Information, system, complexity, feedbacks, retro-causality: an hypothesis based in the new paradigms of the universe, life, evolution and man

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Introduction

According to Lazcano (2008), as life is neither a miracle nor the outcome of a chance event, proper understanding of life requires the recognition of the evolutionary processes that led to it.

The analysis of the nature of the unity of life, which is one of its fundamental characteristics, together with its evolution to man, will lead us to discuss problems related to the ultimate reality of matter and the universe.

Of all modern Sciences only quantum physics seems to have been obliged to tackle the question of what "*is*" the reality of matter. It is important to keep in mind, that Kelppner (2002) affirmed that "*Quantum theory is the most precisely tested and most successful theory in the history of science*". Quantum theory has answered many questions correctly, providing a quantitative theory of matter, an understanding of the details of the atomic and molecular structure, providing the prediction of important molecular properties.

I will use a method of analysis called "*ontological reductionism*". This method goes beyond the traditional reductionism that is observed when systems are explained as the sum of their parts Ontological real reductionism aims to determine the ultimate reality of the whole and the parts as it was already discussed in a previous paper (Yunes 2005).

From the very beginning of the universe we can observe the "*self-ordering*" evolution which follows the physicochemical laws. Systems such as the elementary particles that form the molecules and organize in beautiful crystals. A system is a whole constituted by its parts or components and the relationships between them. The number and variety of the parts and the type and quantity of their connections define the complexity or organization of the system.

A molecule of water is a system formed by two molecules of hydrogen and one of oxygen. The properties of water cannot be attributed or reduced to that of the atoms of hydrogen or oxygen. Thus, we have a new entity with a specific unity. This provides an example of the problem of the whole and their parts. Evidently the properties of the water are very different from those of oxygen or hydrogen atoms. There is an emergent physicochemical property of water.

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The interpretation of classical mechanics, tells that maximal knowledge of the whole system is provided by maximal knowledge of its constituent parts. That is, classical physics follows a separability principle which says that spatial-temporally separated subsystems S1 and S2 of a compound system S are individually well defined and the state of the compound S is wholly and completely determined by them and their interactions. The emergence is in the same level.

However, it has been demonstrated in quantum physics that nonlocal connections between particles exist (Aspect et. al. 1982). Electrons, neutrons, or photons, can be in different points in space and if they have assumed the same quantum state, they remain correlated in the same system. They are entangled.

Thus, quantum mechanics systematically violates the concept of separability (Karakostas, 2004) where compound system states are called entangled state. As lsham (1995) has indicated "*quantum entanglement has the implication that a quantum whole is not the sum of its parts: or, at least, certainly not in the sense of classical mechanics*". The only way that a compound system can be decomposed into its constituent parts is if and only if the state of the compound system is of a product form. But this, accordingly to Korakostas is "*only a highly particular and well idealized case in which a separability principle holds in quantum mechanics*". Thus, the emergence of new properties should be analyzed according to quantum mechanics.

1. Life: Science and Philosophy

The problem appears more complex with life. How can the complex organization of life be originated from the inert matter that is with very different order? Life is a complex and unitary reality and it is very difficult to provide one definition.

We can say that life is the result of their constituents, and that the emergence is in the same level of their material atoms and molecules, or we must say that life is a basic reality of the universe, its emergence is in another level, and for this we must work with other principles to obtain the concept about its nature.

In the following work different theories will be analyzed and definitions will be gathered that better allow us to approximation the reality of life.

NASA gave the following definition in 1994: "*Life is a self-sustained chemical system capable of undergoing Darwinian evolution*" (Luisi, 1998). This definition is questioned by new findings in biology. According to Denis Noble (Noble, 2013) the "*modern synthesis*" (Neo-Darwinism) is a mid-20th century gene-centric view of evolution, based on random mutations which accumulate to produce gradual changes through natural selection. The organism is treated as a mere carrier of the real objects of selection, its genes. We now know that genetic change is far from random and often not gradual. Any role of physiological function in influencing genetic inheritance was excluded. Acquired characteristics can be inherited and in a growing number of cases this inheritance has been shown to be robust for many generations. The 21st century can look forward to a new synthesis that will reintegrate physiology with evolutionary biology.

As Grandpierre (2002) has indicated "*The ontological reduction of biology to physics is one of the oldest and most significant problems of science and philosophy*". This ontological view considers that the laws of physical sciences plus natural selection can give a complete understanding for any

biological phenomenon. Monod declared "*Anything can be reduced to simple, obvious, mechanical interactions. The cell is a machine, the animal is a machine, and man is a machine*" (Gradpierre 2002).

Consequences are very serious and important, considering that the vision of the universe and life affects humans. A known phrase tells "*We become what we think of ourselves*" and as Grandpierre indicates "*A consequent materialistic person narrows his life down, makes it materialistic, and his life will thus express a thought that somebody founded mentally sometime in the past and which gradually became enforced to us*".

For these reasons, it is of great importance to be aware of the driving forces behind the origin of life and mind because it seems reasonable to assume that a relation, or better coherence, between the driving force and that of life and mind must exist. We have indicated that "*The need for a coherent theory is given by the difficulties that still exist in understanding the origin and nature of life and the human mind*" (Yunes 2005).

One important definition of life was given by Koshland (2002), that considers seven pillars, the first being a "*program*". These signify a system that is organized by a logical-mathematic structure and that is autonomous.

