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AS ORIGENS DO PENSAMENTO OCIDENTAL

THE ORIGINS OF WESTERN THOUGHT

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SCIENTIFIC EVOLUTION OF PHILOSOPHICAL CONCEPTS OF THE ORIGINS OF UNIVERSE AND LIFE

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Abstract: In order to demonstrate the great importance of Philosophy in the elaboration of current scientific theories, a parallel was drawn between concepts of pre-Socratic Philosophy and current modern theories. Thus, throughout this essay, the convergences between some elaborations developed by philosophers and their reinterpretation from a scientific point of view, supported by the scientific method and the present technological apparatuses, were exposed. In this sense, having as its core the reflection about the atomic theory of Leucippus and Democritus, we investigate the way in which atomism dialogues with the modern Atomic Theory to the Quantum Theory, through concepts of *Kosmos* and Cosmology. In a second moment, origin of life theories were revisited from the pre-Socratic concepts of *Psyche*. Finally, Philosophy and Science are brought together as possible and complementary tools for the restoration of the amplification of thought and investigative processes.

Keywords: Modern Science, Philosophy, Pre-Socratics, Universe, Life.

1.Introduction

The explanations of the first philosophers concerning the origin and the maintenance of the Universe can be considered a point of departure to posterity. The views of these philosophers play an essential role in the solidification of the researches which aim at investigating the transformations that the cosmos has undergone in what concerns both its elementary constitution as well as the origin, evolution and extinction of several species that inhabit it. However,

most of the scientific research in the last centuries was only possible due to the development and help of technical and technological apparatuses that made it possible to precise and detail phenomenic data so as to reach mathematical objectivity.

Although the first philosophers did not have these precision apparatuses at hand, it was within the Eleatic philosophical scenario that a discussion about the necessity of a method previous to any investigation took place. Although the observations regarding *nature* that had their origin in the period between the 7th and the 4th centuries B.C. could not rely on what nowadays operates as a pre-condition to any scientific research, viz, laboratories and its instruments as well was mathematization, they set the paradigmatic use of a *method* to answer questions such as *what is the Universe? What is movement? What is everything?* The use of a method is another pre-condition to any scientific research and demands a well-established path to allow the resulting scientific speech to show in its particularities the methodology which bases its logics.

This essay aims at delineating an argumentative thread in which some essential philosophical contributions from the Antiquity can be somehow found both in Modern and Contemporary Sciences. However, besides theoretical and methodological contributions one cannot overshadow that which may be considered to be the very essence of Science – and what is certainly the very essence of philosophy – viz, *endless enquiry*. Both Science and Philosophy are activities which are works in progress: always open to be reviewed, revisited and even falsified. The idea that a final objective was reached, and thus further researching is not necessary and legitimate denies both Science and Philosophy's zetetic character and would be valid if an Unquestionable Truth was to be achieved. But unquestionability may suit religious dogma and when applied to scientific and philosophical researches it originates stagnation and often fosters setbacks. The very idea of *terminus* is alien to the structuring logics of the philosophical speech as well as for the scientific one. If by any chance the very idea of unquestionability and *terminus* are present and spreading fast, it is not due to philosophy and science, but due to the presence of Ideology. Hence, one must

understand the way through which philosophy plays a fundamental role in the elaboration of scientific theories.[2]

In a famous passage from the *Politics*, when commenting on Thales of Miletus, Aristotle states:

> All these methods are serviceable for those who value wealth-getting, for example the plan of Thales of Miletus, which is a device for the business of getting wealth, but which, though it is attributed to him because of his wisdom, is really of universal application. Thales, so the story goes, because of his poverty was taunted with the uselessness of philosophy; but from his knowledge of astronomy he had observed while it was still winter that there was going to be a large crop of olives, so he raised a small sum of money and paid round deposits for the whole of the olive-presses in Miletus and Chios, which he hired at a low rent as nobody was running him up; and when the season arrived, there was a sudden demand for a number of presses at the same time, and by letting them out on what terms he liked he realized a large sum of money, so proving that it is easy for philosophers to be rich if they choose, but this is not what they care about. Thales then is reported to have thus displayed his wisdom, but as a matter of fact this device of taking an opportunity to secure a monopoly is a universal principle of business. (*Pol.* 1259a6-21)

