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THE CREATION OF A BACTERIUM

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> "The world may one day have new lights, but from Tales to our days we do not have them".
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> **"Le monde pourra avoir un jour de nouvelles lumières, mais depuis Thalès jusqu'à nos jours nous n'en avons point"**. Voltaire, *Dialogues entre Lucrècio et Posidonius*.

Introduction

"Philosophy, let's add, makes a few "progresses". She deals with simple, totally simple things. She deals with the being, with the knowledge, with the man, simple things and always current. The answers given also by the great philosophers to these simple questions maintain their importance during centuries, more still they maintain during thousands of years. Philosophical actuality extends as far as philosophy itself" ("**La philosophie, avouons-le, fait peu de <<progrès>>. Elle s'occupe de choses simples, toutes simples. Elle s'occupe de l'être, de la connaissance, de homme. Choses simples, et toujours actuelles. Aussi les réponses données par les grands philosophes à ces questions si simples restent-elles importantes pendant des siècles, et même pendant des milliers d'années. L'actualité philosophique s'étend aussi loin que la philosophie elle-même**". Koyré, A., 1944, p.15). This idea according which philosophy deals with always current issues and, therefore, the answers to these questions provided by the great philosophers are also always current answers, is what we will try to exemplify throughout this writing.

In the year 1756, at sixty years of age, of the 84 years that he lived, Voltaire wrote two small dialogues in which he interacts with Lucrecio and Posidonio (Voltaire, 1891). In these two papers, he deals with things that are always current and whose answers have also remained for several centuries. In what follows, we will try to show the presence of these problems for many years. The dialogues between Lucretius and Posidonius deal with two questions, the first addresses the problem of the existence of a supreme being and the second deals with the attributes of the soul. Previously, in Book X of the Laws of Plato, the problem of the origin of life is presented in a manner very similar that presented by the French philosopher; finally, the two topics discussed in these dialogues are closely related to the problem of the origin of life; this problem is the center that we will try to explore in what follows. The objective of this paper is to show that the problem of the origin of life has very important consequences in the philosophical and ethical field. We describe the direction in which molecular biology treats the problem of life, particularly

by pointing out the results of Creig Venter's group experiments in 2010 on the creation of a bacterium. Let's see how the arguments continue in the same order.

I. The creation of bacteria

1. The origin of life and modern science

In the book *The Principle Life*, Hans Jonas states that the question about what is the origin of life? It is a question of modern science, but not of ancient thought, because for the ancient thought the life is given and the ancients question rather about death. Modern thought took up with new vigor the problem about the origin of life from the theory of evolution. The idea that the various species of living organisms change over time and their changes accumulate over the years, allowed us to assume the possibility that many species, if not all, came from a common ancestor. This assumption based on this idea of the common origin of the species, allowed, in turn, a new assumption about the origin of life, which hoped to explain the emergence of life through the combination of various factors (Hans Jonas, Alexander I. Oparin).

The notion of evolution as a process of change without purpose, but governed by laws, was applied not only to the organic world but extended to all aspects of the world, both physical and historical and social. Thus, not only the species of animals and plants evolve by changing their material, but also the societies they "evolve" through history, and our planet as whole has not existed since always but had an emergence through the "evolution" of matter, the entire universe as whole, has an "evolution" by changes of matter. Modern science was presented as being in sufficient conditions to face with relative success the problem about the origin of life, the following paragraphs clearly summarize what was said previously, so although we allow ourselves to reproduce long:

"In silo XIX another devastating blow was applied to religious ideas, regarding the origin of life. C. Darwin and, later, many other scientists, among whom are the Russian researchers K. Timiriázev, the brothers A. and V. Kovalevski, I. Mécnikiv and others, demonstrated that, unlike what the Sacred say Scriptures, our planet had not always been populated by the animals and plants that surround us today. On the contrary, higher plants and animals, including man, did not emerge suddenly, at the same time as Earth, but in later times of our planet and by a result of the progressive development of other, simpler living beings. These, in turn, had their origin in other organisms even simpler and who lived in earlier times. And so, successively, until we reach the simplest living beings.

By studying the fossil organisms of animals and plants that populated the Earth many millions of years ago, we can conclude, in a tangible way, that in those distant times the living population of the Earth was different from the present one, and that the more we advance in the immense depth of the centuries we see that this population is increasingly simple and less varied. Descending gradually, from step to step, and studying life in ever more ancient ways, we come to conclude how the simplest living beings were, very similar of the microorganisms of our day and that in past times were the only ones that populated the Earth. But, at the same time, the question of the point of origin of the

simplest and most primitive manifestations of living nature, which constitute the starting point of all the living beings that populate the Earth, also inevitably arises.