However, the Nobel Prize Manfred Eigen (1992) says that "*Life is a dynamic state of matter organized by information*" and then adds "*information arises from non-information. The state of the system has a completely new quality after information has arisen*". Evidently information of this kind, logic-mathematics cannot arise from non-information. Life is a dynamic state of matter that must be explained, and it is intimately related to information, which origin we will discuss further.
Another peculiar fact of life is indicated by Attila Grandpierre (2002) "*I regard sensitivity as the real fundamental specification of life. Without sensitivity life would not be worthwhile to be lived. Sensitivity is based on our connections with our internal and outer sources of information. Without having access to any source of information life is not possible*".

Recently, Theise and Kafatos (2013), indicate that their analysis should consider how complexity theory actually points away from an emergentist perspective toward a panpsychist position: '*sentience everywhere*'. They wrote an important concept "*We note that sentience does not imply self-consciousness which may be confined to higher species. Self-consciousness implies sentience but not necessarily the other way around*".

A fundamental fact in life is the role and nature of sensitivity or sentience.

Loewenstein (1999) considers the information and the feedbacks, two fundamental factors, affirming that the information flow started 20 billion years ago with the big bang. Information surging from an uncomprehend source and transferred by forces unfolding from an ever-increasing space, engenders organization: the elementary particles and the hydrogen and helium nuclei took some 700.000 years. Eventually, information flow makes loops which, by the power of their feedback, switch to a livelier space. With time, the information flow gets more and more convoluted and the system engendered, more and more complex. After some 4 billion years, we have humans that wonder about it all.

Loewenstein does not explain the nature of the uncomprehend source, he uses the word engender in the sense of immanent cause, but he doesn't explain why this cause exists, He indicates a fact that is important: loops that are feedbacks, but he does not explain its power.

The importance of the feedbacks appears in the paper of Korzeniewski (2005) and on his definition of living individual: "*is a network of negative feedbacks (or in broader terms, regulatory mechanism and signal transduction pathways) that are subordinated to (are at the service of) and over-arching positive feedbacks (corresponding to reproduction)*."

Considering the challenging question of the ultimate origin of genetic information, from a thermodynamics perspective, McIntosh (2009) after demonstrating that the theory of evolution by random mutations and natural selection can increase genetic information, because this does not violate the second law of thermodynamics, considering that the entropy of a non-isolated system can reduce due to energy input from an outside source, especially the sun when the earth is a biotic system. The proposal is that a particular system can become organized at the expense of an increase of entropy elsewhere. However, this argument works for structures such as crystals or snowflakes that are formed by natural forces, it does not work for genetics information because this information system is composed of processes which require a non-spontaneous raised free energy levels. Crystals and snowflakes need and have zero free energy as the phase transition occurs.

According to McIntosh the functional machinery of systems such as DNA, RNA, and proteins requires precise, non-spontaneous raised free energies to be formed in the molecular bonds which are maintained far from the equilibrium state. Besides, biological structures contain instructions that are not defined by the matter and energy of the molecules carrying this information.

McIntosh affirms: "*The genetic information needed to code for complex structures like proteins actually require information which organizes the natural forces surrounding it and not the other way around-the information is crucially not defined by the material on which it sits. The information system locally requires the free energies of the molecular machinery to be raised in order for the information to be stored. Consequently, the fundamental laws of thermodynamics show that entropy reduction which can occur naturally in non-isolated systems is not a sufficient argument to explain the origin of either biological machinery or genetic information that is inextricably intertwined with it*".

Finally, McIntosh concludes: "*It is proposed in conclusion that it is the non-material information (transcendent to the matter and energy) that is actually itself constraining the local thermodynamics to be in ordered disequilibrium and with specified raised free energy levels necessary for the molecular and cellular machinery to operate!*"

I think that it is now possible to formulate a new definition of life in the following way: "*Life is a dynamic complex chemical system, far from the thermodynamics equilibrium, autonomous, spontaneous and sensitive, self-sustained and organized by information, transcendent to matter and energy, with special internal and external adaptive processes of negative and positive feedback between the system and the environment*."

Like all the definitions of life also this definition cannot be complete, but it includes some fundamental factors.

a) Information predominance

This signifies that life is not fundamentally a problem of chemistry but of an non-material information program that is based in logic-mathematics and that underlies all the universe. This fact is supported by the well-known physicist Wheeler (1996) that, considering the ultimate reality of the quantum, wrote: "*I suggest that we may never understand this strange thing, the quantum, until we understand how information may underlie reality. Information may not be just what we learn about the world. It may be what makes the world*".

Zeilinger (2006) also affirms *"In conclusion it may very well be said that information is the irreducible kernel from which everything else flows. Then, the question why nature appears quantized is simply a consequence of the fact that information itself is quantized by necessity*". We have indicated the meaning of information (Yunes 2005) that can be summarized in three concepts:

1) an additional knowledge that diminishes the uncertainty of a given event. This permits to make predictions with an accuracy which is better than chance;
2) Is a measure of order and organization following the same networks;
3) To learn a message, an information is to actualize one possibility and to rule out others, thus the concept of information is related to that of possibilities and to freedom. It is also a semantic information that does involve consciousness.