The wise Thales due to his knowledge regarding astronomy is able to foretell that "there was going to be a large crop of olives". Astronomy, as referred to by Aristotle, means literally the study of the stars observed with naked eyes. The ceaseless investigation carried out by Thales enables him to be the only one capable of foretelling a "large crop of olives" and the very comprehension of the stars occurs due to a technique that is developed on Earth, not in Heaven. This investigation connects two different spheres and Thales

[2] One does not intend to argue for an identity between Philosophy and Science: each one has its own legitimacy. Science seeks the establishment of certainties leaning on the scientific method, knowledge that will explain, foresee, and control the reaction of the natural world. On the other hand, philosophy is concerned, for instance, with the conditions that *allow* such knowledge or how knowledge is possible or not and *what* is knowledge. What ones want to emphasize is that the same *élan* moves both science and philosophy.

can demonstrate how elements *outside* the earth (i.e., the stars) influence the Earth itself. This means that astronomy makes it possible to think a cosmogony without an arbitrary or divine referential. Also, when taking the stars as paradigm for the seasons of the years, he is able to say that they exert their influence over things on Earth, causing effects on animals and plants. Searching for what his contemporaries thought to be irrelevant, Thales becomes rich and shows that theoretical knowledge concerning the stars is indispensable to make human life dynamic and autonomous from the natural phenomena.

What Thales really observed was the *apparent* movement of the stars, constellations, and planets in the celestial firmament. While the Earth revolves around the Sun (revolution) and spins around its axis (rotation), the sky behaves – to those who are observing from an earthly standpoint – like a carousel where constellations are being exhibited one by one along the year. This apparent movement is cyclical and repetitive and thus *foreseeable*. From this very fact, the philosopher was able to correlate the apparent position of the heavenly bodies in the firmament with environmental variations that are also cyclical and observable through the year such as rain distribution, temperature oscillations, and the number of daily hours of light. Taking these correlations into account, and even if Thales himself ignored Earth's rotation and revolution, he was able to infer that these movements were the origin of the four seasons and the climatic variations, as pointed out by Loutre et al. (2004).

Thales observations went far beyond foretelling large crops and made it possible that he predicted a solar eclipse. He is also credited with creating a sundial and developing the theorem named after him which postulates the proportionality of measurements of delimited segments in transversal lines cut by a bundle of parallel lines (Eves, 2005). It is noteworthy that this renowned theorem derives from the mensuration of the height of a pyramid what shows us the relevance of ancient civilizations, as that of Egypt, where Thales could measure such a pyramid. As is well known, the mathematics that stemmed from algebra and geometry is possible only due to Greek and Egyptian contributions, not to mention the Arabs which later have aggregated innumerable contributions. These relations enable one to assume a correlation between the development of Modern Science and the researches of pre-Socratic philosophers.

However, the investigation of natural phenomena and more precisely that concerning the solar system needed to overcome many obstacles. The main obstacle was clearly both Aristotelian Cosmology and Physics which were seized by the Catholic Church during the Middle Ages and crystalized as "the Truth" in the scientific field. Aristotelian cosmology understands the Cosmos as eternal and finite, and the Earth is immovable (*Cael*. X). Heaven and Earth are different as their elements differ radically: while air, fire, water and soil compose the earthly realm, the firmament is made of ether. In other words, given that Earth and Heaven are differently composed, they demand different modes of investigation, i.e., one for the sublunar world and other to the supralunar one.

During the Middle Ages, the long-lost texts of Aristotle reappear in the Western World through the Arabs. Scholars at the universities are amazed at this "discovery" given that the acquaintance with the works of the Stagirite was only possible, until then, via commentaries. Knowledge produced at the universities, where theological, literary and scientific studies were carried out, must now refer to Aristotelian conceptions. Scholars can now establish *new commentaries* based on the very works of Aristotle. Aristotle becomes *the* authority, *the* philosopher, as Thomas of Aquinas – by far the most famous Aristotelian theologian – writes. One must now forget, however, that most of the universities are under ecclesiastical authority, i.e., under the authority of the Roman Catholic Church, and this means that *all the knowledge* produced in the academy should be aligned to the teachings found in the Holy Scriptures. Hence, Aristotelian Cosmology and Physics were aligned to the holy text and established as *the* unquestionable truth.