The natural sciences, while rejecting the possibility that the living be generated outside the concrete conditions of the development of the material world, should explain the passage of inanimate matter to life, that is, explain, therefore, the transmutation of matter and the origin of life "(Alexander I. Oparin, p.11)[1].

This long quote clearly shows, in the first place, the influence of the theory of the origin of species on interest, occupation and direction in the problem of the origin of life. Secondly, the foundations on which the modern idea of evolution is based are also clearly laid out, fossils show different organic populations at different times and seem to advance from the simple to the complex. Finally, in the third place, these fragments express the task that the natural sciences propose as a problem to solve: the passage from the inanimate to the organic; In a word, explain how life arose from the non-living. Put differently, the origin of life is sought through the transformation of inert matter and particularly, through the reaction of molecules. The conjunction of chemistry and biology that has resulted in the specialty called biochemistry.

Biologically speaking, for a long time it has been considered as the minimum unit of life to the cell, the knowledge of the parts of the cell is the means to get to know the "mechanism" of life. All elements of the cell are made up of molecules, mainly water and proteins. Growth and reproduction are the functions of the cell and for the multiple chemical reactions are carried out. In the chemical reactions of the cell, proteins and nucleic acids come into play, the latter being of two types: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The genetic material of the cells is found in the DNA and the functional material is found in the proteins. The DNA structure has the shape of the famous double helix discovered by J. D. Watson and F. H. Crick.

The essence of molecular biology lies in the dynamics between proteins and nucleic acids (DNA and RNA). This dynamic constitutes the process of the production or synthesis of proteins with approximately 20 amino acids to combine and with specific sequences for each protein[2], nucleic acids enter as intermediates. The nucleic acids, in turn, are formed with one of these four deoxynucleotides as a base, in the case of DNA, (adenine, guanine, thymine and cytosine) and four ribonucleotides as a base, in the case of RNA, (adenine, guamine, cytosine and uracil). In the sequence of these acids, adenine (A) binds with thymine (T) (or with uracil in the case of RNA) and guanine (G) with cytosine (C). For example, a DNA fragment, ACTAAGC, (i.e., the sequence: adenine-cytosine-thymine-adenine-adenine-guanine-cytosine), contains the information for the sequence of the

[1] In 1973, L. E. Orgel stated the following: "The last hundred years have seen the explosive expansion of our knowledge of chemistry and biology. For the first time, the problem of the origins of life is within the reach of the experimental and theoretical tools available to us (1984, p.13).

[2] The twenty amino acids are: glycine, alanine, valine, leucine, isoleucine, serine, threonine, cysteine, methionine, lysine, arginine, aspartic acid, asparagine, glutamic acid, glutamine, phenylalanine, tyrosine, tryptophan, histidine and proline.

synthesis of a protein, but this fragment it needs the information to be transmitted by the RNA to produce the protein.

The development of biology has followed the path traced by this path, trying to find the mechanism by which the cell transforms nutrients into energy and trying to replicate in the laboratory the processes of chemical synthesis that produce the genetic material of DNA, because there, it is thought, there is the secret of life, since in those processes the enigma of the transformation of molecules in living organisms is hidden. Thus, after the theory of evolution, the laws of Mendel's inheritance, the discovery of the DNA molecule by Avery McLeod and the double-helical structure of the DNA sequence by Watson and Crick, the main achievements of These efforts are:

"Sanger to achieve **the sequencing of bovine insulin** and Paul Berg to mark the beginning of **genetic engineering creating the first recombinant DNA molecule** and Southern to **locate specific DNA sequences**. At this point we take a leap to address **the creation of the first cloned animals**, from Briggs and King to clone the common American frog, and Gurdon with the cloning of the African frog Xenopus laevis until reaching **the cloning of the first mammal**, Dolly the sheep, by Steen Willadsen "(Orozco, Aurora de la Paz, 2011, p.127).

Before the creation of a bacterium, the situation of natural science is determined by the accumulation of these advances in the search for the origin of life: the sequencing of bovine insulin, by Sanger; the creation of the first recombinant DNA molecule, through genetic engineering by Paul Berg; the location of specific DNA sequences, by Southern. the creation of the first clone animals, by cloning the common American frog and with the cloning of the African frog Xenopus laevis, by Briggs and King; and, finally, the cloning of the first mammal, Dolly the sheep, by Steen Willadsen.

2. La creación de una bacteria

The most recent achievement has occurred in May 2010 with the efforts of the research group of John Creig Venter. The central problem is, then, in all the information contained in the genetic material, therefore you get to know all the genetic information you can discover the mechanism of duplication of cells and, therefore, the main function of life. The objective of finding all the genetic material with the information of human beings was sought with the so-called Human Genome Project (HGP), a research project undertaken by the countries of the United States of America, Germany, France, among others. But along with this official project, the company Celera Genomics also sought to achieve the discovery of the human genome, Craig Venter was in charge of the management of this project. The prognosis was that between 80 thousand and 140 thousand genes would be found in human DNA. In the year 2000 the results of the HGP were announced and it was announced that the human genome was composed of about 25 thousand human genes, much less than expected (Cf. Sheldrake, Rupert, 2011, 13-21 and Alfredo Marcos, 2012).