Yockey (2000), one of the pioneers in applying Shannon's theories of information to biology, comments about living and non-living being "*The genetic information system is segregated, linear and digital. It is astonishing that the technology of information theory and coding theory has been in place in biology for at least 3850 billion years*" and adds "*There is nothing in the physical-chemical world that remotely resembles reactions being determined by sequences and codes between sequences. The existence of a genome and the genetic code divides living organisms from non-living matter*".

The concept of information and its formal reality lead most scientists, from different philosophical opinions, to think that biology does not depend on the physical and chemical reality. The reality of life is beyond the physical and chemical structures (Mayr 1988; Grandpierre 2002; Dupré 2010; Thiese 2013).

Thus, there is a profound dichotomy, that is clear from the microcosm's wave/particle, as mind/brain, formal/material, subject/object, symbol/matter, genotype/phenotype etc. And as Abel suggest there is a gap that "*would have to be closed to achieve the full philosophical naturalization of science*".

Abel also has championed the term "*cybernetic cut*" that defines one of the most fundamental dichotomies of reality: on one side, the law-like orderliness of nature along with the seeming chance contingency of heat agitation and stochastic quantum reality and on the other side, the ability to choose with intent what aspects of being will be preferred, organized, preserved and used. In Abel words "*The Cybernetic cut explains how and where formal controls arise and penetrate the physical sphere to seize arbitrary governance of physic dynamics*". In other words, it explains how life enters in the materialistic world of chance and necessity.

We will develop this concept in the following pages.

b) Dynamic state of matter

The dynamic state of matter is an important factor. In this regard, we must consider the insights of Schrödinger (1944) who discussed the concept of macroscopic order, the inanimate order, of the physicist of his time, which results from the mean of a huge number of atoms and molecules. The pressure of a gas in a specific space is the mean behaviour of a huge number of molecules that randomly collide between them and with the walls of the recipient. Statistical mechanics studies this. The organization of a machine is different, because, in this case, we have the thought of the constructor that uses matter to establish and determine the function and the connection of the parts and the objective of the whole.

In the living organism, according Schrödinger, we must replace the concept of inanimate order with the notion of dynamic order. Ervin Laszlo (2003) explains this fact clearly: "*Dynamic order is not an order based in chance encounters among mechanically related parts; it cannot arise by interaction based in random collisions among individual's molecules. There must be system-wide correlations that involve all the parts, even those that are distant from one another. Rare molecules, for example, though seldom contiguous, need to find each other throughout the organism. There would not be sufficient time for this to occur by a random process of mixing; the molecules must locate and respond to each other specifically, whether they are neighboring or distant*".

The huge complexity of this dynamic system of life in numbers can be observed in the paper of Grandpierre "*Fundamental Complexity Measures of Life*" (2008).

It is necessary to distinguish self-organization from self-ordering, as was indicated by Abel (2012). Organization is fundamentally formal, not physical. This formal property can be instantiated into matter, but this cannot be the source of organization. Matter can produce self-ordered systems as crystals, such as the self-ordered dissipative structures of the chaos theory, etc. Organization is formal because its symbols are those of mathematics and logic, these are formal symbols. A formal symbol is a singular unity that belongs to a vocabulary of an artificial language which is determined by an arbitrary set of rules (not laws) that arrange the words and phrases to create a sentence with some meaning. The arbitrary assignments of the genetic material symbol system support these facts. Life uses similarly arbitrary rules and choices to create some molecular functions. Only a non-material code of organization can control and coordinate the complexity of biochemical pathways and cycles.

This dynamic state permits livings being to maintain them in the improbable regime of far from thermodynamic equilibrium. This regime is one of the main characteristics of life

c) Spontaneity

A notable difference between living beings and machines is the capacity of the former to be spontaneously active. Machines follow and are reducible to physical laws. Biological systems follow different arbitrary rules that give them the capacity and conditions to govern the biological processes, keeping their universal validity even of the physical laws.

Animals are considered to behave as automata, as robots responding predictably to external stimuli. They would be input-output devices. However, recent studies show that the flight paths of flies in a completely featureless environment are neither random nor predictable, but are generated spontaneously and non-randomly by the brain (Maye 2003). Raja (2013) affirms that the ellipsoid body ring neurons R1, R3 and R4d have an important role in the spontaneous yaw turning of fruit flies. His study demonstrates the "*neuronal basis of spontaneous flight behavior in Drosophila and may lead to future studies of intrinsic properties of the brain*".

Living organisms must solve new problems encountered in their lives within a complex environment. Jacob et. al. (2004) in respect to bacteria affirm that "*We now begin to realize the power of bacterial cooperation and social intelligence that allows these microorganisms to learn from experience when solving newly encountered problems and then to share their new skills far and wide*".

This kind of intelligence needs the freedom of spontaneity. In order to explain spontaneity, we need to apply the ontological reductionism and consider the problem in the level of quantum physics.

d) Sensitivity or sentience

Sensitivity is the ability to feel or perceive internal and outer sources of information. Sentience does not comprehend self-consciousness. But, self-consciousness implies sentience. As Grandpierre (2002) indicated as the real fundamental specification of life. Theise and Kafatos (2013) suggest "*The living system, on the other hand, senses and processes the perceived information about the environment in a complex, non-mechanical, not completely predictable way; as with all complex systems, there needs to be an element of low level randomness or quenched disorder in the system which allows for variant responses*". This also specifies the difference between a programmable machine, that is deterministic, and a truly living system.

e) Feedback

It is known that negative feedback loops constitute the basic unit in cybernetic control theory. Feedback is the basis of self-organization and of life. The negative feedback occurs when the outputs of a system are looped back into the system to achieve some kind of steady state to compute, compare or correct this output, thus feedback enables homeostasis which maintains the internal stability of the organism in relation to changes in the environment.