The geocentric model proposed by Aristotle and grounded mainly in his own physics does not contradict Joshua words: "So the sun stood still in the midst of heaven and hasted not to go down about a whole day" (Josh. 10:13). However, originally Aristotelian Physics conceives of earthly bodies as heavy bodies (water and soil) and light bodies (fire and air), and also postulates a natural place to them, while the supralunar world is described as containing heavenly bodies which run round a perfect and eternal movement, thus being completely different of those earthly movements. Hence, Earth's immobility and centric position is due to the great amount of heavy bodies in it. Heavy bodies tend *naturally* downwards once this is the

movement which allow them to find their natural place and thus repose. According to this logic, Earth is *necessarily* immovable once there is an inherent tendency of heavy bodies both to *stay in* response and *search for it* as well as to get closer to the center of the Universe. One is able to say without exaggeration that the discussion regarding the geocentric model was crucial up to the 20th Century, when the Roman Catholic Church recognized the mistake in prosecuting Galileo and others.

Long before the Middle Ages and its important quarrels between the Church and scientists other clashes between Christian faith and scientific research took place. The groundbreaking researches of Hypatia (350 – 425 AD), a Neoplatonist, mathematician and astronomer, as well as an important political leader in Alexandria would have accelerated the discoveries in the field of Astronomy in *more than a thousand years* if a great amount of her work had not been destroyed by the already Christianized Roman Empire, as sustained by Richeson (1940). Many other researchers in history were persecuted and many were even killed, and their works marginalized or destroyed. From this perspective one can say that the Church operated, in many aspects, to prevent science from fully developing itself, showing that the Indisputable Truth is the greatest enemy of science and of philosophy.

After centuries of intellectual repression, the European Renaissance paved the way to a reassessment of Ancient Philosophy and Art. Interwoven with such values, the Scientific Revolution takes place in the 16th Century. The theocentric ideal begins to falter. Publications such as Copernicus "On the *Revolutions* of the Heavenly Spheres" and Galileo's "The Dialogue Concerning the *Two Chief World Systems"* are now being discussed and presented to the public (Wightman, 1964). Now, within this environment Modern Science is born: based on a *scientific methodology*, a theory is built empirically and verified through experiments, nature is now quantifiable and can be *proved* to work this or that way.

Although one can say that scientific methodology developed during the 16th Century, and resulted somehow in what nowadays is easily observed, viz, that *methodology* plays a central role in scientific research, one must also bear in mind that the idea that it is *necessary* to devise a *method* beforehand is voiced in the 6th Century BC, with

Parmenides. It was the Eleatic philosopher that sustained that every single researcher *must* delimitate a *true path* in order to carry out an investigation *truly* capable of saying the world. The path chosen by Parmenides as a condition to thinking is that which attributes being to things, in other words: 'if there *are* things, they must necessarily *be* something instead of being *nothing*'.

Hence, the method is a condition of possibility so that scientific speech about the world be more than a set of empty words without a referential. Parmenides philosophically sustains that any single investigation must elucidate what things *are*, not what they *are not* once this way leads to nothing, creating a variety of opinions (*doxai*), viz, prejudices which are not sustained by scientific results. Opinions are *pathless* i.e., are built upon a non-methodic path, they are built upon a confusion between being and non-being and generate speeches that have as offspring ghostly things or events deprived of any ontological feasibility. As a result, human beings are imprisoned in false ideas which lack grounding.

If both the mythic discourse of the archaic period and the Judeo-Christian discourse are based upon the Holy Scriptures have in common the fact that they conceive of nature as a manifestation of a super-nature that is not observable, another scenario is presented by philosophy and science: only what is *observable* can be described as nature, and must be subject to experimentation, theories and scientific paradigms.