On the one hand, in the year of 1999 Creig Venter and his research group published the discovery of the "sequence" of the genome of the bacteria called Mycoplasma Genitaliun, a parasite of the genitals of primates, the genome of this bacterium is constituted by 517 genes, for which it was considered adequate to find the minimum number of genes necessary for the cell to reproduce, duplicate or replicate. In 2002 Venter's group managed to "synthesize" the infectious poliovirus. On the other hand, in 2007 this research team demonstrated the possibility of "transplanting" chromosomes from one microbial species to another: transplanting the Mycoplasma Mycoides DNA to Mycoplasma Capricolum, of which identical cells of M. Mycoides were found. This led to the project of artificially synthesizing the genome of a bacterium and transplanting it into the mycoplasma of another from which its DNA has been extracted.

“In May 2010 they saw their efforts crowned, reporting the design, synthesis and assembly of the M. mycoides genome from digitized information of the genome sequence, and its subsequent transplantation to the recipient cell M. capricolum to create a cell controlled only by the synthetic chromosome, which they called "Mycoplasma laboratorium" (Orozco, 2011, p.128).

“On May 20, the journal Science published an article that caused a real commotion, probably more due to its technological applications and its **philosophical implications** than to the advance it implies for scientific knowledge [Gibson et al., 2010; with access to the web address of the journal, www.sciencemag.org]. The article, signed by a team of 25 researchers from the Craig Venter Institute, directed by Craig Venter himself, bears the stamp of controversy in the careful choice of the first word of the title: "*Creation of a bacterial cell controlled by a chemically synthesized genome* " (Muñoz, Ramón, p.52).

The central question, and not only for biology, is whether indeed on May 20, 2010 Creig Venter and his research group have reached the creation of life. According Ramón Muñoz, professor in animal biology at the University of Malaga, the answer to this question depends on what is meant by "life". According this scientist, since Aristotle life was understood as a substance (soul, spirit, etc.) and, simultaneously, with Democritus was also understood as a combination of atoms; but as the Aristotelian argument is so powerful, it imposed itself on the mechanics of atoms and constitutes the basis of vitalist thought. According this scientist, the development of biology has had to fight against the vitalist thought since Lavoisier (1743-1794) against the theory of phlogiston, Friedrich Wöhler (1800-1882) with the first synthesis of an organic substance, urea, Eduard Büchner (1860-1917) with alcoholic fermentation and until today with the discovery of Venter. The conclusive answer of this scientist is the following one:

“And despite all these advances in the opposite direction of vitalism, it is hard for us to grant the status of living beings to the automatons of our mental experiment[3], probably

[3] "We are going to propose a mental experiment that illustrates this point. Imagine that our technology reaches a point where we are able by build small automatons capable of obtaining their energy from the sun by means of photoelectric cells. Imagine that these automatons, following the instructions contained in their software, are able by move to collect mineral elements from their environment, and process them chemically inside to reconstruct their damaged or worn parts. Moreover, let us continue to imagine that such reparative processes reach such refinement that automata are able by build small replicas of

because we still maintain in our representation of life the historical imprint of vitalism, the assumption, lacking any empirical evidence, that life is characterized by an irreducible essence, not explicable by molecules (that is, by matter) and their interactions. If we were able shake this representation, we would probably appreciate the work of Craig Venter and his team in its proper measure. It is technically complex and scientifically admirable, but it is also to be expected, that replacing a DNA molecule with its synthetic equivalent allows a cell to survive and reproduce. It will be even more complex and admirable, but also technically feasible, to synthesize other molecular components of a living cell and replace them with their "natural" equivalents. It is a question of time and investments, but not of technical impossibilities"[4].

It seems, then, that the dominant theory in current biology is in the direction of the search for the origin of life and its future manufacture in the laboratory through molecular processes. The struggle that this science enters in our days with the vitalist thought, which is expected to be overcome soon. For the issue that has occupied us throughout this essay it may be necessary to point out that the scientists themselves warn of **the philosophical and, particularly, ethical consequences** implied by the direction in which contemporary biology advances and the achievements reached by this science. This reference to the ethical and philosophical consequences of the findings of Venter's research group allows us to establish a link between this problem and Voltaire's two dialogues between Lucrecio and Posidonio and with what Plato explained in book X of Laws.