In the complex mechanisms of life systems also positive feedbacks exist, where the output enhances the original effects of the stimulus. It is the feedback observed in blood clotting. Part of this clotting is that the injured tissues release a chemical signal that activates platelets in the blood. An activated platelet release thromboxane A2 that activates more platelets and produces vasoconstriction accelerating the clot.

Cellular complex circuits have negative and positive feedbacks that allow the cell to respond to external stimuli. These feedback loops maintain homeostasis during regulation, proliferation and differentiation of the cell.

It is known that the signal-response of a living cell, the basic unity of life, is determined by complex networks of interacting genes, proteins, and metabolites in a hierarchical multilevel of control. Using this same analogy, we can compare networks with computer software. For this reason, as Denis Noble (2010) has suggested the modern field of computational biology, necessary for these studies, has expanded rapidly during the first decade of the 21st century and, through its contribution to system biology, lead to the revision of the fundamental principles of biology.

Uri Aron (2007) has demonstrated that transcription regulation networks control the expression of genes showing small sets of recurring regulation patterns, called networks motifs. These networks motifs have been found in diverse organisms from bacteria to humans, showing that they serve as basic building blocks of transcription networks during all the evolution.

Conant and Wagner (2013) have demonstrated, that multiple types of transcriptional regulation circuitry in E. coli and S. Cerevisiae have evolved independently and not by duplication of one or a few ancestral circuits, this convergent evolution is a potent indicator of optimal design and the existence of attractors. The networks have basins corresponding to fixed-point attractors as they have more coupled positive feedbacks loops and basins for limit-cycle attractors as they have more coupled negative feedbacks. Feedbacks are coupled logically to attractors as was suggested by Kwon and Cho (2007).

An important problem is the relation of cause and effect in feedback loops. Simple causal reasoning about feedbacks is difficult because the outputs of a system are feedback as inputs as a part of a chain of cause and effect that leads to a circular argument. However, considering that the feedback is originated by attractors and the existence of convergence to optimal design, within the same limits, we can think that the effects appear first, as a goal. Thus, the attractors are in some sense a final cause or the manifestation of the existence of biological teleology, because it implies goal directedness.

Di Corpo and Vannini (2010) show that the equation of Einstein's special relativity, where the total energy is the sum of the momentum and mass, multiplied by the speed of light, is a second order equation and has two solutions, one positive and one negative. The positive energy describes energy that diverges from causes located in the past and propagates towards the future (retarded waves). The negative energy describes energies located in the future and propagates to the past, or present (advanced waves). See also Cramer's (2009) paper. This retro-causality is now accepted by many scientists.

In this line of reasoning it is possible to assume that feedbacks are fundamental to the origin, and formation of life, to the evolution, and to the emergence of the human mind because they are guided by advanced waves as their attractors.

The power of the feedbacks for the control and the orientation of the process to some goals is due to attractors possibly originated by quantum advanced waves.

f) Autonomy

We have indicated that the necessity to learn and store information "*reveal a general tendency towards 'autonomy' which living systems have undergone during evolution*" (Yunes 2005). Evidently, different levels of autonomy exist.

An important contribution to the concept of autonomy was given by Grandpierre and Kafatos (2013) "*In our best understanding genuine biological autonomy is the ability of living organisms to decide about their acts themselves in a way that is not determined completely by physical or biological laws and previous conditions*". Biological systems are not machines, the laws of classical physics do not explain biological autonomy. Organisms determine the decisions themselves using physical indeterminacy. Thus, genuine decisions correspond to the quantum mechanics world.

Different levels of autonomy are obtained, as was demonstrated for the cellular circuits (Kim et. al 2006) due to multiple positive and negative feedbacks loops which maintain homeostasis during the regulation of cell growth, proliferation and differentiation in response to external stimuli.

The flux of information in a cell and in an organism needs the interconnection of different networks of feedback and different attractors in multilevel systems. Thus, modern computational biology and system biology need to develop the theoretical framework required to deal with multilevel interactions (Noble 2010).

However, it is very important to note, as was demonstrated for the yeast cell-cycle network (Li te.al. 2004), that the stationary states at the checkpoints, in general correspond to global attractors of the dynamics and also that the biological pathways of the cell-cycle sequence, which is a particular trajectory in the state space, is a globally stable and attracting trajectory of the dynamics. These properties are largely preserved with respect to small perturbations to the network. These facts can be generalized to all the mechanisms of life.

It has been explained that feedbacks loops are necessary for control. Control signifies to steer some mechanisms. Control should be distinguished from constrains, as Abel have indicated (2008). Constrains are purely physical. However, control needs the freedom of choice and this freedom is not physical, it is formal.

The formal work appears to be characterized by deduction. Thus, considering true these propositions, axioms, rules that are not laws, because they are arbitraries, it is possible to move to other genuine prepositions. In the formal thought the subject coincides with the object because the object is the same subject. This is a characteristic of the formal, to arrange the object between parenthesis and move to the real formal construction. The formal is not material in the Cartesian meaning.