2. Atomism

When one pays attention to the several ancient theories regarding the origin of life and the Universe, one is led to note that *atomism* is one of the most relevant explanations that has survived. Its survival is easily understood when one bears in mind that the mechanistic understanding of nature which is the benchmark of modernity as seen in Descartes, Leibniz and Newton, for instance, constitutes one of the bases of the atomistic conception of *kosmos*.

Leucippus and Democritus are the two most important names to be remembered. The first, due to the very fact that he founded atomism, according to what Aristotle says (*Metaph.* I 985b4), the other because he fully developed the theory of atoms. Besides ascribing its

founders, Aristotle also describes atomism as being a reaction to the theories which sustained the necessity of unity and immovability of being, i.e., atomism offered a solution to the Parmenidean conclusion that everything is but *one*, identical to itself and movement would be just an illusion thus not pertaining to 'something' or to the effectiveness of being (*GA*, I 324b35-326b6). According to Aristotle, to confront the established theories, in order to introduce the plurality and the movement, generation and degeneration, Leucippus introduces the *emptiness* (*kenos*) as a condition of possibility of aggregation and disaggregation of the atoms: as a result, birth, death and displacements can be now properly explained.

Hence, it is necessary to examine some atomistic ideas in order to understand this intriguing philosophical school from the 5th Century BC.

In his commentary to Aristotle's *Physics*, Simplicius says:

> Democritus of Abdera stated as principles the full and the empty (*to pleres kai to kenon*) that he named being and non-being (*to on and to me on*). Assuming atoms as the matter of beings (*hylen tois ousi*), the other things are born from differences. These differences are in number of three: *rhysmos* (dynamic form), *trope* (position) and *diathige* (disposition), that is to say, *schema* (picture), *thesis* (position) and *taxis* (order). By nature, the similar is moved by its similar and the beings of the same genre are related to each other, and every picture that is in a different order produces other disposition; doing so they wanted to explain in a rational way (*eulogos*), once that principles were unlimited, all accidents and substances through which things are born and how they are born (DK 68 A38).

According to the atomists, principles are unlimited what implies that unlimited are the atoms for if atoms were numerically limited, the unlimited number of compounds as well as their infinite appearances would not be understandable. In other words, there is plurality because the very atomic principle of the *kosmos* is plurally innumerable. In addition to this, the void in which the movement of the atoms occur is also not limited. Thus, as Simplicius put it, Democritus takes the atoms to be the principle of things, being

completely full, the very constituting matter of beings while the void in which the atomic movement took place was named 'non-being'.

It is correct to say that to the atomists, not-being was the explanation of movement, now considered in its effectiveness and not only considered as just an illusion. Indeed, the introduction of non-being in atomist theory allowed both Leucippus and Democritus to sustain not only the possibility of movement as well as its plurality. If there was only being, i.e., the atoms, these would be all united, not constituting different things, but a deformed unity (given that every atom is singular, presenting different shape and size). Thus, it is because *there is* void that atoms can meet each other or move away from each other, forming innumerable compounds, what also allows degeneration. Void is the key that Parmenides and the Eleatics were not able to consider as an exit from the trap of the immovable unity.

However, it must be noted that the atomists were not occupied with the task of explaining *how* atoms displace themselves within void. If atoms are moving *now*, there would be no relevant reasons to doubt that *it has always been this way*. Besides, if atoms displace themselves freely within void, there would also be no reason to suppose that they moved more to one side than another (say, more to the left than to the right) when the primordial movement occurred. Chance is the main feature of the original movement, but after the *very first atomic move*, atoms begun to constantly collide with one another creating movements that were necessarily determined by their size and shapes. Thus, it is possible to determine the movement of the atoms given that they abide by a sort of natural principle. This seems to be the meaning of the only surviving fragment of the researches of Leucippus, what can be read in the following fragment DK 67 B2 "Nothing happens in vain (*maten*), but everything from reason (*ek logou*) and of necessity (*hyp'anankes*)". Given that there is no *nous* organizing the cosmos in the atomistic theory once everything is mechanically determined, it is possible to explain events based on the necessary interactions of the atoms.