Evidently, on the one hand, philosophically speaking, the search for the origin of life by molecular biology leads to cancel the ideas of a higher being, thus eliminating the foundation of all religions, and the idea of a soul or a spirit. But there are other aspects and ideas that are also contrary to the idea, according which life has arisen from innate matter, for example, the very idea of the human being and the faculty by which it produces

themselves, which they endow with a copy of their software. Suppose we have foreseen that the software randomly generates small changes that lead to modifications in the mechanisms of the automata, which leads to an evolutionary diversification. Finally, automata obtain energy and process chemical elements to build their bodies, reproduce and evolve. Will we be willing to accept them as living beings? I am convinced that many readers of *Encuentros en la Biología* will answer negatively. Why? Because it's not about carbon-based life, some will say. Because it is about objects, not living beings, even if they imitate the processes of these beings, others argue. Because they lack the authentic life, they will think almost all ... In summary, because they lack something essential to be considered living beings "(Muñoz Ramón, 2010, p.53).

[4] Another scientific opinion concludes very similar of the question about the creation of life by the research group of Venter: "Evidently progress has been made in the sequencing and analysis of the genome, but there is still a long way to go to understand how they interact among themselves the genes that control the functioning of life. To argue that artificial life has been created is too arrogant. No doubt it has been possible to synthesize the genetic content of a receptor cell, and inserting the known genome of another cell, which was previously assembled in the laboratory. Put simply, the information has only been copied, a synthetic genome has been created, introduced into a host cell to take advantage of its machinery and achieve its self-replication. Genetic information has not been created in any way, and calling it "synthetic cell" may not be adequate, since the cytoplasm of the recipient cell is not synthetic, however, we recognize the commendable work of Venter in creating a synthetic genome, a milestone that sets the pace for a long journey to try to create artificial life, culminating in the creation of complete organisms "(Orozco, Aurora de la Paz, 2011, pp. 119-120, The italics are mine).

knowledge. Indeed, also from and thanks to Aristotle, human beings are conceived as rational beings, many times thinking that reason is what distinguishes them from other beings; and, therefore, this questions what is the reason? and also questions everything traditionally conceived as being produced by reason, for example, what is an idea? In other words, the idea that we have of the meaning of the word "idea" is questioned, which can lead us to a vicious circle.

On the other hand, ethically speaking, every moral principle is questioned, first, ontologically, for questioning its reality and, secondly, for questioning its effectiveness in directing the behavior of the human being. In other words, the acceptance of a "selfish gene" or a murderous gene and, therefore, of an "altruistic gene" or lover of life, puts us in the position of treating all moral aspects as we treat the differences of having standing big or small; No one is responsible for having a big foot or down syndrome, in the same way, we can not rationally hold a person to be selfish or murderous or admire or reward someone for helping their peers or save the life of another person.

II. Conclusion

In the fourth century before our era Plato has said that in all periods there are people who have tried to answer the question of how life is produced from non-living matter and have thought that any answer to that question necessarily produces only a possible speech. In the year of 1756 Voltaire discussed, among other things, how we receive life? and concluded as follows: **"J'avoue sur tout cela mon ignorance. Le monde pourra avoir un jour de nouvelles lumières, mais depuis Thalès jusqu'à nos jours nous n'en avons point"**. In the eighteenth century, the century of lights, the hope remains that in a future day the world may have new lights, but that from antiquity to Voltaire can not give an answer to the question before stated. In the 21st century, in the year 2010, the saying of Plato seems to confirm that in every age there are people who seek to explain the origin of life from non-living matter; in this century, it is thought that the researches of Venter's group have advanced in the long journey to try to create artificial life, culminating in the creation of complete organisms.

Probably we will always be able to maintain the hope that the day will come when the world will have more lights and, finally, the human being will achieve the creation of life, because, as Lucretius says in the dialogue with Posidonius, there is no impossibility, in principle, that from the combination of two entities with different qualities there is an entity that has different qualities from its components. Or, perhaps, as Plato points out, any answer to the questions about the origin are possible discourses and, therefore, any explanation about the origin of life is a possible explanation, including the explanation of the emergence of life from matter not alive; Therefore, we can maintain the hope that it is a matter of time for modern biology to create life.

In addition, the problem about the origin of life has philosophical and ethical consequences that, indirectly or directly, are closely related to our understanding about what we think about the notion of being human, about our conception of knowledge in

general and our conception of science specifically; as well as, has practical implications on the reality and effectiveness of moral values in the behavior of people. The consequences can lead us to the approach of vicious circles that must be taken within account for the search of the origin of life from non-living matter.

Finally, the opinion according which philosophy deals with simple questions such as being, knowledge, man and life, seems, therefore, that these things are always "current" as Koyré says, then, the answers provided by philosophers to these questions also remain for centuries or thousands of years, so, perhaps, we can accept that **L'actualité philosophique s'étend aussi loin that the philosophie elle-même**. If so, then the category of "progress" is not a category that can be applied to philosophical thought. This idea of philosophy, like every idea of it, has its dangerous consequences.

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