Some metaphors set the genome as a program of a computer that reads and executes all the instructions, programs as a blueprint of the same kind of representations. But, the genome is not autonomous and not complete. Epigenetic processes can influence the gene expression. Cohen et al. (2009) explain that "*The organism uses, manipulates, regulates and, in the case of the immune system, creates genes. The genome acts as the organism's servant, not as its master. Why then have knowledgeable people likened the genome to be a master program?*"

Analogically, this is the same as the software and the hardware of a computer with the enormous difference that in the computer the program is formulated and introduced in one disc that commands all the works of the system. In living systems the two realities are together, but they cannot be separated and however one cannot be reduced to the other. It is like the wave-particle reality.

But the fundamental problem is how to explain this autonomy, in particular the spontaneity that was has been proven experimentally.

The autonomous control of life beings is a unitary and whole property that is not localized. These characteristics suggest that it is an informational field.

g) The whole and the parts

Mae-Wan Ho (1996) considering the problem of free will, observes a reproducing life cycle, i.e. an organism arises when the loop of circulating energy is closed. Energy is stored and mobilized. The life cycle is a highly differentiated space-time structure. It is a complex, entangled space-time structure. Energy input into any mode can be readily delocalized over all modes and conversely, energy from all modes can become concentrated into any mode. Consequently, the organism has freed itself from the constraints of energy conservation. Ho considers also that living systems have an exquisite sensitivity to weak signals.

After these considerations, Ho affirms: "*The above considerations and observations show that the essence of organic wholeness is that it is distributed throughout its constituent parts so that local and global, part and whole are completely indistinguishable. This wholeness is only fully captured by quantum coherence that maximizes both global cohesion and local freedom*."

The biological experimental works explain that the structure and function of the molecules are associated between them, with some degrees of arbitrariness, the activities, or the sign functions molecules are determined by the organized system they belong to, and not vice versa (Kawade, 1992). This signifies that the physical structure of the molecules does not determine the functions based on physical laws, as reductionist think, they are parts related to the whole, that is basic.

In the relations between the whole and its parts we must consider two possibilities:

i. the Cantor axiom that says that the whole is equal to the parts of itself, paradoxical as it may seem, it is a conclusion which involves the essence of infinite magnitude. An infinite class, according to Cantor, is a class which can be part into one to one correspondence with a part of itself. This correspondence one to one is immaterial. The logic of the infinities is different than the logic of the finites. Christian Tapp (2012) explain that Cantor distinguishes the infinite in Deo, in mundo and in abstracto. The transfinite are in the nature.

ii. the hologram where every part contains all the information possessed by the whole. The "*whole in every part*" nature of the hologram is a new way of comprehension of organization like the concept of Ho indicated previously. If the whole is in every part, then the whole and its parts are equal.

2. Quantum Physics and biology

a) Coherence

There are many interrelated uses of the concept of coherence in physics. Macroscopic coherence involves multiple particles that share a quantum state that is governed by one wave function. Examples in macroscopic systems are: superfluidity, superconductivity and the laser. The laser is an open system and works in thermal environment (room temperature).

The estimate time of lipid synthesis rate in E. coli is 7000 lipids/s and the protein synthesis is 1000 proteins/s according to Tu (2017). We have 100-200 trillion cells in our bodies. According to L. McTaggart (2008) each cell undergoes, on average, some 100,000 chemical reactions per second. Thus, how can the organism synchronize these huge numbers of different reactions of the approximately 325 different subsystems (dii:10.1371/journal.pcbi.1003575.to01)? How to explain the non-chemical distant cellular interactions? Among the different mechanisms electromagnetic waves have, according to Farhadi (2014), the widest experimental support.

After many years of research Popp proposed that biophotons are emitted from a coherent electrodynamics field within the living system. Some experiments (Konev et al. 1966; Ives et al. 2014) suggest that UPE (ultra-weak photon emission) is specific and that UPE have a role in distant cellular interactions. The synchronization of the huge numbers of biological reactions and mechanisms must be holistic, or integrative of whole and its parts. Only quantum physics can provide this holistic view of the biological reality.

Non-living crystalline materials, such as superconductors, display long-range phase correlations or coherent modes where the movements of the parts are coupled. Coherence is a whole correlation over space and time. Since 1968 Frohlich suggested that there might be a similar mechanism for energy storage and communication in living systems. However, coherence has many requirements: extreme cold, vacuum and isolation from the environment. The decoherence, the loss of coherence, could be interpreted as an exchange of information between the quantum system and its environment (Zurek 1991).

Kurian et al. (2014) recently proposed that collective electronic behavior in the DNA helix generates coherent oscillations that synchronize the catalytic centers of type II restriction endonucleases. For this reason, the authors affirm that "*as this work has shown, molecular systems must be contextualized in their local biological environments to discern appreciable quantum effects*". Vattay et al. (2012) give a new explanation for why some biological systems can stay quantum coherent for long times at room temperatures.

b) The vacuum fluctuations

As I have mentioned, we need to recur to quantum physics that has been forced to face the question of what "*is*" the reality of matter and life.

Heisenberg's uncertainty principle states that more precisely one measures a particle's position the less exact is its moment measure. This uncertainty manifests an intrinsic quantum energy fluctuation of the quantum system that constitutes the zero point energy, that is essentially the

energy that remains at 0 degrees Kelvin (= -273 degrees Celsius). This is the quantum vacuum, the ground state of a quantum mechanical system.