The movement of the atoms is ruled by the necessity that regulates both birth (aggregation of atoms) and death (dispersion of atoms). Democritus held the necessity as a cosmological principle not related to any nuance of fatality or the divine. It is a principle of order and disorder to the extent that it constitutes "the correlation of mechanical

forces, between the internal resistance of a compound and the pressure of the surrounding environment" (Morel, 2000, p.14). Hence, everything that happens in the *kosmos* is due to the fact of this mechanical necessity and as a result all events can be explained.

According to the atomists, two different effects result from the collision of atoms: they can shock against each other violently as snooker balls, or in the case they are of the same shape, they can unite and constitute homogenous bodies, like water, air, earth and fire. Therefore, atomic collision and its resulting compounds explain how *kosmos* and *kosmoi* are constituted and develop themselves.

The Modern Atomic Theory describes matter as a composition of discrete units, name atoms. Although the origin of the word *Atomos* meant originally *indivisible*, during the 19th Century several experiments dealing with electromagnetism and radioactivity made it possible to discover that the atom is not indivisible. They are a conglomerate of subatomic particles (electrons, protons, and neutrons) that can coexist separately, have mass and are destructible. The classic atomic model is the planetary model of Rutherford (1911): a cloud of electrons (negative charge) orbited around a compact nucleus composed of neutrons and protons (positive charge). The evolution of this model, proposed by Bohr (1913), added that every time an electron was accelerated, it would create an electromagnetic wave.

In the beginning of the 20th Century, Planck (1900) and Einstein (1905) postulated the basis of Quantum Theory according to which luminous energy is emitted or absorbed discreetly, in blocks of energy called *quanta*. This theory was incorporated by Bohr and others (1924) to his atomic model that postulated that an electron orbits around the nucleus in layers that have fixed angular momentum and energy. The distance between the electron and the nucleus would be proportional to this energy. According to this model, and electron can never shock against the nucleus once he cannot lose energy continuously. It can, however, realize quantum leaps between the energy levels that are closer. When this happens, light is emitted or absorbed, and its frequency is proportional to the energy level.

According to classic physics, the concepts of particle and wave are well defined. Particles have more mass and occupy a defined place in space, and if one exerts a force over then and they are displaced their

trajectories can be easily calculated by Newtonian mechanics. To the extent that waves propagate in space, they have frequency, length, and height. Waves can be mechanic so they will need a medium to propagate or they can be electromagnetic and propagate even in the vacuum. Light, for instance, is an electromagnetic wave that is characterized by oscillations in both the electric and the magnetic fields.

The theory of electromagnetic waves postulated by Maxwell (1873) described the electromagnetic phenomena that have scales of length and intensities big enough so that quantum mechanics can be neglected. The quantic atomic model proposed by Schrödinger (1926) stated that the movement of the electron could be better explained if it was considered as a wave, not a particle. This approximation of the spectral phenomena was what Bohr's model was unable to explain. The theories of Bohr-Schrödinger were conciliated in the theory of the duality wave-particle according to which an electron may behave both as a particle and as a wave given that it can refract like a wave and have mass like a particle (Bohr, 1928).

These discoveries help to re-interpret the atomists principles of Democritus. Atoms are, indeed, the matter of all beings and their interactions generate a series of compounds. Besides, today one knows that they are organized in more complex structures, viz, molecules that can be found in nature in varied *diathige,* originating different substances of the same composition, structurally different, named allotropic. Allotropy occurs when the same chemical element can originate different substances due to its structural modifications. Carbon, for instance, is a perfect example of this phenomenon as it can originate diamond, graphite, and charcoal.

However, several of the theories elaborated by the first atomists are being "proved" or are still object of current investigations, as is the case with the problem of atoms being unlimited in number. Although this is one of the unsolved problems in Modern Physics, it is estimated that unlike what is presupposed by the atomists, the number of chemical elements in the universe is finite. On the other hand, the void between atoms, *kenos* or non-being is acknowledged.

3. *Kosmos* and cosmology.

