuovo meccanicismo fisiologico; la seconda tesi ci porterebbe a considerare le leggi di natura di Descartes come un tentativo di integrare le istanze di Descartes e di Hume.

Descartes has a special place in the works of Thomas H. Huxley (1825-1895). Descartes' physics and metaphysics makes him think that the French Philosopher was the ancestor as much of the idealism as of the materialism of his time. Huxley shows that Descartes's works on physics are full of important suggestions for the philosophy and science of the 19th century. The most important paths Descartes pointed out were in his view the «foundations of rational cosmogony and of physiological psychology». The fact that the (physical and organic) world is subordinate to identical scientific laws proves that Descartes was right. I argue that Huxley's intellectual operation strives to undermine Comtean positivism and to preserve the New Philosophy. I suppose that Huxley considers the presence of Cartesian rationalism in the 19th century as necessary: i) to strengthen the methodological assertions of science; ii) to support the argument that the laws of nature are only mathematical abstractions and not 'noumenal' descriptions of nature. On the first issue, Huxley introduces Cartesian physics as a portion of the new mechanism in physiology; the second hypothesis leads us to consider the Cartesian laws of nature as an attempt to integrate both Descartes' and Hume's points of view.