The quantum vacuum is the ground state of the energy of the universe. The lowest possible level, that is the source of all potentialities, because it is filled with potential particles, pairs of virtual particles. However, the spontaneous creation of virtual particles does not violate the law of conservation of mass and energy, since they only exist at times which are much shorter than the Plank time (5,39 x 10-44 seconds).

Zeiger and Bischof (1998) affirm that: "*In the past few decades, the vacuum has found increasing acknowledgement as the central fundamental entity on which the physical description of reality must be based*". Keppler (2102) clarifies this concept: "*In the last decades the awareness has grown that the fundamental questions of quantum physics all boil down to our incomplete understanding of the vacuum, meaning that first of all a theory of the vacuum is required from which we derive a consistent theory of matter*".

Some authors have doubts about the reality and nature of the zero-point energy (Saunders 2002). However, this quantum vacuum fluctuation in the position of a mechanical system has now been demonstrated using a nanomechanical resonator (Safavi-Naeini 2012).

The vacuum fluctuations, were also recently determined experimentally by Reik et al. (2015).

Arndt et al. (2009) affirm that "*In recent years quantum biology has stimulated the scientific reasoning and fantasies and has triggered hypotheses ranging from 'exploratory' and 'visionary' over 'speculative' to 'very likely to be simply wrong'*". For this reason, only experimentally proved results will be used in order to deduce a logical hypothesis.

Several physics think that the vacuum holds the full understanding of the forces of nature and that all the matter of the universe was created from quantum vacuum fluctuations by physical laws (Tryon 1973; Davies 1992).

The quantum electrodynamics theory states that the interaction between particles such as electrons is mediated by virtual photons from the quantum vacuum, zero-point field (ZPF). This theory also states that fluctuations of the ZPF affect the structure of atoms. The hidden mechanism which prevents the collapse of the electron in the nucleus of the atoms was explained by Hal Puthoff (1987). In the case of the hydrogen atom the electron orbits around the proton, like a planet orbits around the sun. In this last case, gravity explains the stability of the orbit. In the case of the electron, which has a charge, according to classic physics must radiate energy and then go toward the nucleus collapsing the atomic structure. Puthoff showed that the stability of the hydrogen atom, and consequently of all matter, depends on the dynamic interchange of energy between the subatomic particles and the zero-point energy field. Thus, quantum physics, as it should be, explains and corresponds to classical physics in the quantum level. Puthoff, also affirms that the fluctuations of the zero-point field drive the motion of subatomic particles and, in turn, generate the zero-point fields in the form of a self-generating feedback cycle, not unlike a cat chasing its own tail.

It is known that the waves encode and carry information. Thus, the zero-point field is an information field transported by energy. Energy and matter are equivalent according to the energy/mass equation $E=mc^2$. In this theory, ZPF would be the beginning and end of everything in the universe.

A probably demonstration of the above-mentioned equation is found in the work of Durr et al. (2008), published in Science magazine on the determination of hadron masses and the comment of Kronfeld (2008) that the proton and neutron masses have been achieved in a 30-years effort of theoretical and computational physics and 200 trillion arithmetical calculation per second. The mass is given fundamentally by virtual gluons, which are the strong force, and virtual quarks and antiquarks, signifying that matter is vacuum fluctuations.

Single quantum fluctuations are not completely determined by physical laws and for this reason are denominated spontaneous. From this concept it is possible to assume that this spontaneity allows human freedom and the spontaneity of living organisms.

In this line of thought Grandpierre and Kafatos (2012) consider that the problem of biological causality led us to the quantum vacuum. They propose that biologically initiated vacuum processes can initiate physical processes when they interact with physical matter. In biology, there are biologically available energies corresponding to biological aims. It is known experimentally that subjective tools of mind like expectations and emotions can markedly modulate neurophysiological and neurochemical activities. This can be interpretable in the context of vacuum processes that are initiated by mental energies corresponding to mental decisions of the organism itself. However, spontaneous vacuum fluctuations are random but the biologically initiated vacuum processes are not random, since they are initiated by biological autonomy. Thus, biological autonomy generates biological aims that create vacuum processes and are transformed into physical forces.

Biological autonomy permits a divergence from a given initial state as a consequence of the freedom to decide about future states. However, biological phenomenon converges towards a prescribed final state (see the discussion about teleology in Grandpierre 2013).

Edward Tryon (1973) suggested a theory according to which the universe originated from quantum fluctuations. Something could arise from nothing if the process satisfies the law of conservation of energy. The total energy in the Fridman-Lemaître cosmological model is equal to zero, because the negative energy of the gravitational field that is negative is cancelled by the positive energy of the masses. As Heller (2009) explains: "*In the deterministic classical physics this would be an impossibility, but it becomes possible if the initial state is a quantum vacuum*".

Heller, discusses the Hartle and Hawking model based on the concept of the quantum function for the universe, and the integration over paths model, and concludes: "*Above all we have to realize that the Hartle-Hawking model is not the cosmological application of a well-established theory of quantum gravitation, as we would like to be, but an extremely hypothetical attempt to make a provisional model stand in for such a theory*".

c) Surpassing the old paradigms about life evolution

The old paradigm was emphasized by the well-known Darwinist Ernst Mayr (1976) affirming in one of the best scientific magazines that the Darwinism revolution needed a new concept of God and a new basis for religion.