Atomistic cosmology is well documented by Diogenes Laertius, who offers a detailed description (DK 67 A1= *Diogenis Laertii de clarorum philosophorum vitis,* IX 30-33). Firstly, a vortex was produced when innumerable atoms from various shapes were detached from the infinite (*ek tes apeirou*) and moved themselves within a giant void (*eis mega kenon*). Following the whirlwind, atoms of the same shape linked to one another and those which were smaller and lighter where thrown into the void. The agglomerated atoms formed a compound coated with a pellicle or spherical membrane (*hymen*). This pellicle became thinner as the bigger and heavier atoms reunited in the center and formed the Earth. Carried away in the whirlwind that surrounds the atom, some of these exterior atoms fixated into one another and formed a humid and mixed soil structure. As the whirlwind follows its movement around the atom, this body dries and inflames itself, becoming a star or another type of celestial body. Once maturity is reached, the *kosmos* grows older and dies as the plants and animals. Because the atoms are unlimited and void is infinite, the atomists held that the coexistence of infinite *kosmoi* engaged in a perpetual movement of generation and degeneration.

It is noteworthy that the atomist theory was the first to shun intervention of a divine entity or a primordial element in the constitution of the world. Atoms are immutable and indivisible particles without any perceivable qualities – once these qualities derive from the compounds – that compose all elements. Contrary to what Empedocles and Anaximenes used to sustain, viz, that the primary substances were material entities, to the atomists, atomic particles are not susceptible of observation, being purely theoretical.

Today, the origin of the universe is still a matter of controversy subject of several scientific investigations. One of the most known theories is Lemaître's (1931) who proposes the expansion of the Universe. He was the first to research and publish his discoveries regarding the expansion of the Universe. Later, Hubble, based upon Lemaître's works derived the Hubble constant and the Hubble Law, also known as Hubble–Lemaître law. He also proposed the theory concerning the origin of the universe known as "Big-Bang' or the hypothesis of the "primordial atom". His model described how the

cosmos would have appeared from its very beginning up to its evolution. This model considers as a fact that the Universe expanded itself from a state of extremely high densities and temperatures in a finite space of a time past. This state is what would be initially called "primordial atom" or "singularity" (Hawking and Ellis, 1973).

According to some estimations, the Universe would be 13.8 billion years old. In 1948, Alpher and others described nucleosynthesis, a process due to which most of the known elements of the Universe could have appeared right after the Big Bang. The elements would have been organized according to a continuous process of construction forced by the fast expansion of the Universe and the consequent cooling of primordial matter (Gamow and Hynek, 1945), when atoms adhered to each other forming new nuclei. This theory applies to elements as hydrogen and helium and is particularly similar to the process described by Diogenes Laertius centuries before.

Seconds after the Big bang occurred, the Universe was too hot, dense and ionized. When the Universe cooled a little bit (between the first three to twenty minutes), lighter elements were formed, such as hydrogen, helium, lithium and the heaviest, beryllium (4 protons and 4 electrons). The other light elements and the medium ones, and some heavy ones also, were generated through stellar nucleosynthesis (Burbidge et al, 1957) due to processes of nuclear fusion between hydrogen and helium (Seeger et al., 1965). Later, giant clouds of this primordial elements agglutinated forming the stars and the galaxies. Diogenes description of a vortex produced from the turbulent atomic movement within a void is somehow paralleled with current cosmological theories, as exposed by Gibson and others (2011).

Indeed, Democritus states that to understand the *rhysmos* and the movement of the atoms is essential to understand the nature of the *kosmos* and the very nature of man as it reflects in a micro scale the same universal complexity. To the extent that there is homology between *kosmos* and man, it is possible to establish the same mechanical explanation of sensations and thinking, as Aetius in states in a fragment (DK 67 A30=IV 8,5). Both Leucippus and Democritus consider sensations and thoughts as alterations of the body. In another fragment, Democritus says that man is a *mikros kosmos*, i.e., a little world, composed of the same principles of the macrocosms: atoms and vacuum, abiding by the same rules that rule the Universe.