Now, we know that organisms alter their environment and that their environment constrains select organisms. "*This connection indicates feedback between life and its environment*" (Lenton 1998).

Again the importance of feedbacks, that appear in Gaia theory. Lenton in his clear and well documented review affirms that the theory of Lovelock proposed that environmental constrains is by and for the biosphere due to the persistence of life in our planet, while the alternative view is that this persistence is just by luck and not by some form of self-regulation.

Now, since 1988 Cairns and his colleagues have demonstrated that mutations arise more frequently when the organism is under selective pressure. The environment not only selects among pre-existing variants it also interacts with the organism in a way that generates variations on which selection acts, thus Thaler (1994) affirms that "*If environmental influences affecting the generation of variation can become coherent with those affecting subsequent selection, then the conditions are ripe for the evolutionary bootstrapping of genetic intelligence*".

Now, we know that the inheritance of acquired characteristic was demonstrated in the last few years. This evidence is also incompatible with the neo-Darwinism synthesis. Epigenetics, a field of genetics, is showing that Lamarck was correct and that some inheritable and reversible changes occur without a change in the DNA. Jablonka and Lamb (2008) have suggested that "*These discoveries are clearly incompatible with the tenets of the Modern Synthesis, which denied any significant role for Lamarckian evolutionary processes. In view of the data that support soft inheritance, as well as other challenges to the Modern Synthesis it is concluded that that synthesis no longer offers a satisfactory theoretical framework for evolution biology*".

Finally, the origin of life can be seen as a cosmic event, as it can be seen in the formation of our planet, where comets participate to the existence of water and some organic molecules that are necessary for life. As Loewenstein explained above, information gave place to the organization of the structure of our planet and then powered the feedbacks to a livelier space. With time, new feedbacks lead to more complex structures and to life.

How can we explain the origin of information? The most complex physical and biological theories are also more highly mathematical. Mathematics was considered the highest form of knowledge, because it provided exact results. Physics and biology with their complex experiments can produce errors giving inexact results and also different interpretations. However, the work of these sciences together, with time, will highlight the truth. My point of view is based on logical premises, experimental results and mathematical demonstrations.

3) The new paradigm about the universe

Two theories have revolutionized the understanding of physics in the 20th century: quantum mechanics and general relativity. Physics unconsciously follows the ontological real reductionism when it looks for the ultimate reality of the universe.

J. A. Wheeler (1996), a well-recognized scientist in quantum physics, writes about his it from bit hypothesis: "*It from bit symbolizes the idea that every item of the physical world has at bottom-at very deep bottom, in most instances- an immaterial source and explanations… in short, that all things physical is information-theoretic in origin and this is a participatory universe*".

In the same book Wheeler asks: Whose information? How does the vision of one world arise out of information-gathering activities of many observer-participants? He adopts four "*no*"s. Considering the fourth and last "*no*" Wheeler says: "*If there are problems with the concept of time, they are of*

our own creation! As Leibniz tells us …time and space are not things, but order of things." or as Einstein puts it *"Time and space are modes by which we think, and not conditions in which we live…*"

Quantum mechanics attempts to explain subatomic particles where time is universal and absolute, whereas Einstein general relativity posits that time is relative and a result of how space, time, and matter interact. According to this, large masses distort the geometry of the space-time. The problem is how to reconcile the absolute and relative notions of time supported by each theory.

A new vision in quantum gravity gives us an insight of how the problem of the time of general relativity and quantum mechanics can be solved. Fundamentally, the concept is that the universe, matter, space and time, arises from quantum bits (qubits) of information.

Seth Lloyd (2014) thinks that the universe is itself a quantum computer, thus he writes: "*The universe computes. The computing universe is not a metaphor, but a mathematics fact: the universe is a physical system that can be programmed at its most microscopic level to perform universal digital computation*".

However, W. Vedral (http://www.pbs.org/wgbh/nova/blogs/physics/2014/04/is-information-fundamental/) admits that the analogy with the computer is imperfect, write "*The computation at which this cosmic computer is uniquely capable is that of computing its own evolution*".

Nevertheless, we should be prudent. Recently, in the French version of Sci. Am., Juan Maldacena (2017), one of the most famous researchers in this subject, affirmed: "*if the equivalence between black holes and entanglement is generalized, the spatial connections can implicate minuscule quantum structures that do not follow our usual vision of geometry. We do not yet know how to describe these structures, but the interactions of these structures, in some way and in some other, will give origin to space-time*".

I have indicated that "*The physical world of matter, is something that permits logic-mathematic information to enter in space and time. This information organizes the universe and is an intrinsic constitutive, irreducible and inseparable part of the physical reality*" (Yunes 1995). Now, if the equivalence above mentioned is generalized, I should write that information creates the physical reality.

Besides, we can say that the first verse of the Gospel of John "*In the beginning was logos*" is a reality and so all materialisms should end.

In my comprehension, the new paradigm could be written as:

Information—logic-mathematics-laws of physics---matter-energy

In these last years we have observed the experimental demonstration of the conversion of information into energy (Toyabe et.al. 2010), the Maxwell demon feedbacks that do not affect the energy of the system but only the energy barriers between the system states. These are of a purely informational nature (Esposito and Schaller, 2012) as Maxwell demon in biochemical signal transduction of bacterial chemotaxis of Escherichia coli with feedbacks loop controller that utilizes information of individual molecules which enhances the robustness of the signal transduction against environmental noise (Ito and Sagawa 2015).

The origin of life, where information is a fundamental component, is a problem without an adequate scientific solution. There is no known law of nature that can cause information to originate by itself. Mathematically Hoyle and Wickramasinghe (1984) have calculated the probability of a cell formation as 1x 10-40.000 showing that life does not have a chance to start.

But, as probability don't grant an absolute certainty, some scientists (progetto cosmo.altervista.org) suggest that the works of great authors as Godel, Turing, Chaitin and Von Newman show that some realities are irreducibly complex because they cannot be derived or calculated from a few rules or laws. Life is clearly an irreducible reality. The natural origins imply the reducibility of information contained in the biomolecules. This fact is mathematically impossible, so it is not possible a spontaneous origin of life.

As I have mentioned, Loewenstein considers information to be originated from an unknown source, and then with different feedbacks gives origin to biomolecules that lead to life. Nevertheless, life can originate only from life. According to Cantor the absolutely infinite sequence of numbers is an appropriate symbol of the absolute infinite, it is as symbol for the unlimited God. Nicholas of Cusa shows that infinity could be accessed by symbolic representation and asymptotic mathematics. Cantor realized this endeavor. This is the bridge between mathematics and theology.

On other hand, the mathematical information, that is immaterial, accessible in the real world, was the driving force of our brain-mind development (Yunes 2005). In this line of reasoning Hermann Weyl writes that mathematics lead to the infinite "*purely mathematical inquiry in itself, according to the conviction of many great thinkers.... lifts the human mind into close proximity with the divine than is attainable through any other medium. Mathematics is the science of the infinite, its goal the symbolic comprehension of the infinite with human, that is finite, means*" (Davis et al. 1995).

Other support to the Absolute is given by the neurosciences, quantum biology and quantum physics that are reveling that our bodies are not only physical-chemical systems, but also a resonating quantum system. These facts demonstrate that a form of non-local consciousness has a scientific basis. "*Further, it demonstrates that certain spiritual or transcendental state of collective Oneness have a valid basis within the new scientific paradigm*"
(from http://ervinjlazlo.com/forum/2010/7/12 quantum consciousness).

Yunes (2016) has shown that the evolution of the increasing cognitive capacities, in disparate ecological world variables and with different neural structures, are convergent towards the attractor which emits the converging advances waves, and at the same way specifies a property of this important attractor, the attractor is the source of information.

The Absolute infinite, that is alive, that has an infinite intelligence which provides power to the feedbacks, to reflect over same effects, to control or to stimulate or accelerate others when necessary, can generate life by the reflection principle, that establishes: if P is any describable property of the Absolute, then there must be something smaller than the Absolute that also has property P. Life can be originated where he believes necessary. Only a life being can give life.

In the evolution of the human mind the implicit learning will contact, with its attractor, the infinite source of information. This source must be the Absolute infinite of Cantor (Yunes, 2013). This fact is also supported by the nature of our brain that is the most powerful computer that new known. The human brain possesses about 100 billion neurons with roughly 1 quadrillion connections called

synapses wiring these neurons together. The total number of synapses in a brain is roughly equal to the number of stars in 1.500 Milky Way galaxies (Micheva et.al. 2010).

According to professor Smith of Stanford University "*A single human brain has more switches than all the computers and routers and Internet connections on Earth*" (http://news.cnet.com/8301-27083_3-20023112-247.html) This fact signifies that the evolution of the complexity goes to infinity until it contacts it.

Besides, the much less developed brain of Chimpanzees, according to the anthropologist Jane Goodall (2005), show experiences, like wonder and awe of humans, when contemplate some marvel of nature.

Karl Jaspers a known German philosopher indicates that Nicolas Cusanus was one of the five most important thinkers of all time. One important concept of Nicolas Cusanus is that mathematics is the way of knowing God, it is then best tool to approach Truth. Mathematical finitude leads towards extra mathematical infinity and to the divine infinity. He liked mathematical analogies. He felt that in the infinite the opposites are reconciled as the "*straight*" and the "*curved*" in the circle, the infinite radius of the curved circumference becomes straight. In theology it is necessary to reconcile the transcendent and the immanent. He affirmed the role of mathematical symbols is that they tend to be univocal and part of a system that carries human certitude to its limits. In this sense he was a philosopher of our time.

According to Drozdek (1999), we are better than animals because we are capable to know numbers. Numbers have a divine status, since God himself used them when creating the universe. Numbers do not come from senses, the laws of numbers are eternal. Thus, how could a mutable body imprint in us eternal laws? The rational numbers are only reflections of the eternal, divine numbers which are in God, whereby the absolute is present in us.

Following the thought of Drozdek (1999), we can say that the Augustine idea of God surpasses the vision of other theologians, God encompasses infinity, himself not being infinite. Drozdek legacy is also found in the philosophy of George Cantor because we must realize that there is a great difference between an absolute infinity or an Absolute and the transfinite, the infinities in the world and in the mind. The transfinite is subject to change, or increase, and thus related to the finite (according to Cantor an infinite series of numbers can have a finite sum), while the absolute cannot be modified, cannot be mathematically determined. The absolute infinity is only God attribute.

The new paradigm appears now to be:

God source of information, and attractor-logic-math laws of physics-universe-complexity-organization and life-life evolution-man brain showing the brain going to infinity-GOD

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