Even though Democritus theory of micro and macro cosmos was elaborated centuries ago, they are somehow still valid. In fact, all things on Earth, including our species, are made of stellar dust. When the Universe began, there were only hydrogen and helium, and a few other elements. These elements organized themselves in stars which operate as nuclear reactors converting simple elements into more complex ones. Thus, hydrogen is converted into helium, helium into carbon, oxygen, neon and so forth until the heavier elements. There are elements that are in our composition. When a star dies, according to its magnitude, it may shrink and implode or explode into a supernova. Thus, as Democritus postulated, the material generated from the death of the stars is what composes us, i.e., the *mikros kosmos*.

4. *Psyche* and the origin of life

In what concerns the appearance of the human species, atomism derives it from cosmogony. Thus, embryos rise out of pustules that originate from the fermentation of the humid and confuse structure of the Earth: doxography states that according to Democritus, human beings and other animals emerged from water and mud (DK 68 A139). The appearance of human life is parallel to the appearance of *kosmoi* that come to be due to the necessary aggregatory spontaneity of the atoms, these very aggregates unleash spontaneous biological processes.

In 1922, Oparin followed this logic when affirming that there was no fundamental difference between a living organism and lifeless matter. The complex combination of manifestations and properties of life should come as part of the evolutionary process of matter. Taking into account the discovery of methane in Jupiter's atmosphere, Oparin suggested that Earth's primordial atmosphere would contain methane, ammonia, hydrogen and water vapor, and these gases would constitute the original matter of life. In Oparin's (1938) hypothesis only simple solutions of organic matter existed in the beginning, ruled by the proprieties of their atomic components and the organization of these atoms in a molecular structure. The gradual growth and increase of the molecular complexity would originate a new order of chemical colloidal succeeding other organic chemicals. This process would generate a biological order which, due to

competition, the speed of cellular growth, survival and natural selection would originate modern human beings (Bennett, 1872).

In 1953 Stanley Miller created an experiment to investigate Oparin's hypothesis regarding the chemical self-organization of the primordial Earth. The Miller-Urey experiment introduced heat and electric energy simulating atmospheric discharges in a mixture of components that simulated a reduced and primordial atmosphere. In a short period of time a variety of organic composites were synthesized, among them some well-known amino acids. The composites were more complex than the molecules present in the beginning of the experiment (Miller, 1953). Thus, the origin of life would have happened through the organization and evolution of a "primordial soup" in ribonucleic acid 4.1 billion years ago (Bell et al., 2015). This theory may be considered a more sophisticated rendering of Democritus water and mud theory. The RNA hypothesis is based in the fact that all living organisms synthesize protein that are amino acid polymers, using instructions registered in their deoxyribonucleic acid. The synthesis of protein implies in intermediate polymers of RNA (Barazesh, 2009). It follows that the first form of life would be base in the RNA which can, as the DNA can, stock information, catalyze properties and replicate itself (Lincoln and Joyce, 2009). This protein material began to organize itself in unicellular organisms, then multicellular ones, developing up to life forms that we currently know.

However, the definition of life is ample and thoroughly discussed. Biologically, an organism is defined as a living organism when it exhibits all or some of the following physiological functions: 1) homeostasis or regulation of internal environment 2) structural organization composed of one or more cells 3) metabolism or capacity to generate energy from chemical conversion 4) growth 5) adaptation to the environment 6) answer to stimuli 7) reproduction. Another fundamental characteristic of life on Earth is its dependency of liquid water once it has developed using this resource.

A physical perspective on life was proposed by Schrodinger (1944): living matter is defined as that which avoids deterioration in equilibrium. This refers to the second Law of Thermodynamics in which entropy always rises. The disorder of particles or chaos of a physical system (entropy) is related to the death of this system or the

total loss of usable energy. Living beings are able to postpone this loss of energy because once alive, their bodily structures are maintained and the energy necessary for this maintenance is obtained through metabolism. In the moment of death, the body collapses due to bacterial action and chemical processes. Decomposition occurs even in the most elementary stage, the atomic. Decomposed matter turned into energy and atoms and is naturally recycled.

Atomists, like the first philosophers, considered the soul (*psyche*) as what separated the living from the non-living beings. According to atomic theory, the soul was formed by spherical atoms, as was the fire, what points out to an identification between life and heat (as in the energetic theory by Schrödinger, 1944). The spherical form of atoms was responsible for the great mobility of the soul within the body given that the spherical form moves by its very nature. Besides, life and death are associated to the mechanisms of breathing (metabolism) and the analogy with the formation of the *kosmos* is clear: constant pressure exerted by the exterior environment over tiny atoms of the soul causes the expulsion of these outside the body like the tiny atoms that were projected into the vacuum by bigger atoms during the formation of the Universe. Notwithstanding, the air in the environment contains atoms of the same nature of the atoms belonging to the soul and thus, through respiration, enter the body (structural organization) carried by the air. Hence, these external atoms prevent other atoms constituting the soul to exit the body, balancing internal pressure from the exterior (homeostasis). The animal lives while this equilibrium between atomic pressures last (adaptation to the environment). Death results in the dispersion of the atoms of the soul throughout the universe.

One can observe that the biological characterization of life is even closer to the philosophical characterization. *Psyche* could be interpreted as the genetic code given that it is capable of transmitting knowledge (mobility of the soul) from one generation to another.

However, death is not the destiny of all living beings, but only of the which are multicellular ones. Each unicellular organism currently living have been living since the beginning of life, billions of year ago. This happens because unicellular organisms do not reproduce but divide themselves into two new identical cells, almost as old as the original cell (Stewart et al., 2005). The strategy of the

multicellular organisms (including the human beings) to perpetuate themselves is the creation of new cellular colonies from a single cell through reproduction not by perpetually maintaining this colony. The main vantage of reproduction over maintenance is that it provides a new beginning with genes slightly different, allowing the selection and evolution of the colony (Harrison and Gerstein, 2002).

5. Conclusion

Ancient Greece may be considered the benchmark in the birth of Western Civilization. Several avant-garde theories, both philosophical and scientific, have been proposed by Aristotle, Simplicius, Democritus, Leucippus, Parmenides and many others. The rise of the Christendom entailed the burial of many theories, and during most of the Middle Ages they remained hidden. However, they were not dead. Some of these theories have been gloriously dug during the period prior to the Renaissance and led to the flourishing of a new scientific approach to nature. Then, during the Renaissance, the very idea of turning the knowledge of nature into something useful to *men* and *society* led researchers to lean on some of the ancient theories previously buried by the church. Galileo Galilei, Nicolaus Copernicus, Giordano Bruno, the development of the Theories of Celestial Mechanics and Heliocentrism were the groundbreaking elements in the equation that aimed at explaining the world without God's intervention. But on the other half of the calculus was the always powerful Roman Catholic Church and its wrath against these new bold assumptions.

The infamous Inquisition was established, science and philosophy and the freedom necessary for their researches were restrained. Nonetheless, the new theories were stronger than any human intervention. They could be refrained from publication, vehemently denied, but they were not falsified. So, in the 18th Century, after a series of clashes between science and the church, science was seen as the only way possible to *really* explain the world and its ways. The Enlightenment paved the way to a new approach between philosophy and science and is tightly connected to the Scientific Revolution. The emphasis on the *method* was crucial to the development of new scientific theories that now demanded more instruments, observation, proof.

It is noteworthy that scientific theories have always dealt upon philosophical theories up to the 20th Century. This is not to say they were *dependent* on philosophy, but it is not possible to deny their proximity. History has shown that philosophy and science have always mutually benefited from each other. However, in the beginning of the 20th Century, a strict separation of their spheres of action resulted it a hyper-specialization. The publication of scientific papers was now only possible in specialized journals. It is also remarkable that the academic structure of the Universities did no good to nurture a healthy relationship between philosophy and science.

This paper aimed to show that both fields cannot go on ignoring each other. One intended to show that the first philosophical ideas about the Universe and Life are nowadays considered by Science as real theories. They are not fanciful delusions of some men walking around the polis, but true and solid researches that aspired at understanding and explaining what surround us (and also, we ourselves). Some of the discoveries of Ancient Greece that could not be proved at that time, are now being validated through scientific method and its technological apparatuses. It seems necessary to sustain that the richness of a true an open relationship between philosophy and science, apart from the academic restraints of hyper-specialization, is a fruitful way to further advance the elaboration of answers to ever more complex questions.

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